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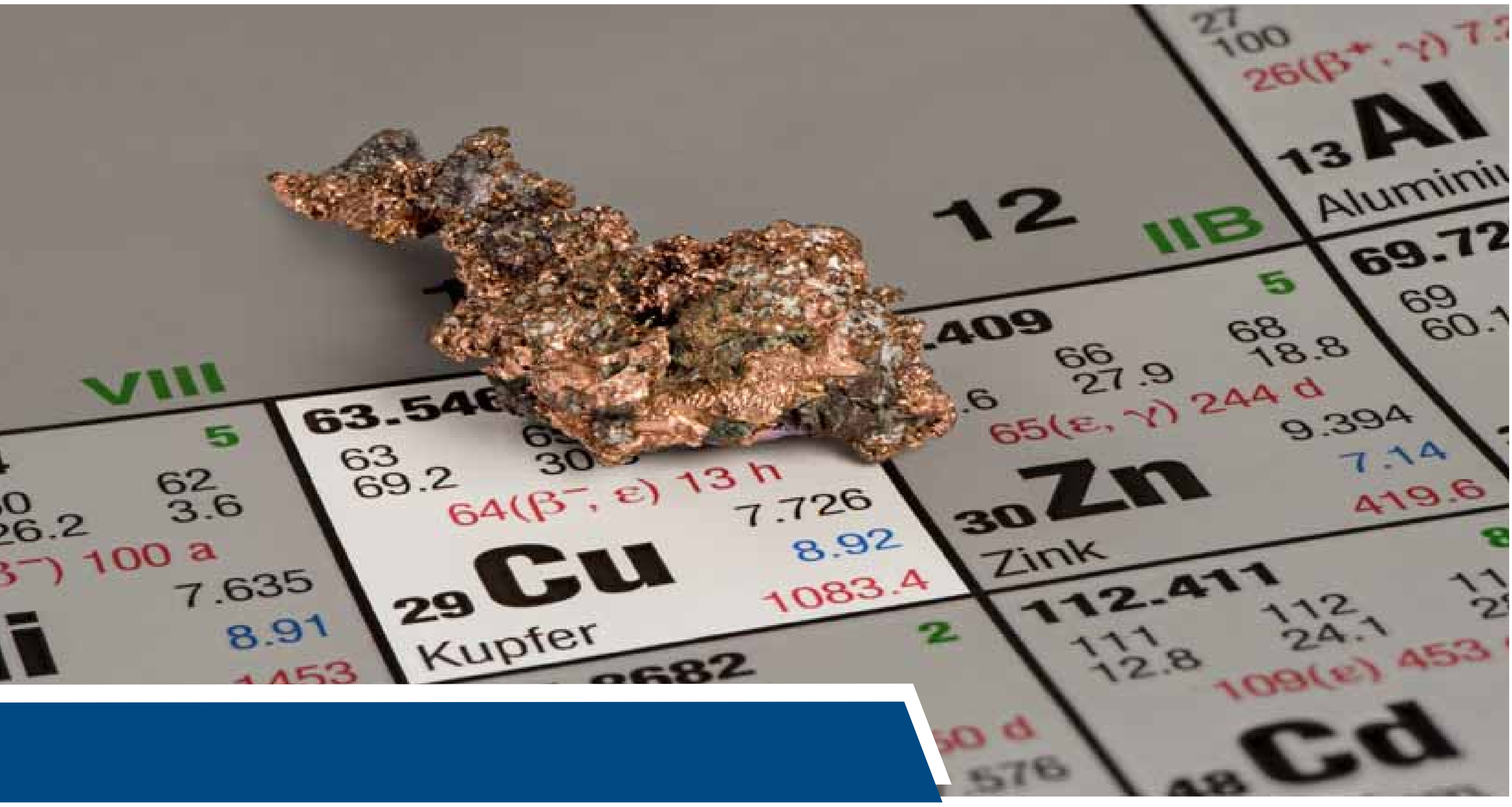


# Copper M&A

## The Cupboard is Nearly Bare

November 2018

*All prices in this document are as of 6 November 2018*

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# Executive Summary

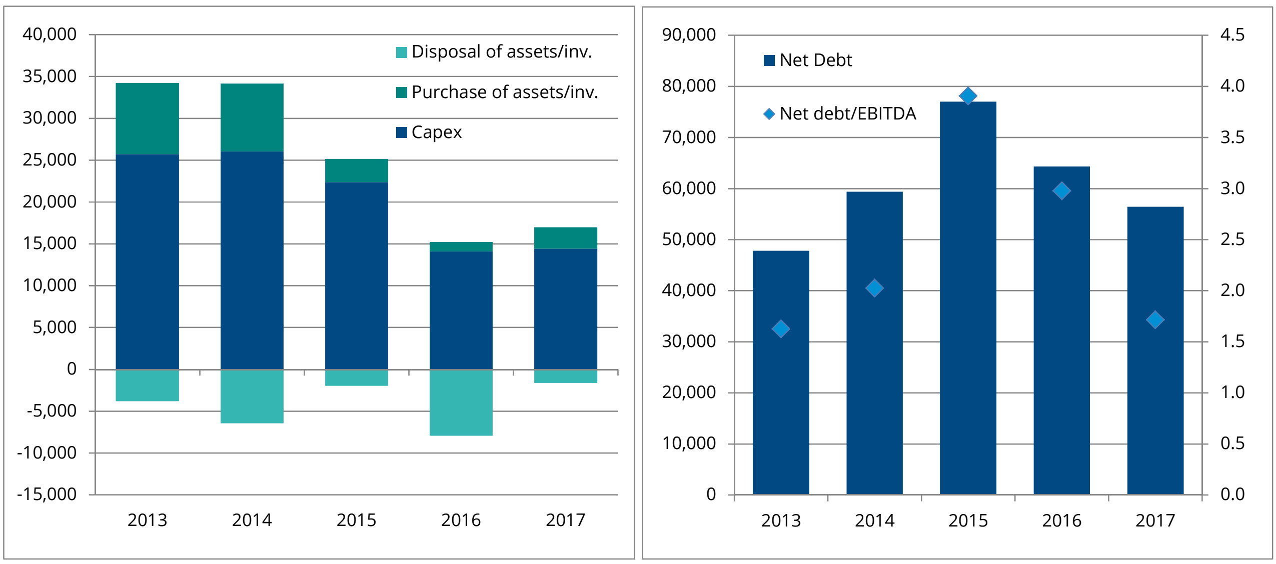
## Introduction

A common theme of every copper producer's presentation is the expectation of insufficient supply over the coming years relative to demand. Maintaining or growing supply requires the continued renewal of resources and companies achieve this through the development of existing mines and/or the development of new projects, either discovered themselves or acquired in the market through M&A. This report focuses on the potential for M&A activity in the copper mining industry.

The copper mining industry is dominated by the large multi-commodity companies and the large primary copper producers. In recent years these companies have been efficiently expanding their large, low-cost operations incrementally, supported by brownfield exploration success. At the same time, they have been rationalising both their portfolios and operations to improve cashflow and strengthen their previously stretched balance sheets.

The companies have benefited through improved operating earnings, and the beneficiaries of the portfolio disposals have mostly been the Chinese companies (many state-owned) that have built up portfolios of Western copper producing assets to feed their domestic smelters.

**Figure 1: Combined Accounts of Top 24 Primary Copper Producers 2013-2017 (US$m)**

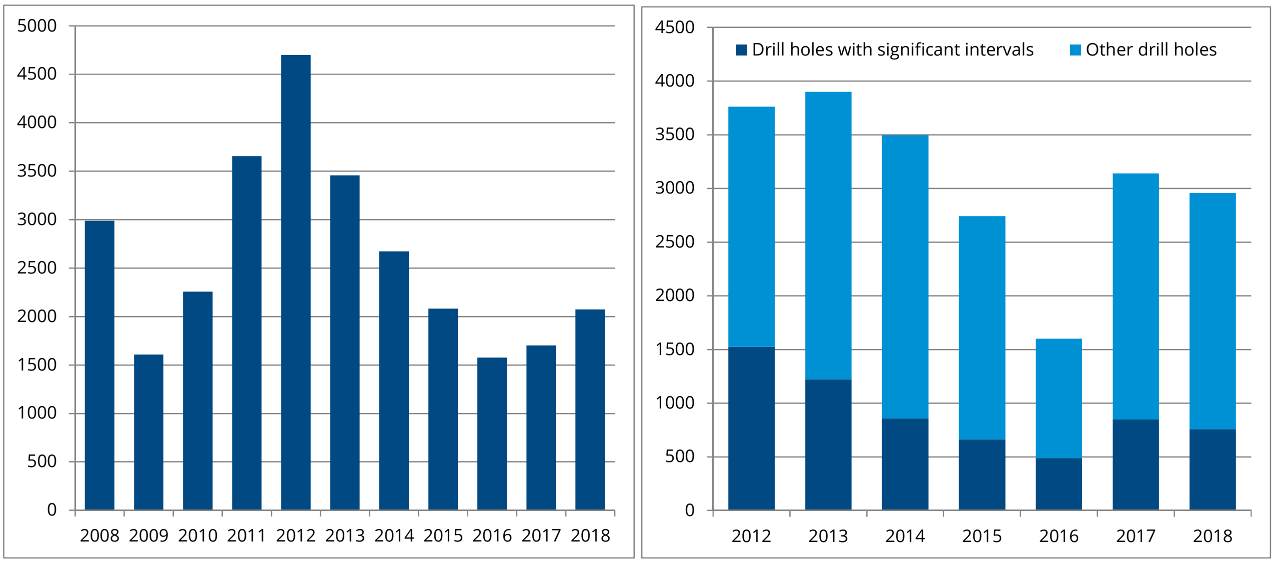



Source: S&P Global Market Intelligence, company data, RFC Ambrian

However, the ability to continue brownfield growth is diminishing and the number of new projects ready for development is also declining. This is partly reflected in the decline of capex on copper over the past four years, but it has yet to be reflected in company copper production numbers.

Figure 2 shows how industry exploration and development expenditure on copper projects has been declining. It also shows the number of copper drill holes undertaken and the declining rate of success.

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




Source: S&P Global Market Intelligence, RFC Ambrian

Some of the companies do have a sufficient pipeline of development opportunities, but for many pipelines are diminished and they need at least to start replacing depleted reserves. The ability to make an acquisition is harder for some companies than others as some are still repairing their balance sheets, but those with stronger balance sheets look primed to take part in M&A to rebuild their portfolios. Our analysis suggests that there are five Tier 1 or 2 companies 'Likely' to make an acquisition in the near term, and a further five where we think it is 'Possible' that they could participate in M&A.

However, we believe that finding a suitable acquisition will not be straightforward:

First, copper asset disposals from the largest copper companies look to be largely over. Any remaining disposals are likely to be low-quality or largely depleted assets, although these could possibly be of interest to the junior companies.

Second, our analysis shows that many of the pure play copper companies with quality assets that could be potential acquisition targets have significant blocking shareholders. While not necessarily insurmountable, this potentially reduces the number of companies in the market that can be acquired.

Third, although there are 55 development and exploration projects with resources of more than 3.0Mt contained copper, we believe that only 21 of these have the potential to involve a third party. Even then, many of these have issues of one kind or another, and we conclude that there are 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.

Finally, the copper industry itself remains cautious and the falling copper price is creating uncertainty. Richard Adkerson, CEO of Freeport-McMoRan, said in the 3Q18 results meeting that, given the uncertainties in today's world, he does not believe there are opportunities for big M&A transactions in the industry.

## Copper M&A Analysis

M&A is an integral part of the mining industry, which covers many transaction types that are driven by a wide range of strategic goals. It is also true that it can have widely varied outcomes. In an industry of annually depleting reserves, M&A and exploration remain the two key routes to sustain and grow mining businesses.

In this report we take a look at the past, present and future of M&A activity in the copper space. We review M&A activity over the past ten years to provide some context, we assess the current strategies and financial position of some of the likely acquirers and review some of the possible targets with a view to anticipating where future M&A could take place.

There are at least 138 significant producing copper mines globally (where we have data), 12 mines under construction, and 55 exploration projects where a resource of at least 3.0Mt contained copper has been discovered. This is the universe we have focused on to look at the M&A market for copper.

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 companies and copper development projects, we have focused on attributable mined copper production, reserves and resources, and cash costs of production.

We have also divided the market of copper producing companies into four categories in order to analyse the market. These are somewhat arbitrary, but we first divide the market into multi-commodity companies producing copper (ie, where copper is just one of several commodities produced) and primary copper producers. 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 have further divided the 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. Tier 1 to 3 covers the top 30 largest primary copper producing companies (in terms of 2017 mined copper production).

## What Does History Say About Copper M&A

Mining companies are under constant pressure to grow their businesses and, in an industry of annually depleting reserves, they must at least replace their reserves each year through exploration or acquisition (if possible). Ideally, they try to grow their resources, reserves and copper production at the lowest cost possible. To do this, larger companies tend to have a pipeline of opportunities, brownfield and/or greenfield, but sometimes gaps in the pipeline must be filled with acquisitions.

Mining companies are always on the lookout for high-quality assets that can be acquired at the right price. The phrase often used is ‘continued assessment of accretive acquisition opportunities’ or ‘growth beyond the core business’. Many producers also increase their exploration exposure by taking some form of partnership with junior exploration companies.

Meanwhile, smaller companies look to be either an acquired asset or have the ambition to grow. The growth can be achieved through the skilful (or lucky) acquisition and/or development of good deposits (and sometimes even poor deposits), or through the accumulation of existing assets (either late-stage projects or existing operations). For success there is not one simple answer, but the price of acquisition and asset quality are often key factors.

We have reviewed M&A activity over the past ten years and looked at some of the larger deals, examined the type and structure of deals, and looked at the prices paid for assets.

### 325 Copper M&A Deals Over US$10m in the Past Decade

We have compiled a database of 325 copper M&A deals involving global assets (ex-China) that have taken place since 2008. These deals have a combined value of US$88.8bn. We have sourced our data from S&P Global Market Intelligence and appended it with some additional company data. These deals are all above US$10m in value and involve the acquisition of shares or assets in primary copper deals.

The deals took place across 21 different countries and, as would be expected, countries with a high level of existing copper production stood out in terms of both the number and value of the deals. From a country perspective, without considering individual assets, this is also the expected group of countries that are most likely to attract deals in the future.

Looking closer at the underlying acquired assets, included were:

- 92 operating mines with deals totalling US$45.3bn;
- 31 mines under construction with deals totalling US$10.6bn;
- 89 projects at the feasibility stage with deals totalling US$23.6bn;
- 57 projects undertaking resources definition with deals totalling US$5.5bn; and
- 47 exploration projects with deals totalling US$1.8bn.

The data shows a preference for acquiring operating or later-stage development assets, with 51% of the deals being for operating assets and a further 13% for assets at the pre-production stage, and a further 23% at the feasibility stage.

Looking at the split between company and property acquisitions over time, the data shows that the number of company acquisitions was significant in 2011-2013, but since then property acquisitions have been the dominant type of acquisition.

There has been a decline in the number of deals since 2011 (when metal prices peaked), but the number now appears to have stabilised. However, the overall value of deals has been erratic over the past four years, but has averaged US$6.7bn per annum over the past seven years. The variability in value appears correlated to the copper price.

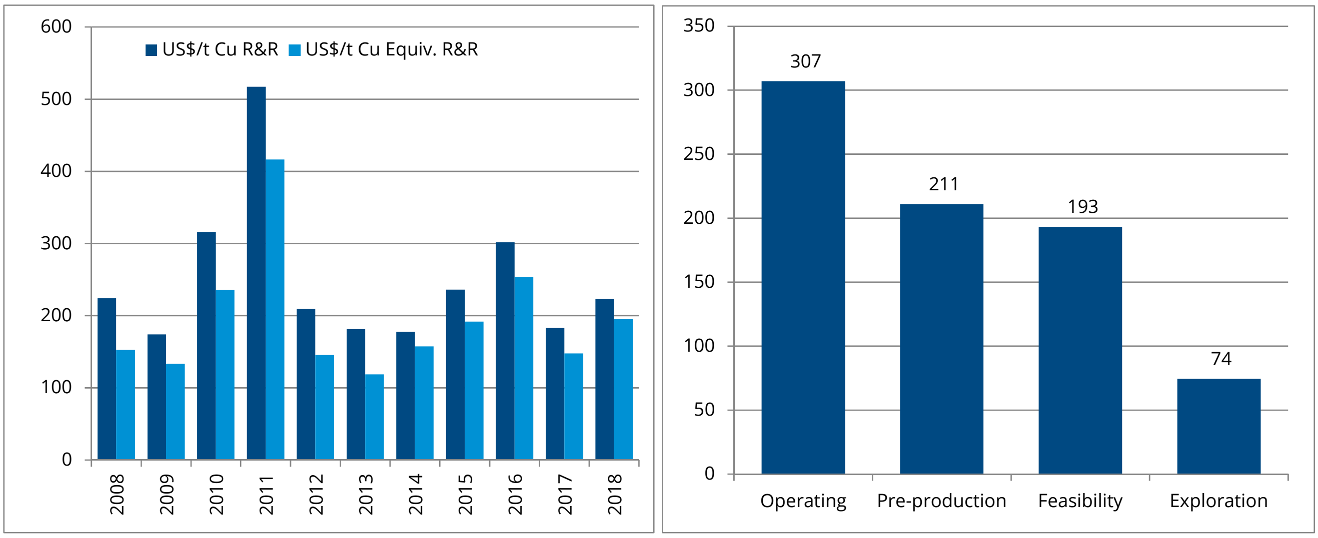
### Prices Paid for Underlying Copper Assets

We have analysed this by looking at prices paid per tonne of copper resource in past deals. For direct asset purchases this is straightforward, while for share purchases and takeovers we have calculated the resource base of the underlying assets.

The overall deal values reflect the average price paid for the acquisition of company shares, and the acquisition of assets. These values have varied over time and for copper equivalent resources the price paid has varied between US$119-254/t (US¢5-11/lb) for the past seven years. The overall average for the period 2008-2018 was US$196/t (US¢9/lb).

Looking more closely at the stage of development of the underlying assets, the data 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 3: Prices Paid for Copper M&A Over Time and Type Average (US$/t of Cu Equivalent Resource) 2008-2018**




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

We have also examined the type of payment used for these deals, either cash, stock or a combination of the two. The data shows that cash was the main payment method for most years from 2008-2018, and accounted for 63% of the overall value of the deals, with stock purchases accounting for just 3% of the value.

## The Assets that Might be Available

### Limited Availability of Primary Copper Companies to Takeover

For a company to be a target for M&A, it requires a shareholding structure that can be relatively easily acquired by another company. However, for many of the top 30 primary copper producers, shareholder structures suggest that they are unlikely to be acquired. This is because they have a controlling or significant shareholder(s), and these tend to be a government shareholding, a family holding, a private company stake or a public company holding.

In some cases, mainly in the Tier 3 companies, these large shareholdings are often held by private equity or other investment groups, who would more than likely welcome a takeover.

Within the Tier 1 copper companies, we believe that there are just two that could potentially be acquired in some form of M&A activity. These are Freeport-McMoRan and First Quantum, although we think the probability is low. Within the Tier 2 group, we believe that there are five copper companies that have the potential to be acquired; Hudbay Minerals, OZ Minerals, Capstone Mining, Sandfire Resources and Taseko Mines, although the quality of these assets is mixed.

Within the Tier 3 group, we believe that there are six copper companies that are available to potentially be acquired; however, we also believe that most of the Tier 3 companies have a lower probability of being acquired due to the relatively low quality of their current assets, although they could be involved in some form of consolidation amongst the smaller copper producers.

### Limited Further Disposals from the Larger Copper Producers

A significant proportion of the recent disposals have come from the assets of the multi-commodity copper producing companies. However, asset disposals from the largest copper companies look to be largely complete.

Any further asset disposals from the larger producers are most likely to be assets that might be undersize or underperforming, or in a country which has become too risky, or if the reserves are approaching the end of their life. Shorter-life assets are often better served by smaller companies that have more focus to better manage the resources.

We have identified 24 copper mines that could be disposed of by the multi-commodity or Tier 1 copper producers. These are based on the view that these assets are too small for the size of company, have too high costs, or have a limited life.

We have only highlighted the potential for disposal and not necessary the desire for disposal. Sometimes larger companies can implement plans to resurrect the fortunes of an asset, through successful brownfield exploration, development of satellite deposits, or cost reduction measures. Many of these assets will likely not be for sale.

### Limited Possibilities to Acquire Assets under Construction

We have identified 11 new copper operations with construction planned, under construction, or recently completed. Of these, due to their shareholding structure, only three look like they might be acquisition targets to a Tier 2 copper company wishing to broaden its portfolio. The three assets are Pumpkin Hollow, Bystrinskoye and Copperwood.

### Shortage of Late-stage Development and Exploration Projects

We have a database of 128 exploration projects where a resource of at least 1.0Mt contained copper has been discovered. However, we have chosen a cut-off of 3.0Mt resource, which gives a more manageable universe of 55 projects.

We have 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.

As a further benchmark for thinking about sizes of potential acquisitions for different groups of companies, Table 1 summarises the average for a number of criteria for the existing operations of each group of companies. While some of these averages can be slightly distorted by a particularly large project, they do give an indication of the general characteristics of each group.

**Table 1: Average Characteristics of Copper Mine Companies**

| Copper Group | Mine Prod'n 2017 (t) | Cash cost 2017 US¢/lb | Prod cost 2017 US¢/lb | Reserve Life years | R&R Life years | No of Operating Mines |
|---|---|---|---|---|---|---|
| Multi-commodity | 241,284 | 121 | 178 | 28 | 90 | 3.9 |
| Tier 1 Cu | 151,994 | 129 | 177 | 25 | 51 | 5.5 |
| Tier 2 Cu | 98,225 | 137 | 194 | 14 | 33 | 1.6 |
| Tier 3 Cu | 27,928 | 201 | 257 | 17 | 56 | 1.7 |
| **Overall average** | **131,006** | **131** | **186** | **24** | **66** | **3.8** |

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

We have then identified 34 development projects that are likely to be developed by their current owners, because they have financial and technical resources to complete these projects without third-party involvement. This leaves 21 projects where there is potential for third-party involvement. However, more detailed analysis of these projects has allowed us to divide them into three groups that we have called Low, Medium, and High probability cases. 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.

Our conclusion is that there are just five development projects that have a High probability of potential M&A activity by a third party or existing minority shareholder. These are: Los Azules owned by McEwen Mining, Los Helados owned by NGEx Resources, Cascabel owned by SolGold, Vizcachitas owned by Los Andes Copper, and Upper Kobuk owned by Trilogy Metals.

## The Potential Acquirers

We have identified 135 Western copper mines in operation in 2017. Of these, 70 produced more than 50kt and 40 produced more than 100kt. The top 40 operations were operated by just 21 different listed mining companies, including three Chinese-controlled companies.

In order to analyse who will be the next acquirer of copper assets, we have scrutinised the strategy statements of each of the existing copper producers, reviewed their past acquisitions and disposals, and looked at recent presentations and transcripts. We have also analysed their balance sheets and cashflows to try and make considered opinions about their likely involvement in future M&A. We have also looked at new entrants, including the step-up in involvement of Chinese companies in Western assets, private equity and private investment firms. A summary of each of the Tier 1, 2 and 3 companies can be found in the Appendices.

**Figure 4: 21 Copper Projects with Potential for Third-party Involvement**


Source: RFC Ambrian

## Multi-commodity Copper Producers

All of the multi-commodity copper producers have the potential to acquire copper assets, but we believe they are only likely to purchase large operations or projects to complement their existing portfolios. Further, for these copper producers, any acquisition or development project would also have to compete for capital with assets in other commodities within their portfolios. Consequently, the strategy of these companies is beyond the scope of this report.

## Existing Copper Producers have been Active in M&A

Tier 1 to 3 primary copper producers have been active in acquisitions and sales of assets in recent years, with US$23.2bn of acquisitions and investments over the past five years and US$21.8bn of disposals, although not all were copper transactions. Of these, the Tier 1 producers account for 92% of the acquisitions and 96% of disposals. They are therefore potentially the key candidates for further M&A activity in our view.

## Tier 1 Copper Producers have Diminished Pipelines

It would be easy to say that all of the Tier 1 copper companies are potential asset acquirers. While this is probably true if they had a strong desire to acquire a particular asset, in the medium term several of them have exploration and development projects that require capex commitments, while some of these companies still need to strengthen their balance sheets further.

The Tier 1 combined accounts on page 73, show that this group has steadily improved operating cashflow and generally been reducing capex over the past five years, improving free cashflow and reducing net debt. Exploration and development expenditure and capex for the Tier 1 copper producers have also fallen steadily.

There also appears to be limited advanced-stage copper development projects within this group. This suggests that over the next few years strategic decisions will need to be made about what to do with this free cashflow. These companies will either have to use their stronger balance sheets to step up exploration and/or M&A activity to improve their exploration and development pipelines.

The three Tier 1 companies that we currently believe are most likely to be involved in some form of acquisition activity in the near term are Freeport-McMoRan, Antofagasta and Lundin Mining.

### Tier 2 Producers have some Pipeline, but need to Increase Expenditure

A similar picture can be seen with the Tier 2 copper producers' financials. The combined accounts on page 95 show that over the past five years operating cashflow has steadily improved and capex and exploration expenditure have been generally trimmed, improving free cashflow and reducing net debt. Since the completion of Hudbay's Constantia mine in 2014, the only new greenfield asset that is being developed is OZ Minerals' Carrapateena Project. However, there are a further six late-stage development projects amongst the group.

Of the eight companies analysed, we suggest that four of these are unlikely to be involved in M&A activity in the near term, partly due to capex commitments to finance existing projects, a weak balance sheet, or a combination of the two.

This suggests that the other Tier 2 companies need to use their stronger balance sheets to step up exploration and/or M&A activity. Sandfire has already raised its expenditure in 2018, OZ Minerals has recently acquired Avanco Resources, and Hudbay Minerals has just made an agreement to acquire Mason Resources.

The two Tier 2 companies that we currently believe are most likely to be involved in some form of acquisition activity in the near term are Boliden and Sandfire Resources.

### Tier 3 Copper Producers have some Pipeline but Weak Balance Sheets

Like the Tier 1 and Tier 2 copper producers, the Tier 3 group has steadily improved operating cashflow and generally trimmed capex and exploration expenditure over the past five years. However, the difference is that free cashflow has largely remained negative and net debt has remained high. This reflects the fact that these companies generally operate at lower EBITDA margins. The combined financials of this group are shown on page 110.

This group of companies has seven late-stage development projects, but some will find it more difficult to finance these projects and others will find it difficult to increase exploration expenditure and/or make acquisitions given the generally weaker balance sheets. Nexa Resources and Aeris Resources are two companies that have increased exploration expenditure for 2018.

The amount of M&A activity over the past five years within the Tier 3 group has been small. However, the data excludes Copper Mountain's recent acquisition of Altona Mining for US$93m.

In recent months, Imperial Metals has announced a financial restructuring and is considering all options for its assets, while Atalaya Mining has announced that it is re-evaluating its strategic options. However, we have not ranked any of the companies as being 'Likely' to be acquirers of assets and just five of them as 'Possible'. We believe that the best prospect for these companies is to make further brownfield or greenfield exploration discoveries and/or consider being part of some consolidation.

### Acquisitions by Asian Companies Increasing

Asian companies have for a long time been involved in copper mining, often taking minority stakes in companies or operating assets to secure concentrate feed for their domestic smelters. More recently, Chinese companies have become important players in the copper M&A market. Perhaps the highest profile has been the growth of MMG, a Chinese-operated business listed on the Australian Stock Exchange. Other active Chinese companies include Zijin Mining.

### Conclusion

We believe that the copper mining industry is in a better financial shape that it has been for some time. Many companies have rationalised their operations, improved cashflows and repaired their balance sheets. However, over the same period, capex on new projects has fallen, exploration expenditure has declined and, as a result, the number of new projects available to be developed in the near term has fallen and the project pipelines of many of these companies is diminished.

While some copper producers do have development opportunities, and some others still need to strengthen their balance sheets further, we believe that there are a number of companies that look like they will have to participate in M&A in the near term in order to refresh their development and exploration pipelines.

However, we also believe that the number of opportunities is limited for them. Many companies that are potential takeover targets have difficult shareholding structures, the number of quality disposals from existing producers is likely to be a lot lower than in the past, and the number of late-stage development projects with resources of >3.0Mt that we believe are likely candidates to be acquired is limited to just five.

This lack of opportunity looks set to raise the stakes for those assets that are available.

# Section 1 —
# Assets Likely to be the Subject of M&A

## Assets Most Likely to Acquired

There are at least 138 significant producing copper mines globally (where we have data), 12 mines under construction, and 128 exploration projects where a resource of at least 1.0Mt contained copper has been discovered. This is the universe we have focused on to look at the M&A market for copper. These assets could sit with an existing mining or exploration company and any acquisition could be for an individual asset within a company or for the company itself.

### Acquisition of Existing Producers

Business combinations between copper companies do occur, but a problem with the mining industry is that most mines tend to be discrete assets. As a result, other than in cases where assets are located near to each other, there are normally limited synergies in M&A (apart from head office savings). These are usually insufficient to justify the premium that is often demanded by the market and investors. Thus, the majority of deals in the copper industry are acquisitions by a larger company of a smaller one, usually to acquire a particular operating or exploration asset, or for consolidation to create larger companies with better liquidity, access to capital and (hopefully) market rating. Geographical diversification can also be a factor.

We have focused on attributable mined production and have divided the market of copper producing companies into four categories. These are somewhat arbitrary, but we firstly divide the market into multi-commodity companies producing copper — where copper is just one of several other commodities produced — and primary copper producers. We have called these primary copper producers as copper is the main commodity; however, copper normally comes with associated products, such as gold, zinc, silver, lead and molybdenum, and the level of production of these commodities can vary considerably from company to company. Equally, they can also enhance the economics of the copper operations.

**Table 2: Copper Producing Companies, Ranked by Attrib. Mine Prod'n 2017**

| | Multi-commodity Cu Producers | Tier 1 Cu Producers | Tier 2 Cu Producers | Tier 3 Cu Producers |
|---|---|---|---|---|
| 1 | Glencore | Codelco | Hudbay Minerals* | Nexa Resources* |
| 2 | BHP Billiton | Freeport McMoRan | Boliden* | Imperial Metals |
| 3 | Rio Tinto | Grupo Mexico | OZ Minerals | Atalaya Mining |
| 4 | Vale | Southern Copper | OK Tedi Mining | S. Punta del Cobre |
| 5 | Anglo American | KGHM | Turquoise Hill | Atlas Cons. |
| 6 | Norilsk Nickel | First Quantum | Capstone Mining | Amerigo Resources |
| 7 | CN Nonferrous Mining | Antofagasta | Sandfire Resources | Copper Mountain |
| 8 | Teck Resources | MMG | Western Mining | Aeris Resources |
| 9 | Zijin Mining Group | KAZ Minerals | Taseko Mines | Metals X |
| 10 | Barrick Gold | Lundin Mining* | SM El Brocal* | Ero Copper Corp. |
| 11 | Vedanta Resources | | | |

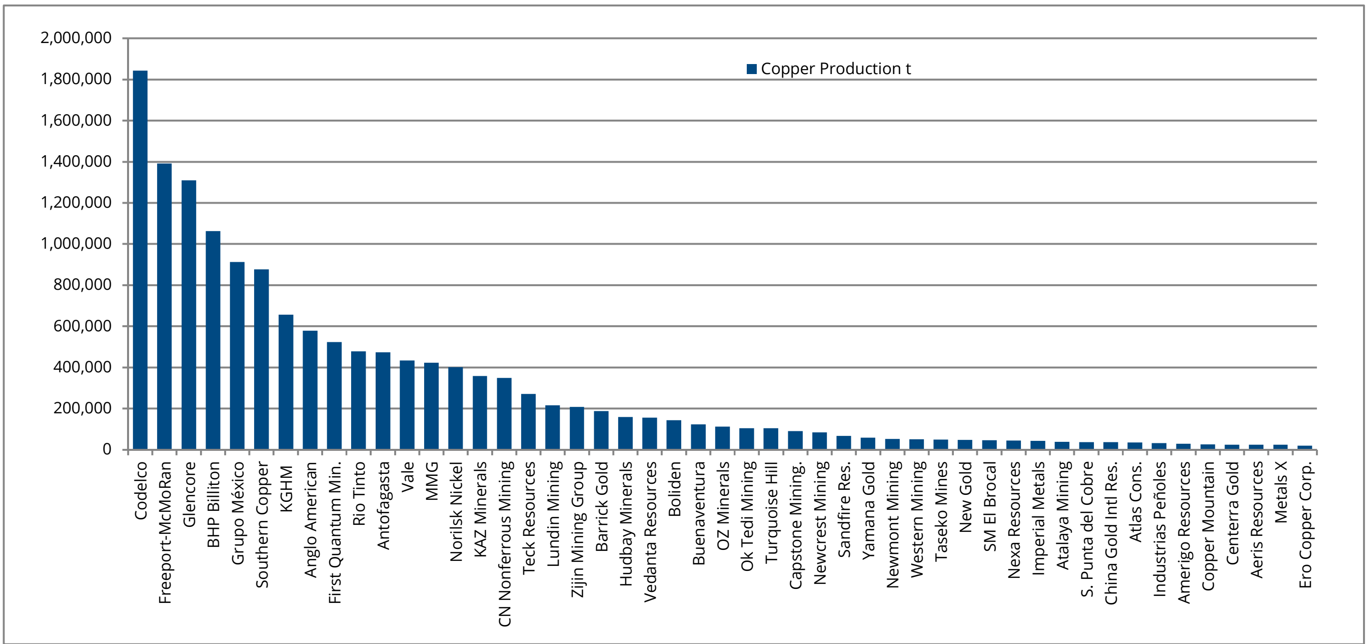
*Significant producers of zinc; Source: S&P Global Market Intelligence, company data

We have further divided the 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.

## Multi-commodity Copper Producers

Any multi-commodity copper producing company could look to acquire a primary copper asset if it felt it could improve the quality of its portfolio (in terms of production, resources and costs). However, whether one of these companies is likely to be the subject of copper M&A activity is largely out of the scope of this report.

**Figure 5: Largest Copper Producing Companies Ranked by Attributable Mine Production 2017 (t Cu)**



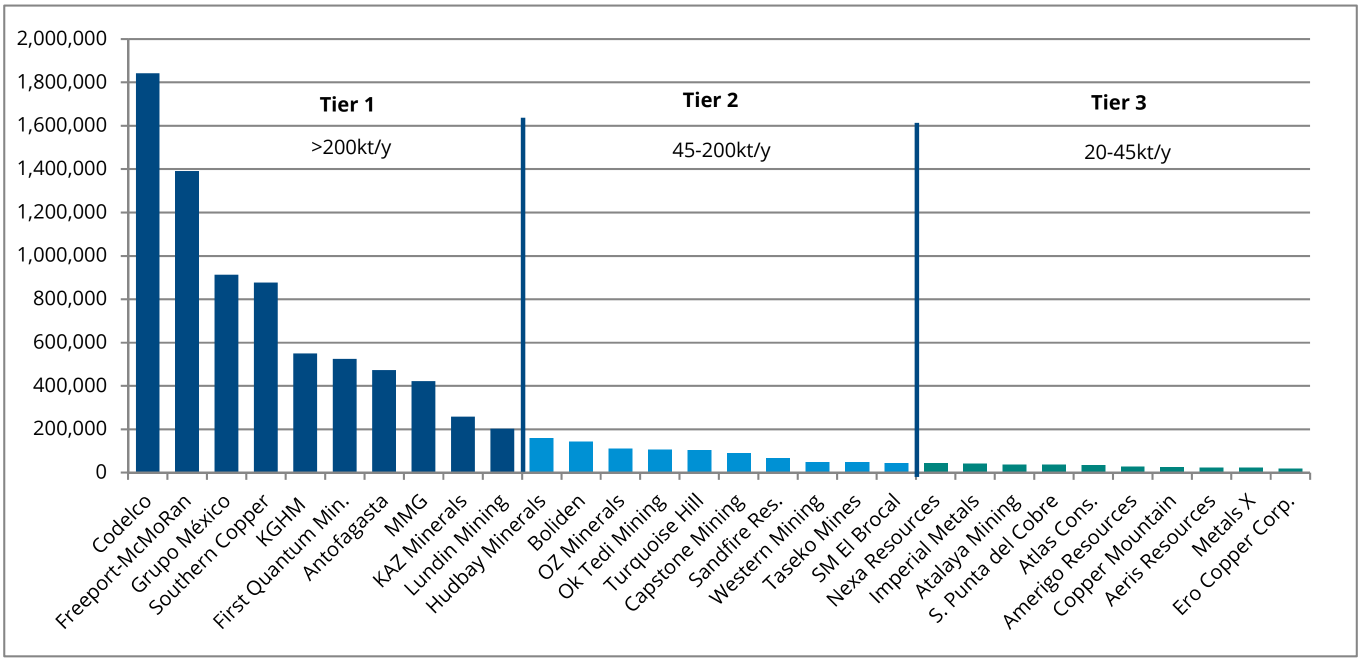

Source: S&P Global Market Intelligence, company data

## Primary Copper Producers

This report rather focuses on the primary copper producers shown in Table 2 and Figure 6. Later in the report, in Tables 10, 11 & 12, we have tried to show the overall quality of each company's portfolio of copper assets relative to the universe. We have ranked production, resources and cash costs by quartile. This, along with analysis of their financial metrics and strategic comments, helps provide a more quantitative approach to their potential as an acquirer and/or attraction as a potential takeover target.

We have sourced our data from S&P Global Market Intelligence and appended it with additional company data and some RFC Ambrian estimates. We have focused on mined copper production, reserves and resources, and cash costs of production. While this is a good proxy for this group of companies, it sometimes doesn't reveal the additional value in reserves and resources and in production from the mining of by-products, the two most important being gold and zinc. We have attempted to highlight this issue for particular companies where it is meaningful.

**Figure 6: Primary Copper Producers Ranked by Attributable Mine Production 2017 (t Cu)**




Source: S&P Global Market Intelligence, company data

## Tier 1 Copper Producers

The companies in the Tier 1 group have Enterprise Values ranging from US$2.1bn (Lundin Mining) to US$35.6bn (Southern Copper).

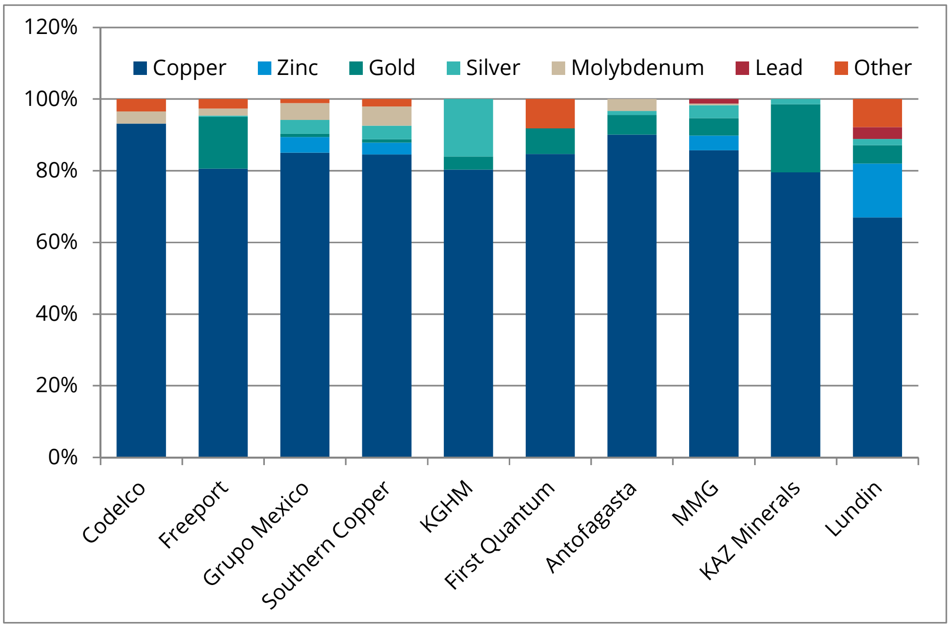
Within the Tier 1 copper producing companies, the largest producer is Codelco. **Codelco** (Corporación Nacional del Cobre de Chile) is unlisted and owned by the Chilean state, making it impossible to be acquired. Furthermore, it plans to invest some US$39bn over the next ten years, largely in order to maintain future production levels caused by the abrupt decline in the copper ore grades that the it is currently undergoing. We believe this also makes it unlikely that it will be involved in any M&A activity in the copper market.

The company that stands out in terms of quality of assets is **Southern Copper**. It has first quartile assets for reserves and resources, production and cash costs. However, Southern Copper is already owned 89% by **Grupo Mexico**. Grupo Mexico also holds US copper assets through Asarco, which slightly dilutes the quality of its copper portfolio. Grupo Mexico in turn is owned 51% by a Mexican individual, Mr Larrea Mota Velasco. It is therefore unlikely that Southern Peru or Grupo Mexico could be acquired.

Other companies in this group unlikely to be acquired include: **Antofagasta**, which is 65%-owned by the Luksic family; **KGHM**, which is 32%-owned by the Polish Government; and **MMG**, which is 74%-owned by the Chinese state-owned company China MinMetals Corp. **Lundin Mining** is only 13%-owned by the Lundin family, but its chairman is Lukas Lundin and so we see a lower likelihood of it being a takeover target, although it could be part of merger activities. Finally, **KAZ Minerals** has insider ownership of an estimated 48%, including 33.4%-owned by Mr Vladimir Kim and 7.8% by Mr Oleg Novachuk. Also, its assets are located in Kazakhstan, Kyrgyzstan and Russia, making it an unlikely takeover target.

This then leaves just two Tier 1 companies that could potentially be acquired in some form of M&A activity: **Freeport McMoRan** and **First Quantum**.

**Figure 7: Tier 1 Copper Producers' Proportion of Mining Revenue from Products**




Source: S&P Global Market Intelligence, company data

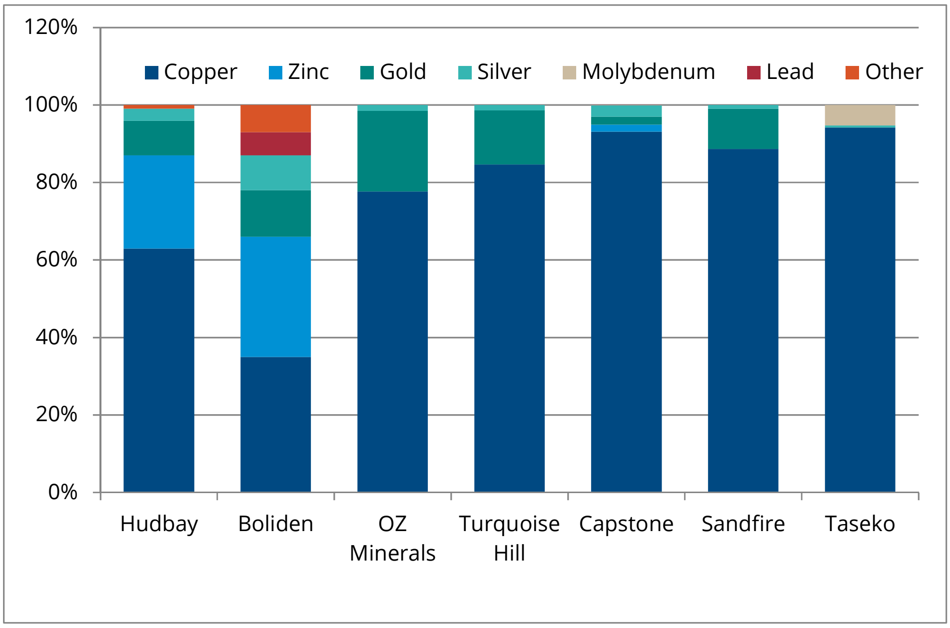
**Freeport-McMoRan** has occasionally been reported as a takeover target for one of the larger global diversified mining companies. However, the risks involved with its main asset, Grasberg in Indonesia, the world's second-largest copper mine, are a major inhibitor to the company being taken over. These risks were reduced in July 2018 when Indonesian investors took a controlling stake (51%) in Grasberg following Rio Tinto's US$3.5bn sale of its interest in Grasberg; this should allow Freeport-McMoRan to secure its status and relationship with the Indonesian Government over the longer term. However, we still believe a takeover of the company is unlikely, especially as Rio Tinto had been the most likely suitor.

**First Quantum Minerals** is the only company in the Tier 1 group that we believe could be a potential takeover target. However, its assets are currently 2nd and 3rd quartile in our ranking and some of its larger assets are located in Zambia, Argentina and Panama, making it an unlikely target for a global diversified mining company. Its Enterprise Value would also make it a difficult sized acquisition for most of its copper peers, although First Quantum could be part of merger activities.

### Tier 2 Copper Producers

The companies in the Tier 2 group have Enterprise Values ranging from US$315m to US$6.7bn. Boliden at US$6.7bn and Turquoise Hill at US$5.6bn are by far the largest and then there is a big step down to OZ Minerals at US$1.6bn. Taseko is the smallest at US$315m.

**Figure 8: Tier 2 Copper Producers' Proportion of Revenue from Products**




Source: S&P Global Market Intelligence, company data

This group of companies has a much higher likelihood of being involved in some form of M&A activity given the smaller Enterprise Values, although once again the number of available target companies is limited.

**OK Tedi Mining** is unlisted and owned by the Government of Papua New Guinea and **Sociedad Minera El Brocal** is owned 61% by Buenaventura, and so unlikely to be acquired. Further, we have not directly considered **Western Mining** as its assets are in north-west China. Possibly the most interesting is **Turquoise Hill**, which owns 66% of Oyu Tolgoi; however, it is already owned 51% by **Rio Tinto**, and may well be fully taken over by it at some point.

The overall relative quality of the assets for many of the Tier 2 copper companies is much lower (in terms of size of production and reserves and resources) than the Tier 1 and multi-commodity producers. However, five of them interestingly have portfolios with first quartile cash costs. This partially reflects high by-product credits for some of them.

The highest quality company in this group is Nordic-based **Boliden**, with second quartile assets and first quartile costs. The company is also a significant producer of zinc and produces lead, nickel, gold and silver, operating both mines and smelters, and is involved in recycling. These are a unique, well run group of assets, but also owning zinc assets and smelters may not be attractive to many copper companies. We therefore think Boliden is unlikely to be acquired.

This leaves five other Tier 2 copper companies that have the potential to be acquired: **Hudbay Minerals**, **OZ Minerals**, **Capstone Mining**, **Sandfire Resources** and **Taseko Mines**. Hudbay Minerals has the highest quality assets and cost base of this group, with the others having a portfolio of copper assets in the third and fourth quartile.

### Tier 3 Copper Producers

The companies in the Tier 3 group have Enterprise Values ranging from US$81m to US$1.8bn. Nexa Resources is the largest and then there is a step down to Atlas, Punta del Cobre, and Ero Copper (all above US$600m). The smallest is Aeris Resources at US$81m.

These are all relatively small producers and the reserves and resources also reflect the small size of operations. Cash costs are in the third and fourth quartile. While they may be viable and profitable operations, they do not necessarily hold a significant prospect of being acquired solely for their current operations. Furthermore, they all have significant shareholdings held by other companies or insiders.

The four most unlikely to be acquired are: **Sociedad Punta del Cobre** (PuCobre), which has just finalised the acquisition of **Pacífico V Región** in a reverse merger under which PuCobre absorbed its parent company Pacífico (85% ownership) and now appears to be held some 80% by insiders; **Nexa Resources**, which is 64%-owned by **Votorantim** (a Latin American industrial conglomerate); **Atalaya Mining**, which is 22%-owned by the Chinese copper company **Yanggu Xiangguang Copper** and 22% by **Urion Mining** (Trafigura); and **Atlas Mining**, which is 43% held by the Ramos family. These companies could be part of some industry consolidation though.

This leaves six Tier 3 companies that have the potential to be acquired: **Imperial Metals**, **Amerigo Resources**, **Copper Mountain**, **Aeris Resources**, **Metals X** and **Ero Copper**. We believe most of these are unlikely to acquired due to their current asset base. We only view Imperial Metals as a 'Possible' disposer of assets, and only view Atalaya Mining as a 'Possible' takeover target given the expansion of its Proyecto Riotinto mine to 50-55kt/y, a size that could attract some companies.

## Potential Disposals from Existing Producers

When looking at individual mines or projects, we have again sourced our data from S&P Global Market Intelligence and appended it with some additional company data and RFC Ambrian estimates. We have focused on assets located in Western markets due to availability of data and because assets in countries like China are unlikely to be acquired by Western companies.

We begin by looking at asset disposals from existing copper producers. Larger producers of copper could dispose of assets that might be undersize or underperforming, or in a country which has become too risky, or if the reserves are approaching the end of their life. Shorter life assets are often better served by smaller companies that have more focus to better manage the resources.

### Recent Disposals of Copper Assets by Copper Producers

In recent years, the largest disposal deal announced has been **Rio Tinto** agreeing to sell its interest in Grasberg for US$3.5bn earlier this year. The sale is part of a complex three-way deal that will see Indonesian investors take a controlling stake (51%) in Grasberg, fulfilling a pledge by the country's President Joko Widodo to boost local ownership of natural resources.

As well as buying Rio Tinto's 40% interest in Grasberg, Indonesia's state miner **Inalum** has also agreed to pay US$350m for an additional 9.36% stake in the mine from **Freeport-McMoRan**. Once these transactions have been completed and Rio Tinto's interest converted into equity, Inalum will then hold a 51% interest in Grasberg. The rest will be controlled by Freeport who will remain the operator.

Freeport has been seeking to retain operational control of the mine until 2041 and keep key legal and financial safeguards enshrined in its current operating licence so that it can push ahead with an underground expansion project at Grasberg. This deal will secure these agreements and should end years of tension between the Indonesian Government and Freeport-McMoRan.

We calculate that Inalum has paid just US$190/t of equivalent copper reserves and resources (excluding the gold reserves and resources). This compares with the 10-year average of US$307/t of copper equivalent reserves and resources for operating assets (see page 58). This looks like a good deal for Inalum.

In June 2018 **BHP Billiton** entered into an agreement to sell its Cerro Colorado mine to **EMR Capital** for some US$320m.

In 2017 **Lundin Mining** disposed of its 27% stake in the Tenke Fungurume mine in the DRC for about US$1.2bn to **Bohai Harvest RST Partners**, a Chinese cross-border private equity investment company. **Freeport-McMoRan** had already disposed of its 56% interest in the Tenke Fungurume mine in 2016 to China Molybdenum for about US$2.8bn.

In 2016 **Newmont Mining** disposed of its 49% of the Batu Hijau copper and gold mine in Indonesia for some US$1.3bn to PT Amman Mineral Internasional (**PTAMI**).

In 2014, **Glencore** disposed of its Las Bambas Project in Peru to a joint venture, owned by **MMG**, GUOXIN IIC and CITIC Metal, which paid about US$3.0bn in cash.

Currently, private equity-backed Chilean mining company **Mantos Copper** is looking to find a buyer to help finance the expansion of mines it bought from Anglo American in 2015 and is reportedly in talks with **Hudbay Minerals**.

### Possible Future Disposals by Multi-commodity Copper Producers

A significant proportion of the recent disposals have come from the assets of the multi-commodity copper producing companies. Looking at the scale of production, cost structure and reserve life of their operations, a number of assets stand out that appear too small for the size of company, have too high costs, or have a limited life. These could be candidates for disposal, possibly to a more junior company.

Mines that satisfy all three criteria for disposal include Alumbrera (**Glencore** 50%), Punitaqui (**Glencore**), El Soldado (**Anglo American** 50%) and Jabal Sayid (**Barrick Gold** 50%).

Another mine that appears particularly small scale is Quebrada Blanca (**Teck Resources** 90%) and Teck has stated that it is looking for a partner for its Quebrada Blanca Phase 2 expansion project in northern Chile. A mine with a particularly low life is Cobar (**Glencore**), and a mine with quite high costs is Highland Valley (**Teck Resources**).

Finally, with **Barrick Gold**'s planned merger with **Randgold Resources**, its Lumwana copper operations in Zambia might also be up for sale.

### Possible Future Disposals by Tier 1 Copper Producers

Looking at the scale of the assets of the current mines operated by the Tier 1 copper producers, mines that satisfy all three criteria for disposal include Miami (**Freeport-McMoRan**), Tyone (**Freeport-McMoRan**), Las Cruces (**First Quantum**) and Guelb Moghrein (**First Quantum**).

Other mines lacking scale with particularly high costs include Chino (**Freeport-McMoRan**), Safford (**Freeport-McMoRan**), Sierrita (**Freeport-McMoRan**), Mission (**Grupo México**), Ray (**Grupo México**), Silver Bell (**Grupo México**), Robinson (**KGHM**), Cayeli (**First Quantum**) and Kinsevere (**MMG**).

Mines that appear particularly small scale are Sudbury Operations (**KGHM**), Franke (**KGHM**) and Pyhasalmi (**First Quantum**).

### Possible Future Disposals by Tier 2 & Tier 3 Copper Producers

Due to the market size and scale of the operations within most Tier 2 and Tier 3 copper producers, we have not considered them as reasonable candidates to be natural disposers of assets, although these companies do dispose of assets from time to time. At present, **Capstone Mining** is trying to dispose of its Minto mine.

We believe that these companies are more likely to be acquirers of assets.

**Table 3: Possible Future Disposals by the Larger Copper Producers**

| Mine | Company | Cu t Prod 2017 | R&R Mt Cu | Reserv Life yrs | Cash Cost US¢/lb | Total Cost US¢/lb |
|---|---|---|---|---|---|---|
| Lumwana | Barrick Gold | 116,120 | 5.88 | 20 | 179 | 215 |
| Miami | Freeport-McMoRan | 97,522 | 0.02 | 2 | 170 | 238 |
| Highland Valley | Teck Resources | 92,800 | 6.19 | 19 | 166 | 242 |
| Kinsevere | MMG | 80,186 | 1.47 | 6 | 163 | 245 |
| Las Cruces | First Quantum | 73,664 | 0.59 | 3 | 90 | 218 |
| Sierrita | Freeport-McMoRan | 72,575 | 8.5 | 71 | 203 | 226 |
| Safford | Freeport-McMoRan | 68,039 | 5.18 | 44 | 194 | 228 |
| Mission | Grupo México | 61,900 | 1.5 | 24 | 283 | 303 |
| Cobar | Glencor | 53,400 | 0.52 | 4 | 150 | 184 |
| Ray | Grupo México | 53,200 | 3.31 | 62 | 303 | 321 |
| Robinson | KGHM | 48,800 | 1.61 | 10 | 191 | 313 |
| El Soldado | Anglo American | 40,500 | 0.78 | 8 | 207 | 258 |
| Jabal Sayid | Barrick Gold | 39,009 | 0.39 | 7 | 162 | 203 |
| Alumbrera | Glencore | 33,300 | 0.16 | 5 | 174 | 320 |
| Guelb Moghrein | First Quantum | 28,791 | 0.31 | 5 | 141 | 214 |
| Tyrone | Freeport-McMoRan | 27,669 | 0.22 | 1 | - | - |
| Quebrada Blanca | Teck Resources | 23,400 | 18.26 | 248 | 197 | 431 |
| Franke | KGHM | 19,600 | 0.25 | 8 | 186 | 207 |
| Silver Bell | Grupo México | 18,600 | 0.51 | 28 | 228 | 253 |
| Cayeli | First Quantum | 16,523 | 0.31 | 7 | 150 | 245 |
| Pyhasalmi | First Quantum | 13,501 | 0.06 | 1 | (26) | 218 |
| Sudbury Ops | KGHM | 9,400 | 0.21 | 4 | - | - |
| Chino | Freeport-McMoRan | 8,618 | 1.93 | 13 | 224 | 254 |
| Punitaqui | Glencore | 5,500 | 0.08 | 4 | 150 | 296 |

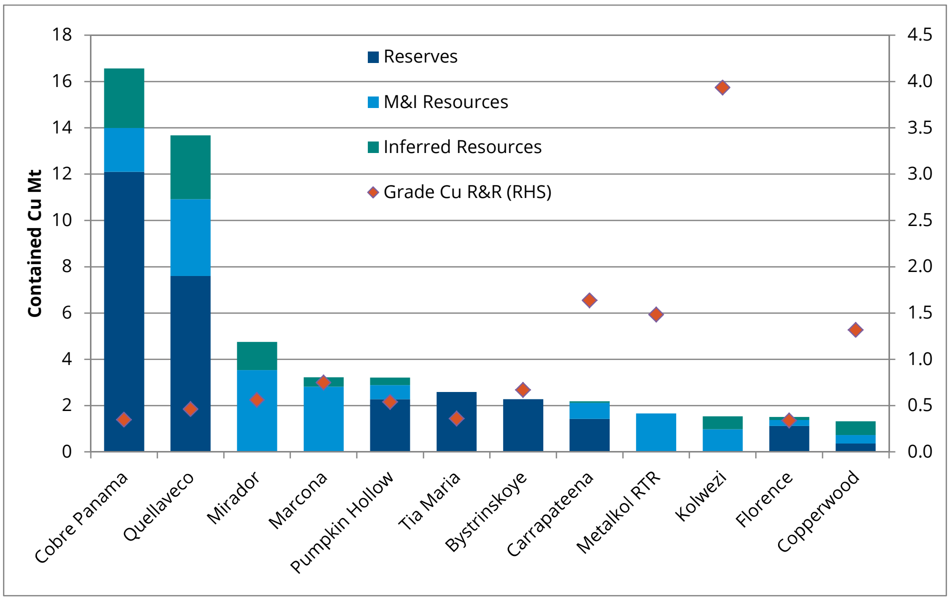
Source: S&P Global Market Intelligence, company data

In this table we are only highlighting the potential for disposal and not necessarily the desire for disposal. Sometimes larger companies can implement plans to resurrect the fortunes of an asset, through successful brownfield exploration, development of satellite deposits, or cost reduction measures. Many of these assets will probably not be for sale.

## Acquisition of Assets under Construction

Figure 9 and Table 4 show 12 new copper operations with construction planned, under construction, or recently completed. Of these, only three look like they might be acquisition targets to a Tier 2 copper company wishing to broaden its portfolio. The three assets are Pumpkin Hollow, Bystrinskoye and Copperwood. A brief summary of each of these operations can be found in Appendix 5.

**Figure 9: Reserves and Resources (by Contained Cu) of New Copper Mines**




Source: S&P Global Market Intelligence, company data

**Pumpkin Hollow**

Pumpkin Hollow is located in Nevada, US, and owned by **Nevada Copper** (NCU CN : C$0.40 | US$123m). An underground mine development has been fast tracked by re-engineering the project and production is anticipated in 2H19. The data in Figure 9 includes open-pit reserves and resources. The underground reserves and resources comprise 21.7Mt ore grading 1.7% Cu equivalent and contain 1.4Mt of copper. The project is planned to produce 23ktpa of copper over a mine life of 13 years. Pre-production capex of US$182m was funded by a mix of conventional project finance and streaming. The underground project reported an $NPV_5$ of US$301m and an IRR of 25%.

The open-pit resource is fully permitted and has the potential for staged growth later so that the capex could be funded internally.

Nevada Copper is a Canadian-listed company (EV: US$266m) without any significantly large shareholders in a relatively low risk operating environment. Initial capex for the open-pit project is US$592m. Planned average life-of-mine production is 76kt/y of copper at a cash cost of US¢167/lb and a reported after tax $NPV_{7.5}$ was US$927m and the IRR 19%.

### Bystrinskoye

The open-pit project in Russia, owned by **Norilsk Nickel** (NILSY US: US$17.28 | US$35.5bn), is planned to be in commercial operation by 4Q18. The mine is expected to produce 65kt/y of copper (in concentrate) from 2021. Powerlines and a 227km of railway connect the operations. Norilsk Nickel has sold a 13.3% stake to a consortium of Chinese investors and 36.6% to CIS NRF Holdings. However, Norilsk states that it is considering a potential IPO of the asset, which may mean Norilsk's interest could be acquired by a company comfortable operating in the Far East of Russia.

### Copperwood

**Highland Copper** (HI CN: C$0.095 | US$40m) is preparing to construct the 100%-owned Copperwood Project, located in Michigan, US. The company expects all required permits in 4Q18 and construction of the underground mine is expected to start in 1Q19. It will produce some 300kt of copper over its 11-year life. However, the company has yet to put in place project finance for the development and it currently has a working capital deficit.

Highland Copper is a Canadian-listed mining company (EV: US$37m) operating in a relatively low risk operating environment. The company has a number of key shareholders, including Greenstone with 17%, Osisko Gold Royalties (16%) and Orion (14%). The project has a cash cost of US¢153/lb and assuming a copper price of US$3.15/lb, reported an $NPV_8$ of US$117m and an IRR of 18%.

**Table 4: Copper Projects with Construction Planned, Under Construction, or Recently Completed**

| | Project | Country | Operating Company | R&R Mt Cu | Grade % Cu | Prod'n Cap. Cu kt/y | Cash Cost US¢/lb | Initial Capex US$m | LoM years | Start Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Cobre Panama | Panama | First Quantum | 16.57 | 0.35 | 150.0 | 120 | 6,300 | 40 | 4Q18 |
| 2 | Quellaveco | Peru | Anglo American | 14.39 | 0.49 | 300.0 | 105 | 5,150 | 30 | 2022 |
| 3 | Mirador | Ecuador | Ecuacorriente | 4.76 | 0.56 | 59.0 | 84 | 1,720 | 17 | 2019 |
| 4 | Marcona | Peru | Minsur | 3.23 | 0.75 | 91.8 | 138 | 1,500 | 16 | 2020 |
| 5 | Pumpkin Hollow | US | Nevada Copper | 3.21 | 0.54 | 22.7 | 181 | 182 | 14 | 4Q19 |
| 6 | Tia Maria | Peru | Southern Copper | 2.59 | 0.36 | 120.0 | - | 1,400 | - | 2021 |
| 7 | Bystrinskoye | Russia | Norilsk | 2.28 | 0.67 | 65.0 | - | 1,700 | - | 4Q18 |
| 8 | Carrapateena | Australia | OZ Minerals | 2.19 | 1.64 | 65.0 | 62 | 916 | 20 | 4Q19 |
| 9 | Metalkol | DRC | Eurasian Res. | 1.67 | 1.48 | 77.0 | - | 650 | - | 4Q18 |
| 10 | Kolwezi | DRC | Zijin Mining | 1.54 | 3.93 | 100.0 | - | 2,006 | - | 4Q17 |
| 11 | Florence | US | Taseko Mines | 1.51 | 0.34 | 38.6 | 110 | 200 | 21 | 4Q18 |
| 12 | Copperwood | US | Highland Copper | 1.33 | 1.32 | 27.3 | 153 | 275 | 11 | 2Q21 |

Source: S&P Global Market Intelligence, company data

## Acquisition of Development & Exploration Assets

Table 5 lists the top 19 global copper projects by resource size. These projects have a resource of greater than 9Mt contained copper. Seven of these projects have resources above 20Mt and a further ten have resources totalling over 10Mt. Over 50% of these projects have a grade below 0.5% copper.

**Table 5: Late-stage Copper Exploration Projects with Resources >9Mt Contained Copper Ranked by Resource Size**

| | Project | Country | Company | Status | Project Stage | Resource Cu Mt | Grade %Cu | Poss prod Kt/y Cu |
|---|---|---|---|---|---|---|---|---|
| 1 | Kamoa-Kakula | DRC | Ivanhoe Mines | Active | Feasibility Started | 43.83 | 2.64 | 215 |
| 2 | Pebble | US | Northern Dynasty | Active | Pre-feas/Scoping | 36.96 | 0.34 | 143 |
| 3 | Resolution | US | Rio Tinto | Active | Feasib Complete | 27.47 | 1.54 | - |
| 4 | Udokan | Russia | Metalloinvest | Active | Feasibility | 27.28 | 0.99 | 537 |
| 5 | Reko Diq | Pakistan | Antofagasta/Barrick | Litigation | Feasibility | 24.35 | 0.42 | 190 |
| 6 | La Granja | Peru | Rio Tinto | Active | Pre-feas/Scoping | 22.06 | 0.51 | 300 |
| 7 | Timok | Serbia | Nevsun Resources* | Active | Feasibility Started | 15.37 | 0.90 | 86 |
| 8 | Tampakan | Philippines | Sagittarius Mines | Active | Feasibility | 15.17 | 0.52 | 450 |
| 9 | El Pachon | Argentina | Glencore | Active | Feasibility | 15.01 | 0.48 | 400 |
| 10 | NuevaUnion | Chile | Teck Resources | Active | Feasibility | 14.25 | 0.41 | 224 |
| 11 | Los Azules | Argentina | McEwen Mining | Active | Pre-feas/Scoping | 13.42 | 0.37 | 188 |
| 12 | Taca Taca | Argentina | First Quantum | Active | Pre-feas/Scoping | 12.93 | 0.42 | 244 |
| 13 | Frieda River | PNG | PanAust | Active | Feasib Complete | 12.55 | 0.47 | 175 |
| 14 | Twin Metals | US | Antofagasta | Active | Pre-feas/Scoping | 10.90 | 0.53 | 88 |
| 15 | El Arco | Mexico | Southern Copper | Active | Feasib Complete | 10.67 | 0.42 | 190 |
| 16 | Los Helados | Chile | NGEx Resources | Active | Pre-feas/Scoping | 10.62 | 0.36 | 115 |
| 17 | Los Volcanes | Chile | Antofagasta | Active | Reserves Devel | 9.90 | 0.50 | - |
| 18 | Wafi-Golpu | PNG | Newcrest Mining | Active | Feasib Complete | 9.79 | 0.98 | - |
| 19 | Baimskaya | Russia | KAZ Minerals | Active | Pre-feas/Scoping | 9.50 | 0.43 | 250 |

*Nevsun is currently subject to a recommended takeover offer from Zijin Mining; Source: S&P Global Market Intelligence, company data

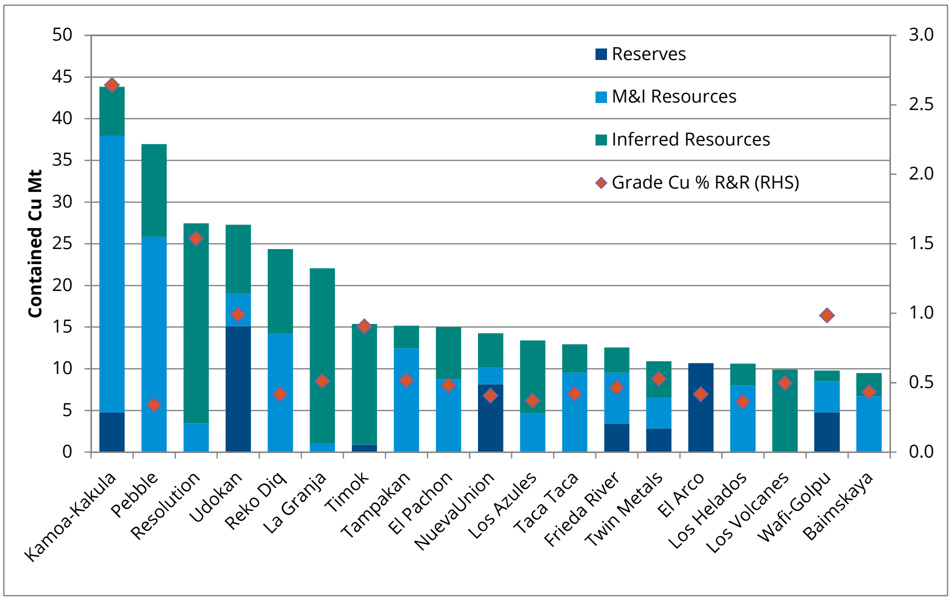
**Key to table**

| | |
|---|---|
| *Likely to be developed by current owner* | *Development possibly involving a third party* |

### Projects Developed by Existing Owners

Of these projects, we believe that 13 of them are likely to be developed by their current owners, which have the financial and technical resources to complete these projects without third-party involvement. Most of these projects are included in the profiles of each of the parent companies in our company analysis in Appendix 1.

**Figure 10: 19 Largest Copper Project Reserves and Resources (by Contained Cu)**



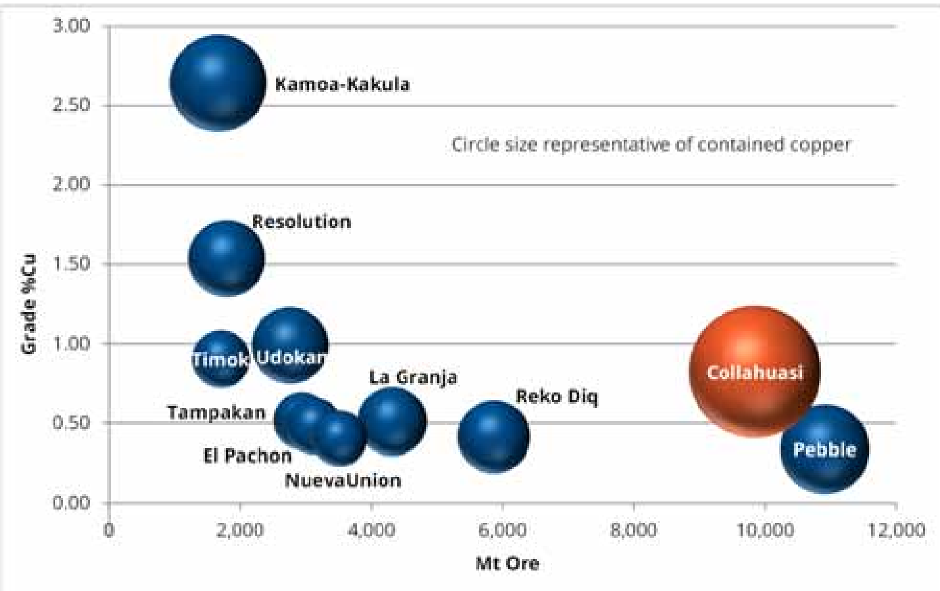

Source: S&P Global Market Intelligence, company data

### Projects with Potential for 3rd Party Involvement

There are a further six projects in Table 5 that have resources of over 9Mt that we consider could lead to third-party involvement.

Beyond these 19 projects, we have identified a further 109 projects that have a resource of at least 1.0Mt of copper. From this we have selected a further 15 projects with a resource of more than 3.0Mt copper that may also require third-party involvement. These are listed in Table 6.

**Figure 11: 10 Largest Copper Projects (by Contained Cu) and Collahuasi Mine**




Source: S&P Global Market Intelligence, company data

We have 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.

This is contradicted somewhat by KGHM's view, which sets criteria for the assessment of new resource projects of 1.5Mt of copper contained equivalent with a mine life of at least ten years, although this suggests a similar size of operation. KGHM also requires the assets to be below the 65th percentile on the cost curve, preferably below the 50th percentile.

**Table 6: 15 Other Selected Late-stage Copper Projects with Resources >3Mt Cu Ranked by Resource Size**

| Size Rank | Project | Country | Company | Status | Project Stage | Resource Cu Mt | Grade %Cu | Poss prod Kt/y Cu |
|---|---|---|---|---|---|---|---|---|
| 20 | Altar | Argentina | Aldebaran Res. | Active | Reserves Devel | 8.41 | 0.32 | - |
| 22 | Agua Rica | Argentina | Yamana Gold | Active | Feasib Complete | 7.58 | 0.43 | 161 |
| 27 | Casino | Canada | Western Copper | Active | Permitting | 6.68 | 0.17 | 78 |
| 29 | Ann Mason | US | Mason Resources | Active | Pre-feas/Scoping | 6.53 | 0.30 | 109 |
| 30 | Santa Cruz | US | Amrich Minerals | Active | Reserves Devel | 6.02 | 0.90 | - |
| 38 | Cascabel | Ecuador | SolGold | Active | Reserves Devel | 4.75 | 0.44 | - |
| 39 | Vizcachitas | Chile | Los Andes Copper | Active | Pre-feas/Scoping | 4.97 | 0.37 | 179 |
| 40 | Khoemacau | Botswana | Cupric Canyon Cap | Active | Feasib Complete | 4.85 | 1.33 | 50 |
| 45 | Josemaria | Argentina | NGEx Resources | Active | Pre-feas/Scoping | 4.34 | 0.29 | - |
| 48 | Upper Kobuk | US | Trilogy Metals | Active | Feasibility | 3.53 | 1.87 | 72 |
| 49 | Canariaco Norte | Peru | Candente Copper | Active | Feasibility | 4.03 | 0.44 | 119 |
| 50 | Harper Creek | Canada | YellowHead Mining | On hold | Feasib Complete | 3.62 | 0.26 | 59 |
| 53 | Ak-Sug | Russia | Intergeo MMC | Active | Pre-feas/Scoping | 3.38 | 0.47 | 96 |
| 54 | King-king | Philippines | St Augustine Gold | Active | Feasibility Started | 3.19 | 0.27 | 62 |
| 55 | Yandera | PNG | Era Resources | Active | Pre-feas/Scoping | 3.08 | 0.42 | 80 |

Source: S&P Global Market Intelligence, company data

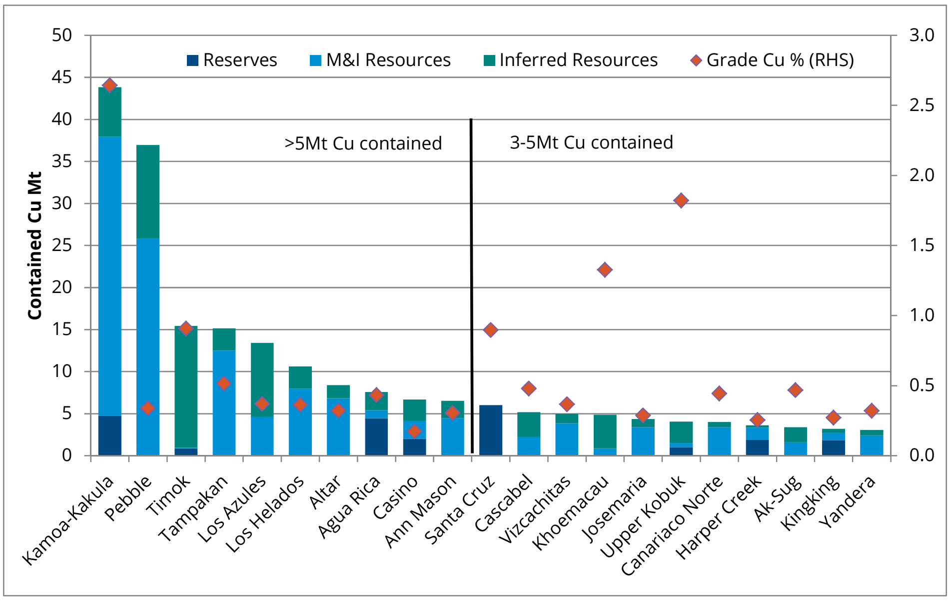
Of the 21 projects selected, it can be seen that most of them are located in significant copper producing regions: four are located in Argentina and the US, and two in each of Canada, Chile and the Philippines. One project is inactive and one is currently on hold. We provide summaries of these projects later in this section and more thorough reviews in Appendix 4.

We have not included Frieda River (ranked 13) in our list because it is 80%-held by PanAust, which is owned by Chinese state-owned company Guangdong Rising Assets Management (GRAM). However, Highlands holds a 20% interest in the project and has been trying to sell its interest in the project due to the scale and financial requirements. Also, Highlands and GRAM have been in dispute since 2016 regarding obligations under the joint-venture agreement. Highlands announced that the process has generated significant interest from potential buyers.

## Some Characteristics of Selected Copper Development Projects

The size and grade of copper reserves and resources are shown for the 21 selected copper projects that we believe could lead to third-party involvement in Figure 12. By far the two largest projects are Kamoa-Kakula and Pebble. It can be seen that the majority of these projects have a grade of about 0.3-0.5% copper, and a few with significantly higher grades but smaller size orebodies.

**Figure 12: 21 Largest Copper Projects that May Require 3rd Party Involvement**




Source: S&P Global Market Intelligence, company data

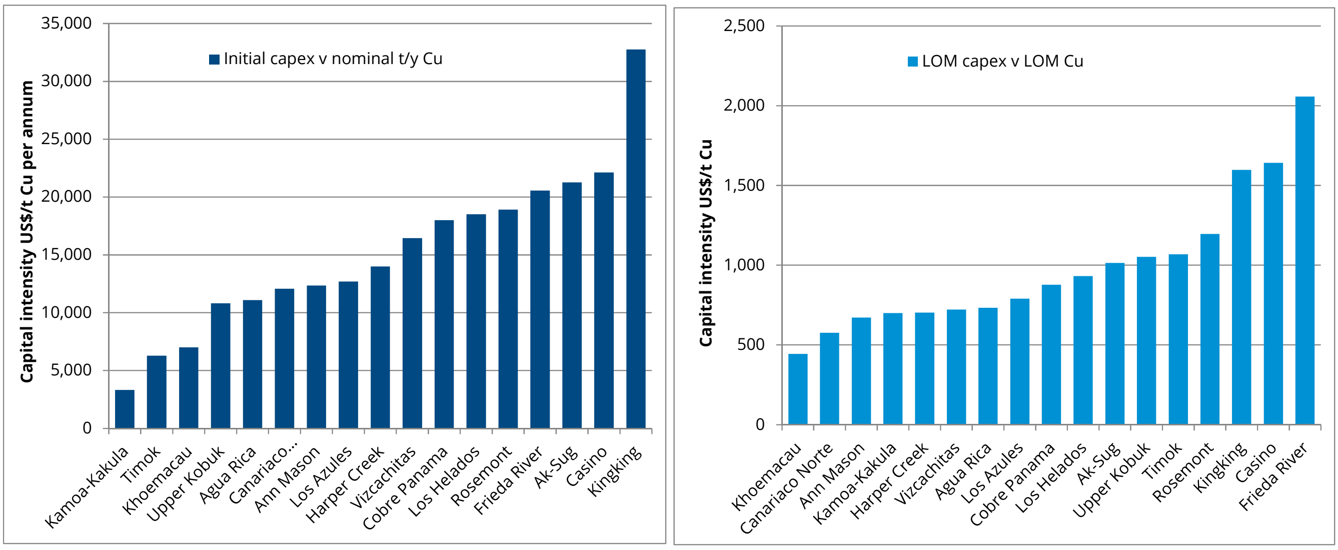
Looking at just the top 55 development projects in our database, detailed project development data is available for 17 of these, mostly from Canadian NI 43-101 technical reports. We have compiled this data, along with data from developing mine Cobre Panama as a benchmark, to try and provide further insight into some of our selected projects, because 15 of our 21 selected projects are within this group of 17 projects.

The scale of the Kamoa-Kakula and Cobre Panama projects once again stand out in Figure 14, both in terms of capital requirement and expected NPV.

### 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 17 projects. However, sometimes this can be misleading and so we have also shown capital intensity on the basis of the life-of-mine (LoM) capex relative to the LoM copper production. This measure shows a narrower range of outcomes and better highlights the more capital-intensive projects.

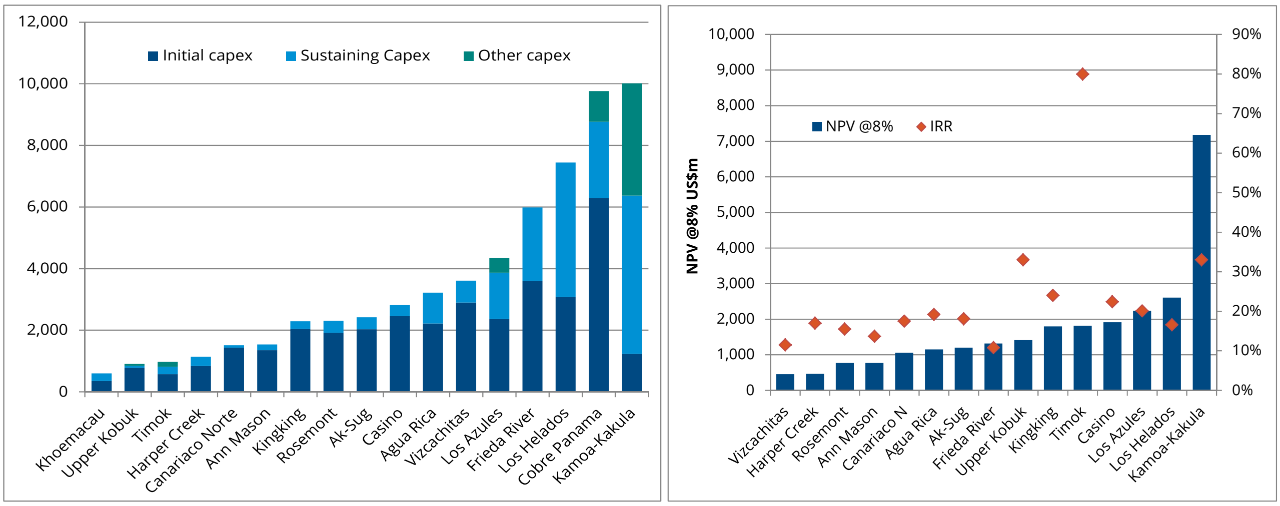
**Figure 13: 17 Copper Projects with Project Data — Capital intensity — Initial & LoM Capex**




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

Figure 14 shows the initial, sustaining and other capex requirements for each of these projects. It shows how the initial capex can sometimes give a misleading picture of the overall capex requirements. We also 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%.

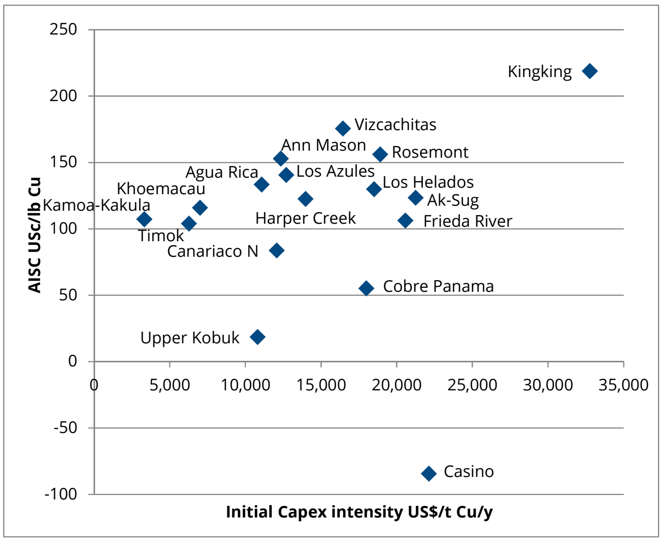
**Figure 14: Copper Projects with Detailed Project Data — Projected Capex and Reported NPV (US$m)**

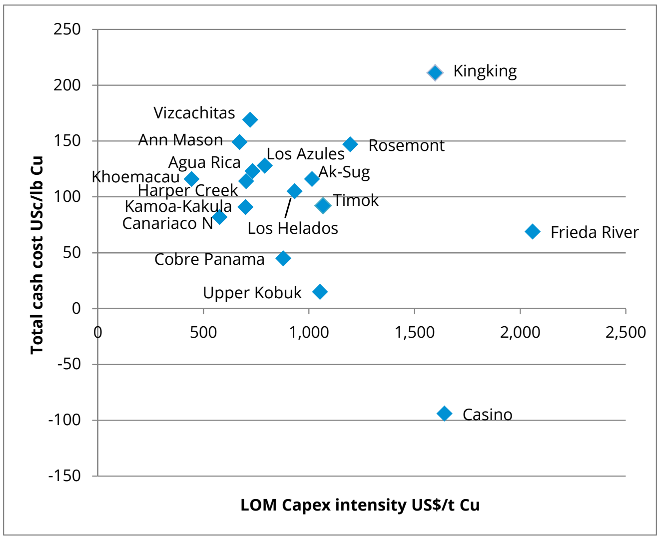



Source: S&P Global Market Intelligence, company data, RFC Ambrian

Of course, it is also necessary to look at the 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 15. 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 15: Copper Projects with Project Data — Capital Intensity (Initial and LoM capex) vs. Costs (Cash & AISC)**

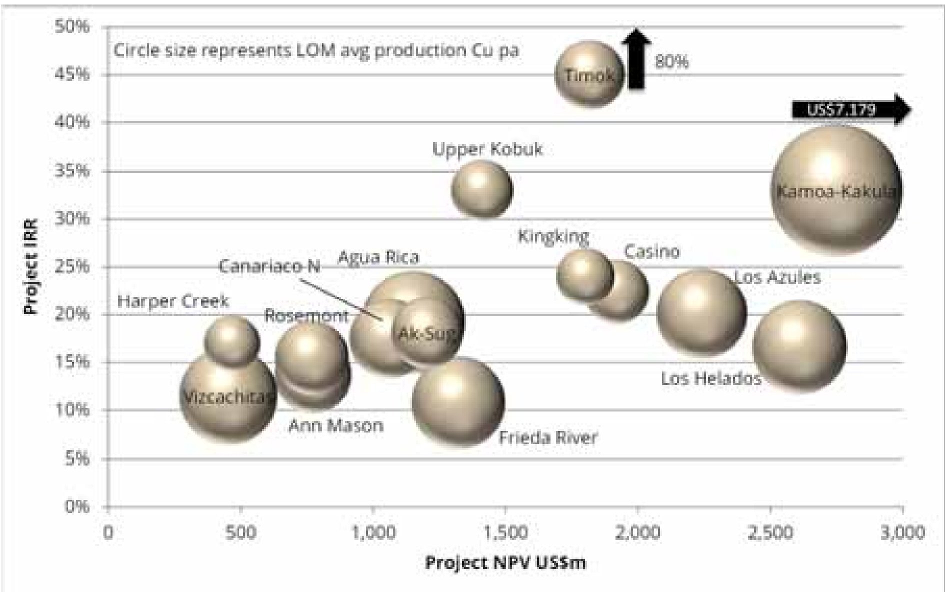



Source: RFC Ambrian, company data

The LoM capex intensity chart shows that the Khomacau, Canariaco Norte, Cobre Panama, Upper Kobuk and Casino projects have the lowest capital intensity and lowest operating cost combination and could be deemed to be the highest quality (or return) projects.

**Figure 16: Copper Projects with Project Data — IRR vs. NPV**




Source: RFC Ambrian, company data

Figure 16 shows the NPV against the IRR and the size of bubble represents the LoM average annual copper production. Timok and Kamoa-Kakula have been moved inwards to better present the data.

## Qualifying the Selected Copper Development Projects

Further to more detailed analysis of the 21 projects, we have divided them into three groups which we have called Low, Medium, and High probability cases. 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 7: Projects Ranked by Probability of Further Outside Involvement**

| Size Rank | Project | Company | RFC Ambrian Probability |
|---|---|---|---|
| 11 | Los Azules | McEwen Mining | High |
| 16 | Los Helados | NGEx Resources | High |
| 38 | Cascabel | SolGold | High |
| 39 | Vizcachitas | Los Andes Copper | High |
| 48 | Upper Kobuk | Trilogy Metals | High |
| 20 | Altar | Aldebaran Res. | Medium |
| 22 | Agua Rica | Yamana Gold | Medium |
| 27 | Casino | Western Copper | Medium |
| 40 | Khoemacau | Cupric Canyon Cap. | Medium |
| 49 | Canariaco Norte | Candente Copper | Medium |
| 50 | Harper Creek | YellowHead Mining | Medium |
| 1 | Kamoa-Kakula | Ivanhoe Mines | Low |
| 2 | Pebble | Northern Dynasty | Low |
| 7 | Timok | Nevsun Resources* | Low |
| 8 | Tampakan | Indophil Resources | Low |
| 29 | Ann Mason | Mason Resources | Low |
| 30 | Santa Cruz | Amrich Minerals | Low |
| 53 | Ak-Sug | Intergeo MMC | Low |
| 54 | King-king | St Augustine Gold | Low |
| 55 | Yandera | Era Resources | Low |
| 45 | Josemaria | NGEx Resources | See Los Helados |

*Significant producers of zinc; Source: S&P Global Market Intelligence, company data

We believe that just five projects have a high probability of potential third-party activity. A brief summary of the five projects is given below. A detailed description of each of these 21 projects can be found in Appendix 4.

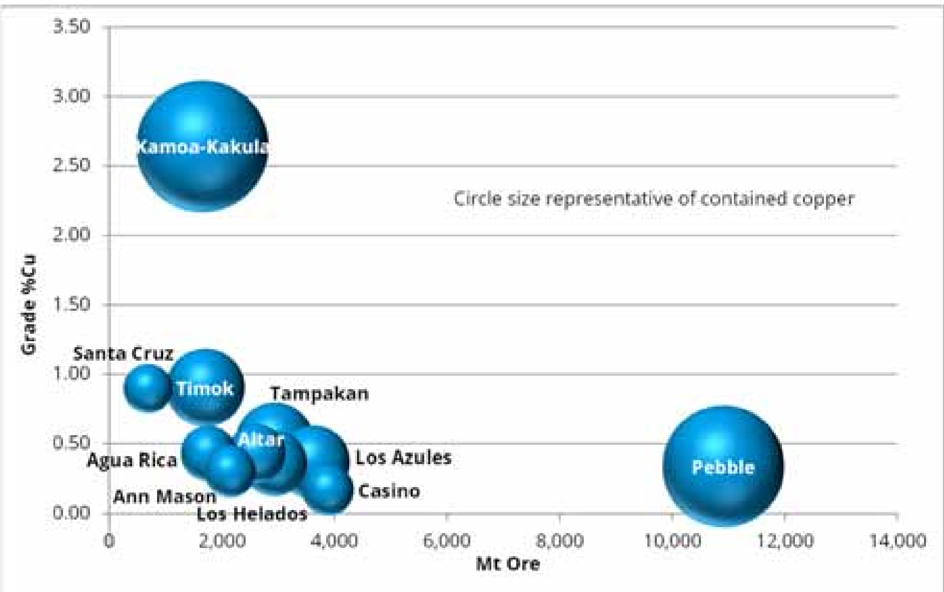
### Los Azules

The Los Azules Project is 100%-owned by **McEwen Mining** (MUX CN: C$1.96 | US$509m) and is a porphyry copper deposit located in the San Juan Province of Argentina, near the border with Chile. A PEA scoping study was completed on Los Azules in 2009 and most recently updated in 2017. The project contains 13.4Mt of copper. An open-pit mine and concentrator plant that produces a copper concentrate as the final product for export is anticipated. Production of some 153kt/y at a cash cost of US¢128/lb is anticipated over a 36-year life with an initial capital cost of US$2.4bn.

### Los Helados

**NGEx Resources** (NGQ CN: C$1.00 | US$175m) holds a 60% interest in the Los Helados Project and 100% of the Josemaría deposit. **Pan Pacific Copper** holds 40% of Los Helados. In 2016 NGEx completed a PEA for an integrated mining operation that incorporated the Los Helados deposit, located in the Andes mountains of the Atacama Region in Northern Chile and the Josemaría deposit, located in San Juan Province, Argentina, collectively termed the Constellation Project. Los Helados contains 10.6Mt copper and Josemaría 4.3Mt copper. Project Constellation is expected to produce 166kt/y of copper at a cash cost of US¢105/lb over a 48-year life. The initial capital investment for the project is estimated to be US$3.08bn. A pre-feasibility study is expected to be completed in 1Q19 and then the company will start permitting.

**Figure 17: Copper Projects >5Mt Cu Which May Require 3rd Party Involvement**




Source: S&P Global Market Intelligence, company data

### Cascabel

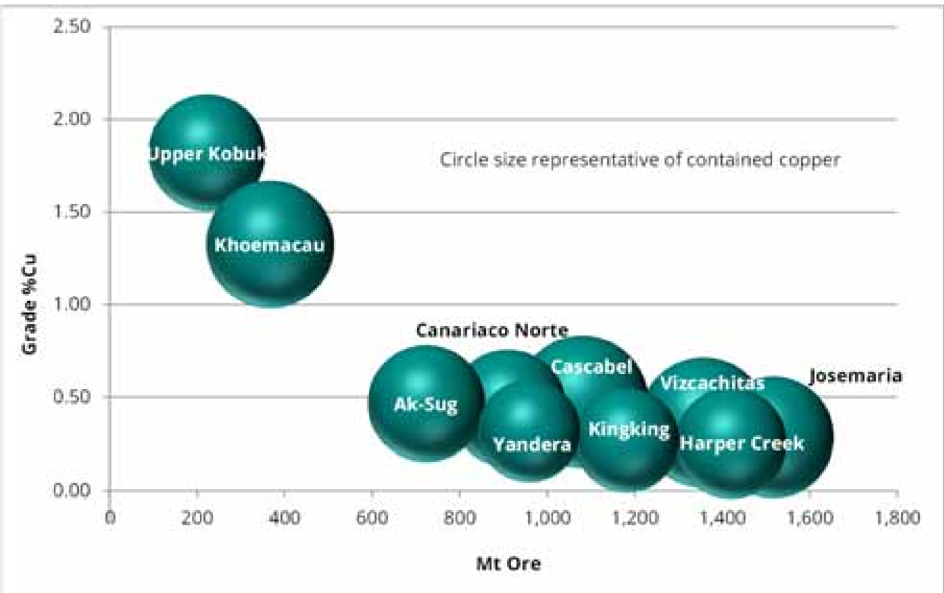
Australian-based **SolGold** (SOLG CN: C$0.67 | US$861m) owns 85% of the Cascabel Project located in Ecuador, near the border with Colombia. Cascabel is an early-stage exploration project and the deposit contains 5.2Mt of copper. SolGold has been focused on growing both the core resource and the high-grade zone at Alpala. It expects to provide a significant update to the maiden resource in 4Q18 and a PEA is expected to be complete in 1Q19.

This project has been the focus of both Newcrest and BHP Billiton lately, who have each acquired stakes in the company (14.5% and 11.2% respectively). These two third-party involvements could result in the purchase of further stakes by one or both companies.

### Vizcachitas

**Los Andes Copper** (LA CN: C$0.25 | US$52m) owns 100% of the Vizcachitas Project, located in Chile in an area of good infrastructure. Vizcachitas is an advanced-stage copper-molybdenum porphyry deposit containing 5.0Mt of copper. A PEA was reported in 2014, with subsequent drilling taking place in 2017. A PFS and progression of the environmental permits is expected by 2020. The PEA proposed an open-pit mine with a number of scenarios, but potentially producing 178kt/y of copper at a cash cost of US¢169/lb over a 28-year life, with initial capex of US$2.9bn.

**Figure 18: 11 Copper Projects >3Mt Cu Which May Need 3rd Party Involvement**




Source: S&P Global Market Intelligence, company data

### Upper Kobuk

**Trilogy Metals'** (TMQ CN: C$2.70 | US$273m) principal asset is the Upper Kobuk Mineral Projects (UKMP), located in Alaska, US. The most advanced projects in this prospective district are Arctic and Bornite. The project has 4.0Mt of copper as well as cobalt at the Bornite deposit. This operation is expected produce about 72kt/y of copper at a cash cost of just US¢15/lb over a 12-year life with an initial capital cost of US$780m. Trilogy anticipates a draft EIS by March 2019 and final EIS by December 2019. It expects the National Park Service to complete the EEA by end of 2019.

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# Section 2 —
# Potential Acquirers

# Who Could be the Acquirers?

## Existing Copper Producers

First, in order to consider the potential acquisitions landscape, it is necessary to be aware of who the main players are in the industry, the assets that are potentially available, and the quality of these assets. The top copper producing companies are outlined below, and the top copper mines in terms of production, reserves and costs can be found in Appendix 6. These help to provide a benchmark when looking at current undeveloped exploration projects.

Second, in order to analyse who will be the next acquirer of copper assets we have scrutinised the strategy statements of each of the existing copper producers, reviewed their past acquisitions and disposals, and looked at recent presentations and transcripts. We have also analysed their balance sheets and cashflows to try and make considered opinions about their likely involvement in future M&A. A summary of each of the Tier 1, 2 and 3 companies can be found in the Appendices. We have also looked at new entrants, private equity and private investment firms.

### Top Producers of Mined Copper 2017

We have identified 135 Western copper mines in operation in 2017. Of these, 70 produced more than 50kt and 40 produced more than 100kt. The top 40 operations were operated by just 21 different listed mining companies, including three Chinese-controlled companies.

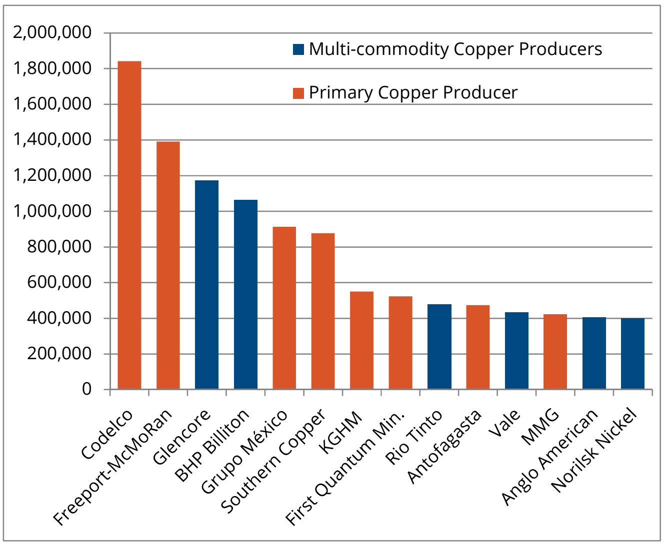
The 14 largest producers of copper (producing >400kt/y), based on 2017 attributable mined production, are listed in Table 8. The top four companies have been consistent +1.0Mt copper producers for the past three years.

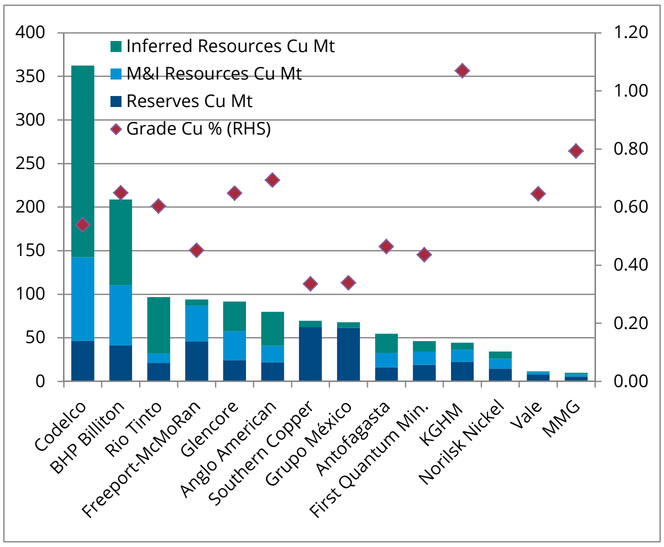
**Table 8: Top 14 Mined Copper Producers 2017**

| | | Attrib Mined Copper Production (t) | | | No of copper |
|---|---|---|---|---|---|
| | Company | 2015 | 2016 | 2017 | mines 2017* |
| 1 | Codelco | 1,891,376 | 1,827,267 | 1,842,075 | 10 |
| 2 | Freeport-McMoRan | 1,513,638 | 1,695,528 | 1,391,168 | 10 |
| 3 | Glencore | 1,502,200 | 1,425,800 | 1,309,700 | 9 |
| 4 | BHP Billiton | 1,177,763 | 1,113,400 | 1,063,200 | 4 |
| 5 | Grupo México | 795,821 | 954,322 | 913,285 | 7 |
| 6 | Southern Copper | 742,993 | 899,955 | 876,979 | 4 |
| 7 | KGHM | 564,200 | 677,000 | 656,400 | 5 |
| 8 | First Quantum Min. | 349,923 | 495,157 | 523,803 | 6 |
| 9 | Rio Tinto | 504,400 | 523,300 | 478,100 | 3 |
| 10 | Antofagasta | 351,160 | 476,620 | 474,140 | 5 |
| 11 | Vale | 400,700 | 431,900 | 433,700 | 2 |
| 12 | MMG | 186,544 | 351,049 | 423,389 | 3 |
| 13 | Anglo American | 708,800 | 577,100 | 579,300 | 3 |
| 14 | Norilsk Nickel | 369,426 | 360,217 | 401,081 | NA |

*Including minority interests; Source: S&P Global Market Intelligence, company data

**Figure 19: Top 14 Copper Producers' Attributable Mined Copper Production 2017 (t) and Reserves & Resources (Mt)**

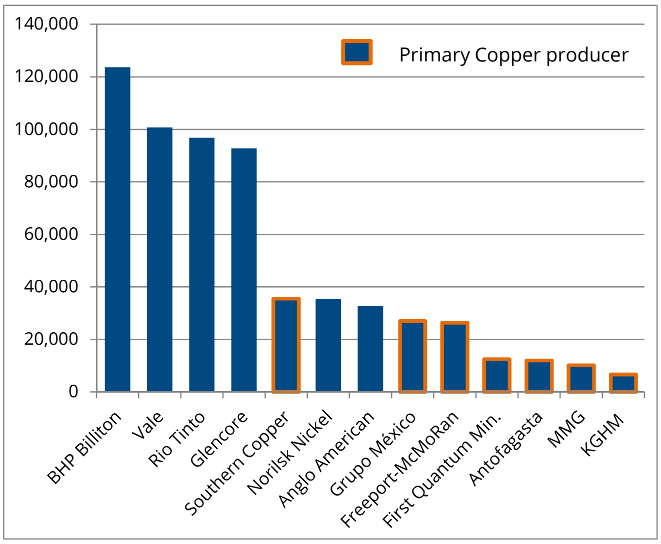


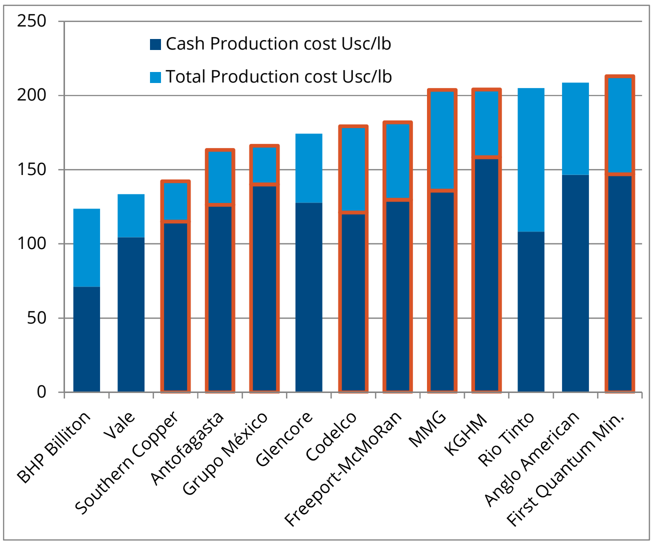




Source: S&P Global Market Intelligence, company data, RFC Ambrian

Apart from **Codelco**, all of these top 14 companies are listed and eight of these companies are primary copper producers. All of these companies have the potential to acquire copper assets, but we believe they are only likely to purchase large operations or projects to complement their existing portfolios. For the multi-commodity copper producers, any acquisition or development project would also have to compete for capital with assets in other commodities within their portfolios.

**Figure 20: Top 14 Copper Producers' Enterprise Value (US$m) and Attributable Production Costs (US¢/lb)**




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

Figure 20 shows the production costs of the top 14 producers that are attributable to their mined copper production (where data is available) and are weighted to the 2017 copper production at the different mining operations. The total production cost is the cash cost plus depreciation and amortisation. Similar data is shown for each of our copper tiers further within this section.

As a further benchmark for thinking about sizes of potential acquisitions for different groups of companies, Table 9 summarises the average for a number of criteria for the operations of each group of companies. While some of these averages can be slightly distorted by a particularly large project, they do give an indication of the general characteristics of each group.

**Table 9: Average Characteristics of Copper Mine Companies**

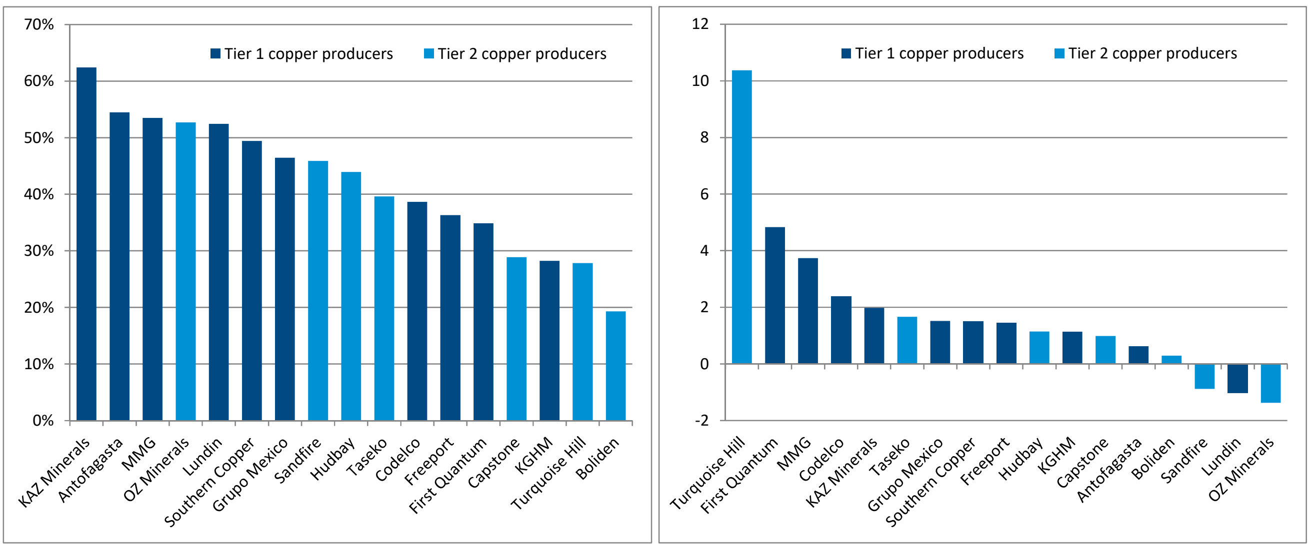
| Copper Group | Mine Prod'n 2017 (t) | Cash cost 2017 US¢/lb | Prod cost 2017 US¢/lb | Reserve Life years | R&R Life years | No. Oper. Mines |
|---|---|---|---|---|---|---|
| Multi-commodity | 241,284 | 121 | 178 | 28 | 90 | 3.9 |
| Tier 1 Cu | 151,994 | 129 | 177 | 25 | 51 | 5.5 |
| Tier 2 Cu | 98,225 | 137 | 194 | 14 | 33 | 1.6 |
| Tier 3 Cu | 27,928 | 201 | 257 | 17 | 56 | 1.7 |
| **Overall average** | **131,006** | **131** | **186** | **24** | **66** | **3.8** |

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

Another key factor in any company's decision to make an acquisition is its affordability. Figure 21 shows the EBITDA margins and Net Debt-to-EBITDA multiples for 17 copper producers from Tier 1 and 2. While this does not show the whole picture, it does highlight the companies with weak and strong balance sheets and gives a measure of the current profitability of the producers. Of course, companies can also use their equity for M&A directly or to raise capital.

**Turquoise Hill** stands out as having a particularly weak balance sheet, although it is majority-owned and backed by **Rio Tinto**, because it is in the middle of development of the Oyu Tolgoi underground mine. Similarly, **First Quantum** is in the middle of development of the Cobre Panama mine.

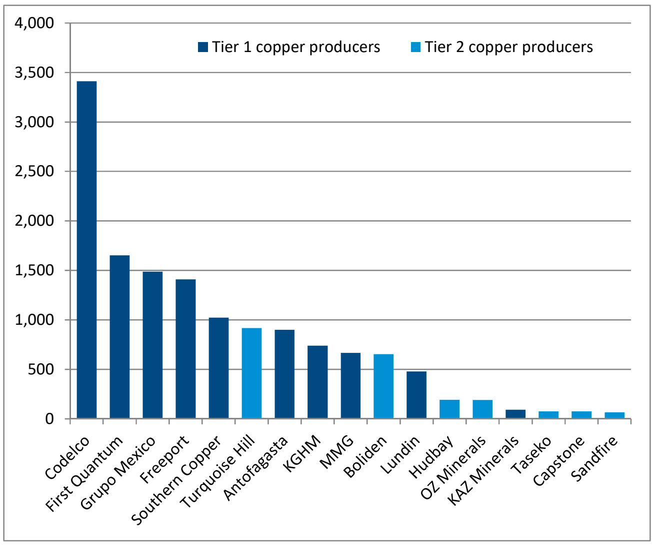
**Figure 21: Company EBITDA Margin and Net Debt/EBITDA 2017**

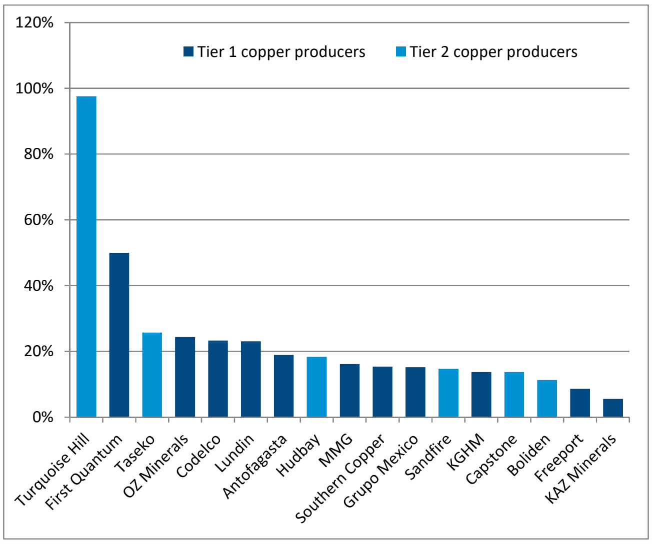



Source: S&P Global Market Intelligence, company data, RFC Ambrian

Another factor in the acquisition decision related to the balance sheet is the expected future level of capex. Companies generally have a level of sustaining capex for their ongoing operations, but may also require capex for new operations or expansions. The pipeline of assets requiring development capex or assets needing expansion capex can be important. Figure 22 shows the amount spent by the Tier 1 and 2 copper producers on capex in 2017 in absolute terms and as a percentage of revenue.

**Figure 22: Company Capex (Including Expansion Capex) (US$m) and Capex as % Revenue 2017**

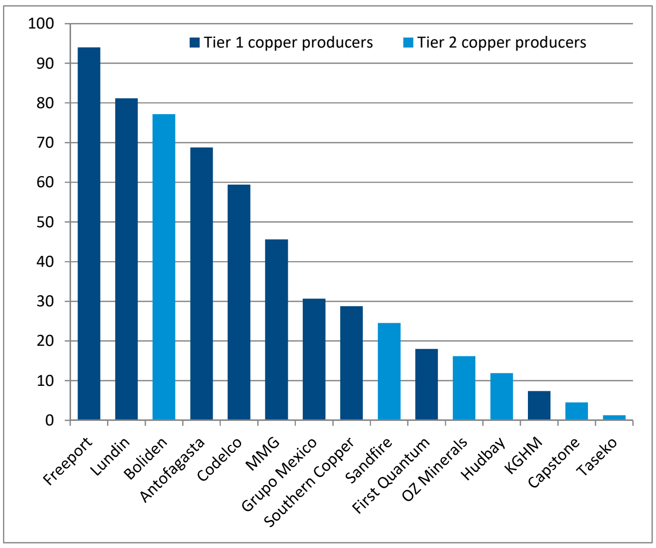


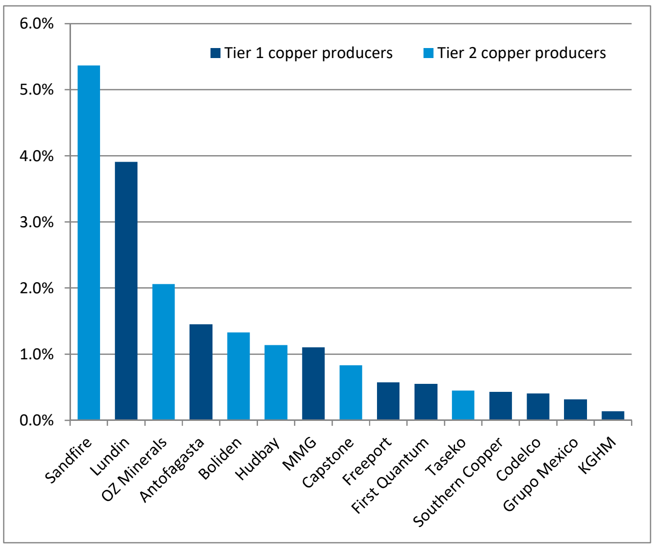




Source: Company data, RFC Ambrian

Also a factor in the acquisition strategy is the approach to exploration and the development of brownfield and greenfield exploration. Figure 23 shows the amount spent by the Tier 1 and 2 copper producers on exploration in 2017 in absolute terms and as a percentage of revenue.

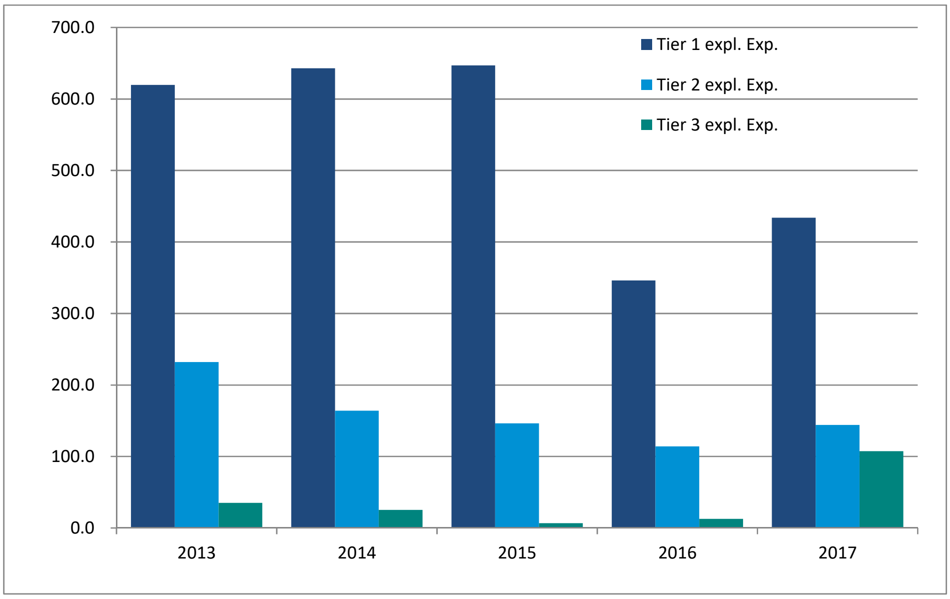
**Figure 23: Company Exploration Expenditure (US$m) and Exploration Expenditure as % Revenue 2017**




Source: Company data, RFC Ambrian

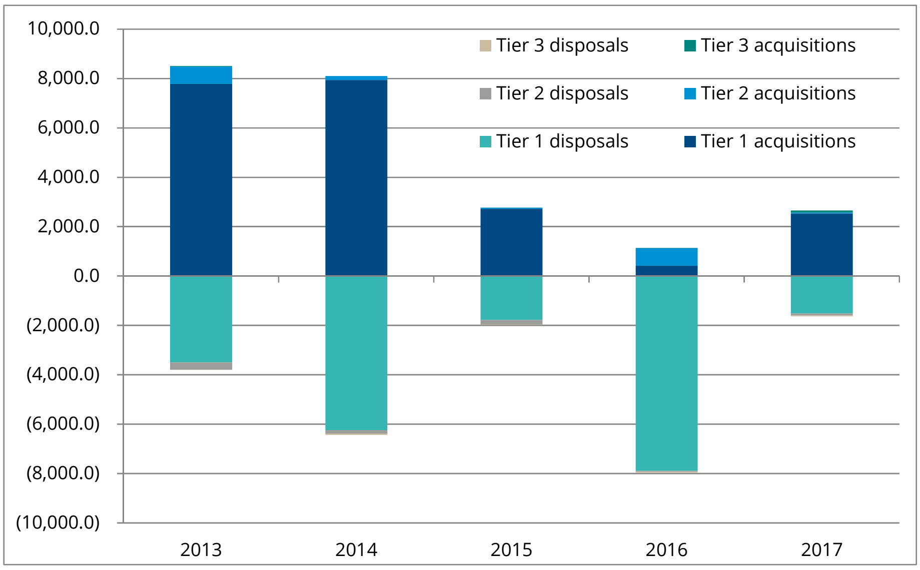
**Figure 24: Tier 1, 2 & 3 Copper Producers' Exploration Exp. 2013-2017 (US$m)**




Source: Company data

Figure 24 shows the combined exploration expenditure of the Tier 1, 2 and 3 copper producers for the past five years. The Tier 3 step up in 2017 reflects the inclusion of Nexa Resources.

**Figure 25: Tier 1, 2 & 3 Acquisitions and Disposals 2013-2017 (US$m)**




Source: Company data

Figure 25 shows the combined asset and investment acquisitions and disposals of the Tier 1, 2 and 3 copper producers for the past five years. These include other assets, including non-core assets, as well as copper assets. It shows how significant the Tier 1 companies are in M&A activity relative to Tier 2 and 3, accounting for 92% of the acquisitions and 96% of the disposals over the past five years.

### Recent Acquisitions of Copper Assets by Copper Producers

In 2018 **KAZ Minerals** agreed to acquire a 100% interest in the Baimskaya copper project in Russia from **Aristus Holdings** for some US$902m in cash and shares. It has the potential to produce some 250kt/y of copper and 400koz/y gold, with first quartile net cash costs over the life-of-mine with an indicative capex of some US$5.5bn.

We calculate that KAZ Minerals has paid just US$71/t of equivalent copper reserves and resources (excluding the gold reserves and resources). This compares with the 10-year average of US$193/t of copper equivalent reserves and resources for projects at feasibility stage (see page 58). This looks like a good deal for KAZ Minerals.

Also in 2018, **OZ Minerals** acquired **Avanco Resources,** a Brazilian-focused copper-gold company, for some US$345m and **Teck Resources** acquired an additional 14% stake in the Quebrada Blanca mine from a private Chilean company for US$263m.

In 2017 **First Quantum** acquired an effective additional 10% interest in the Cobre Panama mine, currently under construction, for about US$635m. This followed the acquisition of 80% of Cobre Panama through its takeover of **Inmet Mining** in 2013 for US$5.06bn.

At the moment **Nevsun** is likely to be acquired by **Zijin Mining**. Nevsun's board has accepted an all-cash offer of C$6.00/share, or US$1.41bn. This follows a hostile takeover bid of C$4.75/share from **Lundin Mining**. The Zijin Mining bid is a 57%, premium to the unaffected trading price prior to Lundin Mining first publicly announcing its desire to acquire Nevsun. Nevsun operates the Bisha copper-zinc mine in Eritrea and is developing the Timok copper-gold project in Serbia.

We calculate Nevsun's total attributable copper reserves and resources at these two operations at 9.2Mt contained copper, or 12.2Mt equivalent copper (with zinc, silver and gold credits). On this basis Zijin Mining is paying US$116/t of equivalent copper assets. On page 58 we show that operating assets have been acquired at an average of US$307/t copper equivalent of reserves and resources and US$74/t for exploration projects. If we weight these two values between the reserves and resources at the mine and project, an indicative price for this acquisition is US$104/t. On this basis, it appears that Zijin Mining is overpaying, albeit not significantly.

### The Strategy of Tier 1 Copper Producers

These ten companies currently have interests in 55 copper mines around the world, which had an average output of some 152kt/y in 2017 and operated at a weighted average cash cost of US¢129/lb and a production cost of US¢177/lb. We believe that these are the benchmarks they will use when looking to acquire/develop new assets.

They also each have a portfolio of copper assets where the average reserve life is 25 years and the resource life is 51 years, based on 2017 reported resources and production levels, although these are slightly distorted higher by the reserves of Grupo Mexico and Southern Copper, and the resources of Codelco.

These companies have been active in acquisitions and sales of assets in recent years, with US$21.4bn of acquisitions over the past five years and US$20.9bn of disposals, although not all of these represent copper transactions. They are therefore potentially the key candidates for further M&A activity in our view.

In order to analyse who will be the next acquirer of copper assets we have scrutinised the strategy statements of each of the existing copper producers, reviewed their past acquisitions and disposals, and looked at recent presentations and transcripts. We have also analysed their balance sheets and cashflows in order to try and make considered opinions about their likely involvement in future M&A. Table 10 summarises our analysis of the Tier 1 copper producers' likely strategy. More detailed analyses of each company can be found in Appendix 1.

**Table 10: Tier 1 Copper Producer Strategy Forecast and Asset Quality Analysis**

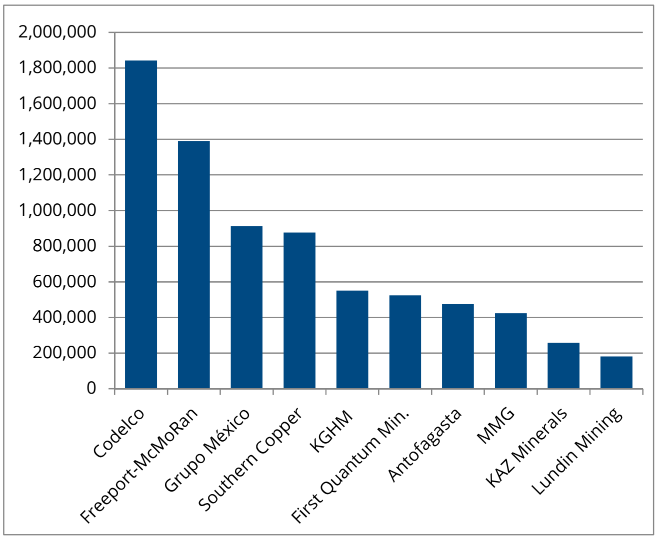
| | Asset Quartile* | | | Asset | Asset | Takeover | Capex | ND/ |
|---|---|---|---|---|---|---|---|---|
| **Company** | **Prod'n** | **R&R** | **Cash Cost** | **Acquirer** | **Disposer** | **Target** | **Outlook** | **EBITDA** |
| Codelco | 1 | 1 | 3 | Unlikely | Unlikely | Unlikely | High | 2.4 |
| Freeport-McMoRan | 1 | 1 | 2 | Likely | Possible | Possible | Moderate | 1.5 |
| Grupo Mexico | 1 | 1 | 2 | Unlikely | Possible | Unlikely | High | 1.5 |
| Southern Copper | 1 | 1 | 1 | Unlikely | Unlikely | Unlikely | Moderate | 1.5 |
| KGHM | 1 | 1 | 3 | Possible | Possible | Unlikely | Low | 1.1 |
| First Quantum Min. | 1 | 1 | 2 | Possible | Possible | Possible | High | 4.8 |
| Antofagasta | 1 | 1 | 2 | Likely | Unlikely | Unlikely | Moderate | 0.6 |
| MMG | 2 | 2 | 2 | Possible | Possible | Unlikely | Low | 3.7 |
| KAZ Minerals | 2 | 2 | 1 | Possible | Unlikely | Unlikely | Low | 2.0 |
| Lundin Mining | 2 | 3 | 2 | Likely | Unlikely | Possible | Low | (1.0) |

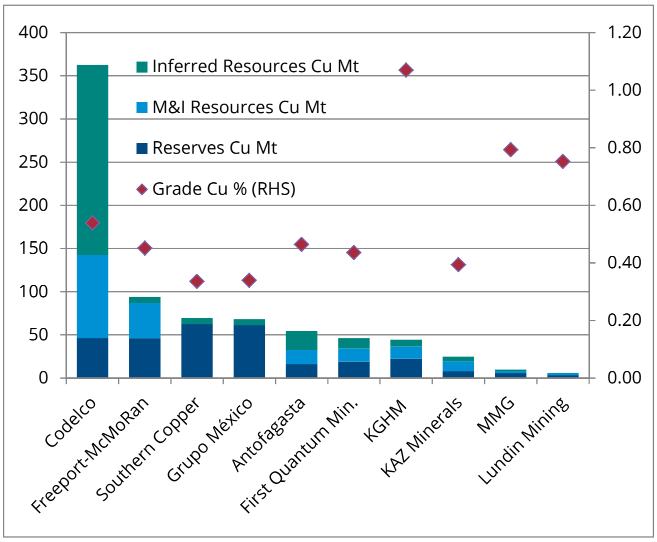
*Relative to top 49 copper producers where data is available; Source: S&P Global Market Intelligence, company data, RFC Ambrian estimates

It would be easy to say that all of these Tier 1 copper companies are potential asset acquirers. While this is probably true if they had a strong desire to acquire a particular asset, in the medium term several of them have exploration and development projects that require capex commitments while some of these companies also need to strengthen their balance sheets.

The clearest example of this is Codelco, which over the next ten years needs to invest US$39bn with a current debt of US$14.4bn. Grupo Mexico continues to invest strongly, not only in its mining assets, but also in its transportation division and is potentially looking to invest in Mexico's hydrocarbon industry. Finally, First Quantum continues to invest in the development of its large Cobre Panama Project while having the highest Net Debt-to-EBITDA ratio of the group.

**Figure 26: Tier 1 Copper Producers' Attrib. Copper Production 2017 (t) and Reserves & Resources Copper (Mt)**



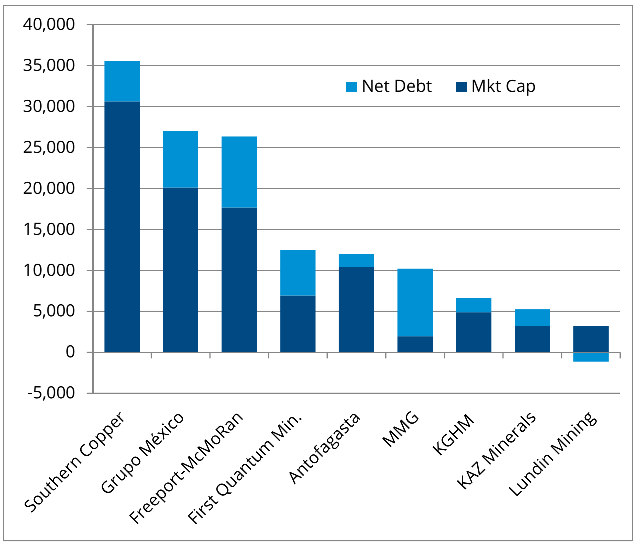



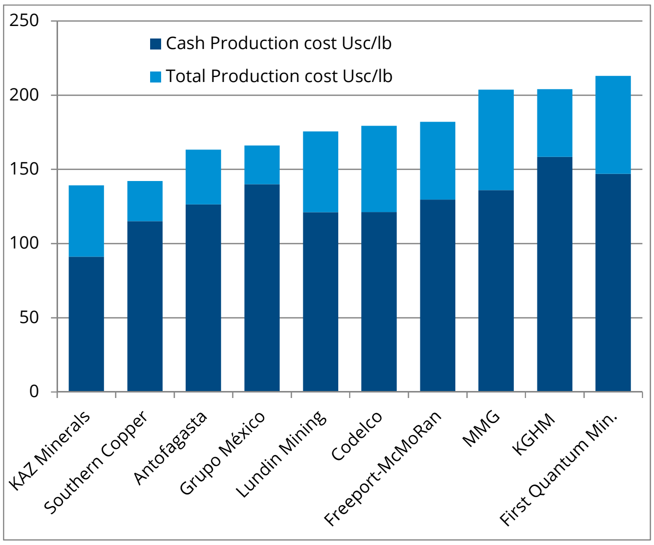

Source: S&P Global Market Intelligence, company data, RFC Ambrian estimates

The Tier 1 combined accounts on page 73 show that this group has steadily improved operating cashflow and generally been reducing capex over the past five years, improving free cashflow and reducing net debt. Over the next few years strategic decisions will need to be made about what to do with this free cashflow.

Exploration expenditure and capex for the Tier 1 copper producers has also fallen steadily over the past five years. Codelco, Freeport-McMoRan, Grupo Mexico, Southern Copper, Antofagasta and KGHM have continued to spend capex mainly on brownfield copper expansion, while First Quantum, MMG and KAZ Minerals have been bringing new copper mines on stream.

**Figure 27: Tier 1 Copper Producers' Enterprise Value (US$m) and Attributable Production Costs (US¢/lb)**




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

There appear to be limited advanced-stage copper development projects within this group. Southern Copper has a couple of projects, the most advanced being the Tia Maria Project, and KAZ Minerals has the Baimskaya Project. This suggests that these companies will now use their stronger balance sheets to step up exploration and M&A activity to improve their exploration and development pipelines.

The three companies that we currently believe are most likely to be involved in some form of M&A activity in the near term are Freeport-McMoRan, Antofagasta and Lundin Mining.

For **Freeport McMoRan**, the resolution of its position in Grasberg puts the company in a position where it has more certainty over its assets in Indonesia. Its balance sheet has improved significantly, following the recent sale of some assets, and as a result we believe it may well seek to re-expand its portfolio and make new copper acquisitions.

**Antofagasta** has a strong balance sheet and has some organic growth opportunities, but its growth pipeline appears limited. With its strong cashflow we believe it may now be in a position to participate in copper M&A to help expand its late-stage exploration and development assets.

It appears that **Lundin Mining** is in the market to make an acquisition given its recent failed bid for Nevsun. It has a very strong balance sheet and a limited pipeline of exploration and new development projects. We would therefore expect Lundin to be a participant in further copper M&A activity in the near future.

It is worth noting that Freeport-McMoRan, Antofagasta and Lundin currently have the highest absolute exploration expenditures in the group, although Freeport appears to be underspending relative to its revenues, but this may reflect the recent issues at Grasberg with the Indonesian Government.

This is another data point suggesting that these three companies recognise the need to improve their exploration and development pipelines.

### The Strategy of Tier 2 Copper Producers

We have aggregated data for nine of these ten Tier 2 copper producers (data for the listed Chinese company Western Mining is limited). Individual company summaries are available in Appendix 2. Combined, these companies have interests in 15 copper operations, which had an average output of some 98kt in 2017, operating at a weighted average cash cost of US¢137/lb and a production cost of US¢194/lb.

They also each have a portfolio of copper assets where the average reserve life is 14 years and the resource life is 33 years, based on 2017 reported resources and production levels, although these are slightly distorted upwards by the significant reserves and resources of Turquoise Hill.

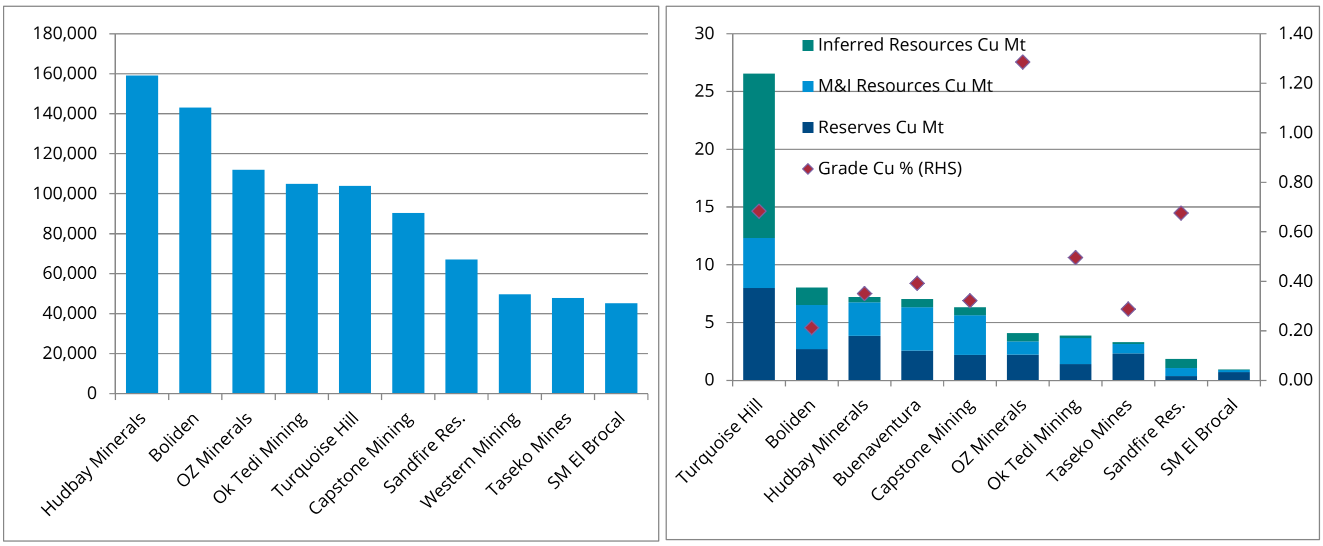
**Table 11: Tier 2 Copper Producer Strategy Forecast and Asset Quality Analysis**

| | Asset Quartile* | | | Asset | Asset | Takeover | Capex | ND/ |
|---|---|---|---|---|---|---|---|---|
| Company | Prod'n | R&R | Cash Cost | Acquirer | Disposer | Target | Outlook | EBITDA |
| Hudbay Minerals | 2 | 3 | 1 | Possible | Unlikely | Possible | Moderate | 1.2 |
| Boliden | 2 | 2 | 1 | Likely | Unlikely | Unlikely | Low | 0.3 |
| OZ Minerals | 3 | 3 | 1 | Unlikely | Unlikely | Possible | Moderate | (1.4) |
| OK Tedi Mining | 3 | 3 | 1 | Unlikely | Unlikely | Unlikely | Moderate | (0.4) |
| Turquoise Hill | 3 | 2 | 4 | Unlikely | Unlikely | Likely | High | 10.4 |
| Capstone Mining | 3 | 3 | 4 | Possible | Likely | Possible | Low | 1.0 |
| Sandfire Resources | 3 | 4 | 1 | Likely | Unlikely | Possible | Low | (0.9) |
| Taseko Mines | 3 | 3 | 3 | Unlikely | Unlikely | Possible | High | 1.7 |

*Relative to top 49 copper producers where data is available; Source: S&P Global Market Intelligence, company data, RFC Ambrian estimates

These Tier 2 companies have also been active in acquisitions and sales of assets and investments in recent years, with US$1.6bn of acquisitions over the past five years and US$0.7bn of disposals. They are therefore potentially candidates for further M&A activity, although the scale of their activity is only a fraction of that of the Tier 1 producers. Table 11 summarises our analysis of the strategy of the Tier 2 copper producers. Detailed analyses of each company can be found in Appendix 2.

**Figure 28: Tier 2 Copper Producers' Attrib. Copper Production 2017 (t) and Reserves & Resources Copper (Mt)**

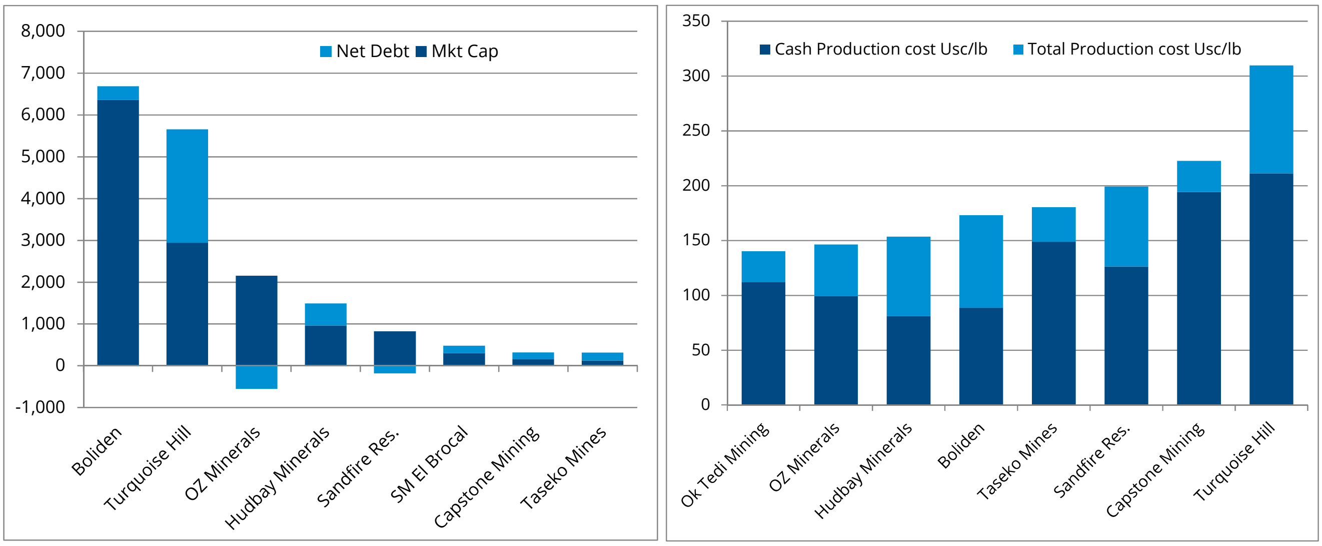



Source: S&P Global Market Intelligence, company data, RFC Ambrian estimates

The combined financials of this group (excluding Turquoise Hill due to its extreme net debt position) are shown on page 95. It can be seen that this group has steadily improved operating cashflow and generally trimmed capex over the past five years, improving free cashflow and reducing net debt.

Exploration expenditure for the Tier 2 copper producers has also fallen steadily over the past five years, and since the completion of Hudbay's Constantia mine in 2014 the only new greenfield asset being developed is OZ Minerals' Carrapateena Project, although there are a number of copper projects in late-stage development. These include Hudbay's Rosemont Project, OZ Minerals' Pedra Balanca and West Musgrave projects, Capstone's Santo Domingo Project and Taseko's Florence and Prosperity projects.

**Figure 29: Tier 2 Copper Producers' Enterprise Value (US$m) and Attributable Production Costs (US¢/lb)**




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

This suggests that these companies will now use their balance sheets as a base for financing existing projects, but some must also step up exploration and M&A activity. **Sandfire** has already increased its expenditure and in 2018 has acquired an outstanding interest in its Monty satellite deposit and minority interests in two junior zinc companies. In October 2018 **Hudbay** announced an agreement to acquire Mason Resources for C$31m, which caused us to downgrade the likelihood of further acquisitions from Hudbay from Likely to Possible.

Of the eight companies analysed, we suggest that four of these are unlikely to be involved in M&A activity in the near term: OZ Minerals, OK Tedi Mining, Turquoise Hill and Taseko Mines. OK Tedi Mining is a state-owned enterprise, but the others have existing capex commitments, weak balance sheets, or a combination of the two. This includes OZ Minerals, where the balance sheet is still robust although the net debt data does not include the very recent acquisition of Avanco Resources.

The two companies that we currently believe are most likely to be involved in some form of M&A activity in the near term are Boliden, and Sandfire Resources.

**Boliden** continues to invest in incremental improvements in operation and capacity at its mines and smelters. It also has a very strong balance sheet, but with limited late-stage development or exploration opportunities. With the integration of Kevitsa now complete, Boliden is once again in a position to make acquisitions in base metals, including copper if the right opportunity arises. However, this would most likely need to be located in Europe.

**Sandfire Resources** is taking the initiative with its strong balance sheet to grow its business. This year it has already taken two minority stakes in juniors with existing projects, although these have been in zinc. We believe that it is likely that Sandfire will make further acquisitions at the company or asset level to help build its exploration and development pipeline of copper assets.

## The Strategy of Tier 3 Copper Producers

We have aggregated data for the Tier 3 copper producers, although available data for Nexa Resources, Atalaya and Ero Copper is only available for the past two years. Individual company summaries are available in Appendix 3. These companies have interests in 17 copper operations, with six of the ten having just one mine. They had an average output of some 33kt in 2017, and, using data where it is available, they operated at an average cash cost of US¢201/lb and a production cost of US¢257/lb.

They also have a portfolio of copper assets where the overall average reserve life is 17 years and the resource life is 56 years, based on 2017 reported resources and production levels (where data is available), although these are slightly distorted higher by the significant resources of Imperial Metals and Atlas.

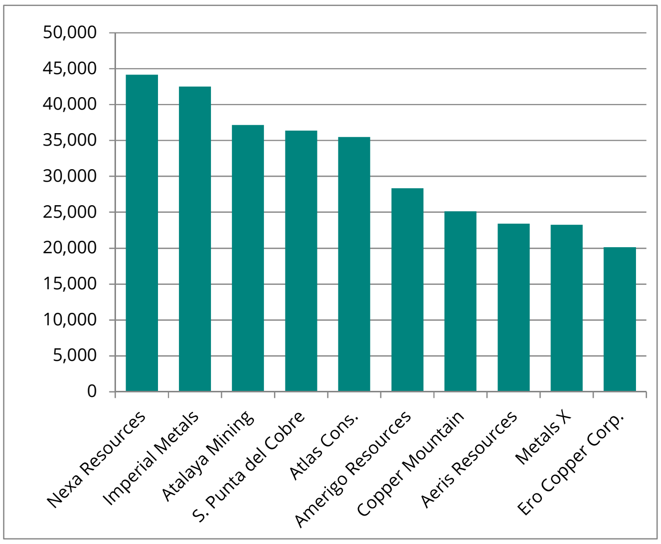
**Table 12: Tier 3 Copper Producer Strategy Forecast and Asset Quality Analysis**

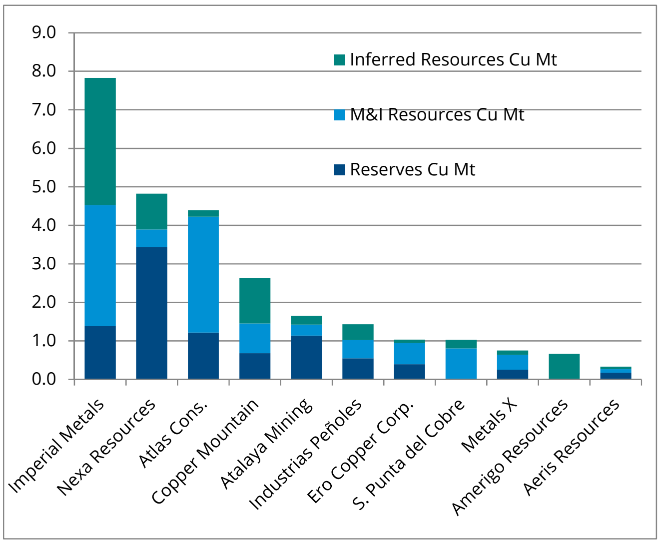
| | Asset Quartile* | | | Asset | Asset | Takeover | Capex | ND/ |
|---|---|---|---|---|---|---|---|---|
| Company | Prod'n | R&R | Cash Cost | Acquirer | Disposer | Target | Outlook | EBITDA |
| Nexa Resources | 4 | 3 | NA | Unlikely | Unlikely | Unlikely | High | 0.7 |
| Imperial Metals | 4 | 3 | 4 | Possible | Possible | Unlikely | Moderate | 6.0 |
| Atalaya Mining | 4 | 4 | 4 | Possible | Unlikely | Possible | High | (1.0) |
| S. Punta del Cobre | 4 | 4 | 4 | Possible | Unlikely | Unlikely | Moderate | (0.6) |
| Atlas Cons. | 4 | 3 | 4 | Unlikely | Unlikely | Unlikely | High | 6.0 |
| Amerigo Resources | 4 | 4 | 3 | Unlikely | Unlikely | Unlikely | Low | 0.9 |
| Copper Mountain | 4 | 4 | 3 | Possible | Unlikely | Unlikely | High | 2.9 |
| Aeris Resources | 4 | 4 | 4 | Possible | Unlikely | Unlikely | Moderate | 1.1 |
| Metals X | 4 | 4 | 4 | Unlikely | Unlikely | Unlikely | High | (0.4) |
| Ero Copper Corp. | 4 | 4 | 3 | Unlikely | Unlikely | Unlikely | High | 3.5 |

*Relative to top 49 copper producers where data is available; Source: S&P Global Market Intelligence, company data, RFC Ambrian estimates

Table 12 summarises our analysis of the strategy of the Tier 3 copper producers. Detailed analyses of each company can be found in Appendix 3.

**Figure 30: Tier 3 Copper Producers' Attrib. Copper Production 2017 (t) and Reserves & Resources Copper (Mt)**



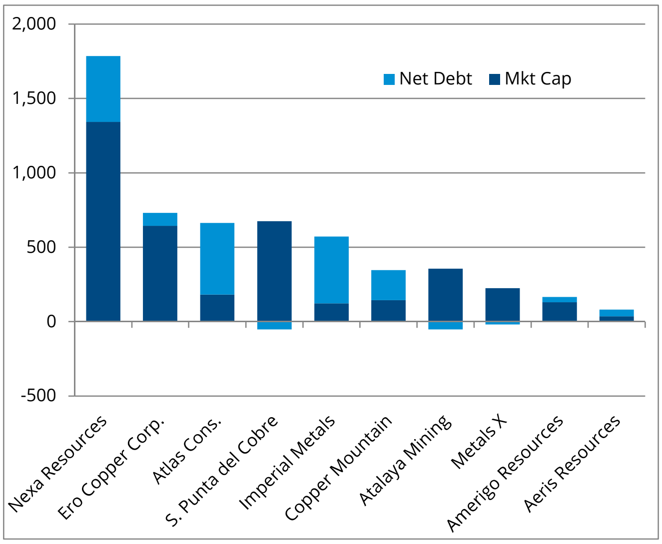

Source: S&P Global Market Intelligence, company data, RFC Ambrian estimates

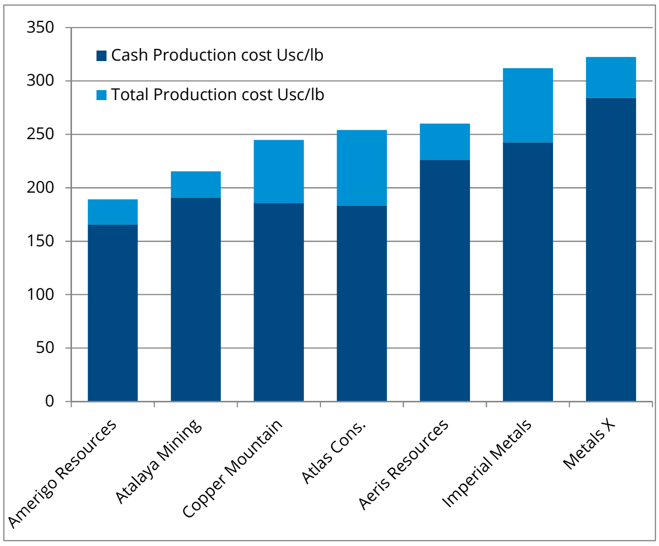
The combined financials of this group (excluding Nexa, Atalaya and Ero Copper due to limited history) are shown on page 110. This shows that this group has steadily improved operating cashflow and generally trimmed capex over the past five years, although free cashflow has largely still been negative and net debt is still high.

Exploration expenditure for nearly all of the Tier 3 copper producers is negligible and has fallen steadily over recent years. Although notable exceptions to this were increased exploration and development budgets at Nexa Resources and Aeris Resources in 2018.

There are a number of copper projects in late-stage development. These include: Nexa Resources' Aripuanã zinc-copper project and its Magistral copper project; Atalaya's Proyecto Touro Project; Sociedad Punta del Cobre's Tovaku and El Espino projects; Copper Mountain's Eva Project; and Ero Copper's Boa Esperança Project.

**Figure 31: Tier 3 Copper Producers' Enterprise Value (US$m) and Attributable Production Costs (US¢/lb)**




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

These Tier 3 companies have been involved in some acquisitions and sales of assets and investments in recent years, with a modest US$123m of acquisitions over the past five years and US$121m of disposals. We therefore believe that they are less likely to be candidates for further M&A activity, although some activity is possible. Excluded from these numbers is **Copper Mountain**'s recent acquisition of Altona Mining for US$93m.

In recent months **Imperial Metals** announced a financial restructuring and is considering all options for its assets, while **Atalaya Mining** has announced it is re-evaluating the company's strategic options. However, we have not ranked any of the companies in Tier 3 as being 'Likely' to be acquirers of assets and just five of them as 'Possible'.

We believe that the best prospect for many of these companies is to make further brownfield and/or greenfield exploration discoveries and/or consider being part of some industry consolidation.

## Acquisitions by Asian Companies

Asian (particularly Japanese and Korean) companies have been involved in copper mining for a long time, often taking minority stakes in companies or operating assets to secure concentrate feed for their domestic smelters. More recently, Chinese companies have become important players in the copper M&A market.

Perhaps the highest profile has been the growth of **MMG**, a Chinese-operated business listed on the Australian Stock Exchange. MMG is 74%-owned by the Chinese state-owned company China MinMetals Corp. It was formed in 2009 following the purchase of the majority of the assets of **OZ Minerals**. In 2012 it acquired **Anvil Mining** with assets in the DRC for about US$1.3bn. Then in 2014, a joint venture, owned by MMG, GUOXIN IIC and CITIC Metal, paid about US$5.8bn in cash to acquire the Las Bambas Project in Peru from **Glencore**.

Also active recently has been **China Molybdenum**. In 2013 it acquired an 80% interest in the Northparkes mine for about US$820m from **Rio Tinto**. Then in 2016 it acquired a 56% interest in the Tenke Fungurume mine for about US$2.8bn from **Freeport-McMoRan**.

In 2017 **Bohai Harvest RST Partners**, a Chinese cross-border private equity investment company, completed the purchase of a 27% stake in the Tenke Fungurume mine for about US$1.2bn from **Lundin Mining**.

Another acquisitive Chinese company has been the **Jinchuan Group**, listed in Hong Kong. In 2008, it acquired **Tyler Resources** for US$195m, then in 2010 it acquired **Continental Minerals** for US$365m, then in 2011 it acquired **Metorex** for US$1.4bn, and in 2017 it acquired the copper assets of **Lupoto** for US$140m.

Finally, at the moment **Nevsun** is likely to be acquired by Chinese company **Zijin Mining**. Nevsun's Board has accepted an all cash offer of C$6.00/share. Nevsun operates the Bisha copper-zinc mine in Eritrea and is developing the Timok copper-gold project in Serbia.

## Other Potential Acquirers — Private, PE Groups and First Timers

A key feature of the last decade's M&A is the emergence of PE groups as significant players in the copper sector.

Research conducted by international law firm Berwin Leighton Paisner (BLP) reported that the volume of private equity deals in the mining sector doubled to 60 in 2017, compared with 30 in 2016. Total deal value rose by 31% in 2017 to US$2.3bn compared with US$1.75bn in 2016.

The report highlights that copper was the most popular commodity in 2017 with US$1.63bn invested, or 70% of the total by value, in 20 copper deals. Gold slipped to second place and battery metals were the third most popular. Africa was the most popular jurisdiction — 45% of funds invested were into Africa, reflecting the popularity of copper.

One of the most active PE groups in the copper space is **EMR**. Significant investments include its US$210m purchase of the Golden Grove copper/zinc mine from MMR in January 2017, its US$97m purchase of the Lubambe copper mine in Zambia from ARM in August 2017 and its US$320m purchase of BHP's Cerro Colorado copper mine in Chile.

Other project acquisitions by PE funds have included the US$300m purchase of the Mantos Blancos and Mantoverde operations from Anglo American in August 2015 by Mantos Copper, a PE vehicle backed by **Audley Capital** and **Orion Mine Finance**.

Other PE firms have chosen to obtain copper exposure by investing through companies. Greenstone owns 17% of Highland Copper, Orion owns 14% of Atalaya Mining, 9% of Central Asia Metals and 14% of Highland Copper. **Pala** owns 36% of Nevada Copper and **Castlelake** a further 18%. **Greenstone Resources** owns 49% of Excelsior Mining (Mkt Cap C$220m) and 56% of **Coro Mining** (Mkt Cap C$73m). Also, **Sentient** took ERA Resource private in June 2017.

One newcomer to the copper sector that appears interested in building a copper position is **South32**. In April 2017 the company announced that it had entered into an option agreement with **Trilogy Metals**, in respect of Trilogy's Upper Kobuk Mineral Projects (UKMP) located in Alaska. The UKMP includes the Bornite and Arctic deposits. South32 will provide US$30m of initial funding over three years that will be used to test the extension of the high-grade copper resource at Trilogy's Bornite deposit. South32 has the option to enter a 50:50 JV with Trilogy in return for contributing a further US$120m to the project.

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# Section 3 —
# Analysis of the Past Decade's M&A Transactions

# Copper M&A Deals

In this section we review M&A activity over the past ten years and look at some of the larger deals, examine the type and structure of deals, and look at the prices paid for assets.

## Explore or Acquire?

Mining companies are under constant pressure to grow their businesses and, in an industry of annually depleting reserves they must if possible replace their reserves each year through exploration or acquisition. Ideally, they should try to grow their resources, reserves and copper production at the lowest cost possible. To do this, larger companies tend to have a pipeline of opportunities, brownfield and/or greenfield, but sometimes gaps in the pipeline must be filled with acquisitions.

Mining companies are always on the lookout for high-quality assets that can be acquired at the right price. The phrases often used are 'continued assessment of accretive acquisition opportunities' or 'growth beyond the core business'. Many producers also increase their exploration exposure by taking some form of partnership with junior exploration companies.

**Figure 32: Strategy Diagram of Antofagasta**


Source: Antofagasta 2017 annual report

Meanwhile, smaller companies look to be either an acquired asset or have the ambition to grow. Growth can be achieved through the skilful (or lucky) acquisition and/or development of good deposits (and sometimes even poor deposits), or through the accumulation of existing assets (either late-stage projects or existing operations). For success, there is not one simple answer, but the price of acquisition and asset quality are often key factors.

### 325 Copper M&A Deals over US$10m in the Past Decade

We have compiled a database of 325 copper M&A deals involving global assets (ex-China) that have taken place since 2008. These deals have a combined value of US$88.8bn.

We have sourced our data from S&P Global Market Intelligence and appended it with some additional company data. These deals are all above US$10m in value and involve the acquisition of shares or assets in primary copper deals. In a few cases a company or asset has been acquired in more than one step over time, and where that occurs we count each step as a separate deal.

For many other deals the data is unavailable or it is difficult to calculate an exact value due to the construction of the deal. Sometimes they involve future payment over a period of time (in cash and/or equity and/or royalty), include capex, and payments can be contingent on achieving certain milestones. The top 20 of these deals by value are shown in Table 13.

**Table 13: Top 20 Copper Deals by Value**

| Target asset | Country | Buyer | Seller | Deal value US$m | Deal Type | Year Annc'd |
|---|---|---|---|---|---|---|
| Lumwana + | Zambia | Barrick Gold | Equinox Minerals | 7,444 | Company | 2011 |
| Los Bronces + | Chile | Mitsubishi Corp. | Anglo American | 5,390 | Company | 2011 |
| Cobre Panama + | Panama | First Quantum | Inmet Mining | 5,062 | Company | 2013 |
| Grasberg | Indonesia | PT Asahan Aluminium | Rio Tinto/FMC | 3,850 | Property | 2018 |
| Las Bambas | Peru | MMG Group | Glencore Xstrata | 2,986 | Property | 2014 |
| Sierra Gorda+ | Chile | KGHM | Quadra FNX Mining | 2,865 | Company | 2011 |
| Los Bronces+ | Chile | Investor group | Anglo American | 2,800 | Company | 2012 |
| Tenke Fungurume | DR Congo | China Molybdenum | Freeport-McMoRan | 2,770 | Property | 2016 |
| Candelaria+ | Chile | Lundin Mining | Freeport-McMoRan | 2,000 | Property | 2014 |
| Ruashi/Kinsenda+ | Zambia | Jinchuan Group | Metorex | 1,359 | Company | 2011 |
| Batu Hijau | Indonesia | PT Amman MI | Newmont Mining | 1,323 | Property | 2016 |
| Esperanza+ | Chile | Marubeni Corp | Antofagasta | 1,310 | Property | 2008 |
| Kinsevere+ | DR Congo | MMR Groupes | Anvil Mining | 1,282 | Company | 2011 |
| Kolwezi+ | DR Congo | ENRC | First Quantum | 1,250 | Property | 2012 |
| Lumwana+ | Zambia | Equinox Minerals | Citadel Resource | 1,192 | Company | 2010 |
| Tenke Fungurume | DR Congo | Bohai Indl Invt Fund | Lundin Mining | 1,187 | Property | 2016 |
| Zaldivar | Chile | Antofagasta | Barrick Gold | 1,005 | Property | 2015 |
| Morenci | US | Sumitomo Metal | Freeport-McMoRan | 1,000 | Property | 2016 |
| Baimskaya | Russia | KAZ Minerals | Aristus Holdings | 902 | Property | 2018 |
| Northparkes | Australia | China Molybdenum | Rio Tinto | 820 | Property | 2013 |

+Additional assets within deal; Source: S&P Global Mining Intelligence, company data

Of the 325 copper deals, 124 are classed as company acquisitions (or part interests), and 201 deals were direct acquisitions of properties (or part interests). The list also includes some streaming deals.

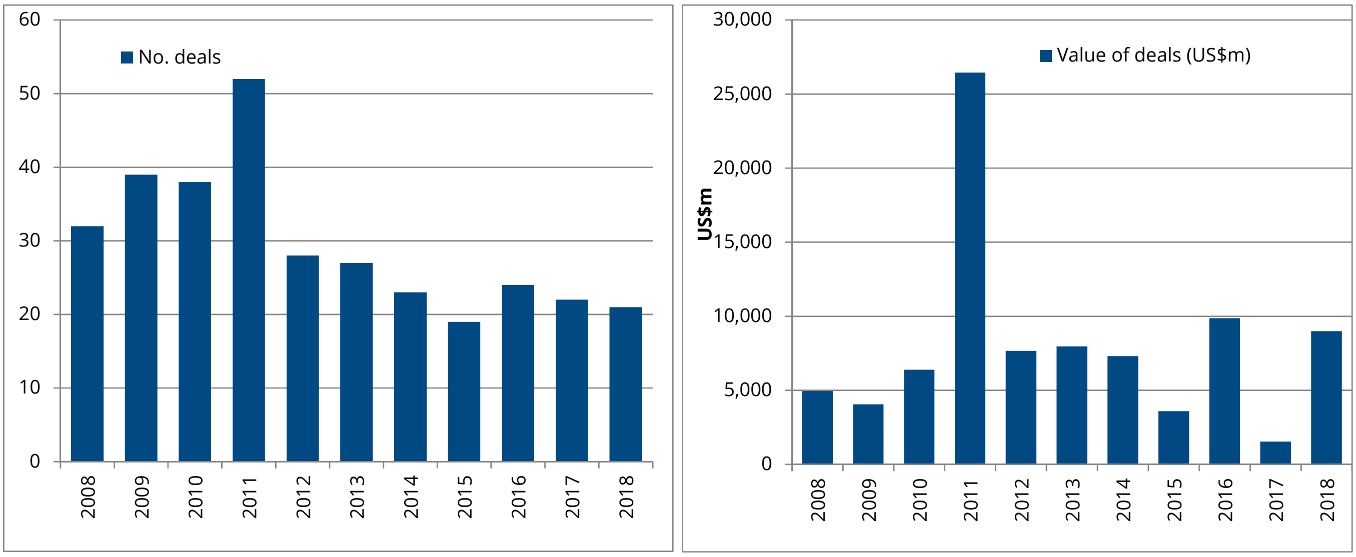
We discuss some of these larger deals later in the report as we look at the track record and analyse the outlook for each of the Tier 1 and Tier 2 companies.

Looking closer at the underlying acquired assets, included were:

- 92 operating mines with deals totalling US$45.3bn;
- 31 mines under construction with deals totalling US$10.6bn;
- 89 projects at the feasibility stage with deals totalling US$23.6bn;
- 57 projects undertaking resources definition with deals totalling US$5.5bn; and
- 47 exploration projects with deals totalling US$1.8bn.

Figure 33 shows how the number and value of deals has changed over time. While the decline in the number of deals since 2011 (when metal prices peaked) appears to have stabilised, the overall value of deals has been erratic over the past four years, but has averaged US$6.7bn per annum over the past seven years. The variability in value appears correlated to the copper price.

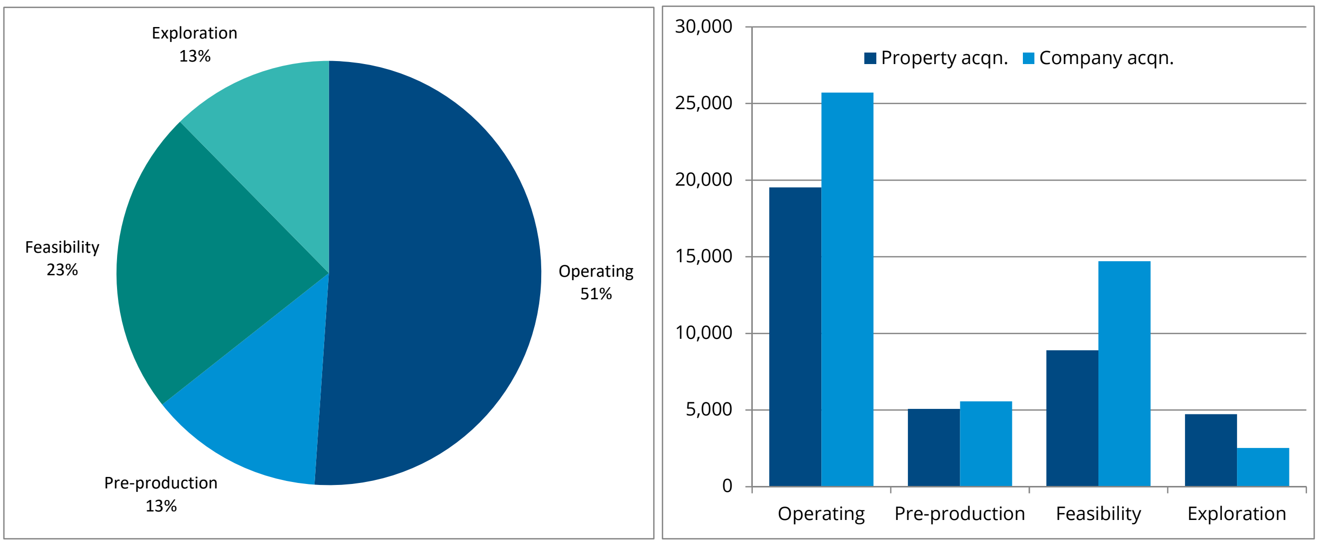
**Figure 33: Copper Deals by Number and Value 2008-2018**




Source: SNL, company data, RFC Ambrian

For deals involving the acquisition of a property, Figure 34 shows a breakdown of the deals by the stage of development of the main acquired property. Interestingly, 51% of them were for operating assets and a further 13% for assets at the pre-production stage. With a further 23% at the feasibility stage, it shows the preference for acquiring operating or later-stage development assets.

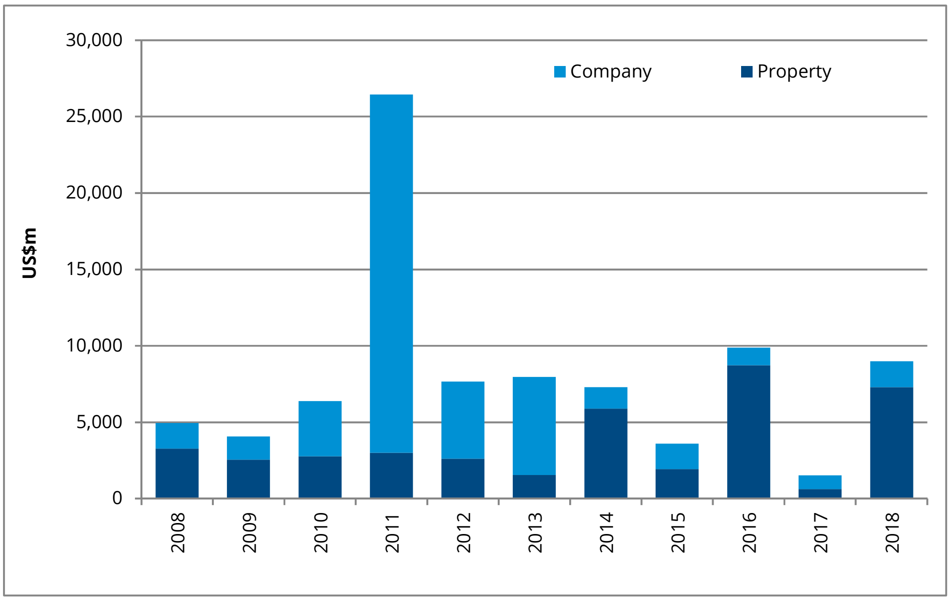
**Figure 34: The Value of Copper Deals (US$88.8bn) by Stage of Asset at Acquisition (2008-2018)**




Source: SNL, company data, RFC Ambrian

Overall, the split between company and property acquisitions for each of the development stages is relatively balanced, with slightly more company acquisitions. However, if we look at the split between company and property acquisitions over time in Figure 35, we can see that the number of company acquisitions is boosted by the activity in 2011-2013 and since then property acquisitions have been the dominant type of acquisition.

**Figure 35: Value of Copper M&A Deals 2008-2018**




Source: SNL, company data, RFC Ambrian

## What Deal Terms Could We Expect at the Moment?

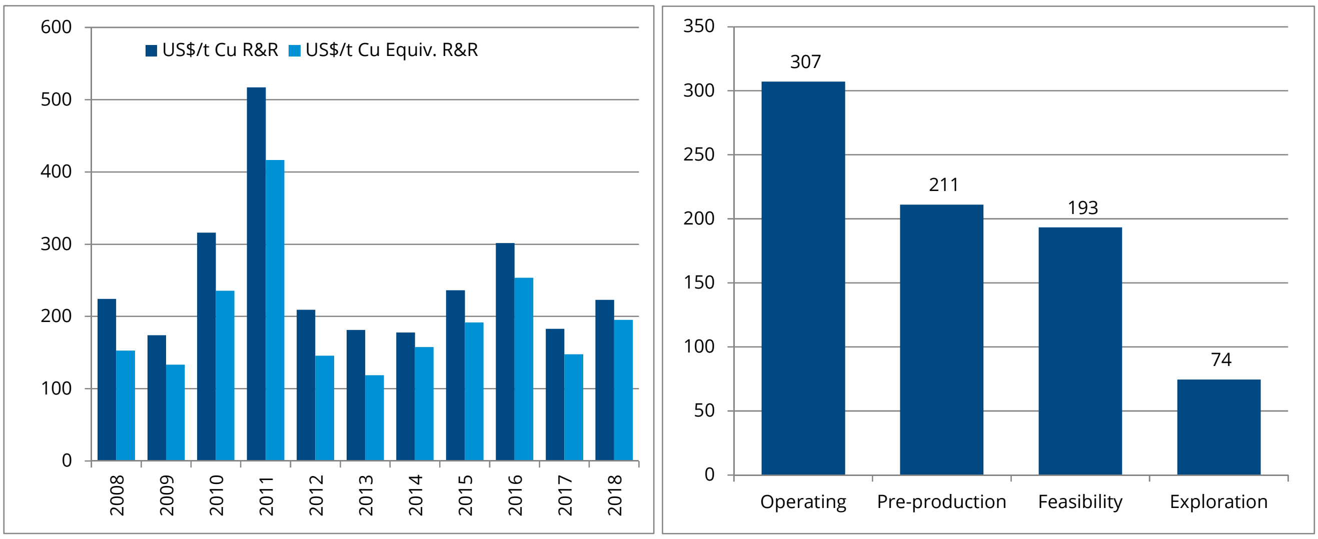
We have tried to analyse this by looking at the historical data and analysing the prices paid for underlying copper assets and the type of payment made (cash or shares).

Unfortunately, we do not have sufficient available data to analyse either the takeover premium that has been paid in these deals or the number of deals that were hostile or friendly takeovers.

### Prices Paid for Underlying Copper Assets

We have analysed this by looking at prices paid per tonne of copper resource in past deals. For direct asset purchases this is straightforward, while for share purchases and takeovers we have calculated the resource base of the underlying assets. We have 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 have also not adjusted for inflation.

**Figure 36: Prices Paid for Copper M&A Over Time and Type Average (US$/t of Cu Equivalent Resource) 2008-2018**



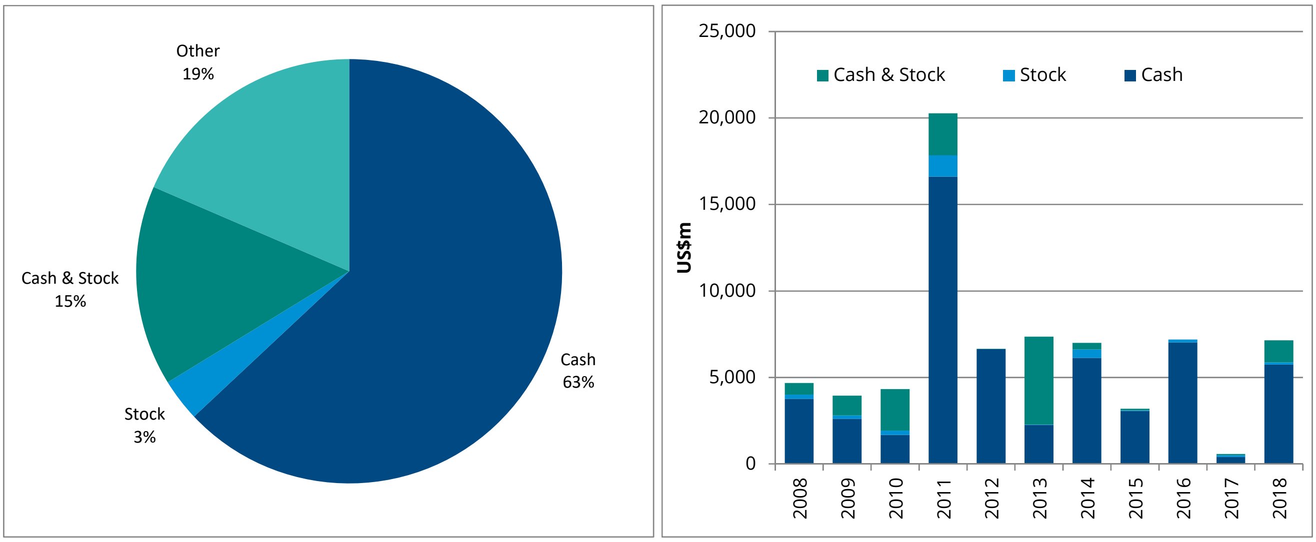

Source: SNL, company data, RFC Ambrian

***Average Deal Value of US$196/t of Copper Equivalent Resources***

The overall deal values are shown in Figure 37 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 past 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 36 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 37: The Value of Copper Deals (US$88.8bn) and Type of Payment (2008-2018)**




Source: SNL, company data, RFC Ambrian

## Type of Payment (Cash or Shares)

We have also examined the type of payment used for these deals. Figure 37 shows the number of deals for each year broken down as either cash, stock, a combination of the two, or other. The chart shows that cash was the main payment method for most years from 2008-2018 and accounted for 63% of the overall value of the deals, with just stock purchases accounting for only 3% of the overall value.

In normal M&A the payment method is often a major signal from management; the use of cash is typical when management is confident that it will be able to realise and retain the synergies or benefits of an acquisition. In the mining industry there are often limited synergies in the acquisition of a mining asset (apart from some senior management) and so in this case this possibly reflects the expected benefits derived from future higher commodity prices. Unfortunately, these benefits do not always materialise or are not always sustainable.

However, companies have to take many factors into consideration when an offer is put together. These include the potential presence of other bidders, the target's willingness to sell and payment preference, tax implications, transaction costs if stock is issued, the balance sheet, and the impact on the capital structure.

## Which Countries will Attract Takeovers?

Table 14 gives a profile of the countries where copper deals took place in 2008-2018. The table is ranked by the total value of copper deals from 2008 to 2018 and there is a strong correlation between the ranking and the number of operating mines, the copper exploration expenditure, and the mine reserve and resource levels of the country. From a country perspective, without considering individual assets, this is also the expected group of countries that are most likely to attract deals in the future.

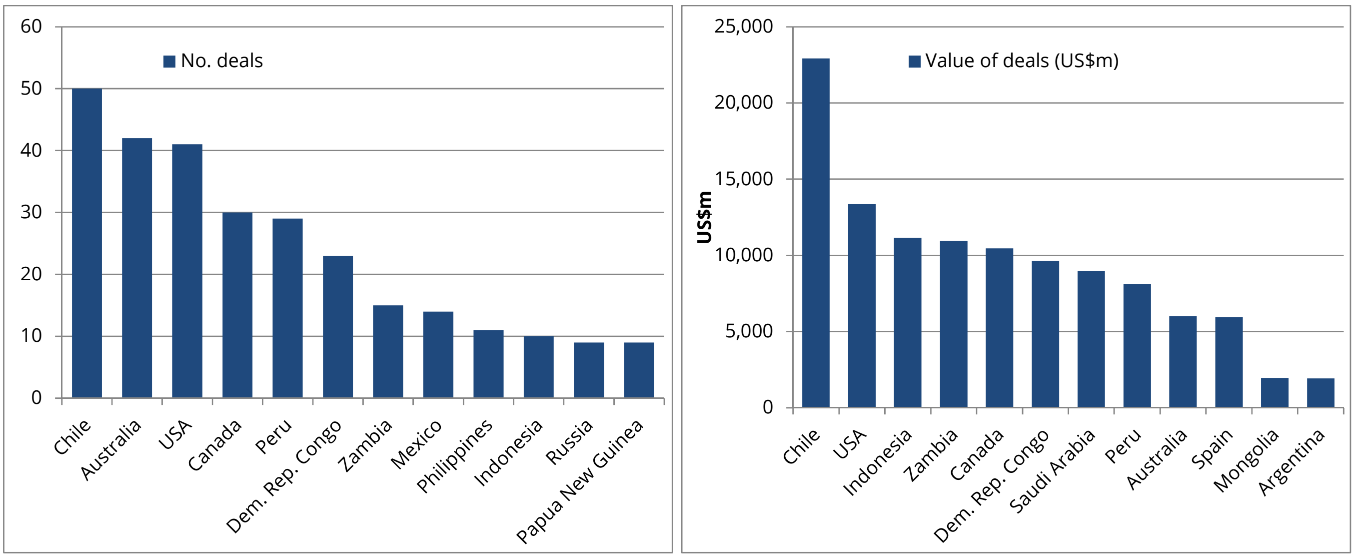
**Table 14: Number and Value of M&A Deals Regionally 2008-2018**

| Country | Number Deals | Value of Deals US$m | Value R&R US$/t Cu Equiv. |
|---|---|---|---|
| Chile | 50 | 22,922 | 208 |
| US | 41 | 13,362 | 131 |
| Indonesia | 10 | 11,153 | 430 |
| Zambia | 16 | 11,019 | 386 |
| Canada | 30 | 10,468 | 126 |
| Dem Rep Congo | 24 | 9,716 | 260 |
| Saudi Arabia | 4 | 8,959 | 818 |
| Peru | 29 | 8,100 | 197 |
| Australia | 42 | 6,001 | 246 |

Source: S&P Global Market Intelligence

The deals took place across 21 different countries and the countries with a high level of existing copper production tended to rank highly.

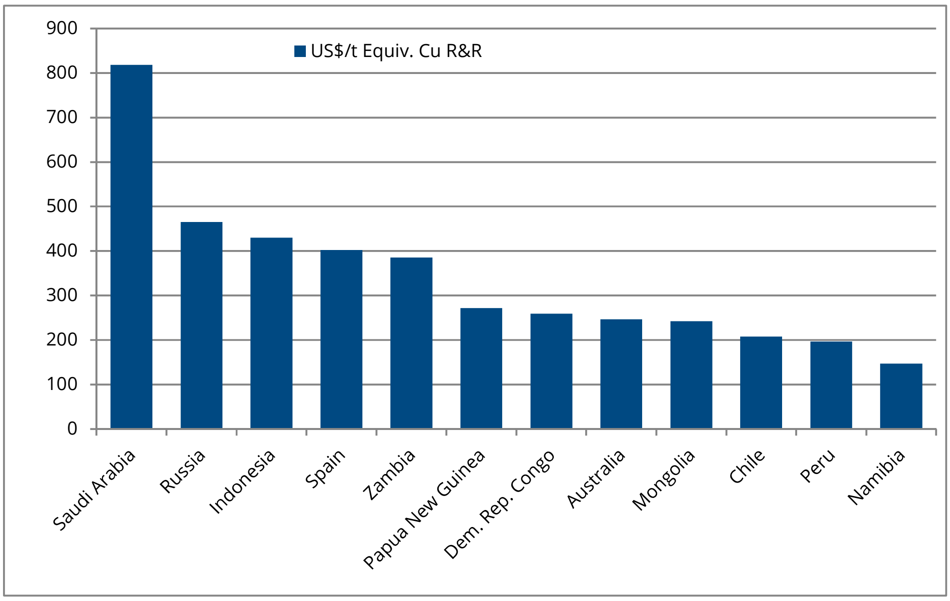
**Figure 38: Copper Deals by Number and Value across the Different Countries**




Source: SNL, company data, RFC Ambrian

Figure 39 shows the average deal price for the main countries in terms of US$/t of copper equivalent resource acquired from 2008-2018. The higher-cost regions are partly influenced by the low number of deals in these countries, but it is also interesting and counterintuitive that the highest prices have been paid in many of the higher-risk regions.

**Figure 39: Asset Price Average Cost (US$/t Equiv. Cu R&R) by Country 2007-2018**




Source: RFC Ambrian

## Geopolitical Risks

Mining as an industry has a series of sector-specific risks. However, it can also hold another layer of risks dictated by the region of operation. While we believe that geopolitical risk does play a role in the M&A decision, this will usually depend on a company's pre-determined country risk appetite. For example, some companies are content to be operating in some of the higher-risk countries in Africa (DRC), South America (Argentina) and Asia (Indonesia), while others avoid these countries.

Control Risks highlights four main areas of risk: political, operational, security and terrorism. Mining companies and investors are concerned about these factors, but usually manage them appropriately. We have included Control Risks' ratings for the main copper producing countries in Table 15.

The problems occur when instability of some kind takes place, which is usually unexpected. This is often caused by government changes in mining regulations, but sometimes happens at the operational level. The impact on investment and M&A will usually depend on the severity and magnitude of the event and the perceived impact on investment risk.

Recent examples of serious geopolitical issues in the copper industry include pressure by the Indonesian Government on Freeport-McMoRan to sell down its interest in Grasberg, recent proposed changes in the tax code in Zambia, and changes to the mining code in the DRC.

***Changes in the Tax Code in Zambia***

The Zambian Government has proposed changes to the Zambian mining tax regime. The proposals were included in the country's 2019 Budget, delivered in September 2018 to the National Assembly, and are expected to take effect from 1 January 2019.

This includes an increase in mineral royalty rates by 1.5% at all levels of the existing scale, the introduction of a fourth-tier rate at 10%, which applies when the copper price is above US$7,500/t (US$3.40/lb), and making mineral royalty tax non-deductible for income tax purposes.

**Table 15: Control Risks' Ratings for Major Copper Producing Countries**

| Country | Political | Operational | Security | Terrorism |
|---|---|---|---|---|
| Chile | Low | Low | Low | Low |
| US | Low | Low | Low | Low |
| Indonesia | Medium | Medium | Medium | Medium |
| Zambia | Medium | Medium | Low | Insignificant |
| Canada | Low | Low | Low | Low |
| Dem. Rep. Congo | High | High | Medium | Low |
| Saudi Arabia | Medium | Medium | Low | Low |
| Peru | Medium | Medium | Medium | Low |
| Australia | Low | Insignificant | Low | Low |
| Spain | Medium | Low | Low | Low |
| Mongolia | Medium | Medium | Medium | Insignificant |
| Argentina | Medium | Medium | Low | Low |

Source: S&P Global Market Intelligence, Control Risks

***Changes in the Mining Code in the DRC***

A new mining code has come into effect in the Democratic Republic of Congo (DRC) after being challenged by the mining companies operating in the country. Under the code, miners will be subject to new royalty charges, including copper royalties increasing from 2% to 3.5%. Other key changes include a provision that doubles the state's free share in mining projects to 10% and a reduction on the period during which contract stability is guaranteed from 10 years down to 5 years.

## Impact on M&A

Incidents like these have caused significant disruptions to the companies involved and operating in these countries, at both an operating and financial level, and have affected the companies' valuations.

Larger companies are known to have certain risk thresholds, while many smaller companies are more flexible. Some of the companies already operate in riskier areas and are already aware of the higher risk level and the different types of risk, and therefore have a higher risk appetite to start with. However, we believe companies seek stability and continuity of politics when making investment decisions, and focus particularly on a stable and sound tax, legal and property ownership framework. As a result, future deal activity in places like Indonesia, Zambia and the DRC are likely to be negatively affected by recent events.

# Section 4 —
# Company Valuations

# Current Company Valuations

## Producing Company Valuations

We have looked at 27 listed primary copper producers and have separated them into three tiers in the tables. The range of EV of the producing companies is very broad, from Southern Copper at US$35.6bn to Aeris Resources at just US$81m, as shown in Tables 16-18.

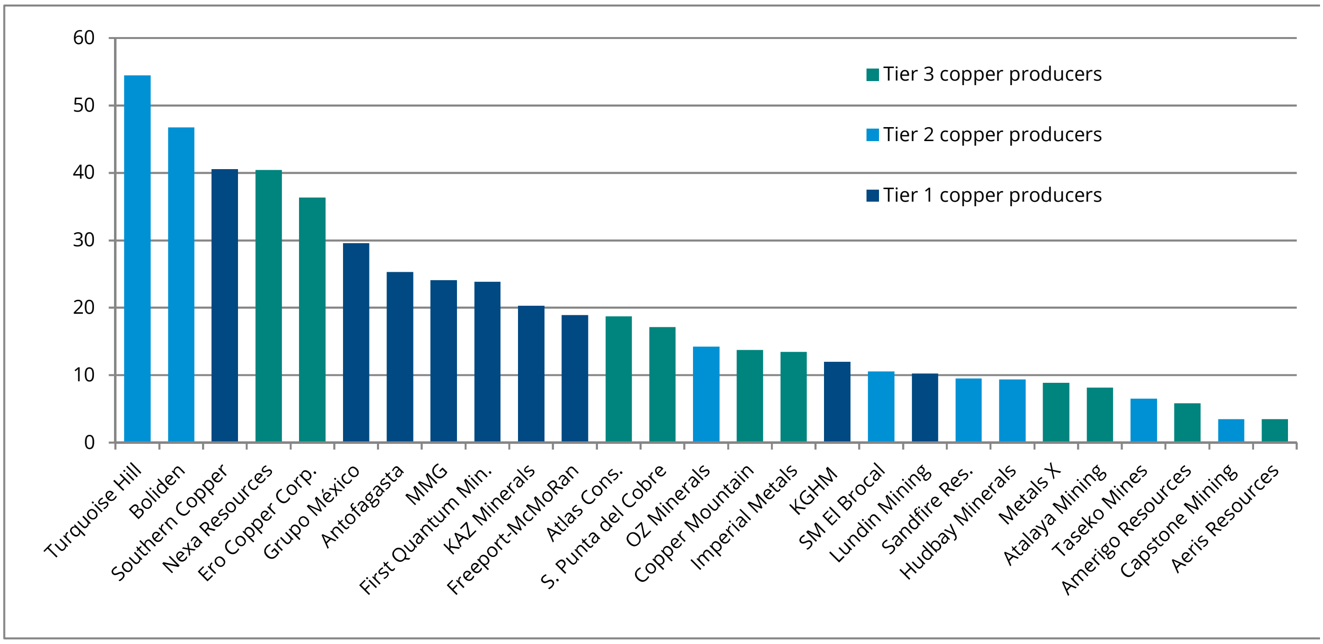
**Table 16: Tier 1 Copper Producers Ranked by EV**

| | | Company | EV US$m | Prod'n Attrib kt | EV/t Prod'n | Attrib. Res. Mt Cu | EV/t Reserve | R&R Attrib Mt | EV/t Resource |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCCO US | Southern Copper | 35,571 | 877 | 40.6 | 74.9 | 475 | 82.2 | 432 |
| 2 | GMEXICO B | Grupo México | 27,000 | 913 | 29.6 | 54.2 | 498 | 54.2 | 498 |
| 3 | FCX US | Freeport-McMoRan | 26,352 | 1,391 | 18.9 | 46.3 | 569 | 91.0 | 290 |
| 4 | FM CN | First Quantum Min | 12,502 | 524 | 23.9 | 19.5 | 641 | 48.7 | 257 |
| 5 | MMG AU | MMG | 12,001 | 423 | 24.1 | 5.4 | 1,887 | 15.1 | 673 |
| 6 | ANTO LN | Antofagasta | 10,200 | 474 | 25.3 | 16.3 | 736 | 68.4 | 175 |
| 7 | KGH P | KGHM | 6,616 | 551 | 12.0 | 22.5 | 294 | 48.5 | 136 |
| 8 | KAZ LN | KAZ Minerals | 5,248 | 259 | 20.3 | 7.7 | 678 | 24.9 | 211 |
| 9 | LUN CN | Lundin Mining | 2,084 | 203 | 10.3 | 3.2 | 647 | 6.9 | 304 |

Source: Company data

The 27 companies are shown together in the figures (where the data is available) for valuation comparison.

**Figure 40: Tier 1-3 Copper Producers EV/t of Attributable Copper Production (US$)**




Source: Company data, RFC Ambrian

Codelco and OK Tedi Mining are unlisted, and we only have limited data for Western Mining and so they are not included.

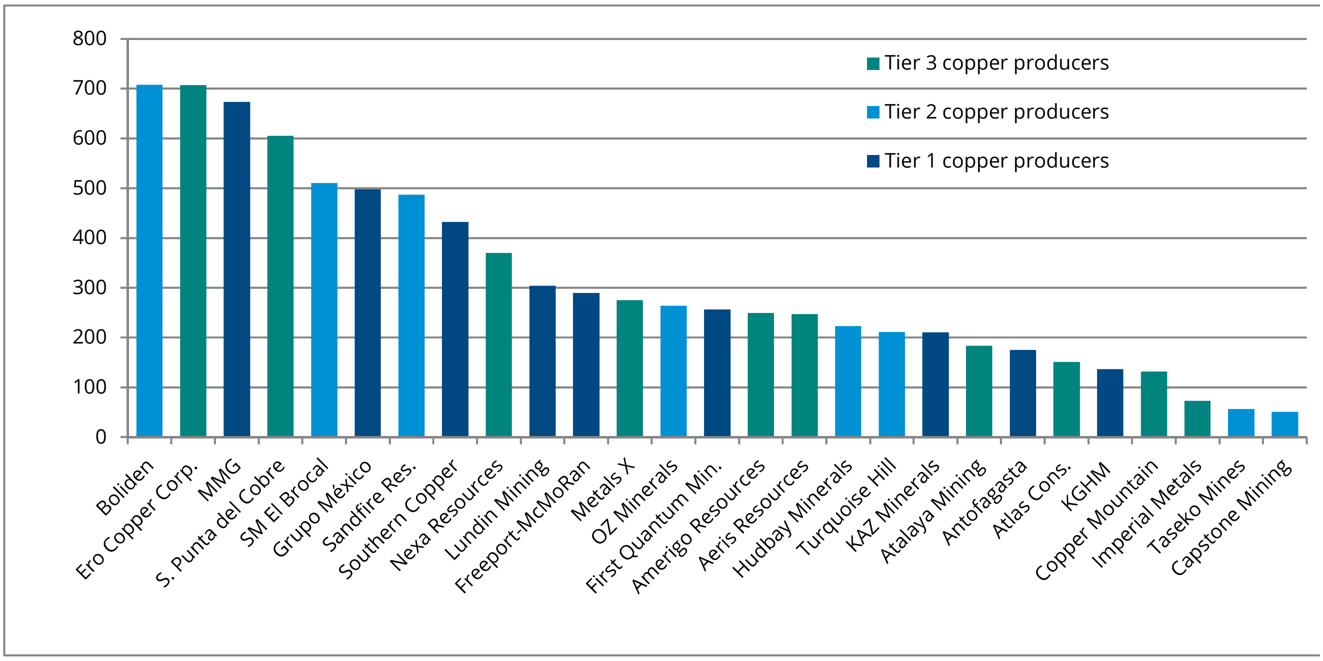
**Table 17: Tier 2 Copper Producers Ranked by EV**

| | | Company | EV US$m | Prod'n Attrib kt | EV/t Prod'n | Attrib. Res. Mt Cu | EV/t Reserve | R&R Attrib Mt | EV/t Resource |
|---|---|---|---|---|---|---|---|---|---|
| 1 | BOL SW | Boliden | 6,689 | 143 | 46.7 | 3.3 | 2,034 | 9.4 | 708 |
| 2 | TRQ CN | Turquoise Hill | 5,658 | 104 | 54.5 | 8.0 | 711 | 26.8 | 211 |
| 3 | HBM CN | Hudbay Minerals | 1,597 | 159 | 9.4 | 3.8 | 388 | 6.7 | 223 |
| 4 | OZL AU | OZ Minerals | 1,492 | 112 | 14.3 | 2.2 | 727 | 6.1 | 264 |
| 5 | SFR AU | Sandfire Res. | 639 | 67 | 9.5 | 0.4 | 1,727 | 1.3 | 487 |
| 6 | BROCALC1 | SM El Brocal | 477 | 45 | 10.6 | 0.7 | 677 | 0.9 | 511 |
| 7 | CS CN | Capstone Mining | 318 | 90 | 3.5 | 2.2 | 143 | 6.3 | 51 |
| 8 | TKO CN | Taseko Mines | 315 | 48 | 6.6 | 4.2 | 75 | 5.6 | 56 |

Source: Company data

Figure 40 shows the company valuations based on EV/t of attributable copper production. There is a broad range of valuations using this as it is only a crude valuation measure. Turquoise Hill looks particularly expensive on this measure, but it is still in the early development phase of the Oyu Tolgoi mine.

**Figure 41: Tier 1-3 Copper Producers EV/t of Reserves & Resources (US$)**




Source: Company data, RFC Ambrian

Figure 41 shows the EV per tonne of reserves and resources for the primary copper producers. It also shows a broad spread of values for this measure, partly reflecting a number of differences in economics and geographic location of the assets, but mainly it is also a crude valuation measure for producing companies. However, it does perhaps provide a useful benchmark for thinking about exploration and development companies with advanced development projects.

One standout here is MMG, which, relative to its Tier 1 peers, does have a low level of reserves and resources at present.

**Table 18: Tier 3 Copper Producers Ranked by EV**

| | | Company | EV US$m | Prod'n Attrib kt | EV/t Prod'n | Attrib. Res. Mt Cu | EV/t Reserve | R&R Attrib Mt | EV/t Resource |
|---|---|---|---|---|---|---|---|---|---|
| 1 | NEXA CN | Nexa Resources | 1,786 | 44 | 40.5 | 3.4 | 519 | 4.8 | 370 |
| 2 | ERO CN | Ero Copper Corp. | 732 | 20 | 36.3 | 0.4 | 1,842 | 1.0 | 707 |
| 3 | AT PM | Atlas Cons | 664 | 35 | 18.7 | 1.2 | 543 | 1.7 | 151 |
| 4 | PUCOBRE CH | S. Punta del Cobre | 624 | 36 | 17.1 | N/A | N/A | 1.0 | 606 |
| 5 | III CN | Imperial Metals | 572 | 43 | 13.5 | 1.4 | 413 | 7.8 | 73 |
| 6 | CMMC CN | Copper Mountain | 346 | 25 | 13.8 | 0.7 | 509 | 2.6 | 132 |
| 7 | ATYM LN | Atalaya Mining | 304 | 37 | 8.2 | 1.1 | 268 | 1.7 | 184 |
| 8 | MLX AU | Metals X | 206 | 23 | 8.9 | 0.3 | 809 | 0.7 | 275 |
| 9 | ARG CN | Amerigo Resources | 165 | 28 | 5.8 | N/A | N/A | 0.7 | 249 |
| 10 | AIS AU | Aeris Resources | 81 | 23 | 3.5 | 0.2 | 467 | 0.3 | 247 |

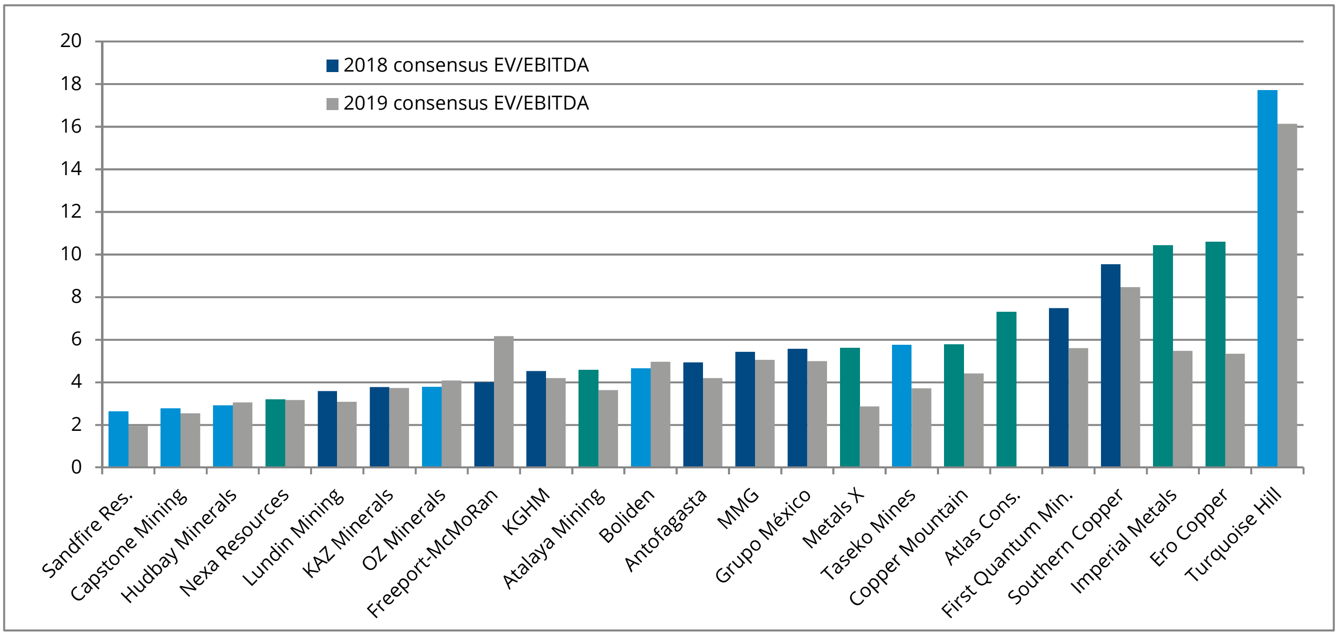
Source: Company data

Some caution should be taken when using these valuation metrics for producing companies. It is usually better to look at discounted cashflow, P/E and EV/EBITDA valuation methodologies. However, DCF analysis is beyond the scope of this report.

**Consensus Estimates of Valuation**

We do not have forward earnings and EBITDA estimates for these companies, but have used consensus numbers. The resulting P/E and EV/EBITDA multiples for 2018 and 2019 are shown in Figures 42 and 43, ranked on 2018 multiples.

**Figure 42: Company Consensus Forward EV/EBITDA Multiples 2018 and 2019**




Source: Bloomberg, company data, RFC Ambrian

Once again, there is a relatively broad spread of valuations using these measures, but the group has an average EV/EBITDA multiple of 5.9x for 2018 and 4.9x for 2019, and an average P/E multiple of 14.5x for 2018 and 9.1x for 2019 (excluding the two extreme valuations in 2018).

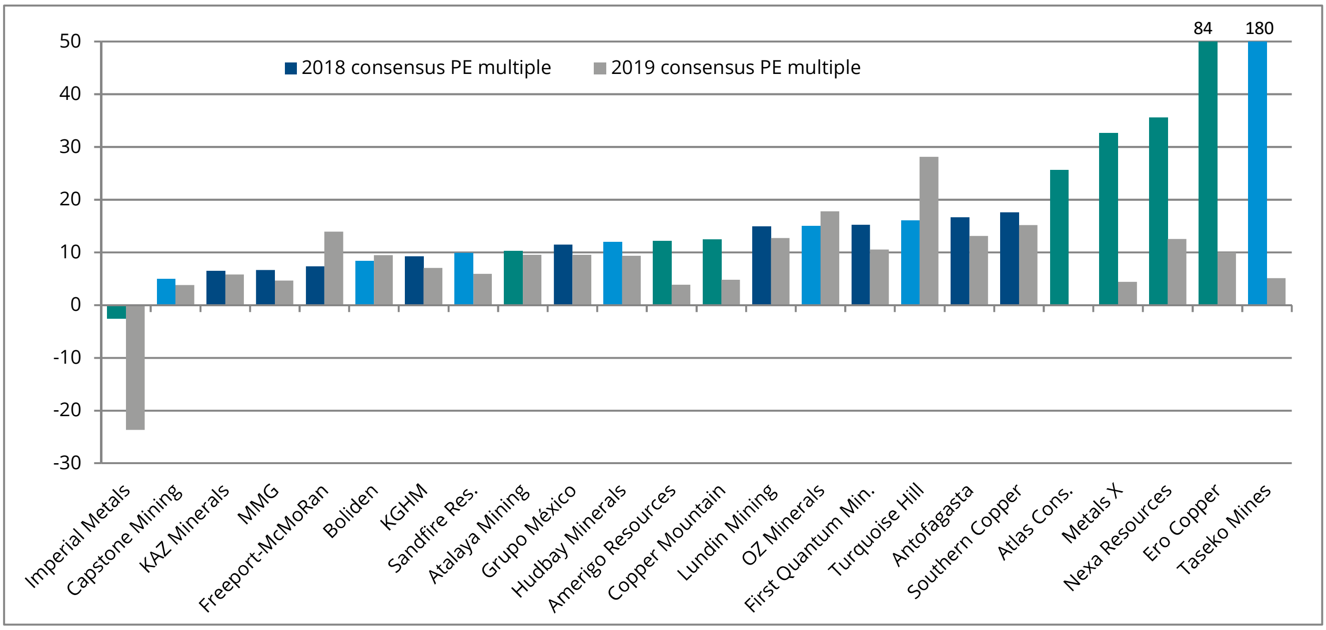
**Table 19: Copper Producers — Consensus EPS and EBITDA and Multiples**

| | | | EPS | | | | EBITDA | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mkt Cap | EV | 2018 | 2019 | P/E multiple | | 2018 | 2019 | EV/EBITDA | |
| Company | US$m | US$m | US$ | US$ | 2018 | 2019 | US$m | US$m | 2018 | 2019 |
| Southern Copper | 30,619 | 35,571 | 2.25 | 2.61 | 17.6 | 15.2 | 3,743 | 4,221 | 9.5 | 8.4 |
| Grupo México | 20,120 | 27,000 | 0.23 | 0.27 | 11.5 | 9.5 | 5,110 | 5,699 | 5.3 | 4.7 |
| Freeport-McMoRan | 17,682 | 26,352 | 1.65 | 0.88 | 7.4 | 13.9 | 6,939 | 4,507 | 3.8 | 5.8 |
| First Quantum Min | 6,927 | 12,502 | 0.66 | 0.95 | 15.3 | 10.5 | 1,740 | 2,318 | 7.2 | 5.4 |
| MMG | 1,944 | 10,200 | 0.37 | 0.52 | 6.7 | 4.7 | 2,037 | 2,189 | 5.0 | 4.7 |
| Antofagasta | 10,376 | 12,001 | 0.63 | 0.80 | 16.7 | 13.1 | 2,238 | 2,631 | 5.4 | 4.6 |
| KGHM | 4,878 | 6,616 | 2.65 | 3.47 | 9.2 | 7.0 | 1,376 | 1,480 | 4.8 | 4.5 |
| KAZ Minerals | 3,192 | 5,248 | 1.10 | 1.23 | 6.5 | 5.8 | 1,215 | 1,229 | 4.3 | 4.3 |
| Lundin Mining | 3,202 | 2,084 | 0.29 | 0.34 | 14.9 | 12.7 | 666 | 773 | 3.1 | 2.7 |
| Boliden | 6,357 | 6,689 | 2.77 | 2.46 | 8.4 | 9.5 | 1,532 | 1,434 | 4.4 | 4.7 |
| Turquoise Hill | 2,944 | 5,658 | 0.09 | 0.05 | 16.1 | 28.1 | 402 | 441 | 14.1 | 12.8 |
| Hudbay Minerals | 962 | 1,492 | 0.31 | 0.39 | 12.0 | 9.3 | 565 | 541 | 2.6 | 2.8 |
| OZ Minerals | 2,153 | 1,597 | 0.45 | 0.38 | 15.0 | 17.8 | 354 | 327 | 4.5 | 4.9 |
| Sandfire Res. | 824 | 639 | 0.52 | 0.87 | 9.9 | 5.9 | 210 | 285 | 3.0 | 2.2 |
| SM El Brocal | 299 | 477 | N/A | N/A | - | - | N/A | N/A | - | - |
| Capstone Mining | 163 | 318 | 0.08 | 0.11 | 4.9 | 3.8 | 141 | 153 | 2.3 | 2.1 |
| Taseko Mines | 123 | 315 | 0.00 | 0.11 | 179.7 | 5.1 | 62 | 96 | 5.1 | 3.3 |
| Nexa Resources | 1,343 | 1,786 | 0.28 | 0.80 | 35.6 | 12.6 | 600 | 604 | 3.0 | 3.0 |
| Ero Copper | 643 | 732 | 0.09 | 0.76 | 83.7 | 10.0 | 67 | 132 | 11.0 | 5.5 |
| Atlas Cons | 183 | 664 | 0.00 | N/A | 25.7 | - | 95 | N/A | 7.0 | - |
| Punta del Cobre | 675 | 624 | N/A | N/A | - | - | N/A | N/A | - | - |
| Imperial Metals | 123 | 572 | (0.40) | (0.04) | (2.6) | (23.6) | 53 | 101 | 10.8 | 5.7 |
| Copper Mountain | 145 | 346 | 0.06 | 0.16 | 12.4 | 4.8 | 60 | 79 | 5.7 | 4.4 |
| Atalaya Mining | 356 | 304 | 0.29 | 0.32 | 10.3 | 9.6 | 61 | 76 | 5.0 | 4.0 |
| Metals X | 225 | 206 | 0.01 | 0.07 | 32.7 | 4.4 | 39 | 77 | 5.2 | 2.7 |
| Amerigo Resources | 130 | 165 | 0.06 | 0.19 | 12.2 | 3.9 | N/A | N/A | - | - |
| Aeris Resources | 36 | 81 | N/A | N/A | - | - | N/A | N/A | - | - |

Source: Bloomberg

A comparison of how the forward P/E and EV/EBITDA multiples have moved over time is shown on page 71.

**Figure 43: Company Consensus Forward P/E Multiples 2018 and 2019**




Source: Bloomberg, company data, RFC Ambrian

## Exploration Company Valuations

Within our database of copper explorers we identified 15 listed junior companies which have undeveloped resources of >3.0Mt or assets in construction phase, where we believe some kind of M&A activity could take place (see Table 20).

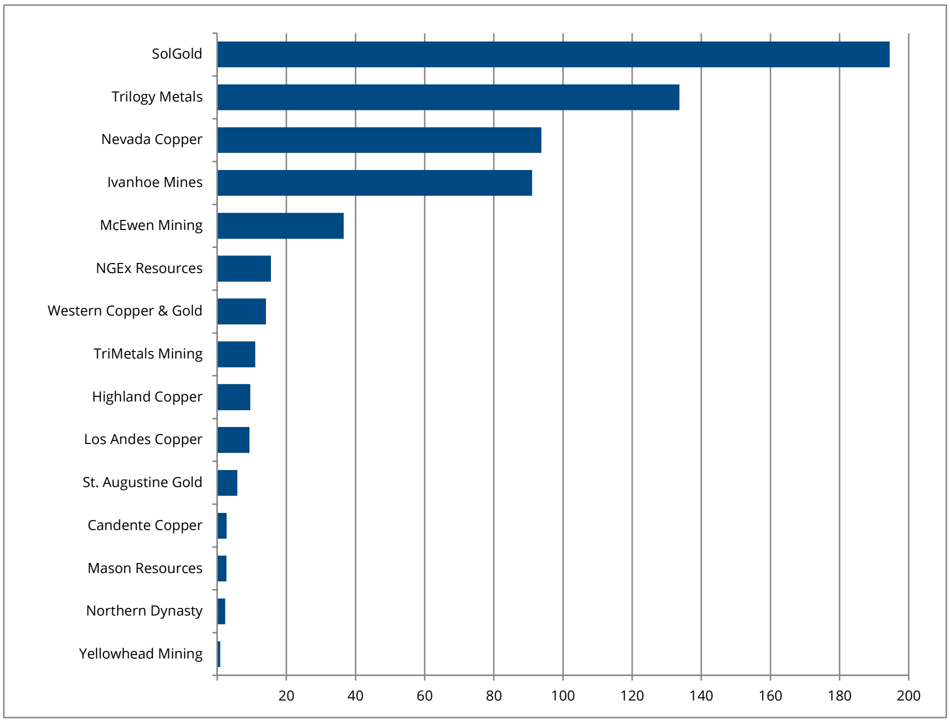
**Table 20: Copper Development Companies with Copper Reserves & Resources**

| | | Company | Mkt Cap US$m | EV US$m | R&R Attrib Mt | EV/t R&R |
|---|---|---|---|---|---|---|
| 1 | IVN CN | Ivanhoe Mines* | 1,638 | 1,581 | 17.4 | 91.1 |
| 2 | MUX CN | McEwen Mining* | 508 | 490 | 13.4 | 36.5 |
| 3 | SOLG CN | SolGold | 861 | 785 | 4.0 | 194.5 |
| 4 | NCU CN | Nevada Copper | 204 | 266 | 2.8 | 93.7 |
| 5 | TMQ CN | Trilogy Metals | 273 | 236 | 1.8 | 133.7 |
| 6 | NGQ CN | NGEx Resources | 175 | 170 | 10.9 | 15.5 |
| 7 | NDM CN | Northern Dynasty | 123 | 84 | 37.0 | 2.3 |
| 8 | WRN CN | Western Copper | 67 | 62 | 4.4 | 14.1 |
| 9 | LA CN | Los Andes Copper | 52 | 46 | 5.0 | 9.3 |
| 10 | HI CN | Highland Copper | 32 | 39 | 4.1 | 9.5 |
| 11 | TMI CN | TriMetals Mining | 11 | 28 | 2.5 | 11.0 |
| 12 | SAU CN | St Augustine Gold | 11 | 11 | 1.9 | 5.7 |
| 13 | DNT CN | Candente Copper | 11 | 11 | 4.0 | 2.7 |
| 14 | MNR CN | Mason Resources | 24 | 17 | 6.5 | 2.6 |
| 15 | YMI CN | YellowHead Mining | 3 | 3 | 3.6 | 0.8 |

*Holds significant other assets; Source: Company data

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.

**Figure 44: Development Company EV/t Reserves & Resources (US$)**

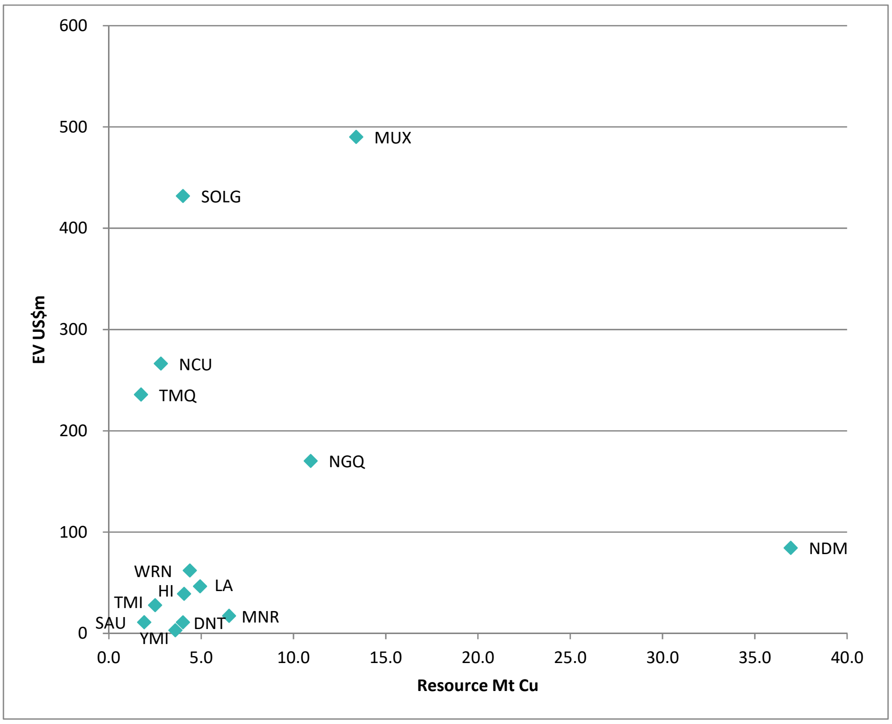



Source: Company data, RFC Ambrian estimates

We have not analysed all of 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.

It should be noted that both Ivanhoe Mining and McEwen Mining both have significant other assets and so the valuation measure of EV/t copper reserves and resources is not totally relevant.

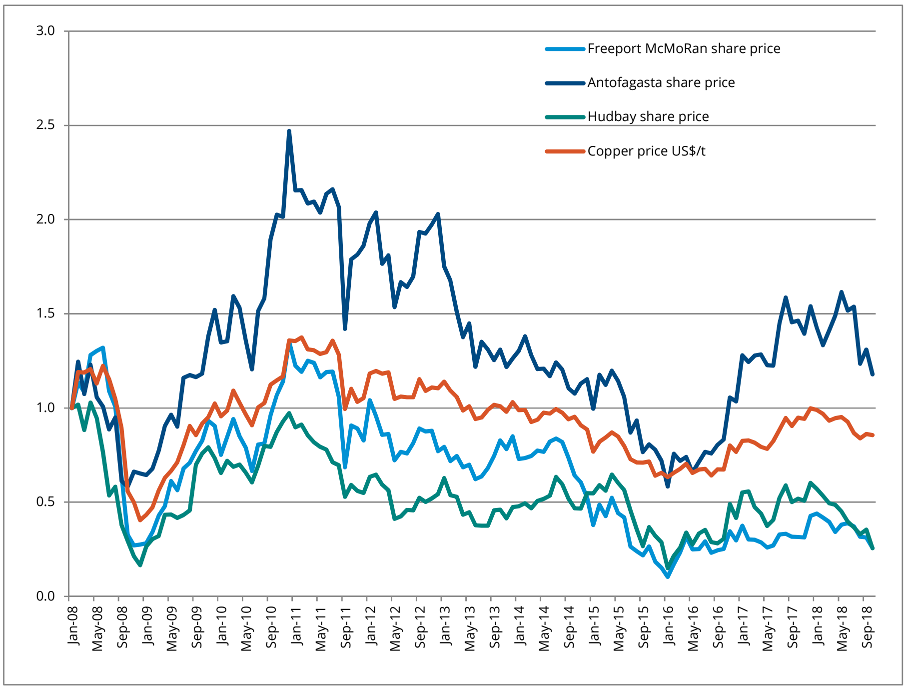
### Figure 45: Exploration Company EV (US$m) vs. Resources (Mt)




Source: Company data, RFC Ambrian estimates

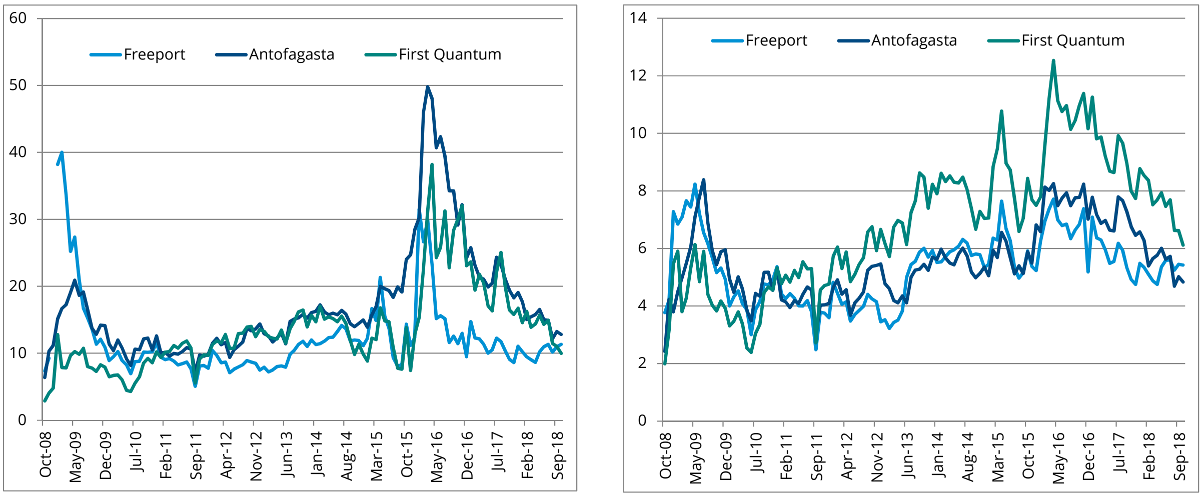
## Historic Share Prices and Trading Multiples

### Figure 46: Copper Price and 3 Copper Company Share Prices Rebased to 100



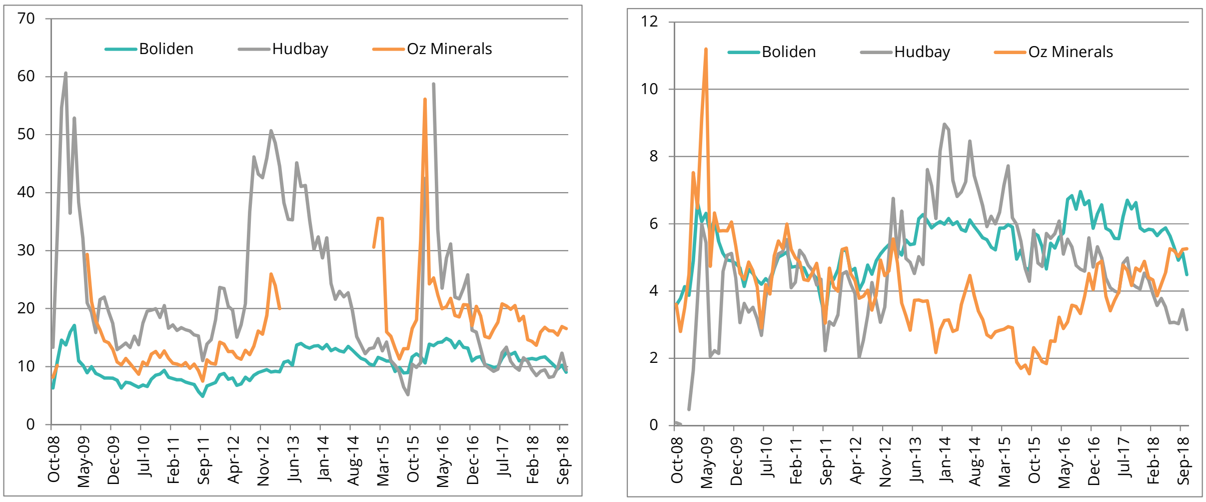

Source: Bloomberg

## Figure 47: Tier 1 Copper Producer Forward P/E and EV/EBITDA Multiples 2008-2018



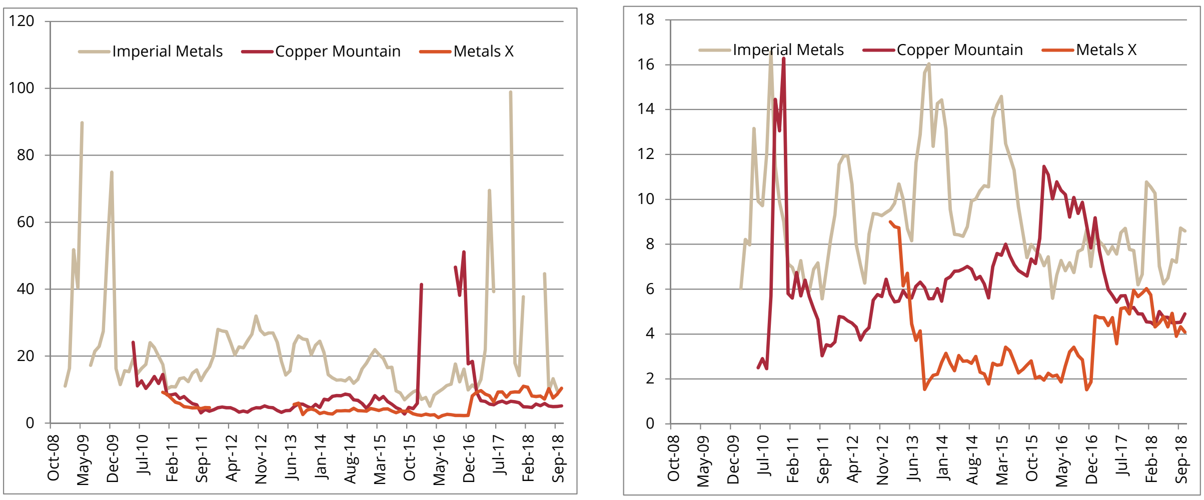

Source: Bloomberg, company data, RFC Ambrian

## Figure 48: Tier 2 Copper Producer Forward P/E and EV/EBITDA Multiples 2008-2018




Source: Bloomberg, company data, RFC Ambrian

## Figure 49: Tier 3 Copper Producer Forward P/E and EV/EBITDA Multiples 2008-2018




Source: Bloomberg, company data, RFC Ambrian

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# Appendix 1 — Tier 1 Copper Producers

**Table 21: Tier 1 Copper Producers Key Attributes of Company and Operating Mines 2017**

| Company | EV US$m | Cu Prod'n Attrib kt | Cash cost US¢/lb | Prod'n cost US¢/lb | Reserve Life yrs | R&R Life yrs | EBITDA Margin % | Net Debt /EBITDA |
|---|---|---|---|---|---|---|---|---|
| Codelco | N/A | 1,842,075 | 121 | 179 | 18 | 160 | 39% | 2.4 |
| Freeport McMoRan | 26,352 | 1,391,168 | 130 | 182 | 27 | 50 | 36% | 1.5 |
| Grupo Mexico | 27,000 | 913,285 | 140 | 166 | 54 | 54 | 46% | 1.5 |
| Southern Copper | 35,571 | 876,979 | 115 | 142 | 54 | 54 | 49% | 1.5 |
| KGHM | 6,616 | 550,505 | 158 | 204 | 20 | 38 | 28% | 1.1 |
| First Quantum | 12,502 | 523,803 | 147 | 213 | 9 | 16 | 35% | 4.8 |
| Antofagasta | 12,001 | 474,140 | 126 | 163 | 14 | 35 | 54% | 0.6 |
| MMG | 10,200 | 423,389 | 136 | 204 | 7 | 14 | 53% | 3.7 |
| KAZ Minerals | 5,248 | 258,500 | 91 | 139 | 29 | 45 | 62% | 2.0 |
| Lundin Mining | 2,084 | 202,989 | 121 | 176 | 18 | 46 | 52% | (1.0) |

Source: Company data

**Figure 50: Combined Tier 1 Copper Producers' CF from Operating Activities and CF from Investing Activities (US$m)**

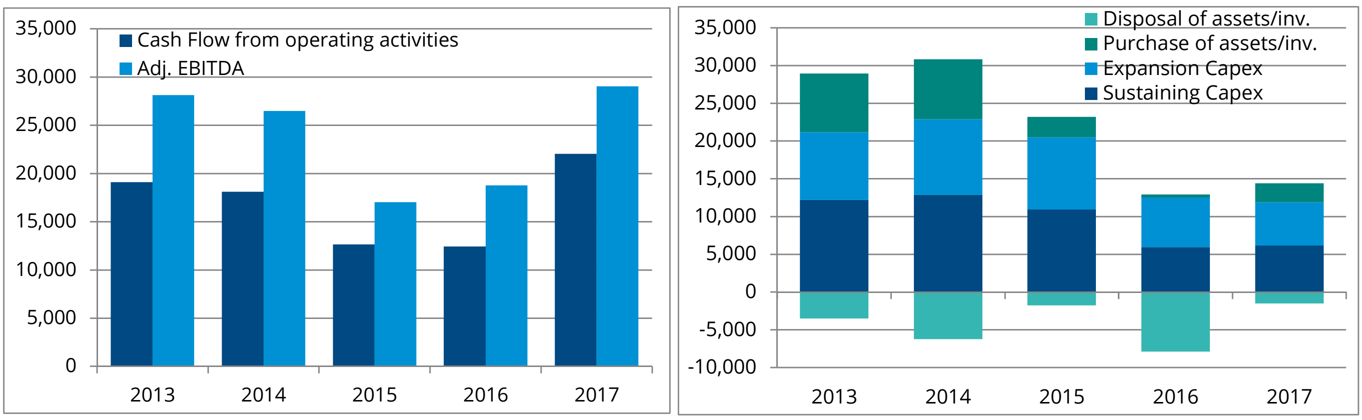
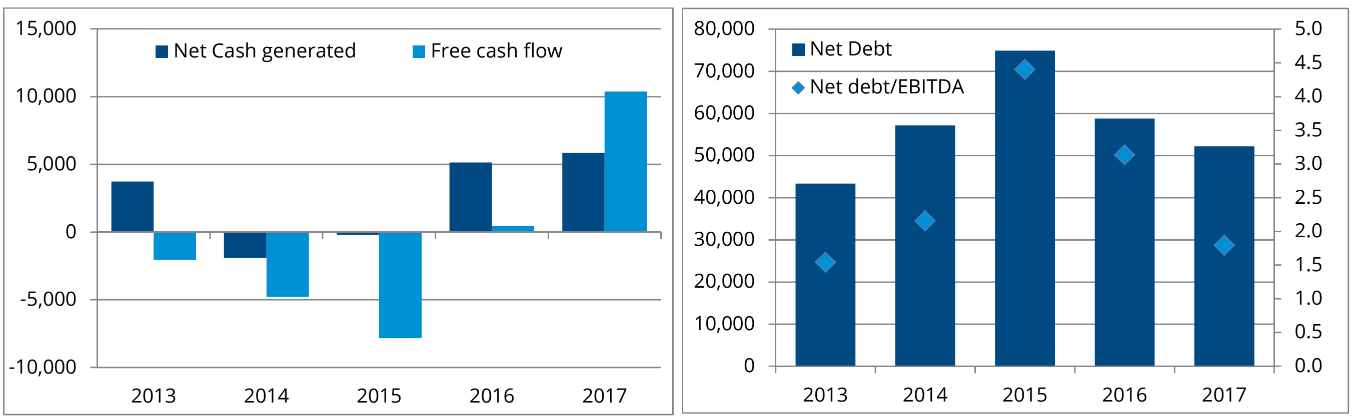



**Figure 51: Combined Tier 1 Copper Producers' Net Cashflow and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## Codelco

Codelco is owned by the Government of Chile and is a key contributor of cash to the state. Codelco is the world's largest copper producer, with some of the largest geological resources and a large reserve base. Codelco is essentially a copper producer, but also produces some molybdenum. Codelco operates eight mining divisions: Radomiro Tomic, Chuquicamata, Ministro Hales, Gabriela Mistral, Salvador, Andina, El Teniente and the Ventanas smelter and refinery.

The two largest resources are the Andina and El Teniente divisions. The company produced 1,842kt of copper in 2017 at a reported cash cost of US¢136/lb. While it remains the world's largest copper producer, within our universe of multi-commodity copper producers, and Tier 1, Tier 2 and Tier 3 copper producers, this makes it a third quartile producer on cash costs.

In 2016 Codelco started a four-year programme to improve productivity by 20% and reduce costs. Since then EBITDA has improved sharply. The company has also started a capital investment programme in order largely to maintain future production levels caused by the abrupt decline in the copper ore grades that it is currently experiencing.

Over the next ten years it needs to invest US$39bn, with current debt of US$14.4bn. This will be financed through three channels: its own resources generated by the operations, debt acquired with private financiers, and contributions by the government through the capitalisation programme currently in progress.

So far the investment programme has been partly financed by a US$975m capital injection by the government and the issue of US$2,750m of 10- & 30-year bonds.

Codelco currently has three projects underway: Chuquicamata underground, the Andina transfer and a new mine level at the Andesita and Diamante projects (part of the El Teniente division). It is also spending significant capital upgrading its smelter.

**Codelco's focus is currently on its planned investment programme to optimise its own existing infrastructure and large resource base. It rarely participates in M&A, although it acquired a 20% stake in Anglo America Sur in 2012. We would not expect Codelco to be part of any imminent M&A because of its relatively high debt levels, future capital requirements and its necessary focus on its existing assets.**

**Figure 52: Codelco Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**

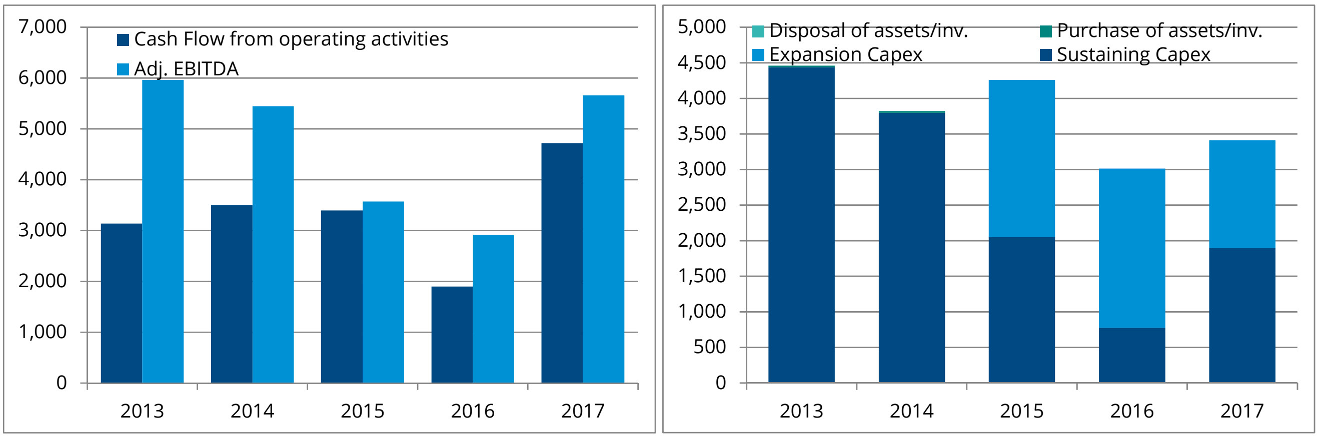



**Figure 53: Codelco Cashflow from Financial Activities and Net Cashflow (US$m)**

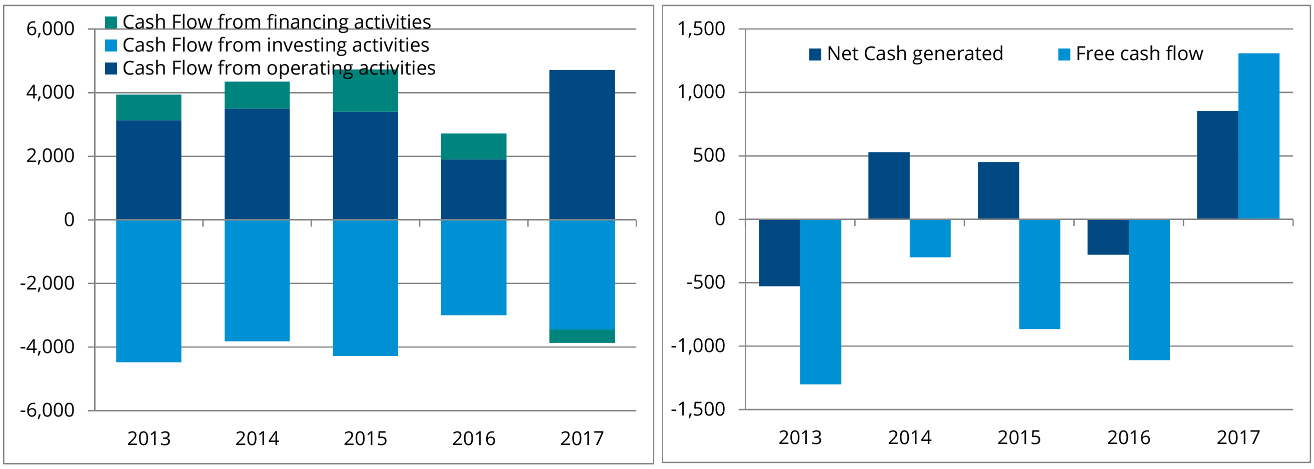
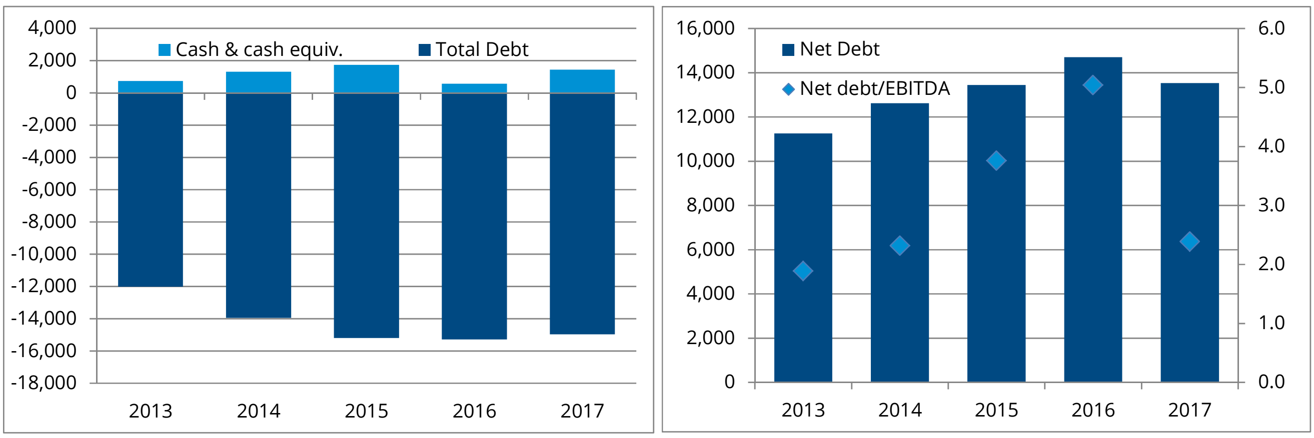



**Figure 54: Codelco Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## Freeport-McMoRan Copper & Gold

Freeport-McMoRan (FCX US: US$12.22| US$17,682m) is the world's second largest copper producer and trades on the New York Stock Exchange. Its portfolio of assets includes the Grasberg mine in Indonesia, one of the world's largest copper and gold deposits, as well as operations in North and South America. Freeport produces copper, gold and molybdenum, and in 2017 produced 1,678kt of copper and 1.6Moz of gold. The gold production is a key factor in making Freeport a low-cost copper producer. Cash production costs were US¢120/lb in 2017.

In North America, Freeport operates: seven open-pit copper mines — Morenci, Bagdad, Safford, Sierrita and Miami in Arizona, and Chino and Tyrone in New Mexico; and two molybdenum mines — Henderson and Climax in Colorado. Freeport has also started to develop the Lone Star oxide ores located near the Safford operation in Arizona. Copper production from Lone Star is expected to average 91kt/y with a 20-year mine life.

Freeport operates two copper mines in South America: Cerro Verde in Peru and El Abra in Chile. Through its subsidiary, PT-FI, Freeport mines one of the world's largest copper and gold deposits at Grasberg in Papua, Indonesia. It has several projects in progress to develop underground orebodies that are expected to transition production from the Grasberg open pit in early 2019.

Freeport has been an active acquirer of assets in the past and from time to time is reported as a takeover target of one of the larger global diversified mining companies. The most notable acquisition was of US-based Phelps Dodge for US$25.9bn in 2007. This move helped diversify its asset base from its main asset, Grasberg in Indonesia, which holds high geographic, operating, and political risks.

These risks were reduced in July 2018 when Rio Tinto agreed to sell its interest in Grasberg for US$3.5bn. The sale is part of a complex three-way deal that will see Indonesian investors take a controlling stake (51%) in Grasberg, fulfilling a pledge by the country's President Joko Widodo to boost local ownership of natural resources.

The company has improved its balance sheet in the past three years with a significant reduction in capex. This primarily reflects a decrease in oil and gas exploration and development activities, as a result of the sale of almost all of its oil and gas properties in late 2016, but also lower spending for major mining projects. The proceeds from asset sales of US$6.4bn in 2016 also helped improve the net debt position.

**Now that Freeport has more certainty over its Indonesian assets and its balance sheet has improved significantly, it may well seek to expand its portfolio. We feel there is a high likelihood of the company being involved in forthcoming copper transactions. At the same time, we feel that Freeport is an unlikely takeover target given that Rio Tinto, its most likely acquirer, has withdrawn from Grasberg.**

**Figure 55: Freeport-McMoRan Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**

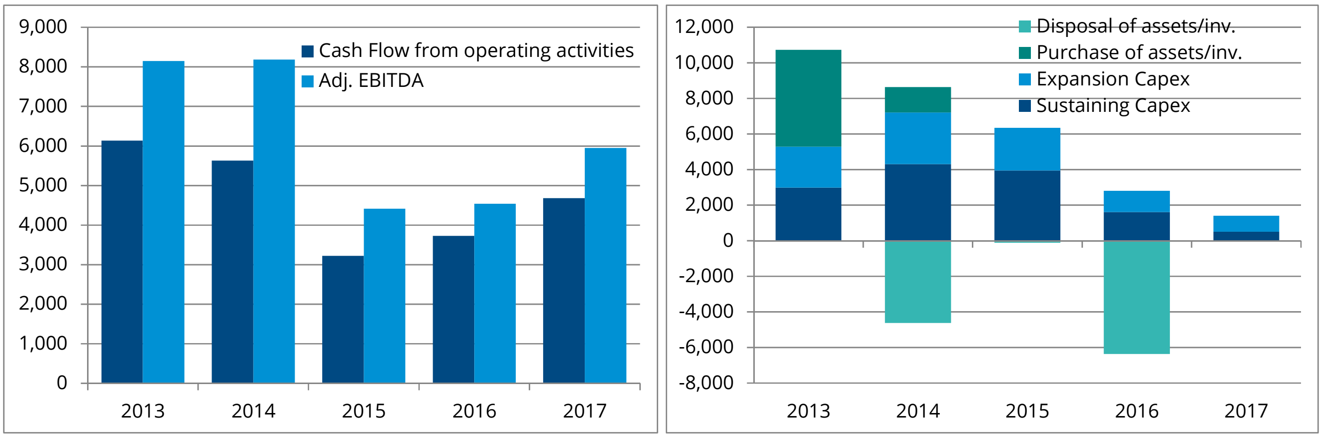



**Figure 56: Freeport-McMoRan Cashflow from Financial Activities and Net Cashflow (US$m)**

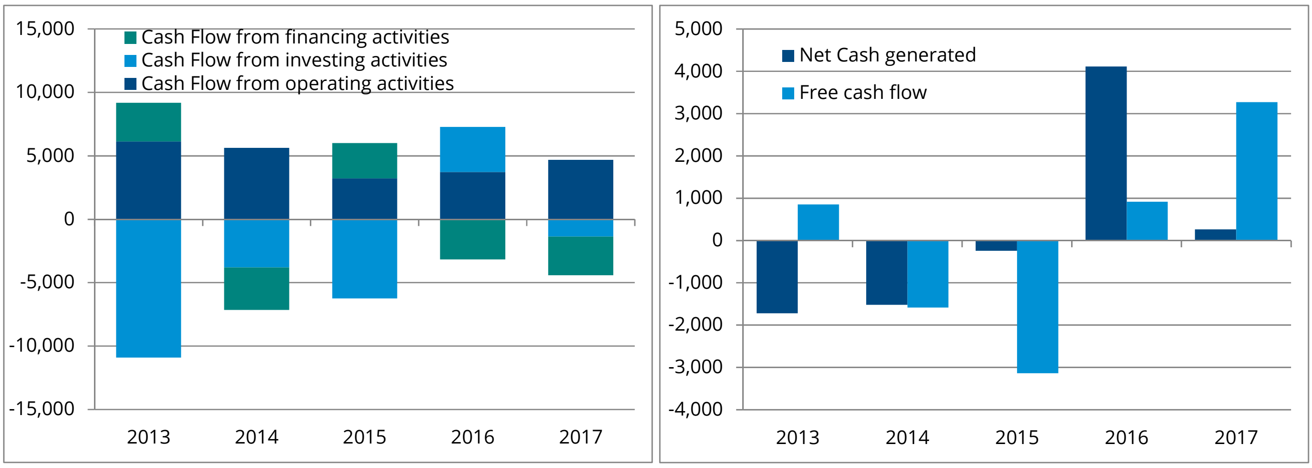
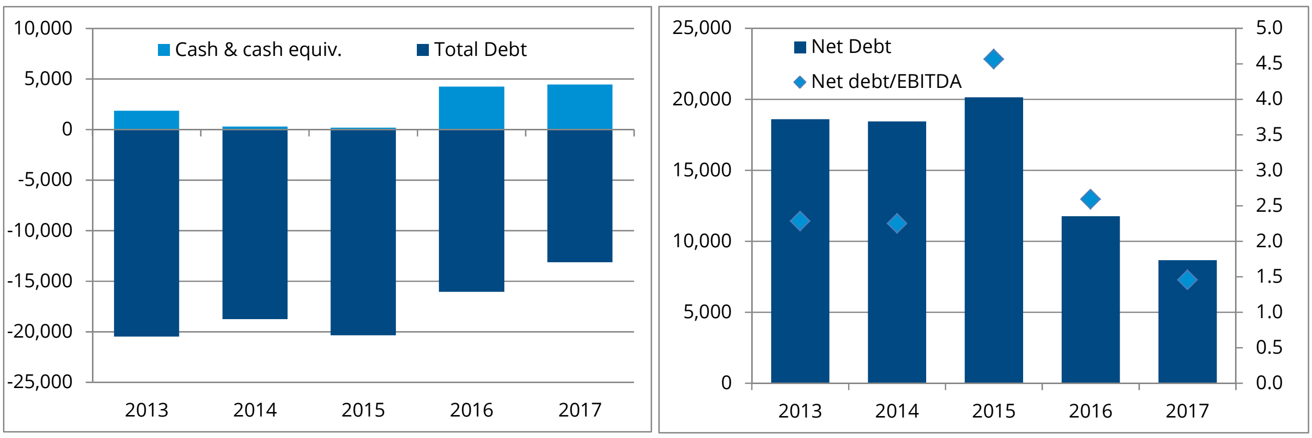



**Figure 57: Freeport-McMoRan Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## Grupo Mexico

Grupo Mexico (GMEXICOB : M$49.70| US$20,120m) is a major copper producer based in Mexico, and also owns a rail transportation and infrastructure business. Copper accounted for 65% of total revenues in 2017. Grupo Mexico has 15 underground and open-pit mines located in Mexico, Peru, the US, Argentina, Chile, Ecuador and Spain. Its Mexican and Peruvian assets are held through its 81% interest in Southern Copper. Its US assets are held through Asarco.

Grupo Mexico acquired a controlling position in Southern Peru Copper in 2005 and has gradually increased its ownership to 89% currently. It re-acquired US-based Asarco in 2009 after a four-year bankruptcy. Grupo Mexico first acquired Asarco in a leveraged buyout in 1999, but lost Board control of the subsidiary due to the bankruptcy.

In 2017 the company produced 1,011kt of copper at a reported average cash cost of US¢111/lb. At a mine production cost level, we calculate the average cash costs to be US¢140/lb using S&P Global Market Intelligence data. The low-cost production of Southern Copper is offset by the high-cost Asarco operations.

The company has just completed the expansion of its Toquepala mine in Peru, which has been a US$1.25bn project including a new copper concentrator that will expand annual copper production by 100ktons to total 245ktons of production in 2019. It also recently completed a modernisation of its Hayden smelter in Arizona.

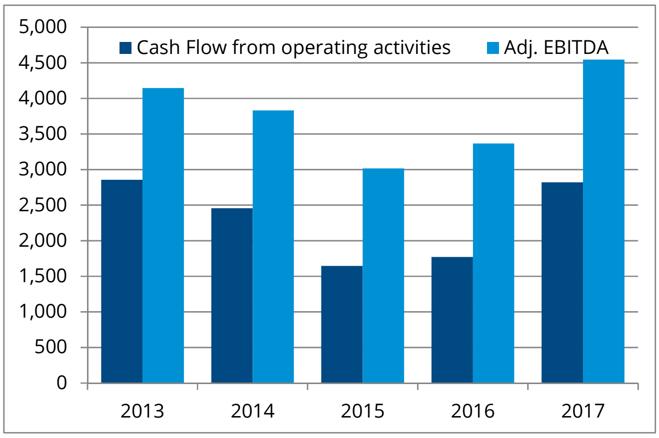
It will shortly begin construction of a new concentrator at a cost of US$413m to increase zinc production significantly at its Buenavista mine. It will also increase production at the La Caridad mine through development of the Pilares high-grade satellite deposit at a cost of US$159m for completion in 2019. It is also advancing its US$290m Aznalcóllar zinc project in Spain, where detailed engineering is expected to begin by late 2018, with operations starting in 2021.

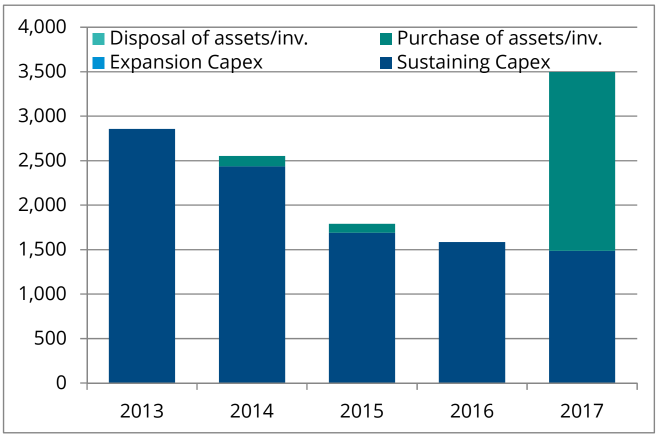
Meanwhile, the company continues to invest in its transportation division's operations, and is considering investments in projects for fuel storage terminals, and participating in Round 3.1 of the National Hydrocarbons Commission bidding for shallow-water oil and gas exploration and extraction projects in Mexico.

The financial data in Figures 58-60 reflect the whole company, including capital expenditure, and in 2017 Grupo Mexico acquired the Florida East Coast Railway for US$2.10bn and in November 2017 listed 13.4% of this division on the Mexican stock exchange. Despite the acquisition, Grupo Mexico only increased its net debt slightly and its Net Debt-to-EBITDA ratio fell to 1.5x in 2017.

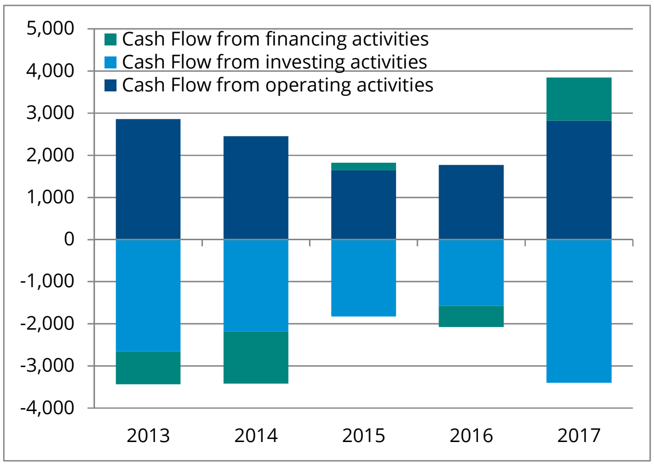
**Grupo Mexico's balance sheet is sound and free cashflow has rebounded. While the company could be involved in copper M&A, particularly in the Americas, it has a number of projects ongoing for mine development and expansion as well as investing in other areas of its business. Investment in the hydrocarbon industry could result in a significant use of capital in the near term. These factors suggest that near-term involvement in copper M&A is unlikely.**

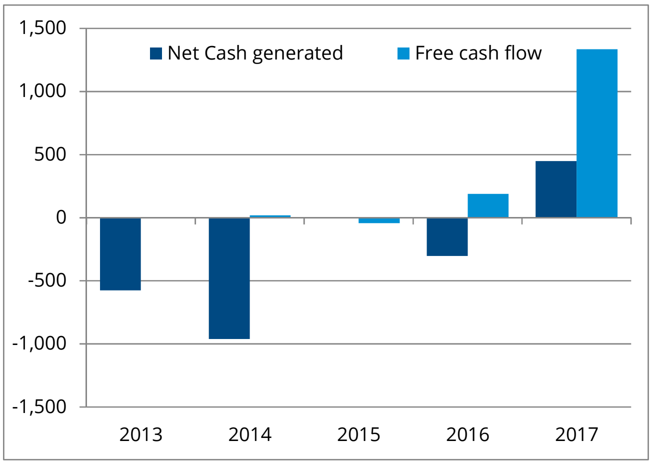
### Figure 58: Grupo Mexico Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)



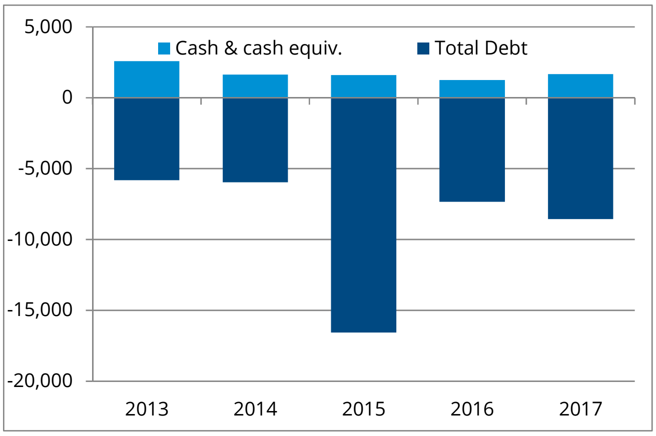



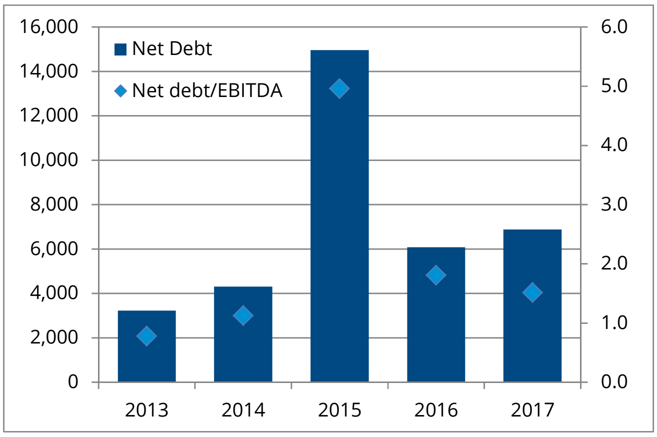

### Figure 59: Grupo Mexico Cashflow from Financial Activities and Net Cashflow (US$m)




### Figure 60: Grupo Mexico Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)




Source: Company data, RFC Ambrian estimates

## Southern Copper

Southern Copper (SSCO US: US$39.61| US$30,619m) is a major copper producer, but is 89%-owned by Grupo Mexico, which acquired a controlling position in Southern Peru Copper in 2005 and has gradually increased its ownership. This has largely been achieved by some US$2.9bn of share repurchases by Southern Copper.

It operates mining, smelting and refining facilities in Peru and Mexico and conducts exploration activities in those countries and in Argentina, Chile and Ecuador. In Peru it operates the Toquepala and Cuajone open-pit mines high in the Andes, and operates a smelter and refinery west of the mines in the coastal city of Ilo.

In Mexico it operates the La Caridad open-pit copper mine, a copper ore concentrator, a SX-EW plant, a smelter, refinery and a rod plant. At Buenavista, an open-pit copper mine which is one of the world's largest copper ore deposits, it operates two copper concentrators and three SX-EW plants. It also operates five underground mines that produce zinc, lead, copper, silver and gold, a coal mine, and a zinc refinery.

The company produced 877ktons of copper in 2017, along with some molybdenum, zinc and silver, at a reported cash cost of US¢92/lb. At a mine production cost level, we calculate the average cash costs to be US¢115/lb using S&P Global Market Intelligence data. The company also has the largest reported reserve base of any copper producer.

In 2018 the company completed the expansion of its Toquepala mine in Peru, which has been a US$1.25bn project including a new copper concentrator that will expand annual copper production by 100ktons to total 245ktons of production in 2019.

In Mexico, it will shortly begin construction of a new concentrator at a cost of US$413m to increase zinc production at its Buenavista mine significantly. It will also increase production at the La Caridad mine through development of the Pilares high-grade satellite deposit at a cost of US$159m for completion in 2019.

Its largest development project is Tia Maria in Peru. However, it has experienced delays while trying to resolve issues with community groups. Southern Copper states that it continues working with these groups in order to resolve open issues concerning the project. Southern Copper has completed engineering studies and obtained environmental approvals and is now waiting for the construction licence, which is expected to be issued imminently by the Peruvian Government. The construction permit has been delayed due to pressures from anti-mining groups. This will be a SX-EW copper greenfield project with a total capital budget of US$1,400m.

**Southern Copper has significantly improved it balance sheet through a sharp reduction in share buybacks, improved cashflow and lower capex. However, the company has a large resource base and it is currently developing a new organic growth plan to increase its copper production to 1.5Mtons by 2025 with the development of new projects. While it is possible, this significantly reduces the likelihood of it being involved in M&A in the near future.**

**Figure 61: Southern Copper Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**

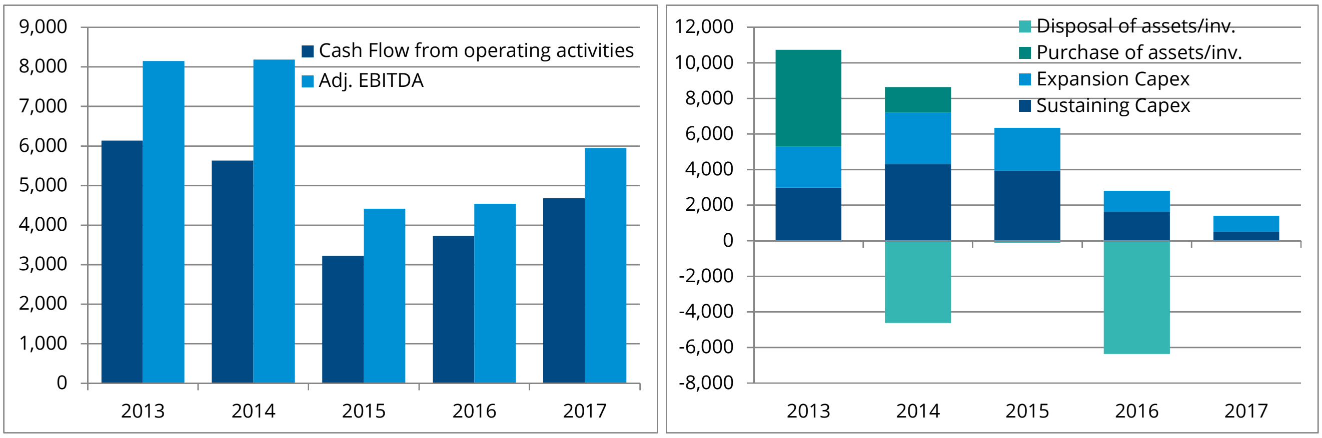



**Figure 62: Southern Copper Cashflow from Financial Activities and Net Cashflow (US$m)**

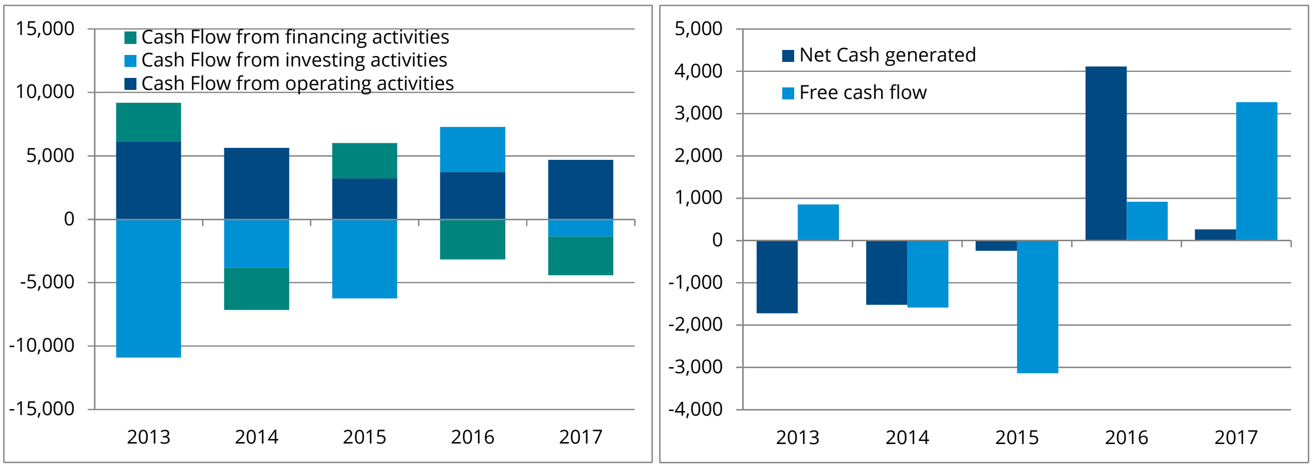
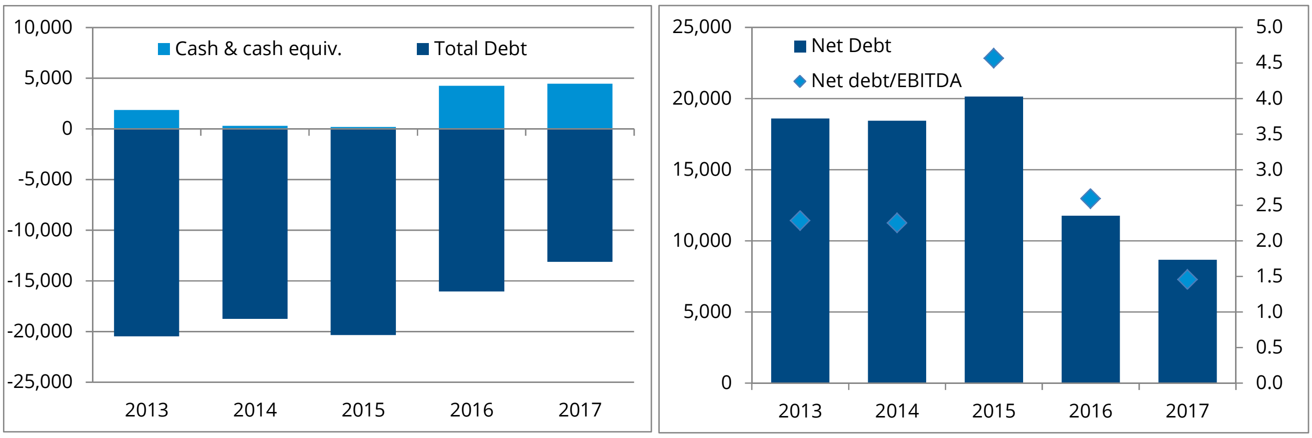



**Figure 63: Southern Copper Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## KGHM

KGHM Polska Miedź (KGH P: P$90.34| US$4,878m) is a large copper and silver producer with its main asset being three underground mining operations in Poland, along with smelters, refineries and a wire rod plant. This is a large historic mining area and KGHM operates the Lubin, Polkowice-Sieroszowice and Rudna mines.

KGHM grew its resource base and significantly increased copper production after the acquisition of Quadra FNX in 2012. This resulted in the acquisition of the Sudbury operations in Canada, the Robinson mine in the US, and the Franke mine in Chile. The 55%-owned Sierra Gorda mine was then brought on stream in 2014. This was an important part of its geographic diversification strategy at the time and also extended production to other non-ferrous metals (eg, molybdenum and gold).

In 2017 KGHM produced an attributable 551kt of mined copper production at an average mined cash cost of US¢158/lb, of which 419kt came from its Polish operations.

In May 2017 KGHM withdrew its 2015 goal — to mine over 1Mt of copper equivalent by 2020. It had planned to develop its existing assets through an investment programme of PLN27bn, but stated that it did not have the funds to implement this in a stable and reliable manner. It further found it a priority to service its existing debts. The investment target was reduced to PLN15bn and the company is now looking for stable annual production. KGHM is now focused in particular on continuing key projects, which include providing access to new areas of exploitation, completing the pyrometallurgy modernisation programme, the smelting development programme, and the Żelazny Most tailings pond expansion.

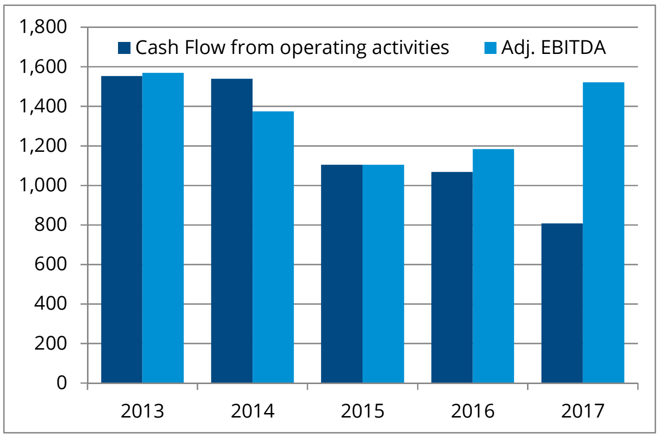
As a result, the capex level has fallen and net debt levels have declined and the company had a Net Debt-to-EBITDA ratio of just 1.1x at the end of 2017.

The original programme also included an extensive exploration programme, combined with potential acquisition of pre-production assets. However, exploration expenditure has also fallen sharply and no acquisitions have been visible, although the company still states that it is looking for potential areas of investment for diversification.

KGHM has two main copper development projects: Victoria and Ajax. The Victoria Project is currently at the pre-production phase. The project involves the construction of an underground polymetallic mine, located near Sudbury in Canada. However, management has put the project on hold due to insufficient financing. KGHM also holds 80% of the Ajax Project. Average production is estimated at around 58kt/y of copper and 125koz/y of gold in concentrate. However, the Environmental Application certificate was not awarded by the Federal Government of Canada in December 2017. The company is considering its next course of action.

**KGHM's balance sheet is sound, but it appears to be focusing on its existing assets, including the late-stage development projects. While it could look to acquire other copper assets, it does not look like a key priority at this stage.**

**Figure 64: KGHM Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**



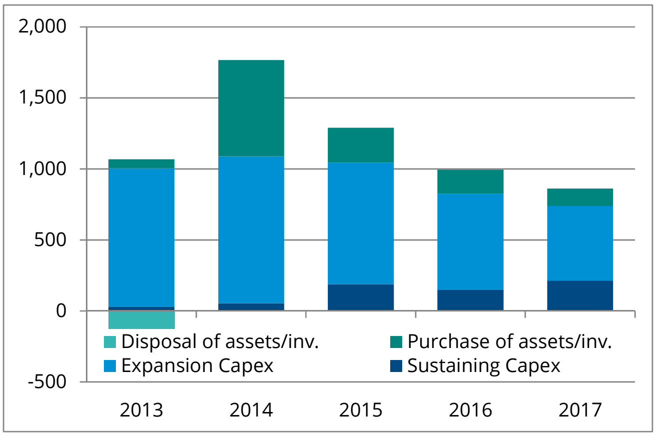
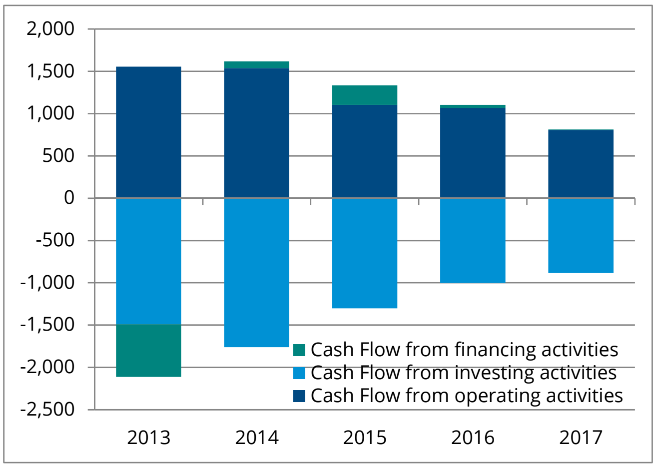




**Figure 65: KGHM Cashflow from Financial Activities and Net Cashflow (US$m)**



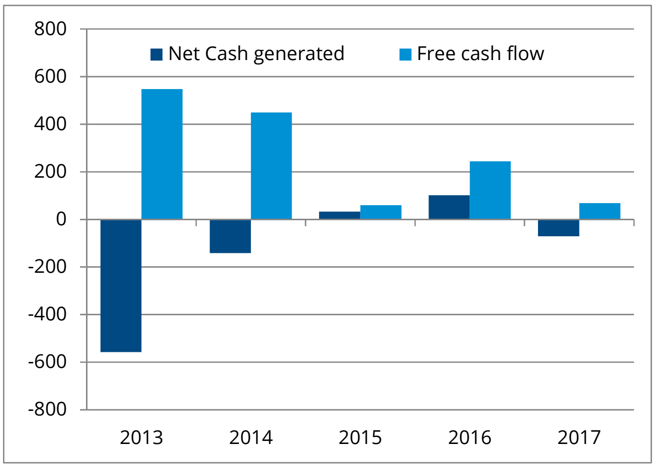
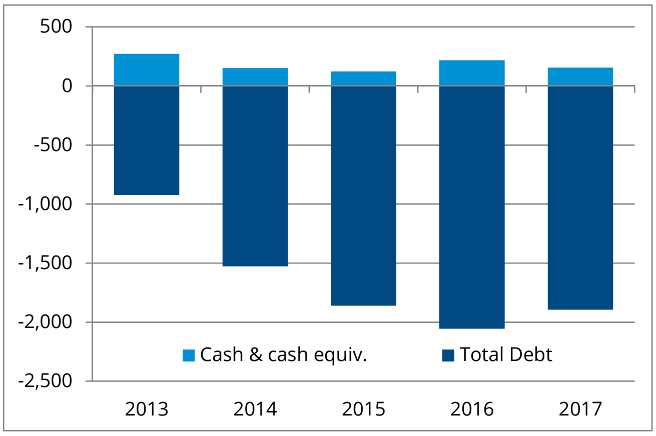
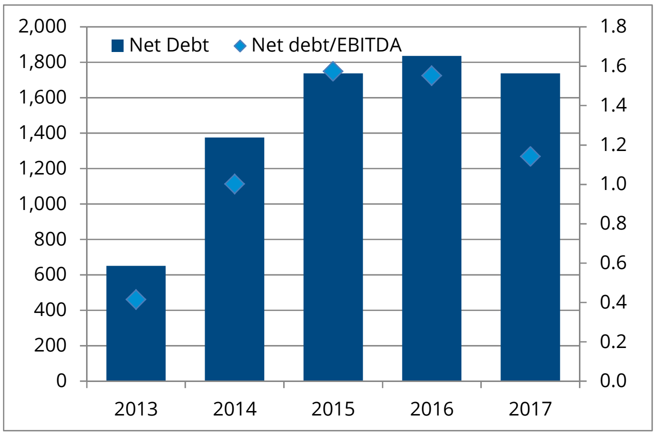




**Figure 66: KGHM Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## First Quantum Minerals

Canadian-listed First Quantum Minerals (FM CN: C$13.05 | US$6,927m) has progressively grown its assets from 1996, through acquisition and the discovery of new deposits, to become a top ten copper producer. In 2017 the company produced 524kt of attributable copper and 200koz of gold at an average mined cash cost of US¢147/lb.

It currently operates seven mines: Kansanshi mine and smelter (80%) and Sentinel (100%) in Zambia, Guelb Moghrein (100%) in Mauritania, Las Cruces (100%) in Spain, Pyhäsalmi (100%) in Finland, Ravensthorpe (100%) in Australia and Çayeli (100%) in Turkey. The company's Ravensthorpe nickel mine was placed under care and maintenance in October 2017.

In 2013 it acquired Inmet Mining, which brought with it the 90%-owned Cobre Panama project, which is now under development. Its next most significant copper development projects are Taca Taca in Argentina (13Mt copper), where an environmental impact study for site construction and operation is underway, and Haquira in Peru (6Mt copper) where an EIA is also underway.

Cobre Panama is a large open-pit copper development project in Panama. First Quantum originally held an 80% equity interest in the project and increased its interest to 90% in 2017. The US$6.3bn project is expected to start phased commissioning during 2018, continue to ramp up over 2019 and reach the 85Mt/y throughput rate by 2020. Over this period, contained copper production is estimated at a minimum of 150kt in 2019, 270-300kt in 2020 and up to 350kt in 2021. At steady-state, the unit cost of production is estimated at US$1.20/lb C1 and US$1.50/lb all-in sustaining, net of by-product credits.

Exploration activities ramped up during 2018, capitalising on the considerable pipeline of early-stage targets generated from sustained investment in information gathering and reconnaissance over the last two years. In May 2018 First Quantum withdrew from an option agreement with Northern Dynasty Minerals over the Pebble Project, with a loss of US$38m.

First Quantum has a high level of debt on its balance sheet, with net debt of some US$5.6bn and a Net Debt-to-EBITDA ratio of 4.8x as at the end of 2017. This partly reflects past acquisitions, but also its high capex on mine development. The company states that it expects to have sufficient liquidity through the next 12 months to carry out its operating and capex plans and remain in full compliance with financial covenants. The company continues to act to manage operational and price risk and further strengthen the balance sheet.

**First Quantum has been an active participant in the copper M&A market throughout its history and is likely to continue to be involved. However, it is currently focused on the development of the Cobre Panama mine and is also somewhat constrained by its balance sheet, but could remain active in early-stage exploration through earn-in arrangements, investment and through its own project generation.**

**Figure 67: First Quantum Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**

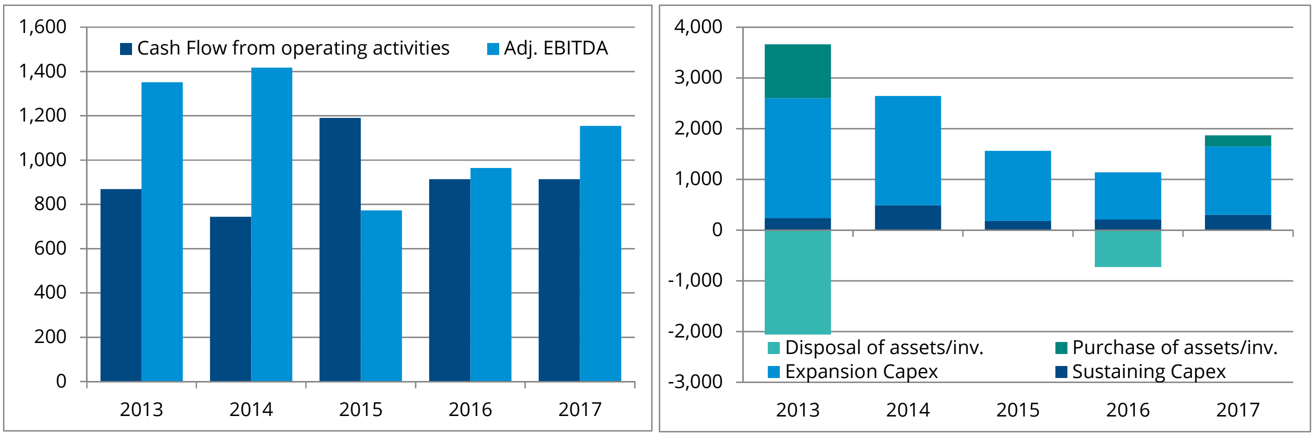



**Figure 68: First Quantum Cashflow from Financial Activities and Net Cashflow (US$m)**

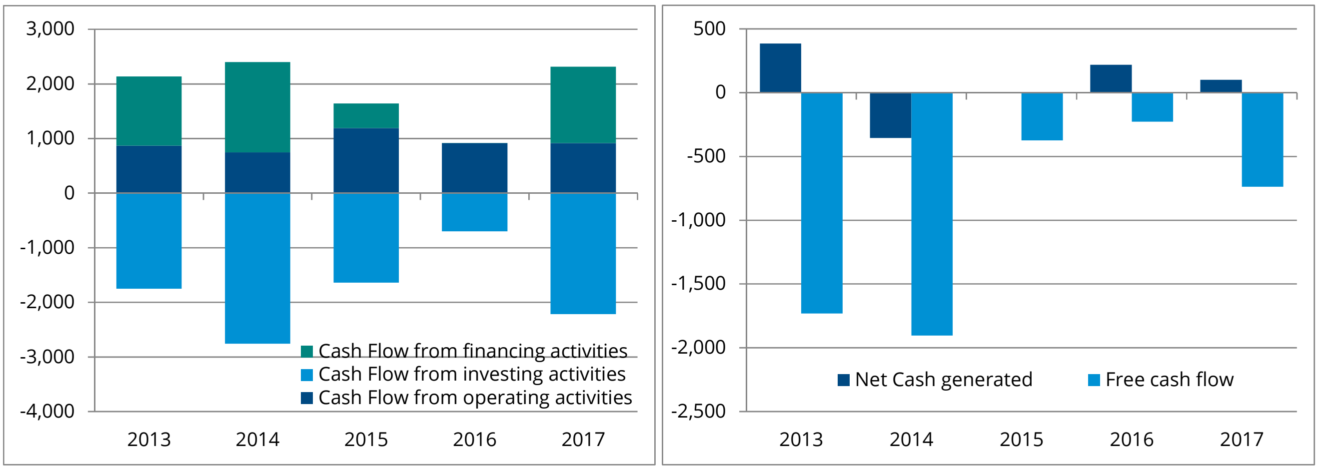
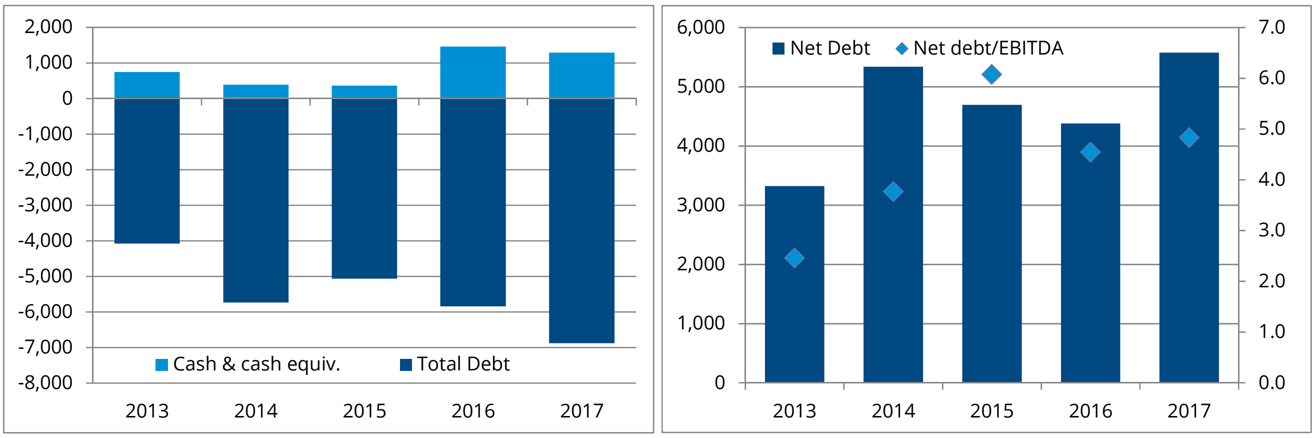



**Figure 69: First Quantum Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## Antofagasta

Antofagasta (ANTO LN: £8.10 | US$10,376m) is a Chilean copper mining company listed in London. Some 65% of ordinary share capital is owned by the Luksic Group of Chile. In 2017 the company produced an attributable 474kt of copper at an average mine cash cost of US¢126/lb.

The company operates four copper mines in Chile, and produces significant volumes of gold and molybdenum as by-products. It also has a portfolio of growth opportunities located predominantly in Chile. In addition to mining, the company's transport division provides rail and road cargo services in northern Chile, predominantly to mining customers, including to some of the company's own operations.

The four mines are Antucoya (70%), Centinela (70%), Zaldivar (50%) and its largest mine Los Pelambres (60%). The interest in Zaldivar was acquired for US$1.0bn from Barrick Gold in 2015, which holds the remaining 50% interest. In 2014 Antofagasta acquired Duluth Metals for some C$96m to acquire the outstanding 60% of the Twin Metals polymetallic project, which the company continues to advance and is updating a PFS.

Antofagasta holds a 50% interest in Tethyan, which owns a 75% interest in the large Reko Diq copper-gold project in Pakistan. This is a joint venture with Barrick Gold, but is now subject to international arbitration.

Los Pelambres produced 344kt of copper, 55koz of gold and 11kt of molybdenum in 2017, at a cash cost of US¢102/lb including by-product credits. Antofagasta expects to start construction of the US$1.3bn Incremental Expansion project at Los Pelambres in 2018. Total company capex for 2018 is expected to be about US$1.0bn.

The company is also examining the expansion of production at Centinela and is considering two alternatives. One is to build a new second concentrator at an estimated cost of US$2.7bn and producing some 180kt/y of copper equivalent. The other is to expand the existing concentrator. Preliminary work on this option suggests lower capex and lower construction and project execution risks.

On the exploration front, the company has a programme focused on the Americas to identify long-term growth options. The exploration and evaluation expenditure was US$69m in 2017. The company has also stated that it monitors the current market to assess potential accretive acquisitions or joint ventures. The company is looking for high-quality operating assets and/or high-potential early-stage developments.

**Antofagasta's strong balance sheet has allowed it to take advantage of organic growth opportunities and should enable it to continue this strategy. It is also in a position (and has the potential) to participate in M&A opportunities should they arise, although these would most likely need to be in the Americas.**

**Figure 70: Antofagasta Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**

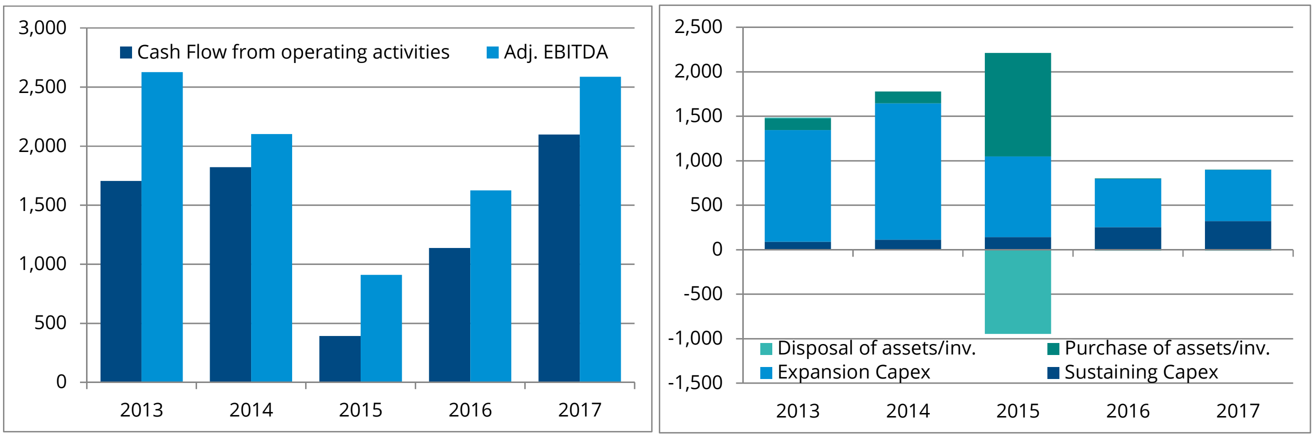



**Figure 71: Antofagasta Cashflow from Financial Activities and Net Cashflow (US$m)**

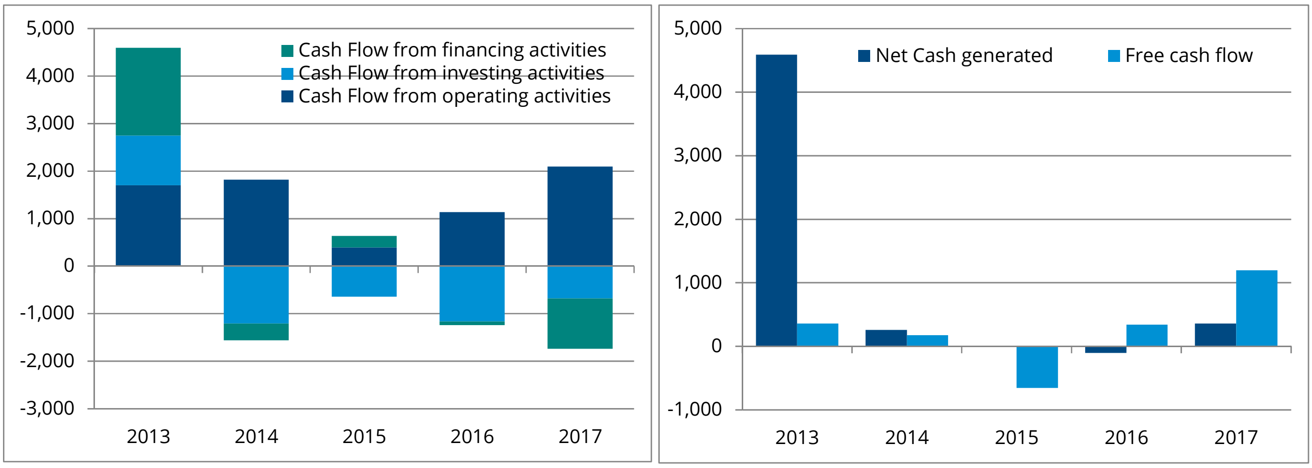
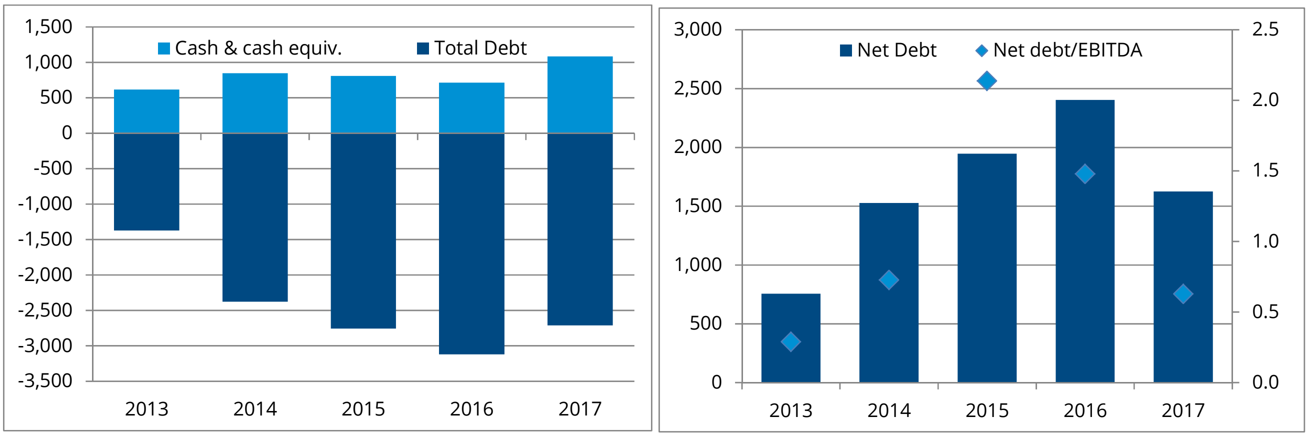



**Figure 72: Antofagasta Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## MMG

MMG (MMG AU: A$3.44 | US$1,944m) is a Chinese-operated business listed on the Australian and Hong Kong stock exchanges. MMG is 74%-owned by the Chinese state-owned company China MinMetals Corp. It was formed in 2009 following the purchase of the majority of assets of OZ Minerals. In 2012 it acquired Anvil Mining with assets in the DRC for about US$1.3bn. Then in 2014, a joint venture, owned by MMG, GUOXIN IIC and CITIC Metal, paid about US$3.0bn in cash to acquire the Las Bambas Project in Peru from Glencore.

MMG currently operates two copper mines — Kinsevere (100%) in the DRC and Las Bambas (62.5%) in Peru. It also operates the zinc mine Dugald River (100%) in Australia, and the polymetallic mine Rosebery (100%) in Australia. The company produced an attributable 420kt of copper in 2017 at an average mine cash cost of US¢136/lb along with zinc. The sharp increase in copper production in 2017 was primarily due to the first full year of commercial production at Las Bambas, which produced 454kt of copper.

Zinc production at Dugald River began in 4Q17 after the completion of the US$560m construction of the new mine, which should produce 170kt/y of zinc in concentrate at a cash cost of US¢68/lb and has a 25-year mine life.

MMG's asset portfolio also underwent significant change in 2017, with the company selling several assets to optimise its portfolio and focus on its strategic development. It sold the Golden Grove mine to EMR Capital, sold the Century mine and associated infrastructure to New Century Resources, and finalised the sale of the Avebury nickel mine in Tasmania, which has been on care and maintenance since 2009. Then in 2018 it sold its 90% interest in the Sepon mine to Chifeng Jilong Gold Mining for US$275m.

Free cashflow improved in 2017 with the operation of Las Bambas, and MMG has been able to reduce debt levels via initiatives that included the sale of assets, the voluntary pre-payment of US$1.0bn on the Las Bambas project debt, a US$338m redemption of Convertible Redeemable Preference Shares and the renegotiated terms of its US$2,262m shareholder loan. At the end of 2017, MMG's balance sheet still had a large level of net debt, with a Net Debt-to-EBITDA ratio at 3.7x.

MMG currently has a limited pipeline of development opportunities and exploration in 2017 focused on sustaining current ore reserves and increasing the mine life of existing assets, with a particular focus on Kinsevere and establishing exploration programmes at Las Bambas.

**Acquisition of assets, along with discovery and development, is part of MMG's stated strategy to become a 'top middle tier mining company by 2020'. While MMG's balance sheet looks stretched, its parent China MinMetals brings financial support, balance sheet flexibility, and access to Chinese financial institutions. This means that it could continue to be involved in M&A activity at all levels, but could look to improve its exploration and development pipeline now that Las Bambas and Dugald River are operational.**

**Figure 73: MMG Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**

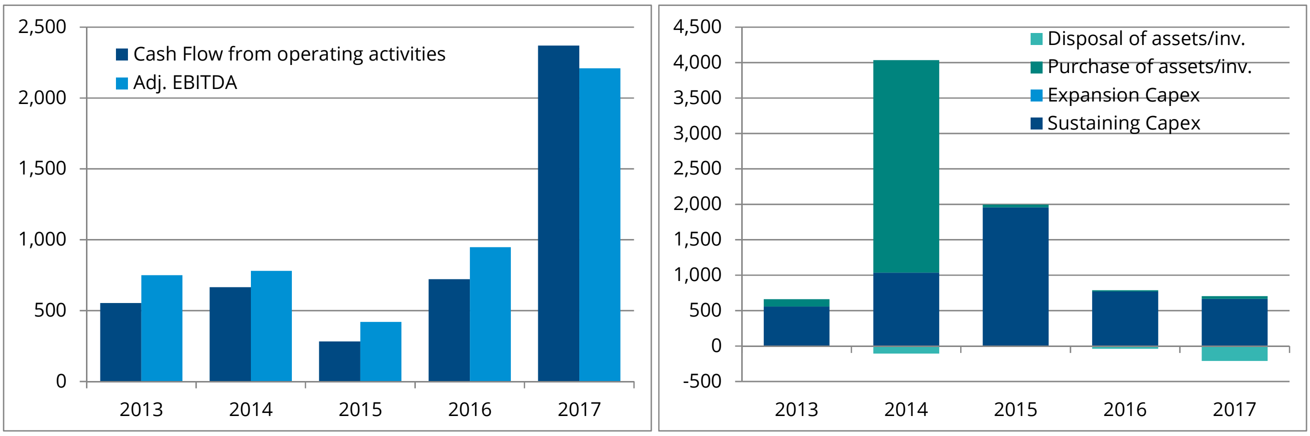



**Figure 74: MMG Cashflow from Financial Activities and Net Cashflow (US$m)**

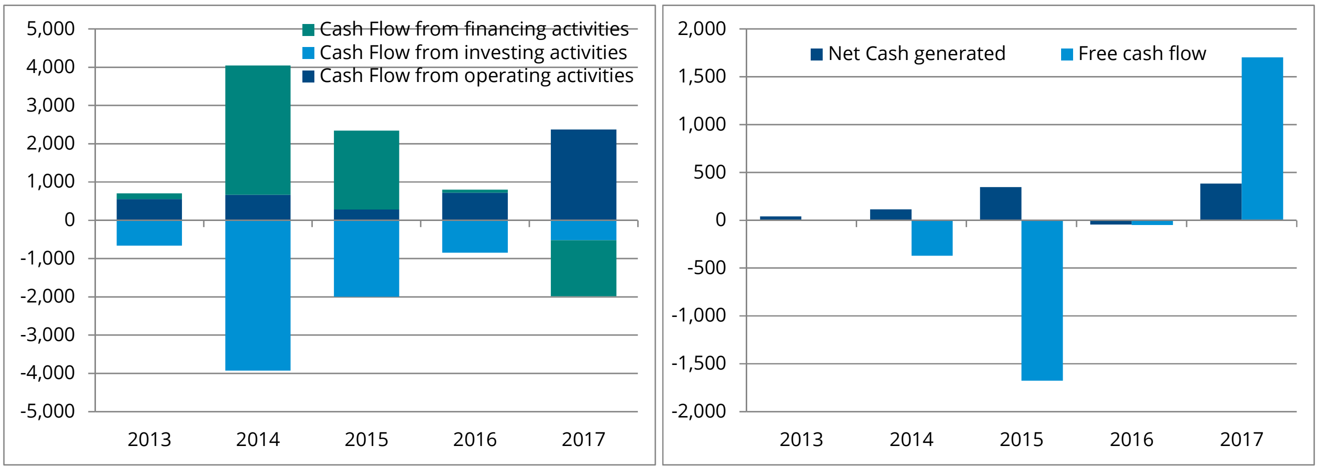
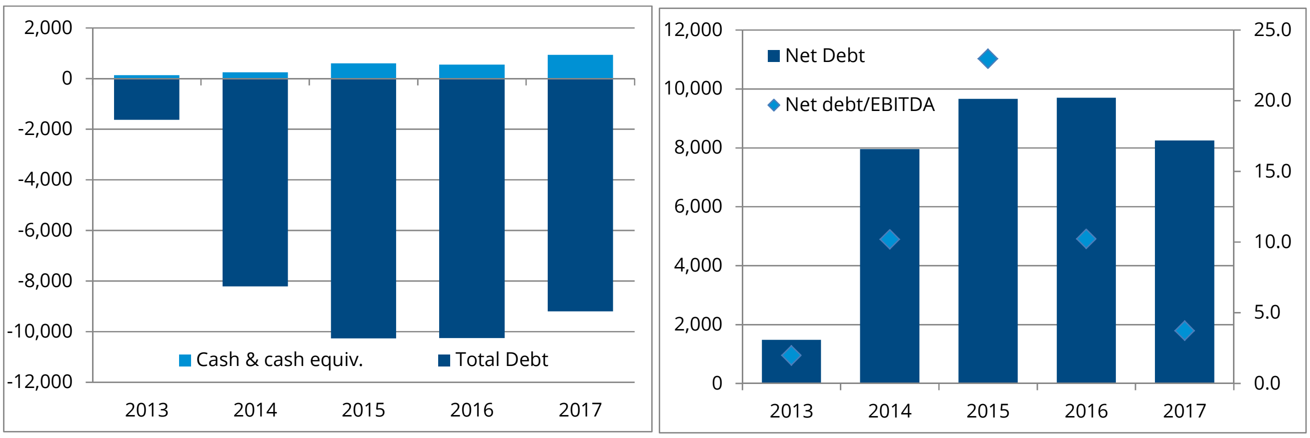



**Figure 75: MMG Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## KAZ Minerals

KAZ Minerals (KAZ LN: £5.48 | US$3,192m) is a copper company based in Kazakhstan and is focused on the mining and processing of copper. It is listed in London and Kazakhstan. The company has insider ownership of an estimated 48%, including 33.4% owned by Mr Vladimir Kim and 7.8% by Mr Oleg Novachuk. KAZ Minerals was created from a restructuring of Kazakhmys in October 2014.

The group has undergone a period of significant change since 2014 when 12 out of 16 mines and other assets were divested for US$2.2bn of cash proceeds and KAZ Minerals was created to hold the remaining mining assets and complete the construction of the major growth projects at Bozshakol (US$2.2bn) and Aktogay (US$2.3bn).

KAZ Minerals now operates the Bozshakol open-pit mine in the Pavlodar region of Kazakhstan, the Aktogay open-pit mine and three underground mines in the East Region of Kazakhstan, and the Bozymchak open-pit mine in Kyrgyzstan. The company produced 259kt of attributable copper in 2017 at a mined cash cost of just US¢91/lb. The company has tripled its copper production from 2015 to 2017 following the completion and ramp up of the Bozshakol and Aktogay mines.

The company announced a US$1.2bn expansion at Aktogay in December 2017, a low-risk project to construct a duplicate of the sulphide processing facilities it recently commissioned at Bozshakol and Aktogay. The expansion will deliver an additional 80kt/y of copper production from 2022-27 and 60kt/y from 2028 onwards.

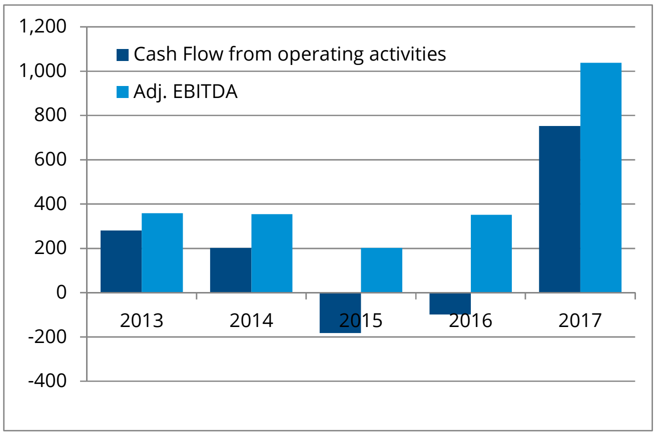
Future growth could come from the Kolsay copper project in Kazakhstan, where a feasibility study is underway. Nonferrous China recently invested US$70m for a 19.4% stake in this project. However, the company states that the Aktogay expansion project is the immediate priority. A project to construct a copper smelter in Kazakhstan has been stopped following a feasibility study.

Further growth in the longer term is likely to come from the Baimskaya copper project in Russia, where KAZ Minerals acquired a 100% interest from Aristus Holdings in 2018 for some US$902m in cash and shares. It has the potential to produce some 250kt/y of copper and 400koz/y gold, with first quartile net cash costs over the life-of-mine with an indicative capex of some US$5.5bn.

With the completion of construction of the Bozshakol and Aktogay mines, capex has fallen sharply. This, along with improved operating cashflow from the new mines, has allowed net debt to decline sharply, such that the Net Debt-to-EBITDA ratio at the end of 2017 was 2.0x.

**With the completion of its two new major copper mines, KAZ Minerals is now in a stronger financial position and can continue its growth. This is most likely to come from its project pipeline, which includes the Aktogay expansion and Kolsay and Baimskaya projects. However, it could participate in further M&A if the opportunity arose, but most likely in its existing operating region.**

**Figure 76: KAZ Minerals Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**



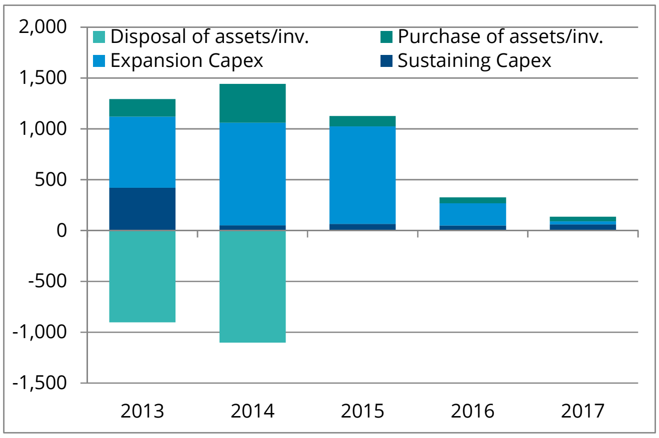
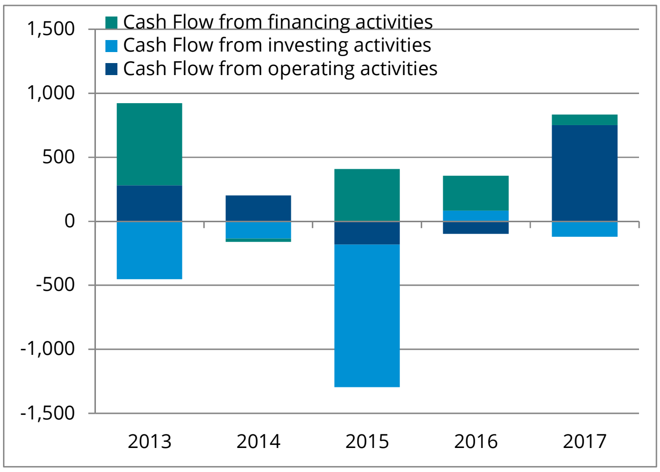




**Figure 77: KAZ Minerals Cashflow from Financial Activities and Net Cashflow (US$m)**



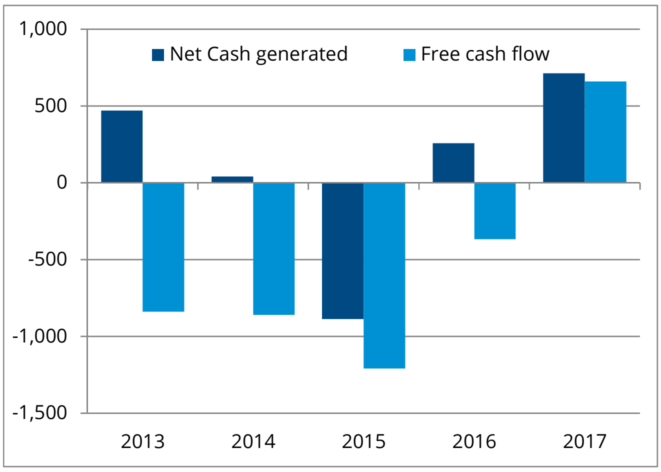
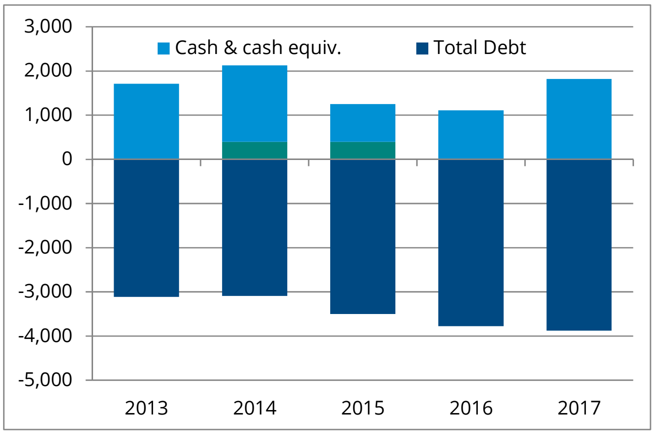
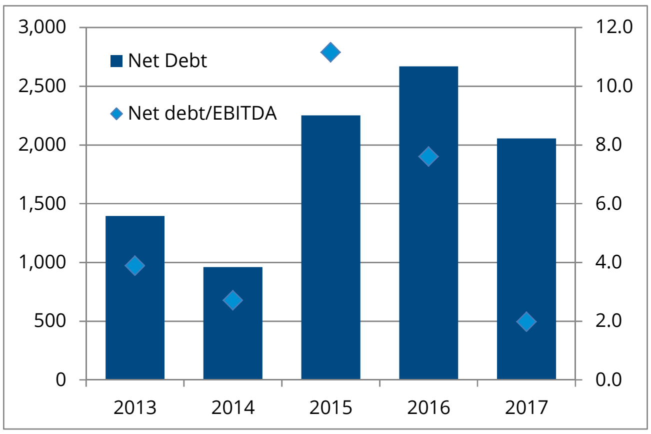




**Figure 78: KAZ Minerals Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## Lundin Mining

Lundin Mining (LUN CN: C$5.68 | US$3,202m) is a diversified Canadian-listed base metals mining company with operations in Chile, the US, Portugal and Sweden, primarily producing copper, nickel and zinc. In addition, Lundin Mining holds an indirect 24% equity stake in the Freeport Cobalt Oy business, which includes a cobalt refinery located in Kokkola, Finland.

The company operates the large Candelaria (80%) copper mine in Chile, the Eagle copper-nickel mine in the US, the Neves-Corvo copper-zinc mine in Spain, and the Zinkgruvan zinc mine in Sweden. Lundin acquired the Eagle Project in 2013 and the interest in the Candaleria mine in 2014. In 2017 Lundin produced 203kt of attributable mined copper at a cash cost of US¢121/lb. It also produced 149kt of zinc and 22kt of nickel.

Lundin had held a 24% interest in the Tenke Fungurume copper mine in the DRC, but sold its interest in 2017 to Chinese private-equity firm BHR Partners for about US$1.2bn in cash. This followed the announcement by operator Freeport-McMoRan in 2016 of the disposal of its 56% interest in the Tenke Fungurume mine to China Molybdenum for about US$2.8bn.

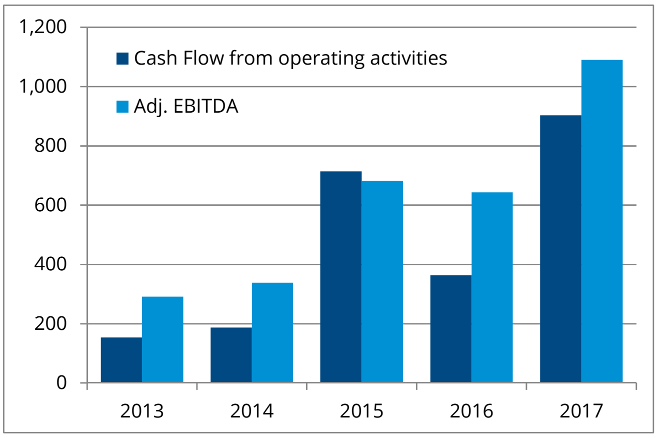
In 2017 the company commenced the Neves-Corvo zinc expansion project to double zinc plant capacity. It also announced a significantly improved life-of-mine plan for the Candelaria complex and investment initiatives. General exploration and business development expenses were US$81m in 2017 and increased as a result of expanded exploration activities based on discovery success primarily at the Candelaria operations and, to a lesser extent, at Neves-Corvo and Zinkgruvan.

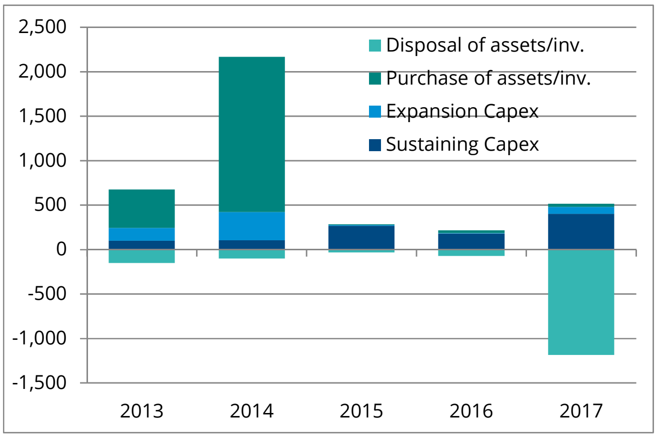
Apart from brownfield exploration, Lundin is progressing an early-stage copper-gold exploration project in Peru and project evaluation work is continuing on new copper and zinc-lead opportunities in Eastern Europe.

The company has a very strong balance sheet, with a net cash position of US$1,117m at the end of 2017, partly as a result of the Tenke sale proceeds, but also due to strong free cashflow. Lundin used some of the funds in November 2017 to redeem all of its 7.5% Senior Secured Notes due 2020 for a total redemption price of US$571m plus accrued and unpaid interest. The early redemption of the 2020 Notes will save the company US$41m per annum in interest payments.

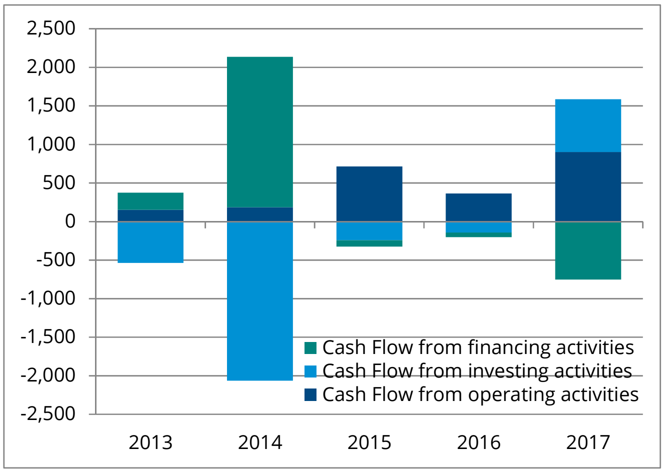
**It appears that Lundin is in the market to make an acquisition given its strong balance sheet and limited pipeline of exploration and new development projects. In May 2018 Lundin made a C$1.12bn hostile takeover bid for Nevsun, but this was rejected. Nevsun then accepted an all cash agreed bid from Zijin Mining for US$1.41bn. We would therefore expect Lundin to be a participant in further M&A activity in the near future.**

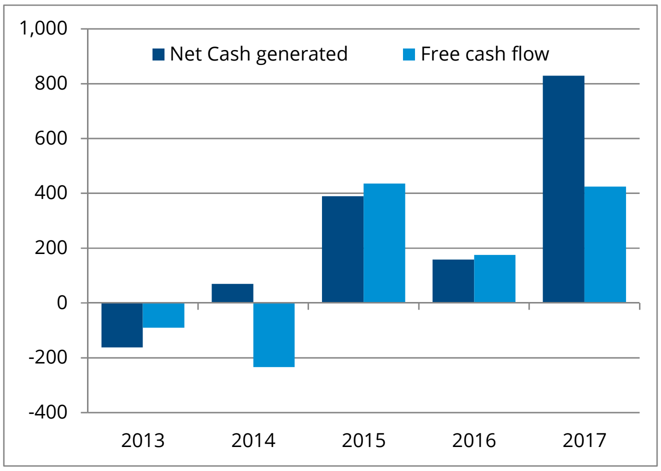
### Figure 79: Lundin Mining Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)



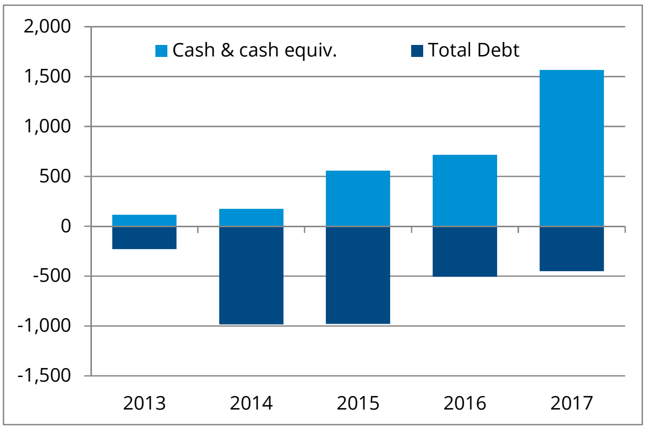



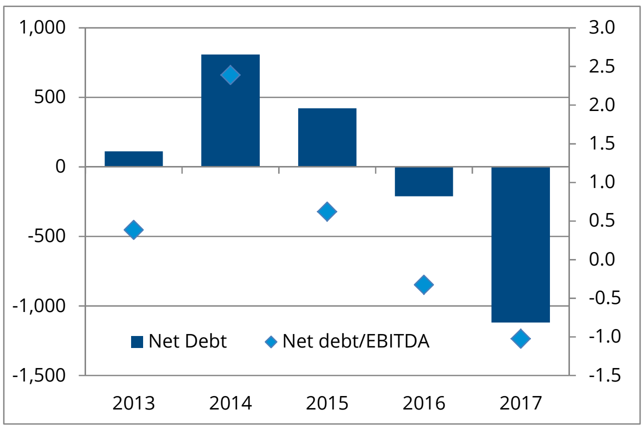

### Figure 80: Lundin Mining Cashflow from Financial Activities and Net Cashflow (US$m)




### Figure 81: Lundin Mining Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)




Source: Company data, RFC Ambrian estimates

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# Appendix 2 — Tier 2 Copper Producers

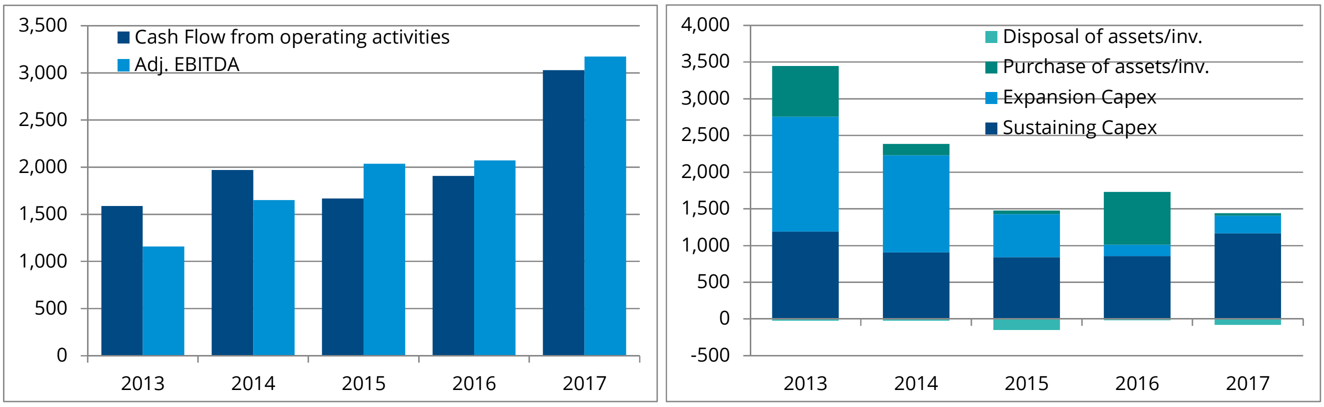
### Table 22: Tier 2 Copper Producers Key Attributes 2017

| Company | EV US$m | Cu Prod'n Attrib kt | Cash cost US¢/lb | Prod'n cost US¢/lb | Reserve Life yrs | R&R Life yrs | EBITDA Margin % | Net Debt /EBITDA |
|---|---|---|---|---|---|---|---|---|
| Hudbay Minerals | 1,492 | 159,192 | 81 | 154 | 9 | 15 | 44% | 1.2 |
| Boliden | 6,689 | 143,116 | 89 | 173 | 14 | 32 | 19% | 0.3 |
| OZ Minerals | 1,597 | 112,008 | 99 | 146 | 6 | 17 | 53% | (1.4) |
| OK Tedi Mining | N/A | 105,000 | 112 | 140 | 13 | 37 | 43% | (0.4) |
| Turquoise Hill | 5,658 | 103,884 | 211 | 310 | 49 | 134 | 28% | 10.4 |
| Capstone Mining | 318 | 90,395 | 194 | 223 | 9 | 40 | 29% | 1.0 |
| Sandfire Resources | 639 | 67,088 | 126 | 199 | 4 | 4 | 46% | (0.9) |
| Taseko Mines | 315 | 48,024 | 149 | 181 | 19 | 28 | 40% | 1.7 |
| El Brocal | 477 | 45,097 | N/A | N/A | 16 | 21 | 72% | 0.8 |

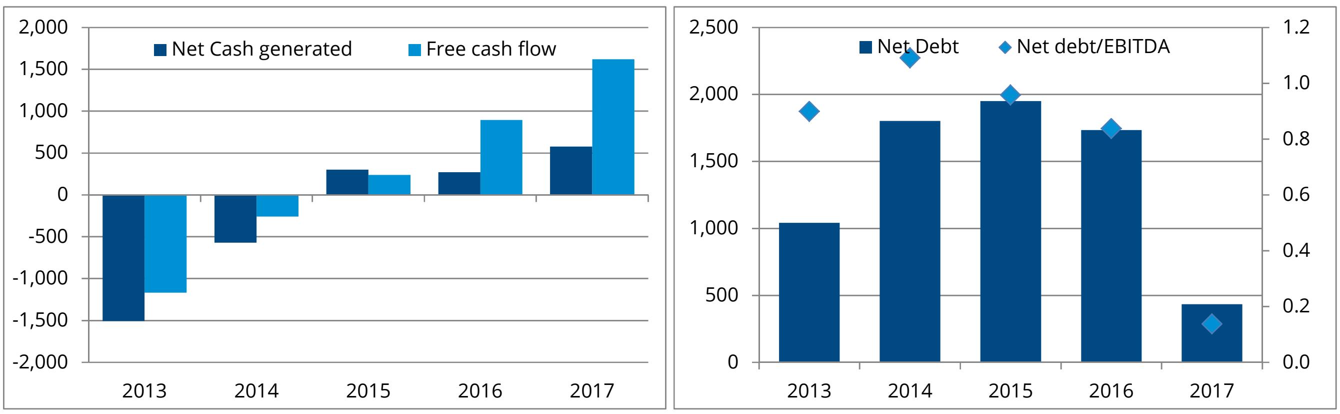
Source: Company data

The charts below exclude Turquoise Hill due to its extreme net debt position.

### Figure 82: Combined Tier 2 Copper Producers' CF from Operating Activities and CF from Investing Activities (US$m)




### Figure 83: Combined Tier 2 Copper Producers' Net Cashflow and Net Debt with Net Debt/EBITDA (US$m)




Source: Company data, RFC Ambrian estimates

## Hudbay Minerals

Canadian-based Hudbay Minerals (HBM CN: C$4.78 | US$962m) operates three mines in Manitoba, Canada, and the Constancia mine in Peru. In 2017 the company produced some 159kt of mined copper, 135kt of zinc, 109koz of gold and 3.5Moz of silver. The copper was produced at a low cash cost of US¢81/lb due to the significant by-product credits at the Manitoba operations.

In Manitoba, Hudbay operates the 777 and Lalor mines, as well as the Flin Flon and Snow Lake concentrators. The 777 mine produces zinc, copper, gold and silver, and the mine is expected to operate until 2021. It also operated the short-life Reed mine; this high-grade copper deposit started in 2013 and closed in mid-2018.

Hudbay acquired the Constancia copper porphyry project, located in southern Peru, in 2011 and completed construction of the mine in 2014 at a capital cost of US$1.7bn. The company will also mine the high-grade Pampacancha satellite deposit, commencing in 2019.

In July 2014 Hudbay acquired control of Augusta Resource and its 80% interest in the Rosemont Project, an open-pit, copper-molybdenum-silver porphyry-skarn deposit located in Arizona. A feasibility study in March 2017 suggests production of 140kt/y in the first ten years at a cash cost of US¢114/lb with capex of US$1.9bn and a mine life of 19 years. The company reports that it is continuing to progress Rosemont through the final stages of the permitting process.

At present, Hudbay is focusing on advanced in-house brownfield growth opportunities, including an increase in base metal ore throughput from Lalor, the development of Pampacancha, enhancing production at Constancia, and advance permitting and technical work at Rosemont.

Hudbay is currently testing promising exploration targets near Constancia and Lalor, and at greenfield sites in Peru, Chile and Canada. It also states that it continues to evaluate exploration and acquisition opportunities that meet its strategic criteria. Hudbay has significantly reduced its capex in the past three years with the completion of Constantia, and, combined with improved operating profit, this has meant that debt levels have fallen and Net Debt-to-EBITDA stood at 1.2x at the end of 2017.

In October 2018 Hudbay entered into an agreement with Mason Resources to acquire the outstanding 86% interest it does not already own for C$31m in an all share deal. Mason owns the advanced stage Ann Mason copper project. The project has 6.5Mt of copper resources (see page 122).

**Hudbay's need to improve its pipeline and replace the depleting Manitoba operations has partly been achieved with the acquisition of Mason Resources. The balance sheet is robust and, although the company plans to continue to reduce its debt further and needs to finance the development of the Rosemont and Ann Mason projects, it could possibly still make further acquisitions in the Americas.**

**Figure 84: Hudbay Minerals Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**

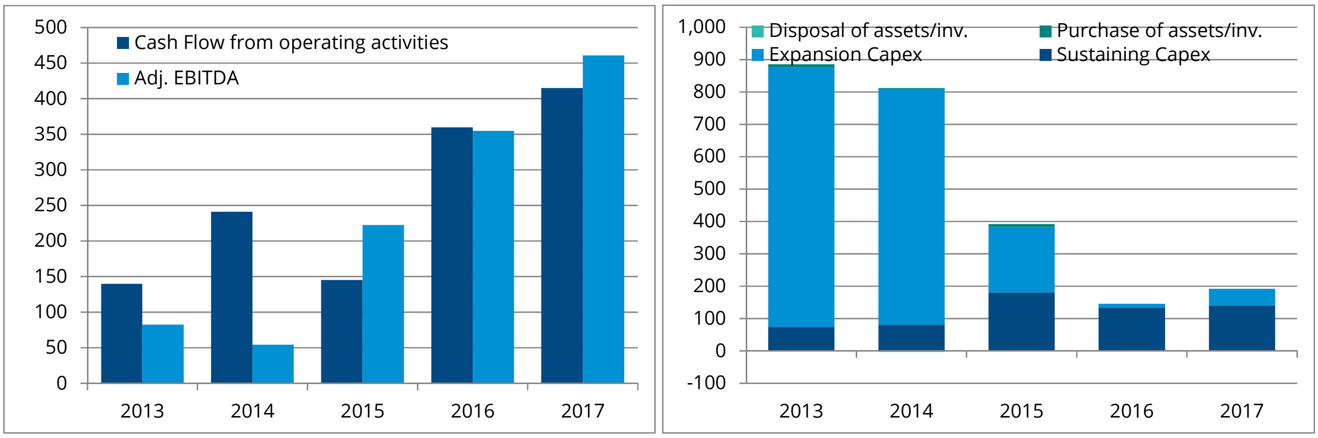



**Figure 85: Hudbay Minerals Cashflow from Financial Activities and Net Cashflow (US$m)**

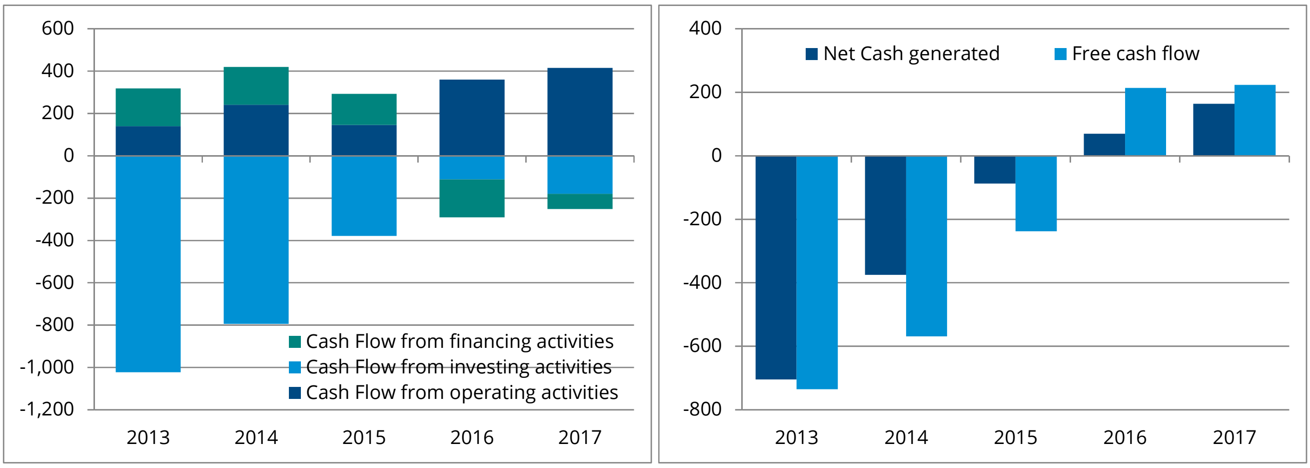
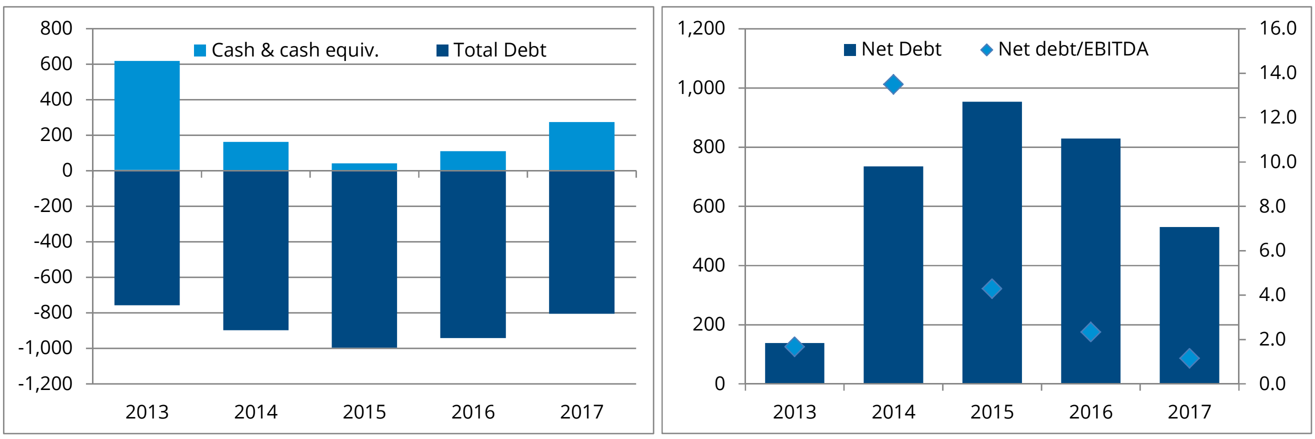



**Figure 86: Hudbay Minerals Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## Boliden

Swedish-based Boliden (BOL SW: SK211.30 | US$6,357m) is essentially a base metals company, operating mines and smelters in Sweden, Finland, Norway and Ireland. Globally, Boliden is also one of the leading operators in the area of electronic scrap recycling. It is listed on the Stockholm Stock Exchange. In 2017 Boliden produced 353kt of copper, 457kt of zinc, 25kt of nickel in matte and 78kt of lead, as well as gold and silver.

Boliden operates six mines, which are situated in Sweden, Finland and Ireland. These are the Aitik and Kylylahti copper mines, the Garpenberg and Tara zinc mines, and the Kevitsa and Boliden Area polymetallic mines. Boliden's open-pit and underground mines are highly mechanised and are some of the world's most productive.

The Aitik mine is large with low grades, world-leading productivity and additional revenues from gold and silver. The Kylylahti mine is small with high grades. Kevitsa is a mine with good productivity, with nickel and copper the primary metals.

It also operates five smelters: Harjavalta, Bergsöe, Kokkola, Odda and Rönnskär. The company's mines and smelters have different business cycles and balance out earnings over time. The competitiveness of the individual units relies on high productivity and stable processes. The combination of mines and smelters also generates flexibility with regard to external supplies of raw materials.

Boliden focuses on brownfield exploration close to its own mines in all of its mining areas. It is a strategy that has proven successful. It also explores in new areas, and evaluates the acquisition of exploration projects from other companies.

Boliden's most recent acquisition was the Kevitsa nickel-copper mine in Finland, which was acquired for SEK6bn in June 2016 from First Quantum. The company stated that the acquisition was consistent with Boliden's growth strategy.

Net debt has fallen sharply over the past five years due to the high free cashflow. Capex has largely remained steady over the period, and in 2017 a significant part of capex was maintenance-related. The Net Debt-to-EBITDA ratio at the end of 2017 was just 0.3x.

**Boliden continues to invest in incremental improvements in operations and capacity at its mines and smelters. It also has a very strong balance sheet, but with limited late-stage development or exploration opportunities. With the integration of Kevitsa now complete, Boliden is once again in a position to make acquisitions in base metals, including copper, if the right opportunity arises. However, this would most likely need to be located in Europe.**

**Figure 87: Boliden Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**

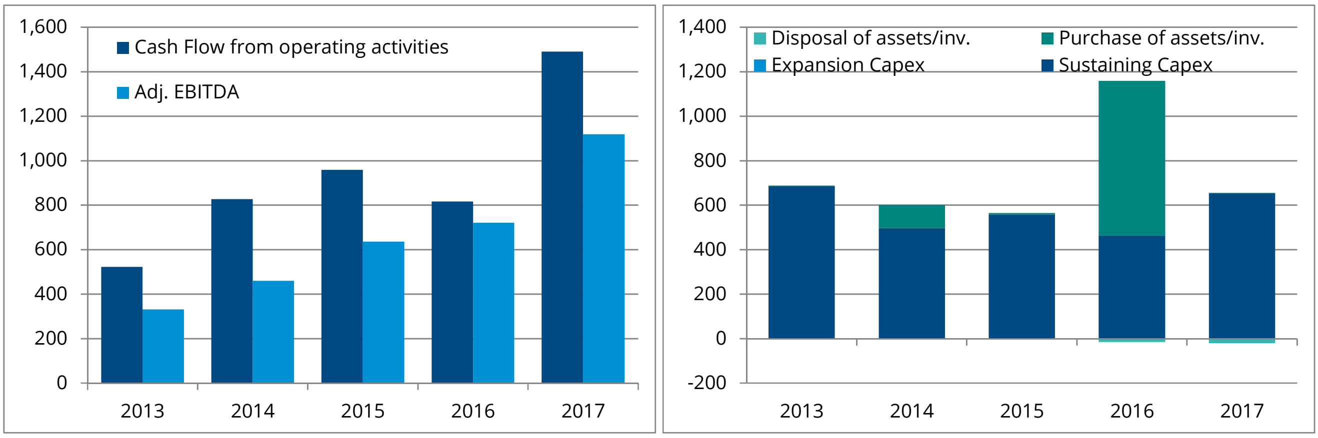



**Figure 88: Boliden Cashflow from Financial Activities and Net Cashflow (US$m)**

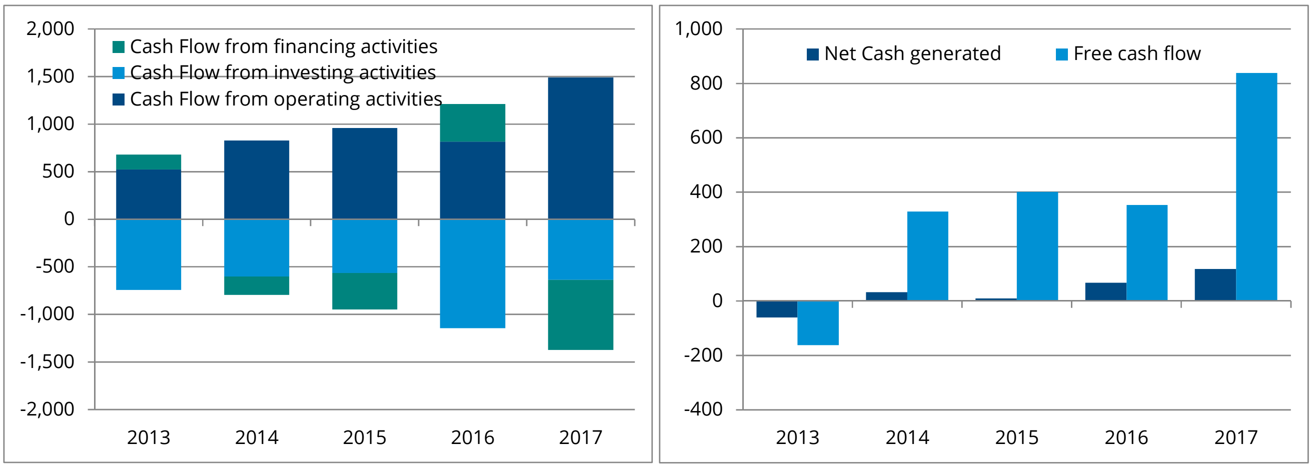
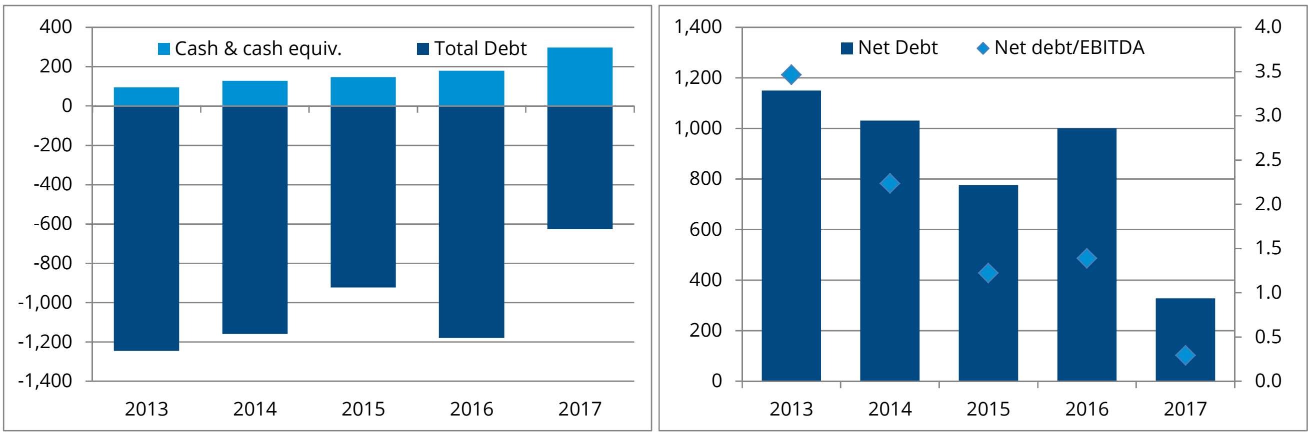



**Figure 89: Boliden Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## OZ Minerals

OZ Minerals (OZL AU: A$9.39 | US$2,153m) is an Australian-based copper company that owns and operates the copper-gold-silver mine at Prominent Hill, the Antas open-pit copper-gold mine in the Carajás province of Brazil, and is developing the copper-gold resources at Carrapateena. In 2017 OZ Minerals produced 126kt of copper at a cash cost of US¢99/lb.

OZ Minerals was formed in 2008 through the merger of two Australian non-ferrous metals mining businesses — Oxiana and Zinifex. A proportion of OZ Minerals' assets was sold in 2009 to China Nonferrous Metals (MinMetals) — the company now operating as MMG. The Carrapateena exploration project was purchased in 2011.

Prominent Hill is a copper-gold mining operation in northern South Australia, comprising the Malu open pit (which recently concluded operations) and the Ankata and Malu underground mining areas. Prominent Hill produces one of the highest grades of copper concentrate traded on the open market.

In August 2018 OZ Minerals completed the A$418m acquisition of Avanco Resources, which included the high-grade Antas copper-gold mine. The mine produced 14kt of copper at a cash cost of US¢164/lb in 2017. The acquisition geographically diversifies the portfolio of OZ Minerals and adds to its organic growth pipeline with development and exploration opportunities.

Carrapateena is a copper-gold project located in South Australia on the eastern margin of the Gawler Craton. Construction of Carrapateena is underway and commissioning is scheduled for 4Q19, after which the project will ramp up to steady-state production. The A$916m project will be an underground operation producing 65kt/y of copper, with an estimated mine life of 20 years.

In August 2016 OZ Minerals signed an agreement with Cassini Resources to earn up to 70% of the West Musgrave Project (currently 51%), Australia's largest undeveloped copper-nickel deposit. OZ Minerals is hoping to establish the West Musgrave project as a scaleable, low-cost, long-life, open-pit mining operation. In November 2017 OZ Minerals and Cassini announced that the project would progress to a pre-feasibility study.

Following its takeover of Avanco Resources, OZ Minerals also has two significant exploration projects in Brazil: Pedra Branca, an underground copper-gold project also located in Carajás, Brazil, where a DFS is underway; and the CentroGold project, with a 2.2Moz gold deposit in the state of Maranhão in northern Brazil.

OZ Minerals also holds a 21% equity interests in Toro Energy (ASX code: TOE AU), an Australian-listed uranium exploration and development company, and a small stake in Minotaur Exploration (ASX code: MEP AU).

**OZ Minerals has a strong balance sheet and at the end of December 2017, before the purchase of Avanco, had net cash of US$570m. However, the acquisition of Avanco, along with its existing Carrapateena and West Musgrave projects, suggests that OZ Minerals has a full pipeline of mine developments to finance for the next five years and is therefore unlikely to be a significant participant in M&A in the near future.**

**Figure 90: OZ Minerals Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**

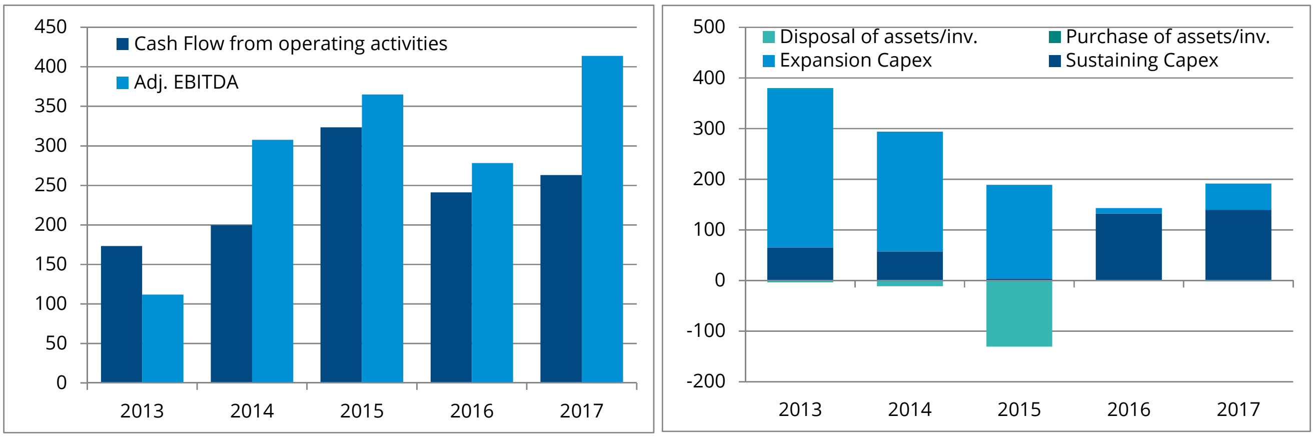



**Figure 91: OZ Minerals Cashflow from Financial Activities and Net Cashflow (US$m)**

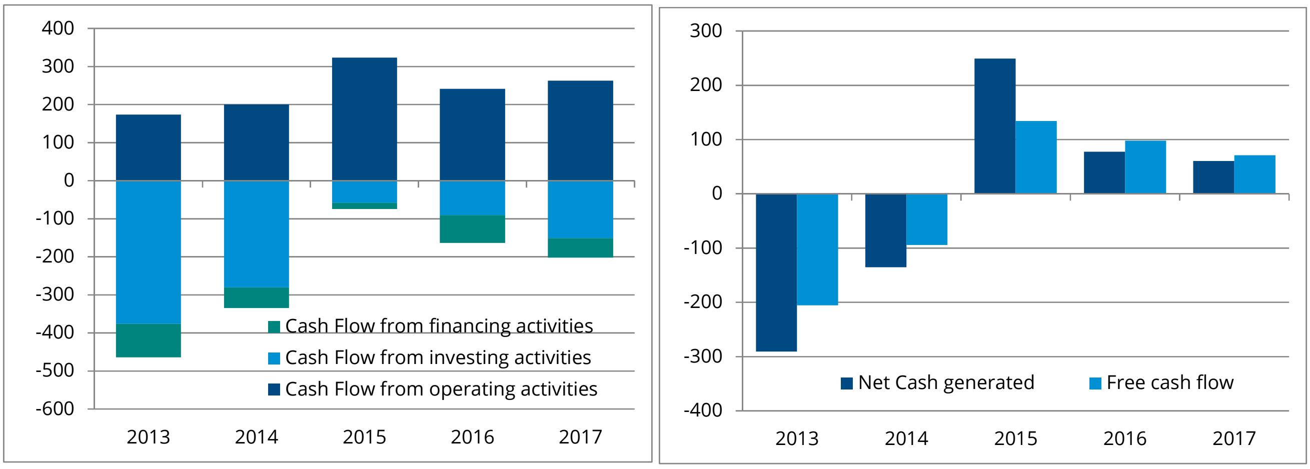
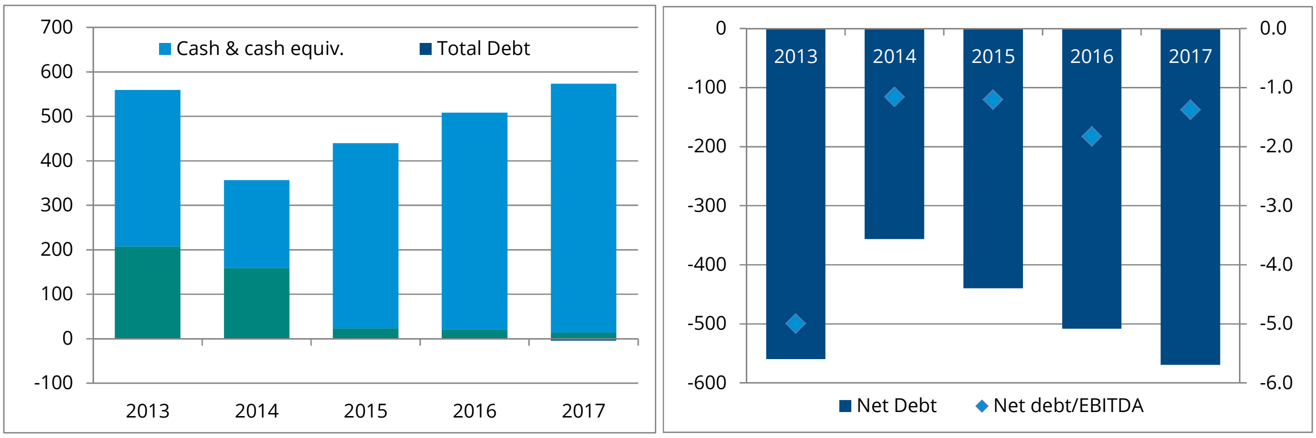



**Figure 92: OZ Minerals Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## Turquoise Hill

Canadian-based Turquoise Hill (TRQ CN: C$1.90 | US$2,944m) owns 66% of the Oyu Tolgoi mine in southern Mongolia, a major copper-gold-silver operation that went into production in early 2013. The remaining 34% of Oyu Tolgoi is held by Erdenes, a Mongolian state-owned entity. This is the company's principal and only material mineral resource property. Turquoise Hill is owned 50.8% by Rio Tinto, which operates the mine. Turquoise Hill changed its name from Ivanhoe Mines in 2012.

Mineralisation on the property consists of porphyry-style copper, gold, silver and molybdenum contained in a linear structural trend of deposits. These include the Heruga deposit, the Oyut deposit and the Hugo Dummett deposits (Hugo South, Hugo North and Hugo North Extension).

The mine was initially developed as an open-pit operation. The copper concentrator plant, with related facilities and necessary infrastructure, was originally designed to process approximately 100kt/d, but has achieved a consistent throughput of over 110kt/d. In 2017 the mine produced 157kt of copper and 114koz of gold at a cash cost of US¢192/lb.

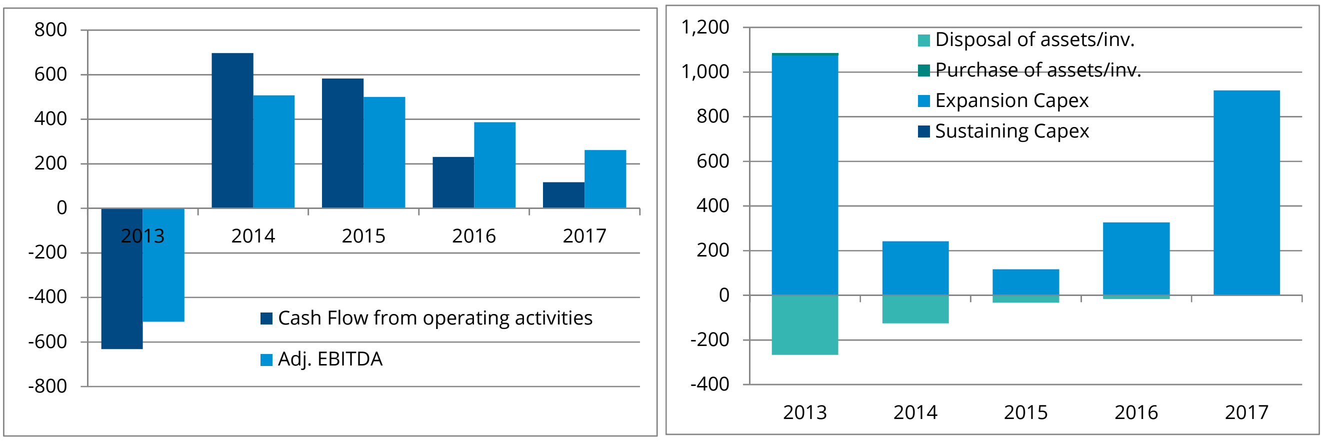
The majority of the value of Oyu Tolgoi, up to 80%, lies deep underground. To access this part of the resource, underground mining techniques will be used at depths of more than 1,300m. In August 2013 development of the underground mine was suspended pending resolution of matters with the Government of Mongolia. These were resolved in May 2015 and, following the signing of a US$4.4bn project finance facility in December 2015, Oyu Tolgoi underground construction recommenced in May 2016. First underground ore is expected by mid-2020, with sustainable production in 2021.

Copper production will start to rise in 2021, and by 2025, Oyu Tolgoi is expected to be the world's third-largest copper mine, with peak metal production in excess of 550kt/y copper and 450koz/y of gold.

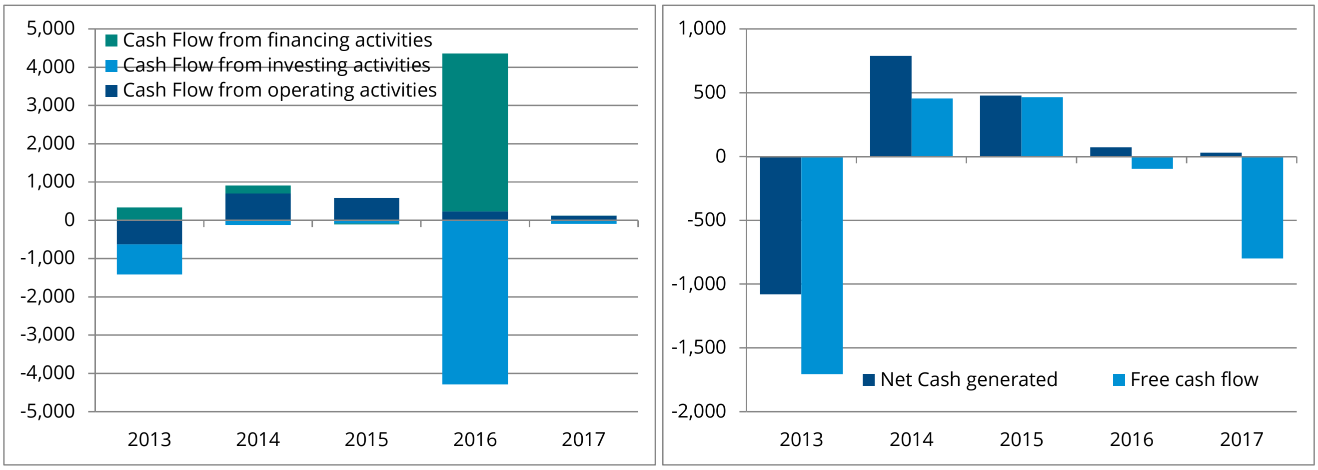
Total underground project spend from January 2016 to June 2018 was approximately US$1.6bn. Turquoise Hill has funded Oyu Tolgoi's cash requirements beyond internally-generated cashflows by a combination of equity investment and shareholder debt. For amounts funded by debt, Oyu Tolgoi must repay such amounts, including accrued interest, before it can pay common share dividends. As of 30 June 2018, the aggregate outstanding balance of shareholder loans extended by subsidiaries of Turquoise Hill to Oyu Tolgoi was US$4.3 bn.

**Turquoise Hill continues to have a high Net Debt-to-EBITDA ratio as it is still financing the underground development of Oyu Tolgoi. This should improve once the underground mine is complete and begins to ramp up production and the mine turns free cashflow positive. However, this company is now primarily a vehicle for the development of Oyu Tolgoi and so is very unlikely to be involved in acquisitions in the copper market in the near term. It could still be taken over fully at some point by Rio Tinto.**

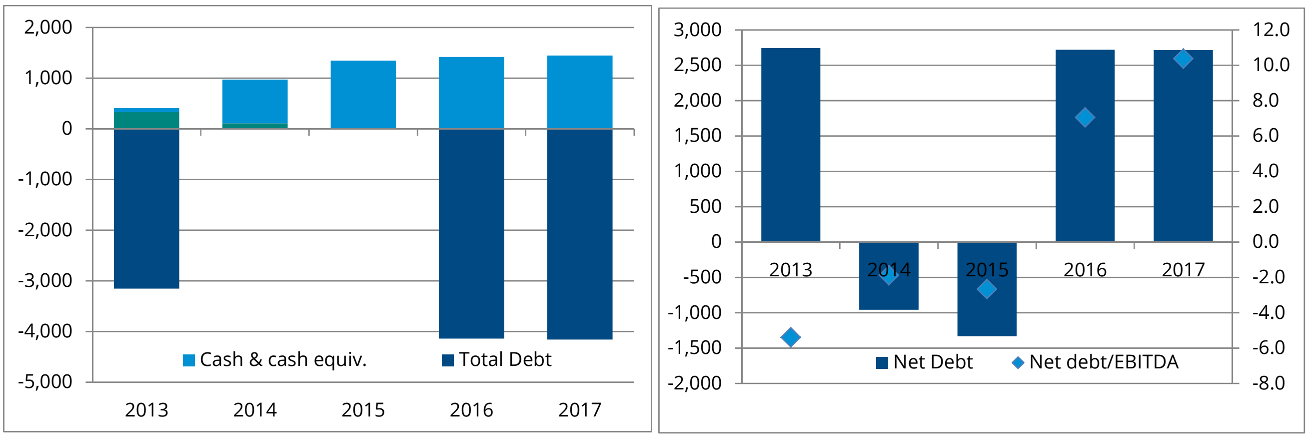
### Figure 93: Turquoise Hill Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)




### Figure 94: Turquoise Hill Cashflow from Financial Activities and Net Cashflow (US$m)




### Figure 95: Turquoise Hill Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)




Source: Company data, RFC Ambrian estimates

## Capstone Mining

Canadian-based Capstone Mining (CS CN: C$0.53 | US$163m) operates two copper mines: Pinto Valley in the US and the underground copper-zinc Cozamin mine in Mexico. In October 2018 Capstone placed the Minto copper mine in Yukon, Canada, on care and maintenance. Capstone purchased the Pinto Valley mine in 2013 for US$650m from BHP Billiton. In 2017 the company produced 90kt of copper at an average cash cost of US¢194/lb.

Capstone's current operations are relatively small in size. Its largest operation, Pinto Valley, produced 57kt of copper in 2017 and still has significant reserves and resources. However, its Cozamin and Minto mines have limited reserves, although still have meaningful resources. Exploration drilling is ongoing at Cozamin to upgrade resources and to extend the mine life. The company has reported some exploration success and notes that increasing the copper resource creates the potential for utilisation of the 20% surplus mill capacity and a mine expansion at Cozamin.

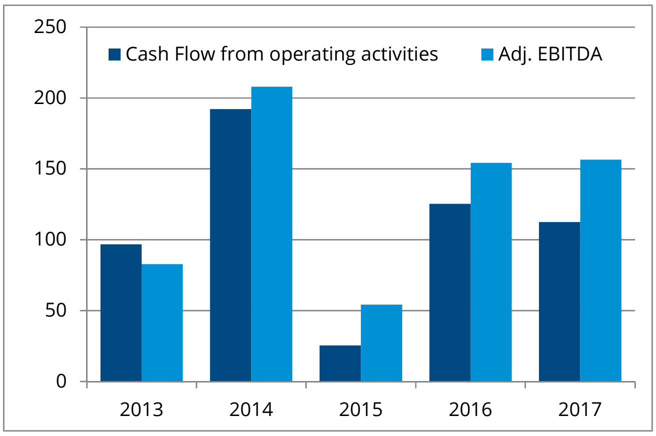
Capstone also owns 70% of the Santo Domingo copper-iron development project in Chile, with Korean Resources owning 30%. The project is strategically located near key infrastructure, at low elevation, and in an established mining district. A 2014 feasibility study indicated that the US$1,751m project would have average 18-year life-of-mine production of 58kt/y of copper, with output of 110kt/y in the first five years. Permitting is ongoing and expected to be completed in 2019. Capstone is focused on updating the 2014 feasibility study by end-2018 to reflect current economic and operational inputs. The reserves and resources contain 1.67Mt of copper and the company is looking for partners in this project.

Capstone had been in the process of selling its Minto mine to Pembridge Resources, but the deal collapsed in October 2018 after Pembridge was unable to raise the necessary financing.

Capstone also has a portfolio of exploration properties, the main one being Providencia in Chile. Capstone's criteria for growth are to look for low-risk copper asset in mining-friendly jurisdictions in the Americas, in or near production.

**Stronger operating cashflow in the past two years and lower capex have allowed Capstone to reduce its net debt and at the end of 2017 the Net Debt-to-EBITDA ratio stood at 1.0x. Capstone continues to direct free cashflow to debt repayments and now has some flexibility. Its strategy appears to be to reduce its interest in Santo Domingo to 50% to enable it to finance development with internal cashflow and debt facilities. Although management is conservative, this could then provide some capacity to make an acquisition of a late stage development or exploration project in order to top up the pipeline.**

**Figure 96: Capstone Mining Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**



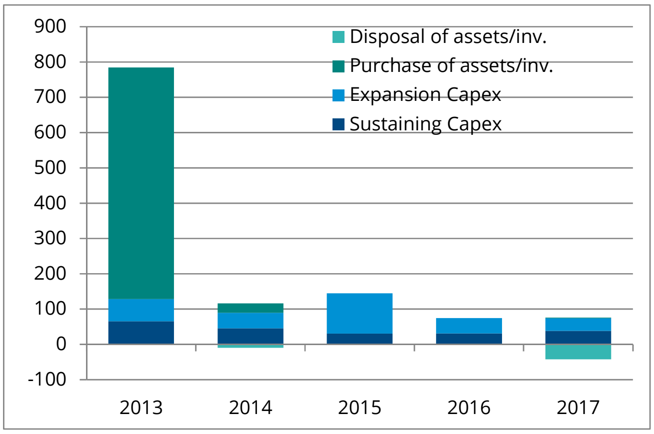
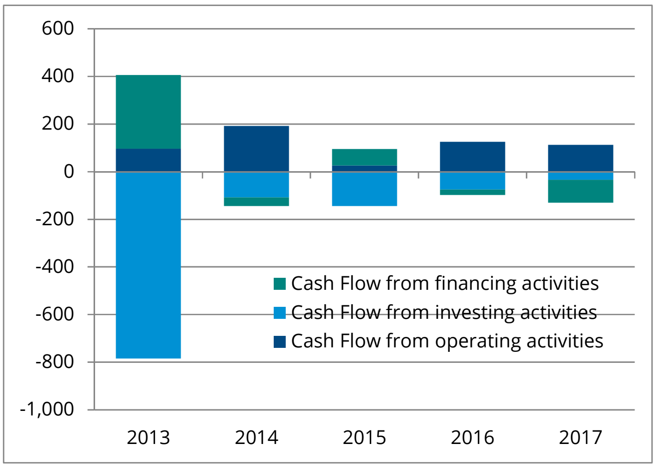




**Figure 97: Capstone Mining Cashflow from Financial Activities and Net Cashflow (US$m)**



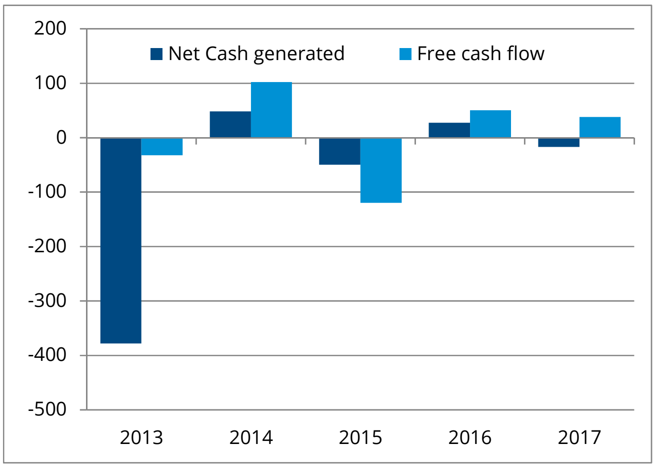
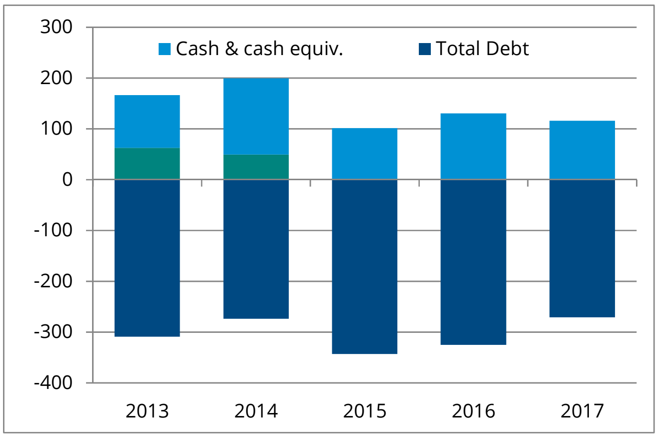
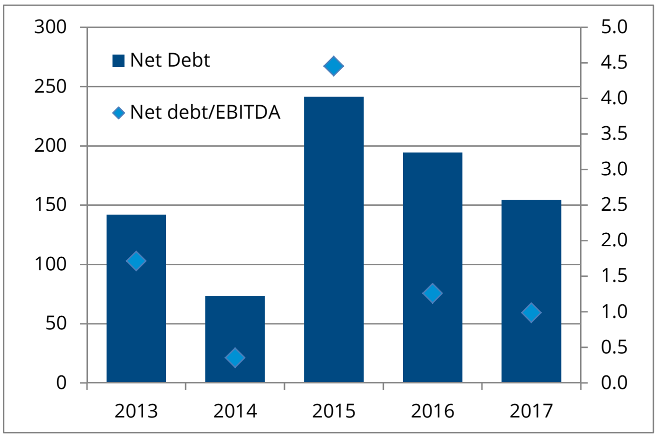




**Figure 98: Capstone Mining Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## Sandfire Resources

Australian-based Sandfire Resources (SFR AU: A$7.29 | US$824m) operates the DeGrussa underground copper-gold mine located in Western Australia. Sandfire discovered and developed this mine, which started production in 2012. In 2017 the mine produced 67kt of copper at a cash cost of US¢126/lb.

Sandfire is developing the Monty copper-gold deposit as a satellite source of ore feed for the DeGrussa mining operation, with first production on target for 4Q18. The introduction of ore from this high-grade (8.7% Cu) project will contribute towards a rising production profile for Sandfire from FY20 onwards. Studies are also underway on the optimal development pathway to exploit the 2.8Mt of oxide stockpiles at DeGrussa.

DeGrussa is now providing strong cashflow for Sandfire and, as a result, the company has been particularly active in making acquisitions recently, utilising its strong balance sheet. This has also resulted in geographic diversification away from its Australian base, as well as diversification into zinc projects.

In October 2018 Sandfire gained 100% control of Monty through the acquisition of Talisman Mining's 30% interest in the Springfield joint ventures for A$72m in cash, plus an ongoing 1% Net Smelter Return (NSR) royalty on future discoveries.

In July 2018 Sandfire acquired a 14.2% stake in ASX-listed White Rock Minerals (ASX: WRM), and formed a strategic partnership under which Sandfire and White Rock will collaborate to advance the development of White Rock's high-grade Red Mountain zinc VMS project in Alaska.

In June 2018 Sandfire completed a restructuring to remove two of its subsidiaries. The company now wholly owns the Black Butte copper project in Montana, where a bankable feasibility study (BFS) is ongoing and where an Environmental Impact Statement (EIS) is underway — the final stage of permitting.

In May 2018 Sandfire acquired a 7.7% stake in ASX-listed Adriatic Metals (ASX: ADT), and formed a strategic partnership under which Sandfire and Adriatic will collaborate to advance Adriatic's zinc exploration and development portfolio in Bosnia-Herzegovina.

Sandfire has a number of exploration programmes, the most significant being the Greater Doolgunna Project in Australia. It also recently acquired a 19.4% strategic interest in unlisted exploration company Andes Resources, which is exploring the Andes Project in Colombia.

Sandfire had cash on hand as at June 2018 of A$243m and management is considering a rights issue to fund ongoing permitting costs, continuing the Black Butte BFS and future drilling activities.

**Management state that Sandfire's key strategic objectives is to find viable pathways to grow the business, either through exploration, acquisitions or the continued development of the assets already within its portfolio. We believe the strength of its balance sheet should allow it to continue to make further investments in all three areas.**

**Figure 99: Sandfire Resources Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**

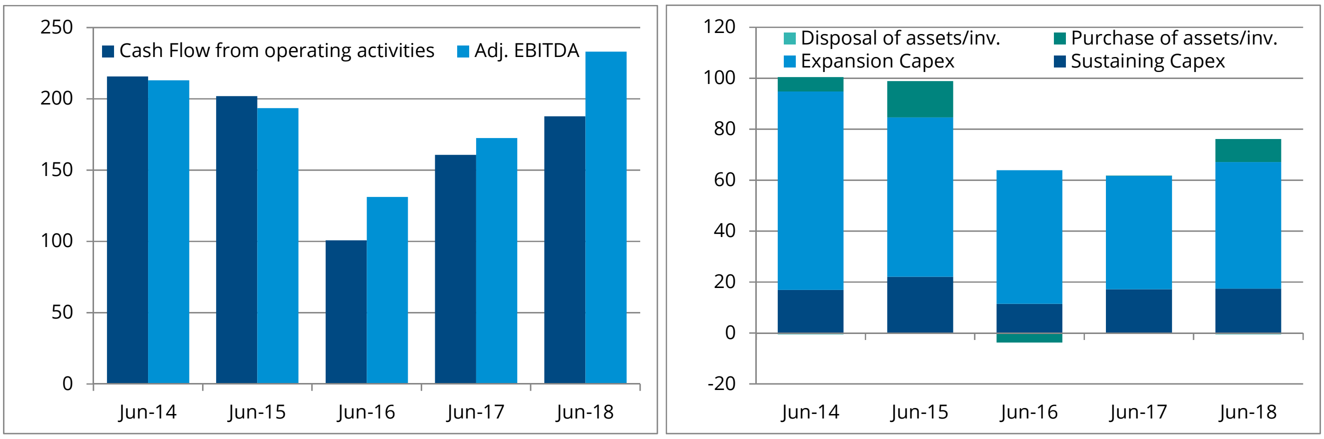



**Figure 100: Sandfire Resources Cashflow from Financial Activities and Net Cashflow (US$m)**

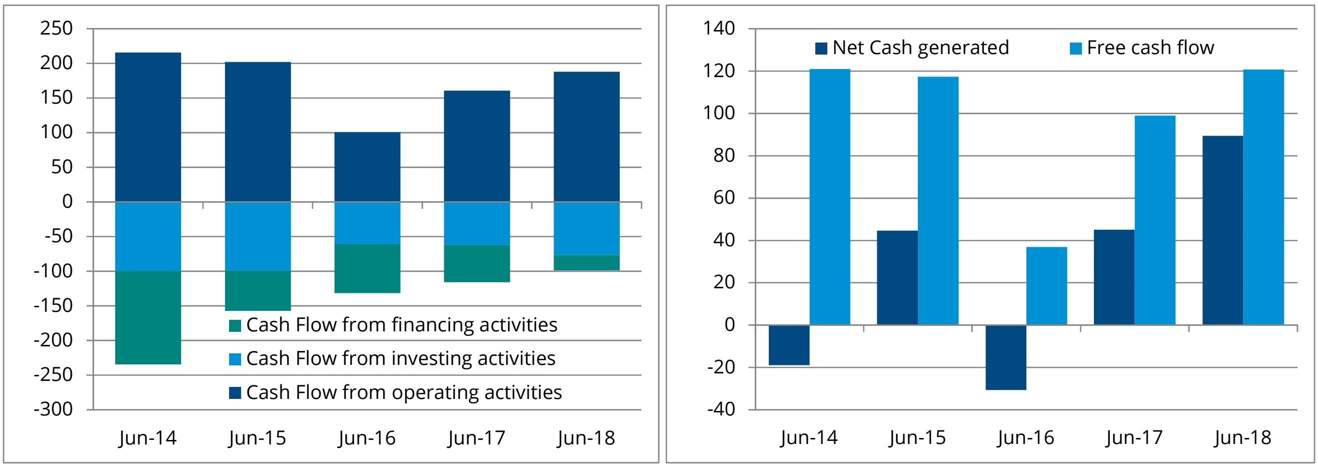
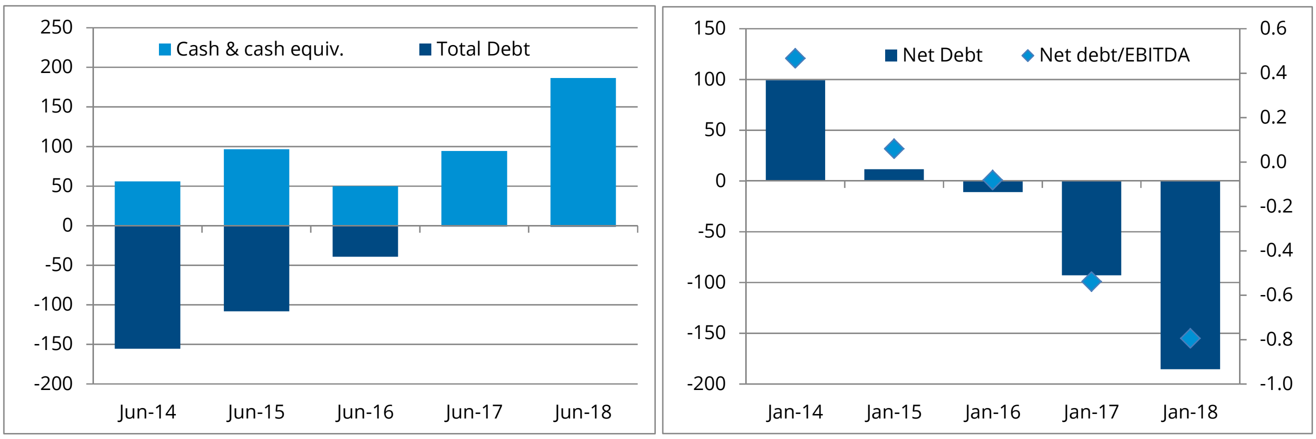



**Figure 101: Sandfire Resources Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

## Taseko

Canadian-based Taseko (TKO CN: C$0.70 | US$123m) holds a 75% interest in the Gibraltar copper-molybdenum mine located in British Columbia, Canada. Taseko acquired the closed Gibraltar mine in 1999 and re-opened it in 2004. In 2017 the mine produced 67kt of copper and 1.2kt of molybdenum at a cash cost of US¢149/lb.

Taseko also holds three advanced-stage development projects: the Aley niobium project in British Columbia, the Florence copper project in Arizona and the New Prosperity gold-copper project in British Columbia. It also owns the Harmony advanced exploration gold project in British Columbia.

Taseko acquired Curis Resources for its Florence copper project in 2014. In September 2017 Taseko announced the decision to construct a US$25m production test facility (PTF). This is well underway, on-time and on-budget, and the new i*n situ* copper recovery facility is on track to produce its first copper cathode before the end of 2018. After the PTF phase is completed, Taseko will advance into full-scale commercial production, with an initial capital cost of US$200m. Once operational, Florence will have a production capacity of 39kt/y of copper at a cash cost of US¢110/lb over its 21-year life.

The New Prosperity deposit is a gold-copper porphyry. However, the federal government has decided not to issue the authorisations necessary for the project to proceed. The related ongoing legal proceedings initiated by Taseko mean there is considerable uncertainty with respect to successful permitting of the project.

Taseko acquired the Aley niobium project in 2007 for US$5m. It is the world's largest niobium deposit outside the two operating mines in Brazil. It is expected to produce 9kt/y of niobium over its 24-year mine life and has an initial capital cost of C$870m. Taseko is currently in the pre-application phase of the environmental assessment process and is in the final stages of completing an updated technical report.

Harmony is a gold project located on Graham Island off British Columbia’s west coast. It has Measured and Indicated resources of 64Mt grading 1.35 g/t gold. Detailed engineering studies are required to assess the project's potential fully. As such, it represents a longer-term development opportunity for the company.

At the end of 2017 Net Debt-to-EBITDA fell sharply to 1.7x, partly reflecting lower debt, but also a strong increase in EBITDA in 2017.

**Taseko’s current focus is on the development of the Florence copper project. This is resulting in higher capex, but the strong operating performance of Gibraltar, along with US$44m from the sale of a silver stream, has resulted in a fall in net debt and a stronger balance sheet. However, Taseko still needs to fund the Florence copper and Aley niobium projects, and additional funding will be required to advance these projects to production. We believe that this makes it unlikely that Taseko will be a meaningful player in the copper M&A market in the near future.**

**Figure 102: Taseko Cashflow from Operating Activities and Cashflow from Investing Activities (US$m)**

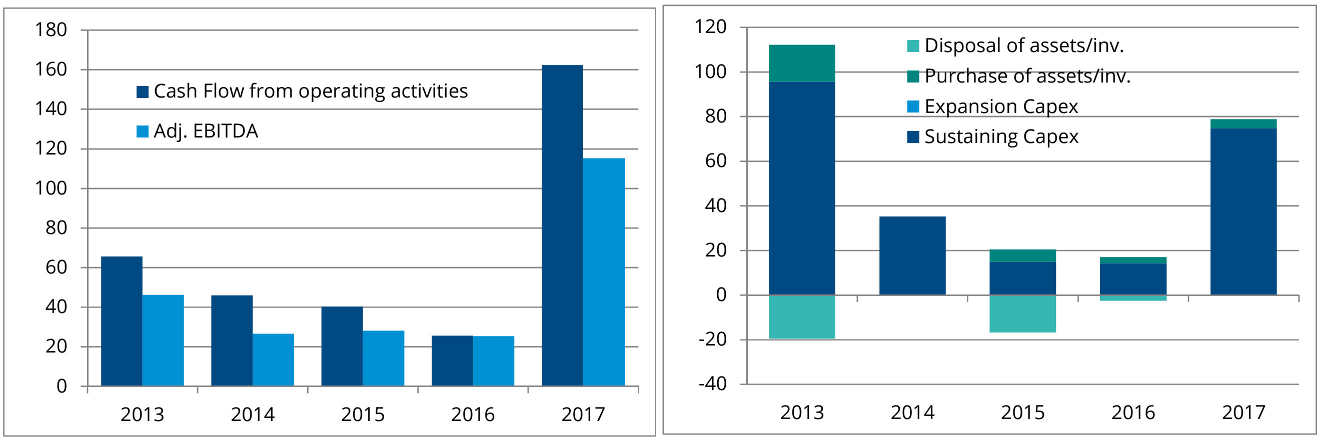



**Figure 103: Taseko Cashflow from Financial Activities and Net Cashflow (US$m)**

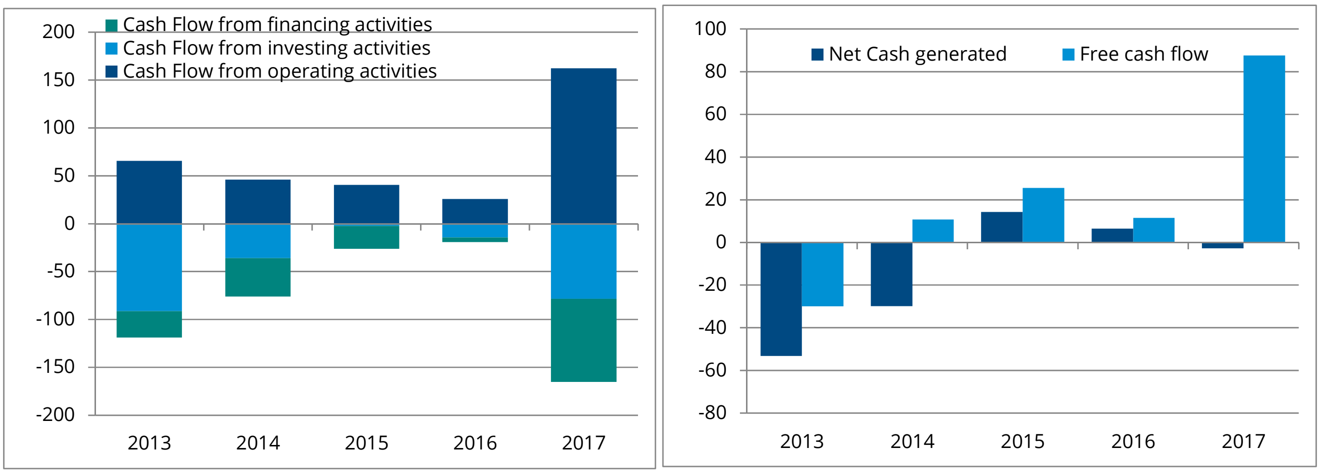
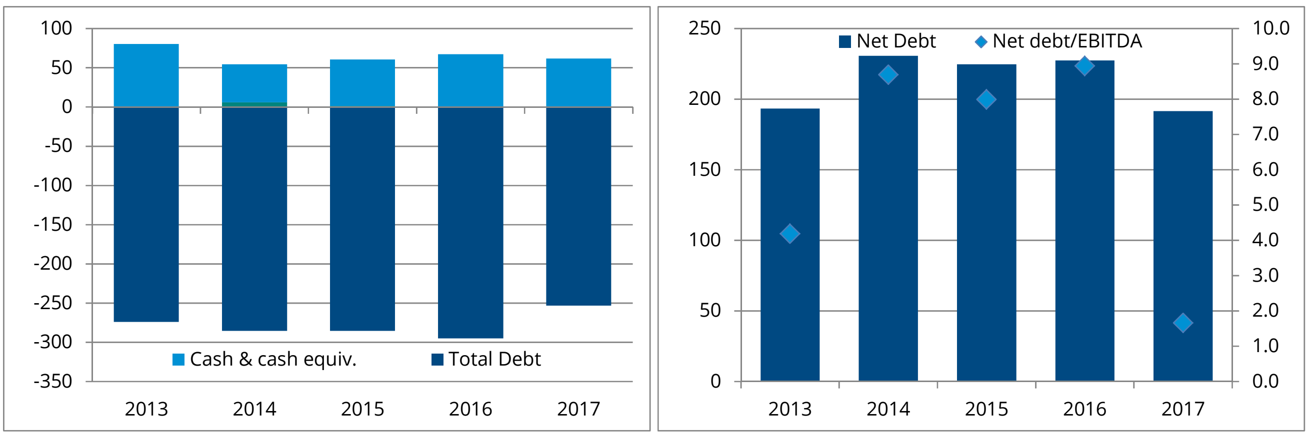



**Figure 104: Taseko Cash & Debt and Net Debt with Net Debt/EBITDA (US$m)**




Source: Company data, RFC Ambrian estimates

# Appendix 3 — Tier 3 Copper Producers

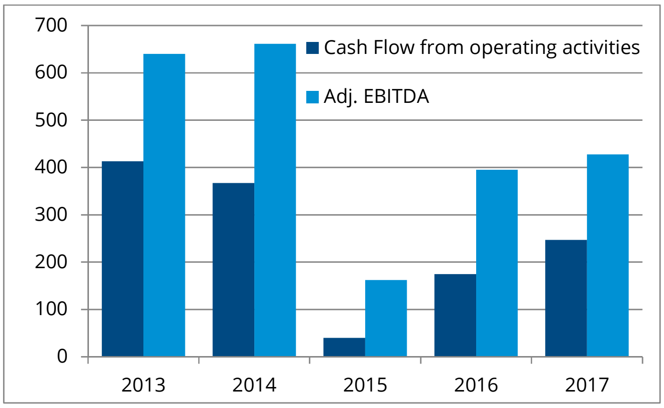
### Table 23: Tier 3 Copper Producers Key Attributes 2017

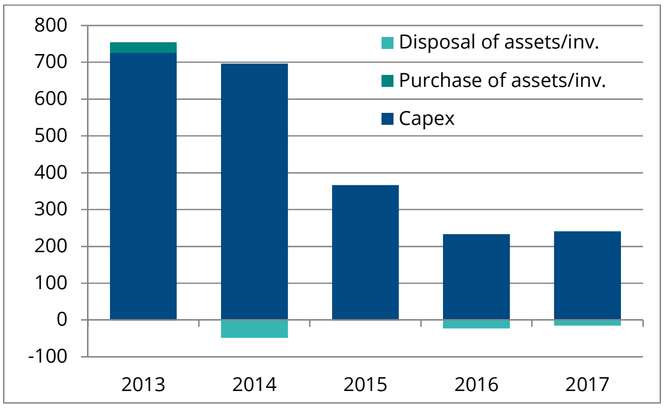
| Company | EV US$m | Cu Prod'n Attrib kt | Cash cost US¢/lb | Prod'n cost US¢/lb | Reserve Life yrs | R&R Life yrs | EBITDA Margin % | Net Debt /EBITDA |
|---|---|---|---|---|---|---|---|---|
| Nexa Resources | 1,786 | 44,161 | N/A | N/A | N/A | N/A | 27% | 0.7 |
| Imperial Metals | 572 | 42,504 | 243 | 312 | 27 | 124 | 21% | 6.2 |
| Atalaya Mining | 304 | 37,164 | 191 | 215 | 22 | 31 | 26% | (1.0) |
| S. Punta del Cobre | 624 | 36,378 | 188 | N/A | N/A | N/A | 35% | (0.6) |
| Atlas Cons | 664 | 35,466 | 183 | 254 | 35 | 123 | 34% | 6.1 |
| Amerigo Resources | 165 | 28,356 | 165 | 189 | N/A | 66 | 28% | 0.9 |
| Copper Mountain | 346 | 34,382 | 186 | 245 | 7 | 28 | 30% | 2.9 |
| Aeris Resources | 81 | 23,404 | 226 | 260 | 7 | 15 | 22% | 1.1 |
| Metals X | 206 | 23,264 | 284 | 322 | 10 | 31 | 31% | (0.4) |
| Ero Copper Corp | 732 | 20,133 | 145 | N/A | 11 | 27 | 22% | 0.8 |

Source: Company data

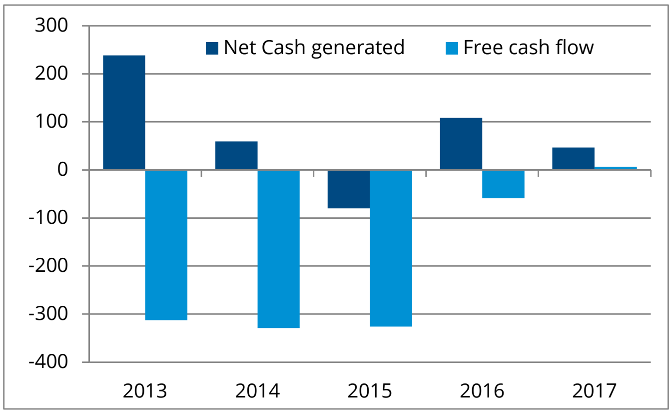
The charts below exclude Nexa, Atalaya and Ero Copper due to limited history.

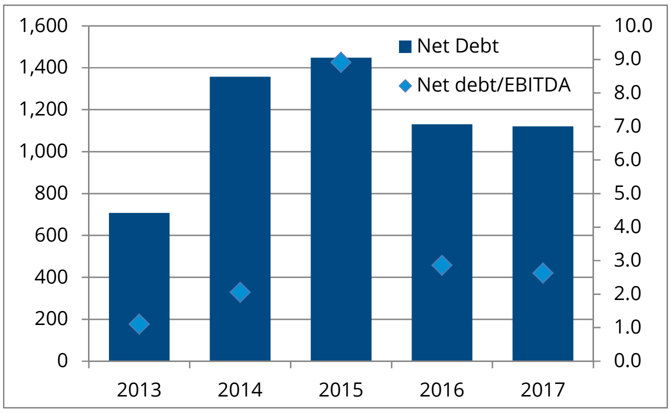
### Figure 105: Combined Tier 3 Copper Producers' CF from Op Activities and CF from Investing Activities (US$m)




### Figure 106: Combined Tier 3 Copper Producers' Net Cashflow and Net Debt with Net Debt/EBITDA (US$m)




Source: Company data, RFC Ambrian estimates

## Nexa Resources

Nexa Resources (NEXA CN: C$13.08 | US$1,343m) was listed in October 2017 on the NYSE and TSX. It raised US$328m and at the same time issued a US$700m bond. It remains 64%-owned by the Votorantim Group of Brazil. The company operates the Cerro Lindo, Vazante, El Porvenir and Atacocha base metal mines in Peru and Brazil. Nexa also operates three smelting assets, two in Brazil and one in Peru. In 2017 it produced 375kt of zinc and 44.2kt of copper and is really more of a zinc company.

Nexa has a high exploration and development budget in 2018 (US$140m, equivalent to 3.8% of revenues) and is undertaking brownfield drilling to extend the life-of-mine of its existing operations and is deepening its main asset, the Vazante mine.

It also has three advanced projects in its pipeline. It owns 95% of the Aripuanã zinc-copper project in Brazil, where a construction permit was submitted in July 2018 and a go-ahead decision is anticipated shortly for start-up in 2020 for capex of US$354m. At the Shalipayco zinc project it is preparing an EIA and planning a scoping study. Metallurgical test work is underway following a drilling campaign at its Magistral copper project where output of 52kt/y is expected in 2022 for capex of US$555m.

**At the end of 2017 Nexa had net debt of US$435m with a Net Debt-to-EBITDA ratio of 0.7x. Its major shareholder makes it unlikely to be acquired, while it has a number of projects and a high exploration budget to keep it busy and, along with its zinc focus, this makes it unlikely to be a participant in the copper M&A market in the near term.**

## Imperial Metals

Canadian-based Imperial Metals (III CN: C$1.32 | US$123m) operates two small, high-cost copper mines — Red Chris, and Mount Polley — although they have significant resources. It also has a 50% interest in the Ruddock Creek lead-zinc property. All its assets are located in British Columbia, Canada. In 2017 the company produced an attributable 43kt of copper and 81koz of gold at a cash cost of US¢243/lb.

In September 2018 Imperial launched a financial and business restructuring process, including: an extension of its debt; steps both to rationalise and improve its mines; and the set-up of a team to identify, consider, negotiate and potentially implement all strategic alternatives, including asset sales, joint ventures, a recapitalisation, and a sale or merger of the company. Imperial also reported that it has already had preliminary discussions with a potential joint-venture partner.

Imperial has interests in various other early-stage exploration properties; however, exploration is currently focused at existing mining operations. Management also states that it continues to evaluate potential acquisitions, although this option is probably unlikely without an equity raising given its balance sheet.

**Imperial continues to be free cashflow negative despite improved operating earnings and a reduction in capex. It had net debt of US$450m at the end of 2017 with a high Net Debt-to-EBITDA ratio of 6.2x. With its recent announcement, Imperial is obviously amenable to a sale of assets, but could strengthen itself through a merger with another junior copper company.**

## Atalaya Mining

Cyprus-registered Atalaya Mining (ATYM LN: £2.32 | US$356m) is listed on the LSE and TSX and is 22%-owned by the Chinese copper company Yanggu Xiangguang Copper, 22% by Trafigura, 14% by Liberty Metals and 14% by Orion Mine Finance. It produces copper concentrates and silver at its wholly-owned Proyecto Riotinto mine in Spain, and is currently undertaking a 50% expansion to produce 50-55kt/y. It also has a phased, earn-in agreement to acquire up to 80% of Proyecto Touro, a brownfield copper project in Spain that is at the permitting stage.

The open-pit Proyecto Riotinto mine commenced production in 2016 and in 2017 produced 37kt of copper at a cash cost of US¢191/lb. The Proyecto Touro Project is expected to produce 30kt/y of copper with a cash cost of US¢173/lb, with pre-production capex of US$195m.

**The company has a strong balance sheet, with some US$50m in net cash at the end of 2017, and is operating well. In October 2018 the Board confirmed that it is undertaking a review to evaluate the company's strategic options. Atalaya could be of interest to a larger producer looking for European assets given the expansion of its existing mine, or could be part of M&A activity to form a larger company.**

## Sociedad Punta del Cobre

Chilean-based Sociedad Punta del Cobre (PUCOBRE CH: CP3,601 | US$675m) is engaged in copper mining in Chile's northern Atacama. Its assets include: the San José copper concentrator and the Punta del Cobre, Granate and Venado Sur copper mines, which supply raw material for the concentrator; the Mantos del Cobre mine, operated through a leasing contract, which also supplies the plant; and the Biocobre copper cathodes plant. In 2017 the company produced 36kt of copper at a cash cost of US¢188/lb.

The company also has two copper projects currently under development: Tovaku in northern Antofagasta, and El Espino, in the Coquimbo region. The company has an option agreement with Codelco to earn a 60% interest in Tovaku, subject to the completion of studies and exploration work. Tovaku is planned to produce 40kt/y of copper with an estimated capital cost of US$470m. El Espino is planned to produce 42kt/y of copper and 20koz/y of gold with an estimated capital cost of US$658m.

In July 2018 the company finalised the acquisition of Pacífico V Región in a reverse merger under which Punta del Cobre absorbed its parent company Pacífico (85% ownership) and Punta del Cobre now appears to be held some 80% by insiders.

**The company has a relatively strong balance sheet, with net cash of US$52m at the end of 2017, with strong free cashflow. This should allow it to develop its two copper development projects, but could also allow it to be involved in strategic M&A if the right opportunity arose, most likely in the existing operating region.**

## Atlas Consolidated

Philippines-based Atlas Mining (AT PM: PP2.70 | US$183m) is listed on the Philippines Stock Exchange and is 43% held by the Ramos family. It operates the Toledo copper mine in the Philippines and holds a 25% interest in Berong Nickel Corp, which operates a nickel laterite mine.

In 2017 the Toledo mine produced 35kt of copper and 22koz of gold, with molybdenum by-products, at an average cash cost of US¢175/lb. The company continues to be free cashflow negative and had net debt of some US$465m as at the end of 2017, with a Net Debt-to-EBITDA ratio of 6.0x.

**We believe it would be unlikely for Atlas to be involved in any copper M&A activity, except perhaps at the local level.**

## Amerigo Resources

Canadian-based Amerigo Resources (ARG CN: C$0.95 | US$130m) owns the MVC operation in Chile, which processes fresh and historic tailings from Codelco's El Teniente mine, a major underground copper mine. In 2017 MVC produced 27kt of copper at a cash cost of US¢164/lb. MVC has been processing copper concentrates since 1992 and has contracts with El Teniente that extend to at least 2037.

Amerigo achieved record annual copper production in 2017 following the completion of Phase 1 of the Cauquenes historic tailings project. The Phase 2 expansion project was completed in 3Q18 and will increase copper production up to 41kt/y and lower cash costs.

Amerigo had net debt of US$33m at the end of 2017, which has increased to fund the Cauquenes expansion project. Free cashflow has improved and net debt has declined. The Net Debt-to-EBITDA ratio is 0.9x.

**It would be unlikely for Amerigo to be involved in any copper M&A activity.**

## Copper Mountain

Canadian-based Copper Mountain's (CMMC CN: C$1.00 | US$145m) main asset is the Copper Mountain mine located in British Columbia, Canada. The company has a strategic alliance with Mitsubishi Materials Corp, which own 25% of the mine. In 2017 the mine produced 34kt of copper at a cash cost of US¢186c/lb.

Mining operations commenced in 2011, but required a US$40m secondary crusher in 2014. Capex requirements have since fallen sharply and free cashflow has improved, allowing Copper Mountain to reduce debt and strengthen its balance sheet. However, at the end of 2017 net debt was still US$202m, with a Net Debt-to-EBITDA ratio of 2.9x. Nevertheless, the company has for some time been looking to utilise its cashflow and diversify its operations through acquisition.

Following a drill programme started in April 2017, the company completed a PEA on its 75%-owned New Ingerbelle Project in September 2018. This is a satellite deposit 1.0km from the Copper Mountain mine. The PEA assumes New Ingerbelle mill feed would be trucked to existing operations. The total initial capital cost is estimated at US$130m. The company is thus studying the potential of expanding the mill at Copper Mountain.

In April 2018 Copper Mountain acquired Australian-based Altona Mining for A$93m. This all share agreed merger deal brought with it approximately A$30m in cash, the development-ready Cloncurry copper project located in Queensland, Australia, and an extensive exploration package. A feasibility study for the Cloncurry (now called Eva) Project was completed in October 2018, which proposed production of 39kt/y of copper and 17koz of gold for a minimum of 14 years at a cash cost of US¢171/lb and initial capex of US$350m.

**Copper Mountain has finally taken the bold move of diversifying its business through the merger with Altona. Copper Mountain could be involved in further deals, but management may wish to consolidate this deal and develop the Eva Project before it takes a further step.**

## Aeris Resources

Australian-based Aeris Resources (AIS AU: A$0.18 | US$36m) owns the Tritton copper operations in New South Wales. There are two active underground mines — Tritton and Murrawombie — and four additional satellite deposits scheduled for future production. These will supplement and then replace production from the two existing mines as they are exhausted. In 2017 the company produced 23kt of copper at an average cash cost of US¢226/lb.

Management has ambitions to grow Aeris into a mid-sized, multi-mine company. The growth strategy includes continuing brownfield and greenfield exploration, and seeking appropriate merger and acquisition opportunities. It completed two major financial restructurings in December 2015 and February 2018.

In the year to June 2018, Aeris produced strong free cashflow and net debt has fallen to US$43m and the company had a Net Debt-to-EBITDA ratio of 1.1x. However, in October 2018 Aeris completed a A$35m equity raise and repaid US$20m debt, and plans to spend A$6.9m to accelerate exploration. Its most advanced exploration project is Torrens in South Australia.

**The stronger balance sheet and investment in exploration after being capital constrained may finally allow Aeris to participate in M&A activity in the copper market.**

## Metals X

Australian-based Metals X (MLX AU: A$0.46 | US$225m) owns the Nifty copper mine, located in Western Australia. Metals X acquired Nifty in August 2016 through the takeover of Aditya Birla Minerals. At the time of acquisition Nifty was effectively in closure mode, having just one year of remaining ore reserves and an inventory of dilapidated equipment and infrastructure. The company has since focused on increasing the production rate, returning the process plant to continuous operation, and extending mine life. The company is currently ramping up production to a targeted rate of 40kt/y of copper. In 2017 Metals X produced 23kt of copper at a cash cost of US¢284/lb.

Metals X is also a significant producer of tin with its 50% equity interest in the Renison tin operations in Tasmania and is advancing the Rentails tailings project.

It further owns the Wingellina nickel-cobalt project, part of Metals X's Central Musgrave Project, which straddles the triple-point of the Western Australia, Northern Territory and South Australia borders. Wingellina is development-ready and is the largest undeveloped nickel-cobalt project in Australia. The company is looking for potential partners to develop the project.

At the end of June 2018 Metals X had net cash of US$19m, but this has been falling steadily over the past four years as the company continues to be slightly free cashflow negative. In July 2018 the company completed an equity raise of A$50m by way of an institutional placement. The placement provides capital for the ramp-up of Nifty, as well as funding increased brownfield exploration at its copper and nickel operations, and advancing its development projects.

**The equity raising has strengthened Metals X and enabled the company to continue focusing on the re-establishment of the Nifty copper operations. It also retains the optionality on the development of its Wingellina nickel-cobalt project, but this could benefit from higher commodity prices. Consequently, while possible, we believe that it is unlikely that Metals X would be involved in acquisition activity in the near term.**

## Ero Copper

Canadian-listed Ero Copper (ERO CN: C$9.89 | US$643m) holds a 99.6% interest in the Mineração Caraíba open-pit and underground copper operations (MCSA), located in north-eastern Bahia, Brazil. In 2017 Ero Copper produced 20kt of copper. Production is expected to increase to about 27kt in 2018 and 37kt in 2019 and for costs to decline.

Management states that its strategy is centred upon increasing the high-grade mineral reserves, extending mine life, and maximising mill throughput to leverage the excess capacity of the installed infrastructure.

MCSA also owns the Boa Esperança copper development project, located in southern Pará State, Brazil. A feasibility study in June 2017 suggests an open-pit mine producing an average of 18kt/y of copper and a cash cost of US¢92/lb for initial capex of US$167m.

**As at the end of 2017 the company had net debt of US$88m, with a Net Debt-to-EBITDA ratio of 3.5x. Ero Copper is focused on the continued optimisation of its MCSA operations and the development of the Boa Esperança Project, and given its balance sheet we would not expect it to be involved in copper acquisitions in the near term.**

# Appendix 4 — Key Development Project Overviews

## Copper Projects Which May Require Third-party Involvement

### 1. Kamoa-Kakula

**Ivanhoe Mines** (IVN CN: C$2.69 | US$1,638m) is a Canadian mining company focused on advancing its three main projects in Southern Africa: the development of new mines at the Kamoa-Kakula copper discovery in the DRC; the Platreef platinum-palladium-nickel-copper-gold project in South Africa; and the extensive redevelopment and upgrading of the historic Kipushi zinc-copper-germanium-silver mine, also in the DRC. The 40%-owned Kamoa-Kakula Project is currently the largest undeveloped copper deposit globally, with total resources of 43.8Mt contained copper. The other major shareholders are Zijin Mining (40%) and the Government of the DRC (20%).

Kamoa-Kakula is a very large, near-surface, stratiform copper deposit within the Central African Copperbelt, near the town of Kolwezi. In February 2018 Ivanhoe announced an updated Mineral Resource of 154Mt at a grade of 5.6% copper at a 3% copper cut-off.

In November 2017 a PEA estimated an initial capital cost of US$1.2bn with average copper production of 284kt/y at an average cash cost of US¢114/lb during the first ten years. Kakula is expected to produce a very high-grade copper concentrate in excess of 50% copper, with extremely low arsenic levels. The Kakula feasibility also includes an option for an integrated, 12Mt/y, two-stage development, beginning with initial production from the Kakula mine, to be followed by a subsequent, separate underground mining operation at the nearby Kansoko mine, along with the construction of a smelter.

**We have included Kamoa-Kakula in our list of mines that may require third-party assistance, although Ivanhoe has already gone some way down the path having sold a 40% stake in the project to Zijin Mining in 2015 in return for a US$412m investment in the project. Also, in September 2018 China-based CITIC Metal Africa acquired a 19.5% stake in Ivanhoe for some US$556m. Zijin Mining already owns a 9.7% stake in Ivanhoe and Mr Friedland retains 17%. Because of the existing Chinese stakeholders, we rank this project as having a low possibility of another party getting involved.**

Along with debt repayment, Ivanhoe intends to use the funds to continue advancing its development and exploration activities at Kamoa-Kakula, and at its other two projects — Platreef and Kipushi.

### 2. Pebble

The Pebble Project is located in south-west Alaska, and is owned 100% by **Northern Dynasty** (NDM CN: C$0.51 | US$123m). This project has had a difficult history, with **Anglo American** withdrawing from it in 2013 after problems in permitting. Anglo paid Northern Dynasty a US$300m impairment charge as a result. The project received fierce opposition from environmental campaigners and local native Alaskan communities opposed to the project, arguing that it posed a threat to the commercial salmon fishing industry as well as their traditional way of life.

Northern Dynasty is now again advancing the large resource containing 40Mt copper towards permitting and development. 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.

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 achieve a partner once there is more certainty on the permitting outcome. As a result, we have ranked this project as having a low possibility of another party getting involved in the near term.**

**3. Timok**

**Nevsun Resources** (NSU CN: C$4.47 | US$1,041m) owns the Timok copper-gold project in Serbia and also owns the Bisha copper-zinc mine in Eritrea. However, Nevsun is currently the subject of an agreed takeover bid from Zijin Mining with an all cash offer of C$6.00/share. This is a 26% premium (US$1.25/share) to a previous hostile bid by Lundin Mining.

**We have included Timok in our list of projects that may require third-party assistance, but given the expected conclusion of the takeover by Zijin, we rank this project as having a low possibility of another party getting involved, unless Zijin decides to seek a partner.**

The Timok Project consists of the Cukaru Peki Upper Zone and Lower Zone, which combined contain 15.4Mt copper. Nevsun owns 100% of the Upper Zone and 46% of the Lower Zone, a joint venture with Freeport-McMoRan. The deposit is located in Serbia within the Bor mining district of the Timok Magmatic Complex. The deposit comprises two different styles of copper-gold. The Upper Zone is high sulphidation (HS) epithermal mineralisation occurring at depths from 450-850m below surface. The Lower Zone is porphyry-style mineralisation found from 700-2,200m below surface.

The Timok Upper Zone PFS suggests an underground sub-level cave operation producing some 77kt/y of copper at a cash cost of US¢92/lb over a 10-year mine life, with initial capex of US$574m. Construction started in June 2018 on an exploration decline.

**4. 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 that has faced permitting issues, as well as problems with the resettlement of 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 (US$13,867/tpa).

**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.**

**5. Los Azules**

The Los Azules Project is 100%-owned by **McEwen Mining** (MUX CN: C$1.96 | US$509m) 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 three gold mines in Mexico, Argentina and Canada, which produced an attributable 110koz in 2017. As at June 2018, the company had net cash and investments of US$18m. The CEO Rob McEwen owns 24% 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 as the final product for export is anticipated. The Los Azules deposit is a classic Andean-style porphyry copper deposit. The upper part of the system consists of a barren leached cap, which is underlain by a high-grade secondary enrichment blanket. Production of some 153kt/y at a cash cost of US¢128/lb is anticipated over a 36-year life with an initial capital cost of US$2.4bn (US$15,686/tpa). At a copper price of US$3/lb, the project returned an $NPV_8$ 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. McEwen has budgeted US$5.3m to continue with further technical and environmental baseline analysis, of which the majority will be spent in 2018. The project still requires a lot of work and McEwen is planning a northern access road through Chile, starting preliminary engineering plans, and initiating permit applications. It is also looking at how it could integrate with other mines and projects in the area.

**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. Operating in Argentina may put off some companies, but we believe there is a high possibility of a third party either looking to acquire the project outright or taking a significant interest.**

**6. Los Helados and 15. Josemaría**

**NGEx Resources** (NGQ CN: C$1.00 | US$175m) is Canadian-based and holds a 60% interest in the Los Helados Project (PanPacific Copper 40%) and 60% of the Josemaría deposit (JOGMEC 40%). NGEx is a Lundin Group explorer and developer, with Lukas Lundin the chairman. As at June 2018 the company had net cash and investments of US$6.3m.

In January 2016 NGEx Resources completed a PEA for an integrated mining operation that incorporated the Los Helados deposit, located in the Andes mountains of the Atacama Region in Northern Chile, and the Josemaría deposit, located in San Juan Province, Argentina, collectively termed the Constellation Project. Los Helados contains 10.6Mt copper and Josemaría 4.3Mt copper.

Constellation contemplates sequential production from an open-pit mine at Josemaría, followed by a block cave, underground mine at Los Helados. The two deposits are located approximately 10km apart, and material from both deposits will be processed at a centralised facility.

Initial development would target the highest-grade portion of the Josemaría deposit, which is a near-surface zone of supergene-enriched mineralisation. As the higher-grade material at Josemaría is depleted, production will transition to the high-grade core of the Los Helados deposit. Compared with either deposit when considered as a standalone operation, Constellation's shared facilities help improve capital efficiency, reduce overall environmental impacts, and dramatically improve project economics. A central processing facility is planned to be located in Argentina. Material from Josemaría will be transported via a series of three surface conveyors.

Constellation is expected to produce 166kt/y of copper at a cash cost of US¢105/lb over a 48-year life. The initial capital investment for the project is estimated to be US$3.08bn (US$18,554/tpa). At a copper price of US$3/lb, the PEA for the project returned an $NPV_8$ of US$2.1bn and an IRR of 14%. A pre-feasibility study is expected to be completed in 1Q19 and then the company will start permitting.

**The business model for NGEx is to add value to the project and then 'monetise' it. Once the project has made a bit more progress and has been optimised, we would expect NGEx to look for partners or possible acquirers. We believe there is a high possibility of a third party either looking to acquire the project outright or taking a significant interest.**

**7. Altar**

In June 2018, **Regulus Resources** (REG CN: C$1.88 | US$113m) announced the spin-out of a new company, **Aldebaran Resources**, with an option to acquire a majority interest in the Altar copper-gold project in Argentina. Aldebaran's primary focus is on Altar, where it has entered into an option agreement to acquire up to an 80% working interest from **Sibanye-Stillwater** through a combination of cash payments, share issuances and project expenditures. Aldebaran will also acquire the Rio Grande copper-gold project and other earlier-stage Argentine assets from Regulus, including the drill-ready Aguas Calientes gold-silver project.

Altar contains 8.4Mt of copper and 6.3Moz of gold (at grades of 0.3% 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.

Sibanye acquired Stillwater in 2017 and the Altar Project was deemed to be non-core to Sibanye-Stillwater. Regulus subsequently completed an extensive review of the project and entered into discussions with Sibanye-Stillwater that led to the current agreement. Sibanye-Stillwater completed additional drilling at Altar in 1H18 and, as part of the transaction, Aldebaran will compensate Sibanye-Stillwater for the 2018 drilling costs.

**Given the size of resources, we would expect this project to be on the radar screen of a number of companies, albeit that it is at an early stage of development. It may need further de-risking before a third party gets involved, but we believe there is a medium possibility of a third party either looking to acquire the project outright or taking a significant interest.**

**Figure 107: Development Projects 1**

**Los Helados**

**Kamoa-Kakula**

Source: NGEx Resources, Ivanhoe Mines

**8. Agua Rica**

**Yamana Gold** (YRI CN: C$2.41 | US$1,759m) is a Canadian-based gold company and holds a 95% interest in the Agua Rica copper-gold project located in Argentina. The project contains 7.6Mt of copper. Yamana also holds a 12.5% interest in the neighbouring Alumbrera copper mine. Yamana is essentially a gold producer with seven mines that produced 977koz of gold, 5.0Moz of silver and 58kt of copper in 2017.

In terms of the technical reviews, Yamana has advanced two development scenarios, one a large-scale open pit and the other a smaller-scale underground mine. The large-scale, open-pit scenario contemplates an integration of Agua Rica with the neighbouring Alumbrera mine, at which reserves are nearly exhausted. Under this scenario, the company projects a mine life in excess of 22 years at average production levels of 64kt/y of copper and 109koz/y of gold for the first ten years post ramp-up.

The smaller-scale underground scenario employs the application of sub-level caving. For this scenario, based on conceptual level studies, Yamana currently projects a mine life in excess of 28 years at average production levels of approximately 68kt/y of copper and 43koz/y of gold at a cash cost of US¢123/lb for the first ten years post ramp-up. A feasibility study update was completed for the open-pit scenario in 2016 and, as such, this scenario is technically advanced and development-ready. Technical work continues on the more recently studied underground scenario, as the company believes it presents a compelling development opportunity, notably with a marked decrease in development capital while still maintaining the longer-term optionality for a large-scale, open-pit operation in due course.

Yamana continues to advance its alternatives for the development of the Agua Rica Project, while concurrently pursuing various strategic alternatives to maximise value. As such, Yamana has determined that it will undertake the work required to conduct a preliminary economic assessment during 2018, with a pre-feasibility study to follow in 2019.

In March 2011 Yamana agreed an option agreement to integrate Agua Rica into Alumbrera, with **Glencore** holding 50%, **Goldcorp** 37.5% and Yamana 12.5%. The option agreement expired in 2015 after payments of US$50m.

**Integration with Alumbrera might still be possible for Agua Rica, but currently looks unlikely. However, we believe there is a medium possibility of a third party either looking to acquire the project outright or taking a significant interest, but the underground option is a smaller size and reduces the potential candidates.**

**9. Casino**

**Western Copper & Gold** (WRN CN: C$0.86 | US$67m) is a Canadian company focused on developing the wholly-owned Casino porphyry copper-gold-molybdenum deposit located in Yukon, Canada. The project contains 6.7Mt of copper. As at June 2018 the company had net cash and investments of C$5.8m.

The geology of the Casino deposit is typical of many porphyry copper deposits. The open-pit mine is expected to produce an average of 78kt/y of copper and 260koz/y of gold at a cash cost of US¢-94/lb over the 22-year mine life with initial capex of US$2.5bn (US$32,051/tpa). The high gold production causes the negative copper cash cost after by-product credits. At a copper price of US$3/lb the project returned an $NPV_8$ of US$1.8bn and an IRR of 20%.

The feasibility study was updated in January 2013 and an Environment Assessment Application submitted in 2014. Currently the project is in the Adequacy Phase of the permitting process. Western Copper believes the project is some three years away from being fully permitted.

**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 — or even gold — producer. Therefore, we believe there is a medium possibility of a third party either looking to acquire the project outright or taking a significant interest.**

**10. Ann Mason**

**Mason Resources** (MNR CN: C$0.40 | US$24m) is a Canadian-based exploration company with a 100% interest in the Ann Mason Project, located in west-central Nevada. The project contains 6.5Mt of copper. The company has a market cap of C$13m and, as at June 2018, it had net cash and investments of US$6.9m. In October 2018 Hudbay entered into an agreement with Mason Resources to acquire the outstanding 86% interest it does not already own for C$31m in an all share deal. Mason Resources had been looking to find a strategic partner for the project.

The Ann Mason Project hosts two known mineral deposits: Ann Mason, which is a large copper-molybdenum porphyry resource, and Blue Hill, which is predominantly an oxide-copper deposit overlying deeper sulphide mineralisation.

A PEA on Anne Mason was released in March 2017 that envisioned a large-scale conventional open-pit mine, involving the development of a single pit with five pit phases. The mine is expected to produce an average of 109kt/y of copper at a cash cost of US¢149/lb over a mine life of 21-years with initial capex of US$1.35bn (US$12,385/tpa). At a copper price of US$3.00/lb, the project returned an $NPV_{7.5}$ of US$770m and an IRR of 14%. There is also potential for the resources outlined at the Blue Hill oxide-copper deposit to be incorporated into the project.

**Just before Hudbay's announced agreement, we thought there was a high possibility of a third party either looking to acquire the project outright or taking a significant interest. Although a competing bid could emerge, it now looks likely that the Ann Mason Project is no longer available and so have downgraded the probability of another company being interested to Low.**

**11. Santa Cruz**

**Amrich Minerals** is a private company that owns 100% of the Santa Cruz Project in Arizona, US. The porphyry copper project is 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.

RFC Ambrian



**12. Cascabel**

Australian-based **SolGold** (SOLG CN: C$0.66 | US$861m) 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 June 2018, the company had net cash and investments of A$82m.

SolGold delivered a maiden resource for the Alpala deposit on its Cascabel Project in January 2018. The resource contained 5.2Mt of copper and 12Moz of gold. Following a significant drilling programme in 2018, the company plans to deliver a resource update in 4Q18 and a PEA is expected to be complete in 1Q19. SolGold is investigating both high tonnage open-cut and underground block caving operations.

SolGold has attracted considerable corporate interest. **Newcrest** has acquired a 14.5% stake in SolGold for around US$70m through three placings since October 2016. Also, **BHP Billiton** has an 11% interest in SolGold, having acquired a 6% interest from a third party in September 2018 and a further 5% in a placement in October 2018 for a total of approximately US$95m.

**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.**

**13. Vizcachitas**

Canadian-based **Los Andes Copper** (LA CN: C$0.25 | US$52m) 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, year-round exploration and project development. Vizcachitas is an advanced stage copper-molybdenum porphyry deposit containing 5.0Mt of copper.

The Vizcachitas property covers a porphyry copper-molybdenum system with alteration delineated over 3km in a north-south direction and 1.5km in an east-west direction. Within this altered zone is an area of strongly-leached capping, copper oxide and sulphide and molybdenum mineralisation.

A PEA was completed in 2014, with subsequent drilling taking place in 2017. An Updated PEA is planned to be completed in 1Q19. A PFS and progression of the environmental permits is expected by 2020. The PEA proposed an open-pit mine with a number of scenarios, but potentially producing 178kt/y of copper at a cash cost of US¢169/lb over a 28-year life with initial capex of US$2.9bn (US$16,292/tpa). At a copper price of US$2.75/lb the project returned an $NPV_8$ of US$274m and an IRR of 9.4%.

As at June 2018, it had net cash and investments of US$7.6m. 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 outright or taking a significant interest.**

**Figure 108: Development Projects 2**

**Vizcachitas** **Cascabel**

Source: Los Andes Copper, SolGold

**14. Khoemacau**

**Cupric Canyon Capital** is a US-based private company founded in 2010 by several copper mining industry executives and backed by Barclays. It acquired a 100% interest in the Khoemacau copper project in the Kalahari Copper Belt of Botswana in 2013 (through the acquisition of Hana Mining), and in 2015 acquired the adjacent Boseto licences and mining complex (through the acquisition of the assets of Discovery Metals). Since the acquisition Cupric has completed further drilling, feasibility studies and secured a mining licence. The project contains 4.9Mt of copper.

A feasibility study has been completed that demonstrates the viability of utilising the Boseto mill to process Zone 5 ore. Capex of US$350m (US$7,000/tpa) is required to: (a) develop three interconnected underground mines along-strike in the Zone 5 orebody to extract 10kt/d of ore; (b) construct an ore transportation system over a distance of 30km; and (c) expand the Boseto mill. This operation is expected to produce about 50kt/y of copper and 1.4Moz/y of silver contained in concentrate, at a cash cost of US¢108/lb over a 27-year life. The company believes future expansions could increase production at Khoemacau up to at least 120kt/y of copper. Cupric is currently seeking finance for the project.

**This is a smaller-sized African project that might be of interest to a Tier 2 copper producer. We think there is a medium possibility of a third party either looking to acquire the project outright or taking a significant interest.**

**15. Josemaria**

See 6. Los Helados on page 119.

**16. Upper Kobuk**

Canadian-based **Trilogy Metals** (TMQ CN: C$2.70 | US$273m) is listed on the TSX and NYSE. Trilogy's principal asset is the Upper Kobuk Mineral Projects (UKMP), which covers 100km of the Ambler VMS belt in in Alaska, US. The most advanced projects in this prospective district are Arctic and Bornite, which together contain 4.0Mt of copper and which are located approximately 470km north-west of Fairbanks.

Trilogy completed a pre-feasibility study on the Arctic deposit in February 2018. Arctic is a polymetallic volcanogenic massive sulphide deposit located approximately 470km north-west of Fairbanks, Alaska. Current activities are focused on advancing Arctic to feasibility and permitting. The Arctic deposit contains 1.2Mt of copper in resources and is expected to produce about 72kt/y of copper and associated by-products at a net cash cost of US¢15/lb over a 12-year life with an initial capital cost of US$780m. At a copper price of US$3.00/lb, the project had an $NPV_8$ of US$1.4bn and an IRR of 33%. Trilogy anticipates a draft EIS by March 2019 and a final EIS by December 2019. It expects the National Park Service to complete the EEA by end-2019.

The Bornite deposit is a carbonate-hosted copper-cobalt deposit located 25km south-west of the Arctic Project. Current activities are focused on exploration, with mineralisation remaining open to the north, north-east and south.

In April 2017 Trilogy and South32 signed an agreement whereby South32 has an option to form a 50:50 joint venture on Trilogy's Alaskan assets in return for a total contribution of US$150m. It also took a US$12m placing, increasing its interest in Trilogy to 12.5%. Trilogy's shareholders also include the Electrum Group, with 20%, and Paulson & Co (9%). The company is well funded, with C$30m in cash at August 2018.

**This project is still relatively small, but its high returns have already attracted the interest of South32. We therefore rank this project as having a high possibility of another party getting involved, with South32 being a strong candidate.**

**17. Canariaco Norte**

**Candente Copper** (DNT CN: C$0.08 | US$11m) 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.

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 cash cost of US¢99/lb over a mine life of 22 years. Pre-production capex was estimated at US$1.4bn (US$12,076/tpa). At a copper price of US$3.00/lb, the project had an $NPV_8$ of US$3.3bn and an IRR of 36%.

A second mineralised copper porphyry, Cañariaco Sur, has now been discovered adjacent to the Cañariaco Norte deposit. The company is continuing drilling for additional mineral deposits and is progressing development of the project through the planned completion of a feasibility study.

As at June 2018 it had net cash and investments of US$0.4m. The low cash level is currently an issue for the company.

**This project is still at an early stage, but could develop into a project that might be of interest to a Tier 2 copper producer. 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.**

**18. Harper Creek**

**YellowHead Mining** (YMI CN: C$0.20 | US$2.9m) is a Canadian company with a 100% interest in the Harper Creek copper-gold-silver development project in British Columbia. The project contains 3.6Mt of copper. As at June 2018 it had limited net cash and equivalents. In August 2018 the company completed a Rights Offering for C$1m.

The Harper Creek property is an extensive volcanogenic-hosted sulphide system with a mineralised envelope, as defined by drilling to date, greater than 2.5km along-strike, over 2.0km down-dip, and 1.0km thickness of volcano-sedimentary stratigraphy. Copper mineralisation is tabular. The company expects to continue exploration drilling in target areas identified through airborne and ground geophysics and soil geochemistry to expand the resource base.

A feasibility study was completed on the project in March 2012 that concluded that the project could produce an average of 58kt/y of copper at a cash cost of US¢114/lb with initial capex of US$839m (US$14,466/tpa Cu) over a mine life of 28 years. At a copper price of US$3.00/lb the project had an $NPV_8$ of US$1.3bn and an IRR of 27%.

In July 2018 YellowHead reported that the BC Environment Ministry had denied the company's request for an extension for its Environmental Assessment application and had terminated the application. For environmental permitting purposes, the company will now need to begin a new application process, which incorporates new Federal and Provincial regulatory requirements. These requirements are currently scheduled to be effective April/May 2019. Once these requirements are known, the company will review its position and advise accordingly.

**This is a smaller, early-stage project that may be of interest to a Tier 2 copper producer. Given the EAA setback, we think there is only a medium possibility of a third party either looking to acquire the project outright or taking a significant interest in the medium term, although the market cap of YellowHead has fallen significantly in the past year.**

**19. Ak-Sug**

Ak-Sug is a porphyry copper deposit in southern Siberia, Russia, near the border with China, and contains about 3.4Mt of copper resources. Ak-Sug is owned by the private company **Intergeo MMC**, acquired through the takeover of Vancouver-based copper producer Mercator Minerals in 2013. Intergeo MMC is a mining subsidiary owned by Russian billionaire Mikhail Prokhorov's Onexim Group.

The Ak-Sug deposit is a copper-molybdenum porphyry deposit associated with regional fault structures. Two phases of mineralisation have been identified: the initial copper-molybdenum-gold mineralisation and a later molybdenum-copper mineralisation phase. A PEA carried out by Mercator in 2012 suggested an open-pit mine producing on average 95kt/y of copper at a cash cost of US¢116/lb with initial capex of US$2.0bn over a mine life of 25 years.

**Given the lack of visibility on this project and its location in Russia, we would place a low probability of a third party trying to acquire an interest in the project.**

**20. King-king**

**St Augustine Gold & Copper** (SAU CN: C$0.02 | US$11.2m) 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 62kt/y of copper at a cash cost of US¢211/lb with initial capex of US$2.0bn over a mine life of 23 years.

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 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.**

**21. 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 3.2Mt 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.**

# Appendix 5 — New Copper Mines

## 1. Cobre Panama

Cobre Panama is a large open-pit copper development project in Panama. Following the completion of its acquisition of Inmet Mining in 2013, **First Quantum** assumed an 80% equity interest in the Cobre Panama Project and increased its interest to 90% in 2017. The project is expected to start phased commissioning during 2018, continue to ramp up over 2019 and reach the 85Mt/y throughput rate by 2020. Over this period, contained copper production is estimated at a minimum of 150kt in 2019, 270-300kt in 2020 and up to 350kt in 2021. At steady-state, the unit cost of production is estimated at US$1.20/lb C1 and US$1.50/lb all-in sustaining, net of by-product credits.

## 2. Quellaveco

The Quellaveco Project received development approval in July 2018 and will produce its first copper in 2022, ramping up to full production in 2023. **Anglo American** owns 60% of the project and **Mitsubishi Corp** owns 40%. Anglo recently sold a 21.9% share of the project to Mitsubishi to give Mitsubishi its 40% stake to support a broader funding capacity and improve the project risk profile. The operation will use open-pit mining and processing by flotation to produce copper concentrate, as well as molybdenum and silver by-products. The copper concentrate will then be transported to the coast for export.

## 3. Mirador

The Mirador Project is located in the Ecuadorian Amazon and its location has caused contention and conflict. **Ecuacorriente** operates the project and is owned by two Chinese state-owned enterprises — China Railway Construction Company (CRCC) and Tongling Nonferrous. As such, the amount of current information is limited, but the project appears to be at an advanced stage. Resources contain 3.5Mt Cu and 3.6Moz Au. A US$1.9bn open-pit development is planned to produce 120kt/y of copper.

## 4. Marcona

The Marcona or Mina Justa Project in Peru is owned by **Minsur**, which recently sold a 40% stake in the project to the Chilean conglomerate Inversiones Alxa for US$200m. Minsur is a private Peruvian tin producer. The feasibility study was recently approved and early works are ongoing. The mine is expected to begin operating in 2020, targeting a production rate of 92kt/y.

## 5. Pumpkin Hollow

Pumpkin Hollow is located in Nevada and owned by **Nevada Copper**. An underground mine development has been fast tracked by re-engineering the project and production is anticipated in 2H19. The resource includes open-pit reserves and resources, but the underground reserves and resources comprise 21.7Mt ore grading 1.7% Cu equivalent and contain 1.4Mt of copper. The open-pit resource is fully permitted and has the potential for staged growth at a later stage and capex could be funded internally.

### 6. Tia Maria

The Tia Maria Project in Peru has experienced delays while trying to resolve issues with community groups. Southern Copper states that it continues working with these groups in order to resolve open issues concerning the project. **Southern Copper** has completed engineering studies and obtained environmental approvals and is now waiting for the construction licence, which is expected to be issued imminently by the Peruvian Government. The construction permit has been delayed due to pressures from anti-mining groups. This will be a SX-EW copper greenfield project with a total capital budget of US$1,400m.

**Figure 109: Copper Mines Under Construction**

**Carrapateena**

**Pumpkin Hollow**

Source: OZ Minerals, Nevada Copper

### 7. Bystrinskoye

The open-pit project in Russia is planned to be in commercial operation by 4Q18. The mine is expected to produce 65kt/y of copper (in concentrate) from 2021. **Norilsk Nickel** has sold a 13.3% stake to a consortium of Chinese investors, and 36.6% to CIS NRF Holdings. Norilsk states that it is considering a potential IPO of the asset, which may mean it could be acquired by a company comfortable operating in the Far East of Russia. Powerlines and a 227km railway connect the operations.

### 8. Carrapateena

**OZ Minerals** is a copper-focused international company based in South Australia. It also operates the Prominent Hill copper mine. Construction of Carrapateena is underway and commissioning is scheduled for 4Q19, after which the project will ramp up to steady-state production. The project will be an underground operation producing 65kt/y copper, with an estimated mine life of 20 years.

### 9. Metalkol

**Eurasian Resources** is a private company. It will reprocess copper and cobalt tailings previously deposited in the Kingamyambo Tailings Dam and Musonoi River Valley in the DRC through a low-cost hydro-metallurgical facility. In Phase 1, Metalkol is expected to produce 77kt/y of copper cathode and 14kt/y of cobalt once operational, with production expected to start in 4Q18. The financing has been secured with a Chinese consortium, including EPC contractor China Nonferrous Metal Industry's Foreign Engineering and Construction Company (NFC). A subsequent expansion, Phase 2, may increase production to an average of 105kt/y of copper and 20kt/y of cobalt.

### 10. Kolwezi

**Zijin Mining** owns 72% of Kolwezi, a high-grade copper deposit in the DRC. The open-pit operation and flotation plant started production in 4Q17 and is in ramp-up stage. A hydro-metallurgy plant is under construction and is expected to be completed in 1H19 and the operations will then produce some 100kt/y of copper.

### 11. Florence

**Taseko** acquired the Florence copper project in 2014. In September 2017 Taseko announced the decision to construct a US$25m production test facility (PTF). This is well underway, on-time and on-budget, and the new *in situ* copper recovery facility is on track to produce its first copper cathode before the end of 2018. After the PTF phase is completed, Taseko will advance into full-scale commercial production with an initial capital cost of US$200m. Once operational, Florence will have a production capacity of 39kt/y of copper at a cash cost of US¢110/lb over its 21-year life.

### 12. Copperwood

**Highland Copper** is a Canadian company and is preparing to construct the 100%-owned Copperwood Project located in Michigan. The company expects all required permits in 4Q18 and construction of the underground mine is expected to start in 1Q19. It will produce some 300kt of copper over its 11-year life. However, the company has yet to put in place project finance for the development and currently has a working capital deficit.

# Appendix 6 — Top Copper Assets

## Top Copper Mines

There were at least 138 significant producing copper mines globally in 2017 (where we have data), along with 12 mines under construction. These mines produced some 14.3Mt of copper in 2017 and accounted for 87% of reported mine metal production (16.5Mt).

Together these operations had reserves of 446Mt of copper averaging 0.52% copper. Reserves and resources totalled 1,201Mt of copper grading 0.54%. The average mine production was some 104kt. Not all companies report cost data, but of those reporting it, the average cash cost including by-product credits was US¢145/lb and the production cost (including D&A) was US¢207/lb.

**Table 24: Top 20 Copper Mines by 2017 Production**

| | Mine | Country | Main owners | Prod'n 2017 kt | Cash cost US¢/lb | AISC US¢/lb |
|---|---|---|---|---|---|---|
| 1 | Escondida | Chile | BHP Billiton/Rio Tinto | 902,700 | 108 | 185 |
| 2 | Collahuasi | Chile | Anglo Am/Glencore | 524,000 | 118 | 170 |
| 3 | Cerro Verde | Peru | Freeport-McMoRan | 481,810 | 171 | 216 |
| 4 | El Teniente | Chile | Codelco | 464,000 | 99 | 135 |
| 5 | Morenci | US | Freeport-McMoRan | 462,664 | 169 | 229 |
| 6 | Las Bambas | Peru | MMG | 453,749 | 121 | 182 |
| 7 | Grasberg | Indonesia | Freeport-McMoRan | 451,778 | 9 | 80 |
| 8 | Buenavista | Mexico | Southern Copper | 430,685 | 118 | 144 |
| 9 | Antamina | Peru | BHP Billiton/Glencore | 422,500 | 4 | 89 |
| 10 | KGHM Polska Miedz | Poland | KGHM | 419,300 | 152 | 182 |
| 11 | Los Pelambres | Chile | Antofagasta | 343,800 | 115 | 142 |
| 12 | Chuquicamata | Chile | Codelco | 331,000 | 117 | 181 |
| 13 | Radomiro Tomic | Chile | Codelco | 319,000 | 121 | 175 |
| 14 | Los Bronces | Chile | Anglo Am/Codelco | 308,300 | 181 | 259 |
| 15 | Kansanshi | Zambia | First Quantum | 250,801 | 143 | 193 |
| 16 | Mt Isa Copper | Australia | Glencore | 239,900 | 163 | 201 |
| 17 | Andina Division | Chile | Codelco | 220,000 | 121 | 165 |
| 18 | Ministro Hales | Chile | Codelco | 215,086 | 123 | 206 |
| 19 | Tenke Fungurume | DRC | China Molybdenum | 213,800 | 15 | 107 |
| 20 | Antapaccay | Peru | Glencore | 206,500 | 113 | 151 |

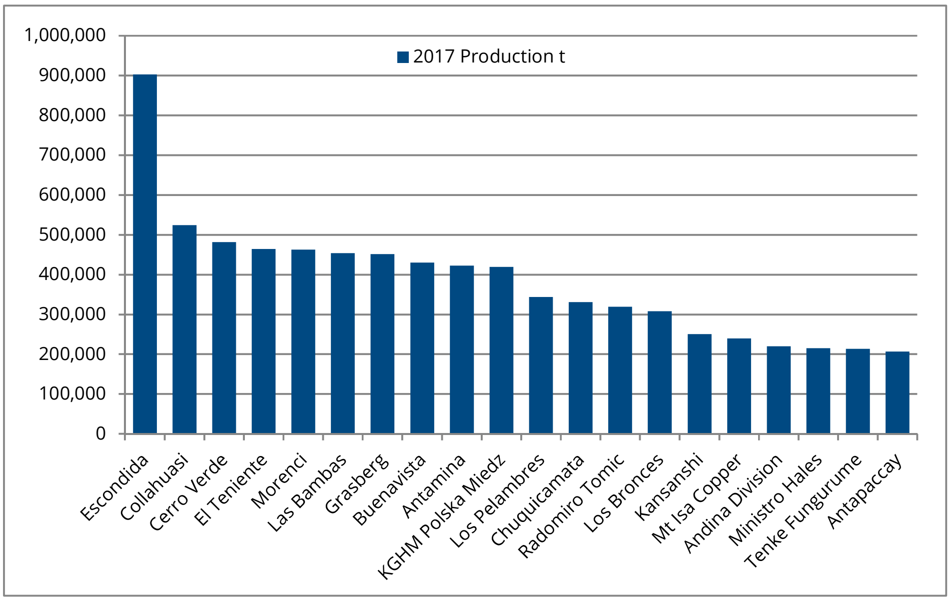
Source: S&P Global Market Intelligence, company data

Table 24 shows the top 20 largest mines in terms of production in 2017, all producing more than 200kt. Nine of these mines are located in Chile, with a further four located in Peru. Escondida continues to be the largest single copper producer, followed by Collahuasi, both in Chile.

In many cases these operations are not just one orebody, but rather a series of different satellite orebodies being mined and fed into a central processing plant. Consequently, satellite deposits and brownfield exploration are important aspects of most operations.

We expect First Quantum's Cobre Panama mine to join the list above in 2020, with production forecast at 270-300kt in 2020 and up to 350kt in 2021.

**Figure 110: 20 Largest Copper Mines by 2017 Production**




Source: Company data, RFC Ambrian estimates

## Top Copper Mine Reserves

The top 15 resources for the operating mines are shown in Table 25 and Figure 111. All of these mines have reserves and resources of greater than 20.0Mt of copper. They are also all in the list of the top 20 mines, apart from Olympic Dam, Oyu Tolgoi and Quebrada Blanca.

The largest copper resource is that of Escondida (141Mt), owned by BHP Billiton and Rio Tinto, followed closely by Andina Division (137Mt), owned by Codelco. The larger the resource, then typically the higher the level of mine copper production. Usually a mine reserve would have a life of around ten years and the resource around 20 years.

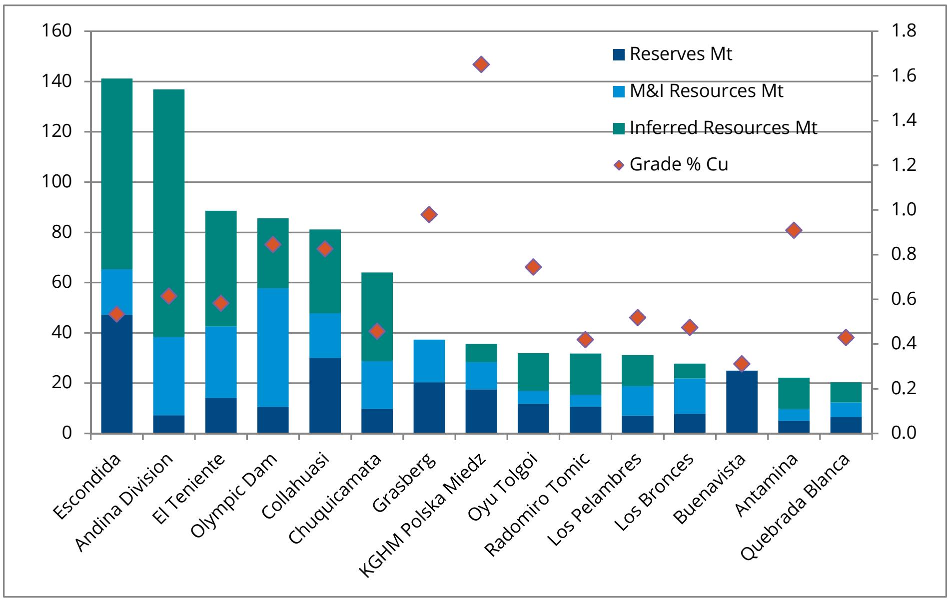
The resource size is, of course, an important factor in the decision of whether or not to develop, own or acquire an exploration project or an existing mine. Also, when the reserves of a mine are approaching the end of their life, companies often dispose of assets. This is sometimes because they can no longer be run at the scale and cost profile required for their portfolio, although it also avoids the burden of rehabilitation. These assets are often recycled and purchased by smaller companies that can often manage them more economically on a smaller scale.

### Table 25: Largest Reserve Levels of Operating Copper Mines

| | Mine | Country | Company | Reserves Mt Cu | R&R Mt* |
|---|---|---|---|---|---|
| 1 | Escondida | Chile | BHP Billiton/Rio Tinto | 47.21 | 141.14 |
| 2 | Andina Division | Chile | Codelco | 7.24 | 136.81 |
| 3 | El Teniente | Chile | Codelco | 14.09 | 88.61 |
| 4 | Olympic Dam | Australia | BHP Billiton | 10.53 | 85.55 |
| 5 | Collahuasi | Chile | Anglo Am/Glencore | 29.95 | 81.19 |
| 6 | Chuquicamata | Chile | Codelco | 9.73 | 64.01 |
| 7 | Grasberg | Indonesia | Freeport-McMoRan | 20.35 | 37.32 |
| 8 | KGHM Polska Miedz | Poland | KGHM | 17.47 | 35.57 |
| 9 | Oyu Tolgoi | Mongolia | Turquoise Hill | 11.65 | 31.92 |
| 10 | Radomiro Tomic | Chile | Codelco | 10.63 | 31.81 |
| 11 | Los Pelambres | Chile | Antofagasta | 7.16 | 31.11 |
| 12 | Los Bronces | Chile | Anglo Am/Codelco | 7.82 | 27.79 |
| 13 | Buenavista | Mexico | Southern Copper | 24.95 | 24.95 |
| 14 | Antamina | Peru | BHP Billiton/Glencore | 4.93 | 22.17 |
| 15 | Quebrada Blanca | Chile | Teck Resources | 6.44 | 20.29 |

*Resources include Measured, Indicated & Inferred resources; Source: Company data

### Figure 111: Top 15 Largest Orebodies of Producing Copper Mines (Mt Cu)




Source: RFC Ambrian

# Appendix 7 — M&A Financing

## M&A Financing in the Copper Space

For over 40 years RFC Ambrian has been involved in numerous advisory, strategic planning, asset review and financing roles with mining companies looking to undertake M&A activity. RFC Ambrian has recently advised on deals worth over US$3bn collectively. These transactions have involved both private and publicly-listed companies in Australia, Asia, Africa and Latin America.

Whilst the range of strategic rationales hasn't changed much over time, the financing alternatives have. There are many options available for companies to raise capital, but it requires innovation, combined with 'tried and tested' solutions. The types of capital used will inevitably have consequences for future returns. Investor appetite may be limited by financing that: i) limits upside exposure to commodity prices; ii) brings in large, strategic investors whose interests may not align with minority shareholders; or iii) involves overly complex structures, ultimately unappealing to the equity investor.

i. **Not all shareholders are equal.** A perceived misalignment of interests between minority shareholders and large, strategic investors can cause investors to shy away from individual stocks.

ii. **Overly complex financing structures can often flag quality issues**, raising the question as to why such complexity was necessary. While market conditions do sometimes require creative solutions, an overly complex structure poses a challenge in the competition for investor attention and capital.

The cost and availability of any one type of capital depends on market conditions, jurisdiction, the company's strategic objectives, asset quality and management credibility. Market conditions are driven by commodity prices, interest rates and investor interest and sentiment towards the sector. Financing has been difficult since 2011, when a long decline in commodity prices reduced investor interest. Many companies are loath to issue new shares when the equity markets are perceived to be low due to the dilution of existing shareholders. Banks have been less interested in lending except with onerous terms.

The difficulty of raising capital has also been compounded by the growth in ETFs where investors are putting their investments in a basket of existing mining assets rather than backing any particular company or project. The rise of ETFs has funnelled investment inflows into the majors and a handful of larger market cap juniors, while the rest have seen limited interest.

There are a number of ETFs in the investment market that are focusing exclusively on copper. These include: COPX, which seeks to track the holdings and performance of the Solactive Global Copper Miners Total Return Index (the Index includes a selection of global copper mining firms); JJC, a fund that seeks to track the return of copper; and CPER, an index fund that seeks to track the performance of the SummerHaven Copper Index Total Return.

### Cash Transactions

Generally, capital has been heavily constrained for most mining companies, and our analysis of the M&A activity for copper producers shows that the focus for many copper mining companies has been on M&A deals funded by cash. About 63% of copper M&A deals from 2008-2018 have been all cash deals.

In cash transactions, acquiring shareholders take on the entire risk that the expected benefits embedded in the acquisition premium will materialise. However, a cash offer is often far more likely to be successful with the target's shareholders than an all share offer at the same premium.

Since 2013 copper companies have become more financially disciplined and most have attempted to rationalise their operations and reduced capex to improve free cashflow. There have been some sales of assets to help strengthen balance sheets, but not in a major way. Within this report's universe of primary copper producers, only seven out of the 30 Tier 1-3 companies currently have a net cash position, with Lundin Mining the only Tier 1 copper producer having net cash.

### Share Transactions

Issuing new shares either to the shareholders of the acquired company or asset, or to investors for cash, is one of the most common ways of raising capital in the M&A market, but has not been used much in the copper sector, with only 3% of copper M&A deals from 2008-2018 being all stock deals. Companies that pay for their acquisitions with stock share both the value and the risks of the transaction with the shareholders of the company they acquire.

Those companies who perceive domestic 'inflation' in their stock ratings may be inclined to take advantage of their relatively highly valued paper to look for assets outside that domestic bubble that trade at lower multiples and lock in the apparent 'mispricing'.

The decision to use stock instead of cash can affect shareholder returns. Research suggests that shareholders of acquiring companies fare worse in stock transactions than they do in cash transactions.

### Combination of Cash and Shares

An offer that combines cash and shares offers the target's shareholders: i) an opportunity to take some cash off the table; and ii) continued exposure to the upside of the combined entity. For the acquiring company it can mitigate the risks of either an all cash or all share offer, or simply be a means of making up for any shortfall in cash available. In copper M&A deals from 2008-2018, only 15% of the deals have involved a combination of cash and stock.

### Debt

- **Bank loan** — Traditional banking sources had, with a few notable exceptions, almost completely withdrawn from the provision of debt to the mining M&A space. There are signs of a limited increase in interest over recent months, but again it is only better-quality assets that are likely to get access.
- **Private investment** — To some extent private investment groups have enjoyed success in deploying debt funding at higher costs to the borrower given the scarcity of traditional banking groups in the space. It would appear increasing competition between these groups is inevitably leading to more competitive pricing on debt being offered and more innovative solutions with combinations of types of capital, across the spectrum, being offered.
- **Convertible shares** — While convertible shares often provide a lower upfront interest rate, the dilutive impact of the convertible component can be a meaningful cost. This structure can be appropriate when near-term cashflow is tight, but significant upside in the medium term is attractive to potential investors.
- **Bonds** — Bonds provide access to a pool of debt that is publicly traded and provides access to competitive capital from long-term investment sectors, including insurance and pension funds. Bonds also provide an easy option for companies to buy back debt without restriction.

### Mineral Royalties and Metal Streams

In recent years, partly due to rising interest and the increased number of royalty and streaming companies (again, investment in pooled assets or diversification of assets is the same argument for investing in ETFs), using mineral royalties and metal streams for finance has become more popular. They are more likely to be used for project finance than direct acquisition, but could be part of an acquisition structure.

Mineral royalties, which provide generally for periodic payments by a mine owner or operator to a third party based on mineral production over the life of a mine, have a long history in the mining industry, but have only recently have become mainstream options for generating funding. Companies are also using metal streams, which are a more recent innovation, but have some features in common with royalties. However, these alternative financing options remain challenging and somewhat inaccessible in many cases for early-stage projects.

Though a number of different types of royalties exist, most are built on either a revenue-based or profit-based interest in a mining venture. The most common types of royalties are:

- **Net smelter returns (NSR)** — This type of royalty offers an interest in the proceeds paid to the miner by a smelter or refiner. Generally, the only costs deducted from the royalty are those associated with the transportation of goods and the cost of smelting or refining the product.
- **Net profit interests (NPI)** — This royalty structure is based on profit after the cost of production is deducted. The specific deductions that will apply are negotiated in the royalty agreement, and vary from project to project. Typically they include operational expenses, such as commercial operation costs and taxes. However, payment of the NPI will often begin only after capital costs have been paid off and the list of applicable deductions is often very diverse, thereby delaying payment (often significantly).
- **Gross royalties or gross overriding royalties (GR/GOR)** — Unlike both NSRs and NPIs, GRs and GORs are revenue-based royalties that do not typically suffer the same deductions as profit-based ones. These royalties are based on the total revenue from the sale of the commodity, with few, if any, deductions.

A metal stream is essentially a financing technique structured as a commercial arrangement, namely a long-term contract for the purchase and sale of production from an identified mineral property. As such, in some ways it resembles an offtake arrangement, while in other ways it can be likened to a royalty with some additional features of a debtor/creditor relationship.

Under a standard streaming arrangement, the purchaser (typically a specialised streaming company) is granted the right to purchase a fixed percentage of produced metal (eg, 70% of payable gold produced) at a fixed price that is expected to be at a significant discount to the spot market price of the metal (eg, US$400/oz Au). In exchange, the purchaser provides significant upfront capital.

In the streaming space, one of the most significant developments in recent years has been their use by some of the world's largest mining companies as vehicles to raise funding to repay outstanding debt and ameliorate their balance sheets. A number of primary copper companies have sold gold and/or silver steams in recent years.

Offtake agreements where an agreement is made between a miner and a buyer of gold and silver to sell portions of the miner's future production are prevalent. This can help de-risk a project and provide construction capital.

# Appendix 8 — Copper Deals >US$10m 2008-2018

### Table 26: Top 70 Copper Deals Ordered by Size of Deal

| | Date announced | Target | Country | Buyer | Seller | Deal Value US$m | Deal Type | Property Status |
|---|---|---|---|---|---|---|---|---|
| 1 | 25/04/2011 | Equinox Minerals | Zambia | Barrick Gold | Equinox Minerals | 7,444.0 | Cash, Debt | Pre-feas/Scoping |
| 2 | 09/11/2011 | Anglo Am Sur | Chile | Mitsubishi | Anglo American | 5,390.0 | Debt | Operating |
| 3 | 09/01/2013 | Inmet Mining | Canada | First Quantum. | Inmet Mining | 5,061.9 | Cash, Common Stock, Debt | Operating |
| 4 | 12/07/2018 | Grasberg mine | Indonesia | Inalum | Rio Tinto | 3,850.0 | Cash | Operating |
| 5 | 13/04/2014 | Las Bambas | Peru | Joint venture | Glencore Xstrata | 2,986.0 | Cash, Debt Repaid | Constr. Started |
| 6 | 06/12/2011 | Quadra FNX | Canada | KGHM | Quadra FNX | 2,864.5 | Cash, Debt | Operating |
| 7 | 23/08/2012 | Anglo Am Sur | Chile | Investor group | Anglo American | 2,800.0 | Cash | Pre-feas/Scoping |
| 8 | 09/05/2016 | T Fungurume | DRC | China Moly | Freeport | 2,770.0 | Cash, Contingent Payments | Operating |
| 9 | 06/10/2014 | Candelaria | Chile | Lundin Mining | Freeport | 2,000.0 | Cash, Contingent Payments | Operating |
| 10 | 05/07/2011 | Metorex | South Africa | Jinchuan Group | Metorex | 1,359.3 | Cash, Debt | Operating |
| 11 | 30/06/2016 | Batu Hijau | Indonesia | PT Amman | Newmont Mining | 1,323.0 | Cash, Contingent Payments | Operating |
| 12 | 24/04/2008 | Esperanza | Chile | Marubeni Corp | Antofagasta | 1,310.0 | Cash | Operating |
| 13 | 29/09/2011 | Anvil Mining Ltd. | DRC | MinMetals | Anvil Mining | 1,282.5 | Cash | Operating |
| 14 | 05/01/2012 | DRC assets | DRC | Eurasian NR | First Quantum | 1,250.0 | Cash, Debt | Feasibility |
| 15 | 25/10/2010 | Citadel Resource | Saudi Arabia | Equinox | Citadel Resource | 1,192.6 | Cash, Common Stock | Pre-production |
| 16 | 15/11/2016 | T. Fungurume | DRC | Bohai Indl IFM | Lundin Mining | 1,187.4 | Cash, Contingent Payments | Operating |
| 17 | 30/07/2015 | Zaldivar mine | Chile | Antofagasta | Barrick Gold | 1,005.0 | Cash, Future Payment | Operating |
| 18 | 15/02/2016 | Morenci mine | US | Sumitomo | Freeport | 1,000.0 | Cash | Operating |
| 19 | 02/08/2018 | Baimskaya | Russia | KAZ Minerals | Aristus Holdings | 902.2 | Cash, Common Stock, Other | Exploration |
| 20 | 29/07/2013 | Northparkes | Australia | China Moly | Rio Tinto | 820.0 | Cash, Unclassified | Operating |
| 21 | 14/06/2011 | Minera Andes | Argentina | US Gold Corp | Minera Andes | 764.0 | Common Stock | Operating |
| 22 | 16/05/2011 | Sierra Gorda | Chile | Investor group | Quadra FNX | 724.0 | Cash, Future Payment | Feasibility |
| 23 | 08/05/2015 | PanAust | Australia | Guangdong Rising | PanAust | 718.4 | Cash, Debt | Operating |

Source: S&P Global Market Intelligence, company data

RFC Ambrian

**Table 26 (cont'd): Top 70 Copper Deals Ordered by Size of Deal**

| | Date announced | Target | Country | Buyer | Seller | Deal Value | Deal Type | Property Status |
|---|---|---|---|---|---|---|---|---|
| 24 | 23/12/2011 | Comval | Philippines | Mining Group | Cadan Resources | 683.8 | Cash, Common Stock | Pre-feas/Scoping |
| 25 | 24/08/2016 | Ernest Henry | Australia | Evolution Mining | Glencore | 673.1 | Unclassified | Satellite |
| 26 | 17/04/2011 | Far West Mining | Chile | Capstone Mining | Far West Mining | 668.0 | Cash, Common Stock | Reserves Development |
| 27 | 28/04/2013 | Pinto Valley | US | Capstone Mining | BHP Billiton | 650.0 | Cash | Operating |
| 28 | 28/12/2009 | Corriente Res | Ecuador | Investor group | Corriente Res | 647.3 | Cash | Feasibility |
| 29 | 31/08/2017 | Minera Panamá | Panama | First Quantum | LS Corp | 635.0 | Non-contingent Future Paym | Construction Started |
| 30 | 14/06/2018 | Quellaveco | Peru | Mitsubishi | Anglo American | 600.0 | Contingent Payments | Feasibility |
| 31 | 10/09/2008 | Udokanskoe | Russia | METALLOINVEST | Russian Govt | 585.0 | Cash | Reserves Development |
| 32 | 07/12/2012 | Camrose Res | DRC | Eurasian NR | Gertler Family | 544.1 | Cash, Debt | Pre-production |
| 33 | 14/04/2010 | Minera Escondida | Chile | Investor Group | Int Finance Corp. | 537.0 | Unclassified | Operating |
| 34 | 24/08/2011 | Ivanhoe Mines | Mongolia | Rio Tinto | Ivanhoe Mines | 534.7 | Cash | Pre-production |
| 35 | 07/01/2010 | El Morro | Chile | Goldcorp | Xstrata | 513.0 | Cash, Unclassified | Feasibility |
| 36 | 23/04/2012 | Marcobre | Peru | Minsur | CST Mining Group | 505.0 | Cash | Feasibility |
| 37 | 24/08/2015 | Anglo Am Norte | Chile | Investor group | Anglo American | 500.0 | Cash, Contingent Payments | Operating |
| 38 | 28/06/2016 | Erdenet | Mongolia | Mongolian Cu | Rostec | 500.0 | Unclassified | Operating |
| 39 | 23/11/2009 | Batu Hijau | Indonesia | Local Government | Investor Group | 494.0 | Cash | Operating |
| 40 | 10/01/2011 | Norsemont | Peru | Hudbay Minerals | Norsemont Mining | 483.1 | Cash, Common Stock, Debt | Pre-production |
| 41 | 29/11/2010 | Cobre Las Cruces | Spain | Inmet Mining | Leucadia National | 478.8 | Cash, Common Stock, Debt | Operating |
| 42 | 11/12/2012 | Palabora Mining | South Africa | Investor group | Investor group | 462.3 | Unclassified | Operating |
| 43 | 11/07/2011 | Peregrine Metals | Argentina | Stillwater Mining | Peregrine Metals | 451.7 | Cash, Common Stock | Reserves Development |
| 44 | 12/02/2013 | MyM del Boleo | Mexico | Investor group | Baja Mining | 443.4 | Unclassified | Pre-production |
| 45 | 09/02/2011 | Jabiru Metals | Australia | Independence | Jabiru Metals | 441.8 | Common Stock, Debt | Operating |
| 46 | 18/10/2010 | Antares Minerals | Peru | First Quantum | Antares Minerals | 438.2 | Cash, Common Stock | Pre-feas/Scoping |
| 47 | 02/08/2010 | Cia Minera Milpo | Chile, Peru | Votorantim | Cia Minera Milpo | 420.0 | Unclassified | Operating |

Source: S&P Global Market Intelligence, Company data

**Table 26 (cont'd): Top 70 Copper Deals Ordered by Size of Deal**

| | Date announced | Target | Country | Buyer | Seller | Deal Value | Deal Type | Property Status |
|---|---|---|---|---|---|---|---|---|
| 48 | 26/05/2015 | Kamoa | DRC | Zijin Mining Group | Ivanhoe Mines | 412.0 | Cash, Future Payment | Pre-feas/Scoping |
| 49 | 14/04/2008 | Global Copper | Chile | Teck Cominco | Global Copper | 406.0 | Cash, Common Stock | Reserves Development |
| 50 | 01/08/2010 | Kansuki | DRC | Glencore | Kansuki Inv. | 400.0 | Cash | Feasibility |
| 51 | 20/02/2018 | Michiquillay | Peru | Grupo México | Undisclosed | 400.0 | Royalty Issued, Unclassified | Feasibility |
| 52 | 29/06/2010 | Ivanhoe Mines | Australia | Rio Tinto | Ivanhoe Mines | 393.1 | Unclassified | Pre-production |
| 53 | 17/06/2014 | Lumina Copper | Argentina | First Quantum | Lumina Copper | 383.3 | Cash, Common Stock, Debt | Pre-feas/Scoping |
| 54 | 09/02/2014 | Augusta Resource | Canada, US | Hudbay Minerals | Augusta Resource | 372.4 | Common Stock, Debt, Other | Pre-production |
| 55 | 24/08/2010 | Mirador | Chile | Marubeni Corp | Antofagasta | 350.0 | Unclassified | Reserves Development |
| 56 | 14/12/2011 | Antucoya | Chile | Marubeni Corp | Antofagasta | 350.0 | Capital Contrib, Unclassified | Feasibility |
| 57 | 31/07/2018 | Avanco Res | Brazil | OZ Minerals | Avanco Resources | 345.1 | Cash, Common Stock, Debt | Operating |
| 58 | 22/05/2012 | Samref Overseas | DRC | Glencore | High Grade Min | 340.0 | Cash, Debt | Operating |
| 59 | 06/07/2008 | Petaquilla Copper | Panama | Inmet Mining | Petaquilla Copper | 337.0 | Cash | Pre-production |
| 60 | 02/06/2009 | Ok Tedi | PNG | PNG Govt | Inmet Mining | 335.0 | Cash | Operating |
| 61 | 23/09/2016 | Chinalco Mining | Peru | Aluminum Corp | Investor group | 325.5 | Cash | Operating |
| 62 | 08/03/2011 | Carrapateena | Australia | OZ Minerals | Investor group | 325.0 | Cash, Contingent Payments | Reserves Development |
| 63 | 19/06/2018 | Cerro Colorado | Chile | EMR Capital | BHP Billiton | 320.0 | Contingent Payments | Operating |
| 64 | 06/07/2008 | Petaquilla | Panama | Inmet Mining | Petaquilla Copper | 316.0 | Cash | Pre-production |
| 65 | 01/09/2011 | Agua Rica | Argentina | Investor Group | Yamana Gold | 310.0 | Cash, Contingent Payments | Feasibility |
| 66 | 24/01/2012 | Ivanhoe Mines | Australia | Rio Tinto | Undisclosed | 300.0 | Unclassified | Pre-production |
| 67 | 26/07/2018 | Galore Creek | Canada | Newmont Mining | Novagold Res | 275.0 | Cash, Cont Payments, Debt | Pre-feas/Scoping |
| 68 | 21/06/2018 | Sepon mine | Laos | Chifeng Jilong | MMG | 275.0 | Unclassified | Operating |
| 69 | 06/04/2009 | Andacollo | Chile | Royal Gold | Investor Group | 271.0 | Cash, Common Stock | Operating |
| 70 | 15/12/2011 | Mount Milligan | Canada | Royal Gold | Thompson Creek | 270.0 | Cash, Future Payment | Feasibility |

Source: S&P Global Market Intelligence, Company data

RFC Ambrian

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