As an industry, mining has heavily relied on the tried and tested approach of ‘drill, blast, mine’ as far back as the 17th Century when black powder was reportedly used to ease the initial stage of rock breaking.

The method has been refined over the years and whilst black powder is still with us it has been commonly replaced with more stable emulsion and ANFO products. The precise quantity of explosives required to achieve desired breakage is calculable and drill patterns are optimised to deliver the most ‘bang for your buck’. But as a concept, little has changed.

This has been good news for Insurers who can rely on a wealth of data and history to guide the pricing of mining risks.

However, average ore grades are declining and the demand for commodities is evolving.

In this article we look at the new trends in the industry and the associated risks that Miners and Insurers may be facing today and in the near future as Miners seek to chase lower grade in more challenging environments through the use of automation and technology to keep costs down and margins healthy.
Block Caving

Block caving as a principle is not new to the underground mining scene whereby broken ore is mined out via a drawpoint located below fractured ore. The difference being how the initial fracture is achieved and, most importantly, the size. While sublevel stoping, for example, targets a defined stope which is then blasted and mined in series, Block caving can target an entire ore body.

Preproduction development is extensive, resulting in increased up front capital cost however the continuous nature of ‘drawing down’ from the collapsing ore body results in operating costs some 1/10th of conventional underground mining methods. This means massive, lower grade deposits that were out of the reach of conventional open pit mining may now be feasible, such as the Rio Tinto owned Oyu Tolgoi deposit in Mongolia. The use of drill and blast is heavily reduced as breakage is achieved by the ore body’s progressive collapsing under its own weight. The risks associated with regular drilling and blasting are therefore also reduced.

However, the method relies on a far more complicated understanding of geomechanical stresses and in-situ rock mass characteristics. Initial fragmentation is key to allow for the continued collapse and ore availability at the drawpoints.

Traditionally block caving was used for shallow orebodies, but in recent times has been applied to depths of 2km underground. Caving heights are also expected to increase from 200m to 500m, if the geology can sustain this, forming ‘super caves’. In July 2019, Rio Tinto announced that difficult ground conditions were the cause of a potential $1.9bn delay to achieving sustainable production from the Oyu Tolgoi operation.

Whilst the initial capital investment can be relatively high using block caving, the operating cost is low. Professor Fidelis Suorineni of the Nazarbayev University School of Mining and Geosciences in Kazakhstan anticipates that as miners adopt emerging technologies such as artificial intelligence, virtual reality, robotics, automation and big data, that any bottlenecks in the block cave process will soon be eliminated, thus making this method even more cost effective.

Despite the complexity, Block Caving has been successfully deployed and may prove to be the most viable option for exploitation of future massive low-grade ore bodies.
Processing Improvements

One key development in the industry has been the improvements resulting in increased recovery rates. Metallurgical advancements have resulted in complex multi-stage processing circuits being now commonplace on mine sites.

Determining which method of extraction has become far more complicated with the development and improvement of processing techniques such as Froth Flotation, Heap Leach, Carbon in Leach (CIL) circuits and even application of microbial organisms through Bacterial Oxidation (BIOX).

The Kirkland Lake Gold owned, Fosterville Gold Mine, reported a processing recovery of 97.3% in 2018 achieved through applying multiple processing methods including Froth Flotation, BIOX and leaching.

BIOX, Bacterial Oxidation, utilises sulphide eating bacteria to liberate gold from sulphide minerals such as pyrite and arsenopyrite which would otherwise have prevented gold recovery during typical cyanidation. As with any organism, a specific environment is required to achieve the desired result which poses unique risks.

The financial benefits of increased recovery percentages will continue to drive the development of processing techniques and as we are seeing, the complexity of multistage processing circuits.

With such progression and innovation Insurers and their risk engineers will need to carefully understand the processes such that the potential loss scenarios can be predicted with some confidence. This is of particular relevance to matters involving upset process conditions caused by physical damage leading to production losses, etc.
Increased Tailings

The improvements in mining and processing efficiencies has allowed the mining of otherwise uneconomic ore bodies to now be feasible. And the demand for commodities continues to rise as global population increases.

With the likes of Block Caving and recovery improvements resulting in more low-grade, massive deposits now becoming economically feasible, the production of tailings (waste) is also on the rise.

Historic storage methods of tailings have included the mixing into a backfill material and pumping underground back into the voids created by mining, or to deposit in surface Tailings Storage Facilities (TSFs). TSFs take the form of dams, ponds or old workings and as production levels increase, so do the size of TSFs. Sadly, the risks of TSFs are well known too, and as the scale of such facilities increases, so do those risks.

The management of large tailings dams in difficult environments was exposed recently in Brazil, when the Vale-owned Brumadinho dam failed on 25 January 2019. In this case some 270 people lost their lives as they were downstream of the catastrophic failure. The cause of loss took some time to investigate and experts mooted in the media that the failure was probably due to drainage problems and a lack of wall monitoring. This event caused Vale to report a loss of USD1.6bn in the March quarter as their iron ore business was significantly impacted. The Insurance industry was thereafter very alert to tailings dams and scrutiny across the mining industry has increased.

Consequently, the search for alternative tailings storage options has seen the use deep sea storage at the Cayeli Bakir A.S mine in Turkey where tailings are pumped directly into the Black Sea at a depth of 350m. At that depth, the environment is anoxic which prevents the tailings reacting and becoming toxic, although this method has not been without its controversy.
Demand for Commodities

As the global automotive industry evolves and batteries and motors replace internal combustion, the demand for commodities like copper, graphite, lithium and cobalt are set to surge.

Bloomberg New Energy Finance predicts the demand for Cobalt will increase by 4,500% by the year 2030.

Approximately 50% of the world's cobalt supply is currently mined in the Democratic Republic of Congo. The DRC regularly features in the bottom 10 of the Fraser Institutes annual ranking of investment attractiveness primarily due to political risks.

Global cobalt deposits of significant size are few and far between. However, high grade cobalt deposits have been found in the form of deep-sea hydrothermal vents and 'nodules' located on the sea floor at depths of up to 6,000m.

The development of deep-sea mining equipment has been attempted by a number of companies including Nautilus Minerals which commenced sea-trials of their custom remotely operated Seafloor Production Tools (SPTs) in Papua New Guinea prior to running into complications and ultimately entering administration.

However, if the projections for cobalt demand prove true, deep sea mining, and the unique risks that are associated with offshore industries, may become a reality. This may draw Insurers that historically provide cover for onshore mining risks to consider the insurance of offshore mining and the uncertain risks that this may bring.
Conclusion

As technological advancements and commodity demand evolves, the Mining Industry’s tried and tested ‘drill, blast, mine’ technique can no longer be assumed. Insurers and Brokers will likely be faced with new and ever more complex risks and as a result, losses.

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