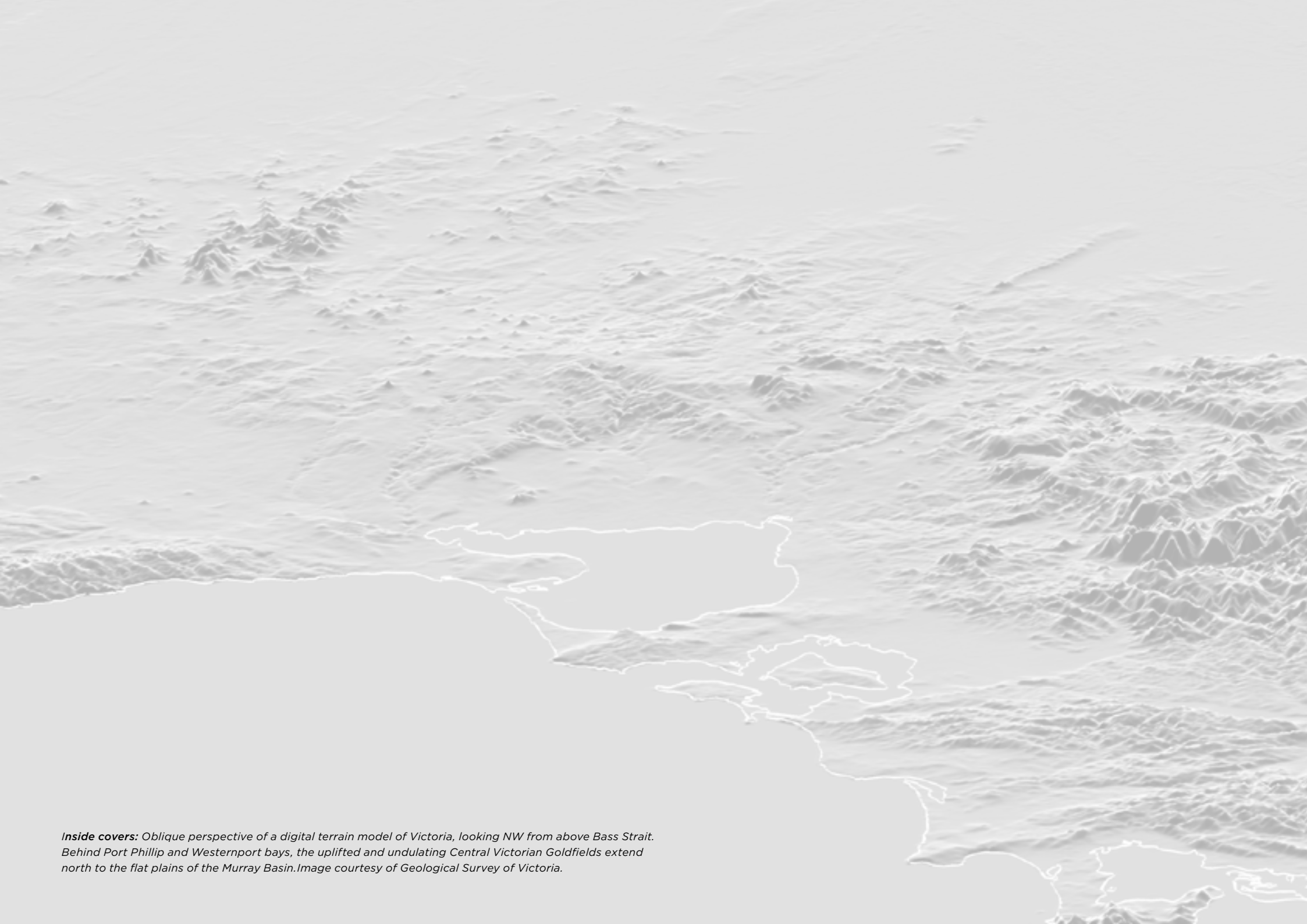
THE MELBOURNE MINING CLUB

20 + 20

Celebrating the first 20 years of
the Melbourne Mining Club
2001 to 2021



Inside covers: *Oblique perspective of a digital terrain model of Victoria, looking NW from above Bass Strait. Behind Port Phillip and Westernport bays, the uplifted and undulating Central Victorian Goldfields extend north to the flat plains of the Murray Basin.Image courtesy of Geological Survey of Victoria.*

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Celebrating the first 20 years of the Melbourne Mining Club 2001 to 2021

“The Melbourne Mining Club is a remarkable organisation that has no Constitution or Articles of Association, no elected Board, no paid-up capital and has distributed a dividend every year.

“It is run by a (volunteer) Steering Committee which for the first five years had no Chairman.”

Sir Arvi Parbo AC, 11 August 2011 (his closing remark: “I wish I could buy shares in it!”)

MMC 20 + 20 book

20 + 20 – celebrating the first 20 years of the Melbourne Mining Club – 2001 to 2021

Published in 2021 by the Melbourne Mining Club

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Placement of venue images in this book do not necessarily imply the keynote speaker or speakers featured on that page, spoke at that venue. The purpose of the images is to acknowledge the five venues that have hosted MMC events over 20 years. In order of usage, they are: the Melbourne Town Hall, Plaza Ballroom, Zinc, the Grand Hyatt and Docklands Stadium.

Foreword

Leigh Clifford AO (left) and Hugh Morgan AC (right), co-Patrons, the Melbourne Mining Club

The Melbourne Mining Club started life at an extraordinary time for the global economy. Doomsayers were warning that mining – and with it, continued Australian prosperity – was inexorably sliding downwards, with technology providing the sole path to the future.

Such forecasts were dashed with the bursting of the dotcom bubble in 2000 and the steady recovery of the mining sector – including through its smart development and adoption of ground-breaking new technologies.

Our industry has also become, more clearly, a leader in training and developing new skills, in sustainable development. It supports, across the supply chain, one in 10 jobs in Australia, including today employing over twice as many indigenous Australians than it did when the Melbourne Mining Club began.

In the financial year ending mid-2020, mining directly contributed 10.4 per cent of Australia's Gross Domestic Product and produced 60 per cent of the country's entire exports.

Such great results are not achieved without hard work, brave and canny finance industry support, and some mis-steps along the way.

The Melbourne Mining Club (MMC) has been there alongside to chart all this – both challenges and achievements.

We could sense, from our own first involvements, the significance of the club's role in the industry's rise – underwritten by the enthusiastic engagement of that great mining figure, founding Patron the late Sir Arvi Parbo AC.

The MMC rapidly built credibility as a unique platform for the latest information and for discussion of key issues – substantially, through two key virtues: it is run with great professionalism and competence, and by enthusiastic volunteers.

Its Melbourne base has been crucial for its success, affirming the major role that the city plays on the global mining stage, and communicating that through great media coverage of its events, spreading that message nationally and, in time, internationally.

The club developed, and has maintained, a truly global perspective. It has hosted large-scale speaker and networking functions in Shanghai, Beijing and Jakarta, as well as a series of MMC major events in London.

It began with 200 people attending luncheon events, growing to up to 700 at the magnificent Melbourne Town Hall, addressed by more than 100 keynote speakers. The highly-popular Cutting Edge Series, launched in 2003, highlights small- and mid-cap companies.

The value of the networking that these events generate is incalculable. In cash terms, surplus funds of about A$900,000 have been steered into educational programs in Victoria and elsewhere, especially in the Science, Technology, Engineering and Maths (STEM) disciplines.

Such successes can be attributed in part to the club's hands-off role with speakers. It does not presume to suggest an agenda for them, but does use the forum to display the high quality of leadership that drives our industry.

Here, in this publication, we present 30 of those keynote speakers, with their modern-day views not only on the achievements and challenges of the past 20 years, but also (intriguingly) of the next 20 years. We are sorry that we could not find the space to invite all, but we are confident that these gems, representing each of the MMC's past 20 years, will offer insights to stimulate your excitement – and discussion – about our great industry and its future.

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From the Chairman

RICHARD MORROW

Little did the first wave of Melbourne Mining Club members know that 20 years after the club's first luncheon event, we would still be going strong – globally recognised as a premier forum for the world's resources industry leaders.

More than 200 people crammed into the Melbourne Town Hall's Supper Room to hear our first speaker, the late Sir Arvi Parbo AC, deliver a keynote that is as fresh today as it was when delivered in August 2001.

Sir Arvi, the club's founding and long-serving Patron, offered insights that you just don't get anywhere other than at a Melbourne Mining Club (MMC) event. As you read through this 20th anniversary commemorative publication, there is a wealth of knowledge and considered opinion garnered from our roll call of keynote speakers, brought together especially for this book.

Every speaker who has taken to the MMC podium has left a lasting impression for our audience of members and guests – and more widely. Some keynotes have thrown down the challenge for the resources industry to lift its collective game or to consider a fresh approach. All have been innovative and inventive.

Who can forget Nick Holland's speech in July 2012 where he challenged the gold sector to have a realistic look at reserves and returns from mining gold? Nick has once again contributed in the pages that follow.

Today, the Melbourne Mining Club has more than 3,000 members, and has links and associations with mining organisations all over the world. Global leaders come to Melbourne and to Victoria because they know their words will reverberate throughout the industry.

The club's reach has extended to offshore events – with spectacular impact – to London, Beijing, Shanghai and Jakarta. Who will forget the wide-ranging and incisive London address from Glencore's Ivan Glasenberg and his view in 2012 on M&As or the maiden address in London one year later from BHP's Andrew Mackenzie?

This reach has helped establish like-minded clubs across the world. The Melbourne Mining Club has a presence and a level of respect across the virtual world, with our representatives active in leading global mining forums while embracing the world of social media to meet our mandate of providing a forum to promote and discuss the resources sector in general and the Australian sector in particular.

The goodwill towards our club often amazes our Steering Committee, made up of volunteers from senior positions across the mining, mining services, media, financial services and associated sectors. Founder of the Steering Committee, Gavan Collery OAM, says this goodwill has been there since day one.

I'd like to acknowledge the support of our founding organisations, the Australasian Institute of Mining and Metallurgy (the AusIMM) and the Minerals Council of Australia. For two decades, these organisations have supported the club's endeavours, with the MCA hosting our Secretariat.

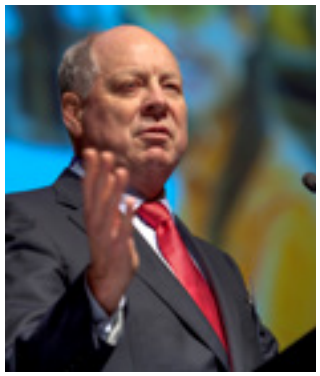
Finally, when you read through these pages, you can see that the mining industry is anything but stuck in the past. Our contributors were asked not just to reflect on the past 20 years, but to look ahead at the next two decades (hence, the theme: 20+20). Their insights are intriguing.

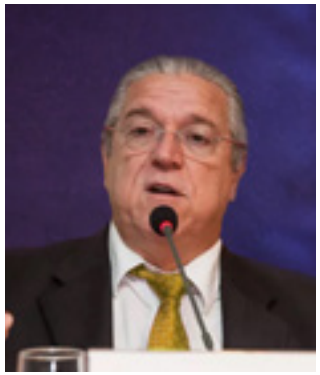
Enjoy!

Richard Morrow FAusIMM
Chairman
The Melbourne Mining Club.

20 | 01 – 20 | 10

From the podium

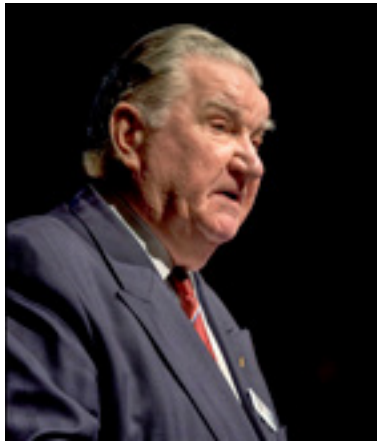




Across the seas

20 | 01

SIR ARVI PARBO AC
(Founding Patron)
WMC



(To follow is an extract of the inaugural keynote address to the Melbourne Mining Club, by its Founding Patron, the late Sir Arvi Parbo AC)

I appreciate the compliment in being invited to be the first speaker of the new Melbourne Mining Club.

The minerals industry, in the past, has not been good at explaining itself to the public. It has therefore suffered at the hands of those much more skilful at publicity, and for various reasons not friendly towards it. The activities of this club should help to redress the balance, and I wish you every success.

Public perceptions and relationships with governments have always been important to the minerals industry because, after all, the minerals belong to the States and the companies merely obtain a licence to produce them, albeit after having first had the privilege of taking the high financial risks in discovering the deposits.

The early relationships with governments were, at times, turbulent as witnessed by the Eureka Stockade; the first in-depth debate between government and the miners on mining taxation.

Overall, however, for the first 130 years of mining in Australia, the public understood and appreciated the benefits from mineral developments and applauded these. There was wholehearted community support and encouragement for the industry, which in turn led to the establishment of manufacturing and service industries.

This long-standing stable environment changed in the early 1970s. The reasons for the change should be analysed by people more knowledgeable in these matters than I, but it seems relevant that the emergence of the negative attitudes was not limited to Australia and not limited to the minerals industry, but directed at economic development generally.

The level of prosperity, which had by then been reached in the developed world, was probably one of the reasons – it seems to be a human characteristic not to appreciate what becomes readily available and to take things for granted.

In Australia, the great minerals developments in the 1960s were the main source of the new level of prosperity. The industry's very success was most likely a cause for the change in attitudes.

Subsequently, the industry recognised that the very best technical performance does not guarantee success if public opinion and public policy are unfavourable.

Sustainable development has become a key concept. Companies are increasingly publishing extensive reports on their environmental, occupational health and safety, and community support activities in addition to financial and operational reports. One important lesson learned from this has been that it is essential to be open and honest – "transparent" in current jargon. The worst thing to do is to leave the impression that one is trying to hide or gloss over something.

Let me now ruminate on what might happen in the Australian minerals industry in the future.

Predicting the future is not an occupation in which you would wish to be paid by results, and predictions of the future of the minerals industry have not been great successes.

In principle, the future of the Australian minerals industry depends on the answers to four questions:

Will there be a continuing world demand for the products?

Does Australia have the mineral endowment to supply a part of this demand?

Will it be possible for the industry to explore for minerals and, if successful, bring the discoveries into production?

Will the Australian minerals producers be competitive in world markets?

The demand for minerals continues to grow. The population of much of the developed world has reached a plateau and has started to decrease, but in developing countries it is still increasing rapidly. All in all, there is no doubt that there will be a growing demand for the products of the minerals industry.

The present production and further growth of the industry comes largely from major deposits discovered many years ago, and their extensions. Large mineral developments have very long lead times from discovery, let alone the beginning of exploration to production.

Australia should now be discovering the orebodies which will be the main producers 20 to 30 years from now. In spite of continuing improvements in exploration technology, this is not happening.

The reasons are complex and you should ask someone now active in exploration to explain the problems, but it is essentially a question of access to prospective land and assurance that any discoveries can be developed into profitable production.

In general, Australia's minerals are at present competitive in world markets. The low exchange rate of the Australian dollar assists in this, although it is a double-edged sword because it also means that the market value of Australian companies in, say, US dollar terms, has been reduced.

Maintaining competitiveness is, as we all know, an ongoing battle. Our competitors in other countries are continuously improving their productivity and efficiency, and we must at least match them. We can never relax.

20 | 01

BARRY CUSACK
Rio Tinto

"The challenge for miners is to diversify their customer bases. It will be difficult to find customers to compete with China which enjoys abundant labour, cheap energy and advantages of scale."

Twenty years ago, I addressed the Melbourne Mining Club, identifying three foremost challenges for the mining industry:

- to lift returns on capital and avoid creating over-supply, leading to productivity gains being passed on to buyers through lower prices;
- to continue to attract the best talent and not be seen as "yesterday's industry;" and
- to convince the world that mining is, and can be, conducted sustainably.

How have we done 20 years on?

Returns on investment have improved, with the average lifting from just covering the cost of capital to now making returns competitive with other industries. Dividends, to shareholders' benefit, have increased to more than three per cent since 2011.

In the past 20 years, there were major economic disruptions, including the 2007-08 Global Financial Crisis (GFC) that triggered a 20 per cent fall in global industrial production, and a commensurate lack of demand for commodities, leading to over-supply and price collapses. The disruption of "today" is the COVID-19 pandemic. Its effects are not yet fully evident while governments around the world stimulate their economies to keep demand robust. Eventually, the piper must be paid: an economic downturn will transpire.

Consider two commodities vital to Australia. First, copper supply outpaced demand, doubling from 2004 to 2014 with a resultant price drop. This curtailed new investment, and supply and demand moved into better balance in 2019; mine capacity is about 24Mt and production 20Mt. Annual long-term demand is about 3.2 per cent and at 870Mt of mine reserves (double the 2000 total) supply is secure. Mining industry discipline post-2014 is reflected in better prices and returns.

Second, iron ore demand was strong post-GFC and the price hit US$180/tonne in 2011 due mainly to a boost in China's steel production. However, new mine capacity and over-production caused a price drop to US$40/tonne in 2016 although demand remained strong. Then a supply disruption in Brazil in 2019 (due to a tailings dam collapse at the Córrego do Feijão mine), coupled with demand, led to a price recovery to US$120/tonne – well above the long-term average.

Clearly, the challenge in the next 20 years is to avoid such boom-and-bust cycles. Both commodities have dominant players on the supply and demand sides. Chile has a quarter of world copper mine supply, and Australia and Brazil dominate the seaborne iron ore trade. China dominates smelting demand for both commodities. China will continue to diversify its supply sources and encourage new mine production in developing projects, both for price and security. Even for iron ore, with Brazil over-coming current issues, there is significant new capacity planned in Africa. In a dominant position, China will exert its power over suppliers.

The challenge for miners is to diversify their customer bases. It will be difficult to find customers to compete with China which enjoys abundant labour, cheap energy and advantages of scale. Ironically,

the world manufacturing response to over-dependence on China is to re-focus on supply security and re-examine domestic or reliable alternative sources. This may be an opportunity.

To exploit this, the supply line must be competitive – a difficult undertaking in many markets for bulk commodities such as iron ore where economies of scale are vital. In many ports, efficient lighterage may be a key issue. For copper, the technical challenge is to combat declining grades and deeper mines.

Neither challenge will be met by the mining industry simply doing more efficiently what it does now. Innovative solutions are required. This relates back to attracting the best talent and creating a climate for mining to flourish. Enlightened leadership is required, focusing the available talent to meet the industry's future needs. Fortunately, this has been and remains a strength in Australian mining.

Finally, the industry must convince the world that it can operate sustainably. It has improved substantially on environmental issues, safety, connection with indigenous and local communities, and sensitivity to social issues. But it has not done enough to combat public perceptions that it is inadequate on these fronts. Community opinions, often uninformed and simplistic, are loudly expressed and inform political and other decision-makers' responses.

A 2017 national perception survey undertaken by the Commonwealth Scientific & Industrial Research Organisation (CSIRO) across more than 8,000 respondents revealed positive signs, yet trust in mining remained questionable. There were positives for regional and indigenous communities, but a perception that financial benefits were not widely felt. (This may have changed during the pandemic, given that the industry has been reported as underpinning Western Australia's position and making a substantial improvement to Australia's status.) Concerns linger over mining's environmental impacts and effects on water supply.

It's unattainable for mining to be universally respected, but the industry must continually improve its public engagement. The challenge is to respond rationally to critics without opposing populist views.

20 | 02

HUGH MORGAN AC
Western Mining Corporation

“There have been tremendous improvements in indigenous engagement (particularly job creation) and in land management, notwithstanding some well-publicised mistakes.”

Like many of my colleagues, my time in the minerals industry has been characterised by two parallel themes: technological advance and social complexity.

The technology is easier to track. From the “bog, bore and fire” approach of my youth, we entered the Japanese national rebuilding revolution of the 1960s; a period which laid the foundations of managerial and technical excellence which still guides our industry today.

From there, it has been spectacular progress – from 35-tonne haul trucks to 400-tonne monsters, to the steady growth of remote and automated services (with parallel improvements in safety), to advances in solids separation materials handling and logistical management.

Not to mention the advance of information technology and the new opportunities of nano-technology.

The monuments to these advances are there for all to see: The Big Pit at Kalgoorlie, the deep underground operations at Olympic Dam and the huge logistics exercise that are the Pilbara iron ore operations. Each of these is, in its own way, a showcase of technology. The dividends flow to all of us – yes, even those on welfare.

This march of progress is far from ended. Processing improvements are on the cusp of delivering the ability to extract very fine amounts of valuable product from ores. This will revolutionise the mining of minority products like rare earths and make accessible a range of materials which will transform our lives.

Globally, the impact of all this has been overwhelmingly beneficial. The improvements I have noted have enabled recovery of lower-grade mineral deposits; the consequence is an exponential increase in the proportion of the earth’s crust that has been turned from an essential mineralisation into a valued resource. The remarkable urbanisation of Asia, with the re-housing of perhaps a billion people from hovels to modern apartments, is visible proof of the benefits of the use of new mineral resources previously advised by world authorities as being exhausted.

That is the technical revolution. The social complexity is, well, more complex.

From the 1970s onwards, our industry made ever-more-serious efforts to engage with the broader community; to address the social and environmental impacts of our actions. We employed trained professionals, lots of them, to engage meaningfully with our critics – and there have been important advances.

Some of those advances were new, others were not. The rehabilitation of large areas around Broken Hill, known as the Regeneration Project initiated by BHP’s Albert Morris in 1936 (the first restoration project of its type in the world, for example) long pre-dates the emergence of popular environmentalism.

There have been tremendous improvements in indigenous engagement (particularly job creation) and in land management, notwithstanding some well-publicised mistakes.

Advances yes, but the process was complicated by the emergence of a core of ideologically committed activists.

Their influence has been leveraged by the dissonance between the global minerals industry and the broader urban populace.

Across the developed world, mining has rarely been popular, but increasingly it now is "on the nose." More of the population is today engaged in the provision of services than ever, so there is a clear disconnect between urban consumers and the producers of material goods, with little tolerance for any untidiness in the process.

That is not a complaint – it is simply an observation. It usually manifests itself in long delays over project approvals, rather than refusal, but adding to costs and disruption to responses to market demands. It plays its part in encouraging concentration of the industry, for smaller firms cannot always survive this marathon negotiation. It is painful, but mostly survivable.

That pairing of committed activists and intrinsically hostile consumers can lead to some strange outcomes.

Take for example NGO activists operating in a developing country. They are quite properly alert for any suggestion of corruption or ESG failures – quite properly because any such failures, like corruption, represent a siphoning-off of value, whether condoned at the higher levels of the company or not. It fosters bad governance and dislocation of resources.

But NGOs have also found that sensitivity to corruption is frequently greater among developed world shareholders than among developing world victims. If you want to hurt the company, that is where you raise the alarm. Anger the investors, hurt the share price.

One consequence of shareholder response is that large corporations with the highest standards have become wary of developing world ventures. The damage from being linked to such allegations can be brutal, regardless of who in the chain of command is implicated (the company directly or one of its local associates). Quite commonly, the company just avoids all LDCs with poor reputations regardless of mineral wealth or simply quits the venture – a PR triumph for the NGO – and the project may be taken by, or pass to, some less scrupulous partner.

One has only to look at the paucity of reputable developed world investment in developing regions to see the impact. The developed world is a much-preferred investment location, but it leaves the LDCs at the mercy of corporations from countries with the lowest ESG standards, frequently perpetuating or even encouraging the worst practices. Personally, I think the NGOs have much to review of their objectives. I am not sure to whom dodgy partners are a benefit.

Even outside of the developing world, however, it is still man-made problems that present the greatest challenges to miners. These challenges are almost universally the product of hostility to the concept of mining rather than to concrete objections; a feeling that industry should be spotless white coats and not large dusty haul trucks.

The basic premise is that there is no limit to the resources of the earth, given the massive positive changes to technology throughout the industry. If there are shortages, it is because they are man-made for whatever reason – not because the resources don't exist.

For that, there is no easy solution. We must work patiently through the system, clearing each newly-raised obstacle in turn. It is tedious and inefficient, but necessary.

For the moment, the sheer technical excellence of mining – its efficiency and its environmental responsibility – are carrying the day. Yes, the occasional and entirely inexplicable glitch occurs, but these are relative rarities in a continuous global program.

Perhaps, at times, some forgiveness is in order.

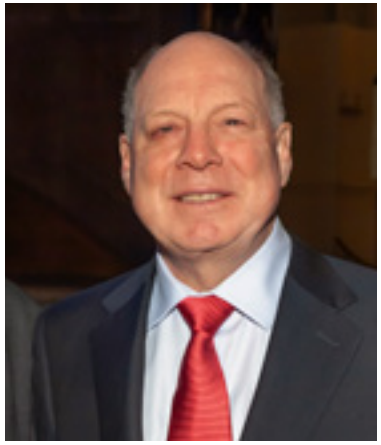
Much of the world still awaits the life-improving products that only mining can supply.

Despite the occasional industry error, history, I hope, will be grateful for the industry's efforts.

20 | 03

also 2008, 2012 and London 2016

ANDREW MICHELMORE AO
WMC Resources
(Zinifex, MMG)



“Decarbonisation is a technology play. Give it time, but we can’t flick a switch – we need a robust plan. Carbon sequestration will come through, but it won’t be a panacea – it needs a plan.”

My early work in the 1970s was in the chemicals and petrochemical industries where, historically, safety had not been a priority area of focus. ICI’s Runcorn plant near Cheshire, UK, manufactured caustic chlorine and sodium hydroxide and in the 1960s leaked chlorine gas across a local school with dire effects. It marked a massive step-change in company attitudes, with diligence into how to prevent recurrences and fostering belief that serious accidents and fatalities were preventable.

I entered mining in the 1980s and found that fatalities remained common-place.

When I joined Western Mining Corporation (WMC) in the 1990s, the company had averaged three deaths annually for the preceding 17 years. There was acceptance that fatalities occurred in underground mining. There had been no improvement. The imperative was to change attitudes, to educate people to believe they could operate without fatalities; no job was so important it couldn’t be done safely. It wasn’t just WMC, but the whole industry.

We grouped together to change attitudes and instil a belief that people could work safely, and fatalities could be eliminated. Attitudes towards fostering safe working environments have totally changed, but the issue remains not to be complacent. Changing people around in their jobs is a big part of this, removing the rote workload.

It’s now across many industries – from manufacturing, to farming, to construction, and not just mining.

In the past 20 years, approaches to safe mining have been a major change. So, too, the industry’s attitudes towards environmental matters which remain under greater focus. It’s easy to think you’re doing a good job technically, but external parties’ constant scrutiny and calls to “do better” have helped mining to come a long way from its earlier practices – from tailings dam collapses and limited mine rehabilitation, to acid-leaching rock dumps.

Changing attitudes towards indigenous communities have improved markedly. They’re still important. I worked for three-and-a-half years with Nabalco in the Northern Territory, engaging with the Yolgnu community of 13 clans with roughly 100 in each. To be allowed in the area of Nabalco, we needed permits to enter, leave and work. I attended the regular meetings of the Laynhapuy Homelands group and visited with their elders. It informed me; gave enormous, first-hand understanding of their culture and the necessary communication and engagement.

Most important was to listen to the elders’ discussions to learn what they wanted and needed – housing, schooling, water, funeral ceremonies, roads, vehicles and airstrips for supplies and people movements. In the past, we told them what we thought they needed, rather than

listening to their needs and priorities. We realised we were doing things the wrong way, and while trying to be helpful we were in fact appearing to be condescending and superior.

This engagement enabled us to set up Yirrkala Business Enterprises and provide training for indigenous people to tender for jobs on their terms, using our facilities – cutting trees, driving bulldozers and trucks; for the women, collecting seeds for propagation, and ultimately for the men mining around and protecting their sacred sites (men's business). It was a win-win.

It was formative. It guided my later work in Australia, Laos, Peru, the Congo and even Russia – to listen and talk with the local people to understand their needs, their perspectives. In Australia in the 1990s, the relationship working with indigenous communities (in which CRA was foremost) improved significantly, and helped the development of sustainable design and construction of mines and infrastructure to the benefit of indigenous communities.

We've come a long way: Aboriginal leader Professor Marcia Langton has delivered lectures at the University of Melbourne about how 1960s miners were the indigenous peoples' biggest enemies, and how 1990s miners were their biggest supporters and partners – it was mining companies that assisted with education, training and employment, and funding to improve standards of living – not governments. That's why it's a shock – when it takes tens of years to build up trust and safety – to witness a recent mining event blowing it all away in one instance.

Communication remains forefront. Alcoa collected data for 40-plus years and one key finding in its annual surveys in the 1990s showed that – despite improvements in its communication levels decade on decade – people wanted greater communication. That's a microcosm of society; people want greater information.

The ongoing problem is that there's often too much misinformation and use of disinformation.

In defined areas, mining competes for people, technology and mineral resources. Where the industry doesn't compete, it must work together on ESG issues to become a leader in safety, environment and community relations. Mining is under pressure worldwide; the issues are so big we need a united approach to share our learnings and continue to improve and communicate.

The starting point is: "is there a demand for what we produce?" Clearly, there is. Why else does Tesla look at buying a lithium plant? You can't replace many of the valuable metals now in widespread, essential use. Hence, the importance of clever use of new technologies when so many companies are massive energy sinks.

Decarbonisation is a technology play. Give it time, but we can't flick a switch – we need a robust plan.

Carbon sequestration will come through, but it won't be a panacea – it needs a plan. Mining is here, but we need collaboration to get to there – to become low-carbon emitting, sustainable, reliable and affordable producers.

When the National Energy Guarantee (NEG) was abandoned, we re-entered cherry-picking territory. It didn't mean shut down all coal-fired power stations now, but determine their phase-out over time to provide reliable, affordable and sustainable energy. It spawned "experts" calls for gas-fired power, subsidised renewables and potential use of nuclear power.

But no Australian government is putting together the proper plan to get there.

For mining, we can't cherry pick. We have to work as an industry for the long term on these issues while we compete in finding orebodies, extracting the metals and managing our workforces. They're the competitive elements. Surrounding this is the issue of driving confidence in the communities where we operate. We're working on doing the right things, we're trying to do them well, and all for the benefit of society. But we can always do better.

20 | 03

PIERRE LASSONDE
Newmont Mining
(and Founder, Franco-Nevada)

"I believe that once realisation grows of how far we have departed from traditional norms of investment and return, the switch to gold will become a flood."

Forecasting the gold price can be a near obsession in our industry. The complexity of estimating supply and demand, and calculating the investment appeal of various asset classes, creates endless permutations for debate – never more so than in times like the present when the world is in uncharted waters regarding government-created credit.

Rather than try to calculate the impact of these individual changes, I have derived a simple historical formula which appears to have asserted itself periodically in times of crisis. With a new crisis looming, I await the correction that will bring it into play again.

The formula is the gold price per ounce compared to the Dow Jones Industrial Average.

The two have come into alignment just twice in the past 110 years – both at times when the global financial system was in extreme stress. The first was at the height (or more correctly trough) of the great Depression in 1933 when the Dow slumped to a measly 36 and gold was US$35 and ounce.

Again in 1980, the Dow and gold achieved parity; the Dow at around 800 and gold at approximately US$800 per ounce. Again, at a time of currency turmoil.

The two have drifted a long way apart since then. The gap is now a staggering multiple of 15 – gold at near US$2,000 an ounce and the soaring Dow testing 30,000. Parity seems so far off as to be almost fanciful.

But is it? Could the stresses on the global financial system be approaching the equivalent of those that drove gold to parity with the Dow in 1933? I am going to postulate that they are.

Currently, there is around US$18 trillion of bonds washing around the system – almost entirely created by governments and bearing interest rates below one per cent; bonds that, to the investor, are virtually worthless.

That has some serious consequences. For endowment funds, which have to manage their operations on this negligible return, or people living off capital, it is a grim outlook.

Not only are bonds earning close to zero return, but the spectre of inflation hovers, constantly threatening to devalue the holding. Investors are tempted – almost forced – to look to riskier options to get any sort of return. The term "secure investment" has become an oxymoron; bonds, realistically, offer no return. The continuous creation of more (ever more) debt – debt which offers close to zero return and little prospect of repayment – simply devalues cash.

I do not hold out much hope for politicians to retrieve the situation. Their instinct, the instinct of politicians everywhere, is always to simply kick the can along the road a little further; to move the problem into the next electoral cycle. I do not foresee any immediate prospect that excess liquidity will go away.

In that scenario gold, secured by its scarcity, gains value. Cash, with its near-zero returns and vulnerability to inflation, loses.

Already around half of all gold purchases are for investment – and the pressures are surely growing for that proportion to rise. I believe that once realisation grows of how far we have departed from traditional norms of investment and return, the switch to gold will become a flood.

Gold is in effect insurance against the devaluation of cash – and when fire is licking at your walls you will pay generously for insurance. You will pay a premium for the security of gold. Perhaps a handsome premium.

Don't dismiss the probability (implausible as it may now seem) that we will see Dow-gold parity again. Whether that is from a fall in the Dow or a rise in gold – or perhaps some of each – I cannot say with certainty, but my money is on gold.

Not that gold is currently in any crisis. The industry is in good shape with most gold producers ticking along nicely. If there is any long-term shadow over the industry, it is the declining success of exploration. The pace of discovery has been slowing for decades now and if it is not reversed, we will eventually see a production shortfall.

A sharp rise in the price of gold will, of course, see an increase in exploration, although the long-term nature of the discovery slowdown suggests scientific and technical breakthroughs are also needed. Perhaps they will come.

In the meantime, a return to something more like Dow-gold parity seems the brightest hope. History is on our side.

20 | 04

also 2011

ROBERT FRIEDLAND
Ivanhoe Mines

“Expect carbon pricing (whether taxes or cap-and-trade schemes) to become not only a tool for abatement, but also a prescription for levelling the playing field on trade.”

It is a tragedy of the human condition that as you get older, you tend to learn more and more about less and less. Famed Italian Renaissance artist Michelangelo worked on his Rondanini Pietà marble statue for more than a decade, until just days before his death in 1564 – leaving his third Pietà unfinished. Before he died, he said he was just beginning to learn how to carve marble.

I've been 50 years in mining. It's one of the most important of all human activities because it is a pre-condition to modernity that will continue to influence lives everywhere. But we are entering an era that none of us can really understand, let alone forecast.

The COVID-19 pandemic is dramatically changing our world. Its implications may resonate for far longer than many anticipate. A great generational shift is under way. Governments are stimulating their economies and money has never been cheaper. Humanity faces threats and challenges that require commitments to a level of inter-governmental coordination that we have never before achieved.

Safeguarding our environment, and its ability to sustain the civilisation we have built, perhaps will prove to be the defining challenge for the next few decades. Geological time shows us that our environment is always changing – including our climate – and that the outcomes are never as quantifiable and predictable as we may imagine and desire.

That said, based on the best science we have, the potential scale of the impacts of climate change require us to apply the precautionary principle, and to do what we can to limit emissions. To this point in time, this is one of the few policy initiatives that has galvanised almost universal support from governments around the world. We can expect that one result will be a vast mobilisation of capital dedicated to the “greening” of our planet.

It is already evident that the world is going electric – and it will be doing it renewably. Cars and trucks are just the beginning. We should expect existing legacy power-grid infrastructures to be overhauled in coming decades to accommodate vast solar and wind electricity generation systems. It will require massive investments in energy-storage technologies, such as batteries.

It's worth noting that this is the first energy transition undertaken by humanity that will result in a regression in energy density. A Tesla vehicle battery stores far less energy than an equivalent volume or mass of gasoline, although it can cycle that charge more than 1,000 times and the conversion efficiency is much higher in an electric motor than in a conventional internal-combustion engine. What does lower energy density imply for mining? It means that for the same amount of energy that is stored, we will need to produce far more of the metals required in the manufacturing of these batteries: copper, nickel, cobalt and lithium.

People have yet to fully appreciate the implications that this mega-change holds for mining. We are entering an era that I call ‘The Revenge of the Miners.” Just imagine the implications as the world moves to reduce, and ultimately virtually stop, burning oil and coal – and starts placing an astronomical burden on a handful of elements in the periodic table. Those metals will become incredibly valuable, as will

the strategic imperative to control them. History, for example, shows that Ford Motor Company was not the largest beneficiary of the past century's automotive revolution. It was Standard Oil.

I also expect markets to become far more efficient and nuanced in the way commodities are priced. Certification and auditing will become standard practice, as will emissions accounting. Block-chain technologies could enable far greater pricing transparency and differentiation than exists today. Expect carbon pricing (whether taxes or cap-and-trade schemes) to become not only a tool for abatement, but also a prescription for levelling the playing field on trade. Everything will be priced in relation to emitted gases that contribute to climate change.

The automotive industry has been slow to recognise that it is already in a game of musical chairs. The old "just-in-time" procurement paradigm for components simply doesn't work when you need to secure the volumes of metal that this transition requires. If the automotive industry is serious about building its supply chains responsibly and sustainably – not simply pushing the carbon impact from the tailpipe to the shovel – it will need to work very closely with the mining industry. There will be clear winners and losers. The winners will be the fastest to adapt. The losers? Well, it is existential.

I foresee some very important knock-on effects from this energy revolution.

- If we want to capture the true benefits of decarbonisation, there is an imperative for mining to reduce its energy consumption, effectively manage waste, and recycle. Comminution technologies are fundamental in reducing energy usage. New thinking around hydromet processing will be required to treat oxidised ores, something we're demonstrating at the Sunrise Battery Metals Complex in central New South Wales. Mining must adapt.
- Expect government policies to be highly proactive on critical and strategic minerals. Whether this is to support domestic industry or to further a country's defence or national security interests, the focus will be on building reliable and safe supply chains. Countries such as Australia and Canada, hosting large resources of many of these key minerals, will be obvious beneficiaries.
- The Balkanisation[1] of raw-material supply chains to service China, North America and Europe will be highly inflationary. It will require duplication of infrastructure, take time to build and require development of entirely new resources to support.

On inflation, it has been so long since we have experienced it that people have forgotten how corrosive its effects can be on wealth.

One of the uncertainties we all face is the impact that new technology will have on fiat currencies. With inflation and repressive debt levels, we cannot presume that government-backed money will be the preferred medium of exchange. We can already see the disaggregation of financial services, in places such as China and Africa, away from the licensed banking system and towards new, tech-driven service platforms. Remember, it has taken humanity almost 10,000 years to mine 200,000 tonnes of gold worth, today, US$11 trillion. In less than a decade, the value of all traded crypto-currency has reached almost US$2.5 trillion.

Just as the world was profoundly and irreversibly changed by the separation of Church and State during the Age of Enlightenment of the 17th and 18th centuries, the separation of Money and State could be equally momentous. This remains an unpopular view for many today – especially those within the gold industry – who widely view digital currency as nothing more than a hollow promise backed by zero collateral and built for speculation. But then again, show me any financial innovation that has not started this way.

Love or hate disruption, there is no hiding, but we can anticipate and adapt. The seismic shifts we are seeing – driven by exponential technologies and the need to address the planet's environmental problems – will soon be reverberating all the way up the supply chain. In the mining sector, we can already feel these tremors. When the music stops the only question is – how many chairs are left?

1. Balkanisation: a term for fragmentation of a larger region or state into smaller regions or states.

20 | 04

CHARLES "CHIP" GOODYEAR
BHP-Billiton

"Confidence in the industry is still being rebuilt as society, shareholders, boards and management teams redefine the role the mining industry plays in the global landscape."

Mining and resources have been under pressure for several decades – with occasional periods of sunshine – and for the most part the 1980s and 1990s were tough times in the business, given slow global economic growth.

People questioned the need for mining. There's always been a disconnect between people living middle-class or better lifestyles and the perception of the resources industry. People love modern conveniences, but disconnect this from the activity of actually developing and producing resources, and creating products they recognise.

So, many people were saying: "do we really need mining?" There were all kinds of questions, not only about what we did and how we did it, but what was the need for doing it?

Towards the end of the 1990s, the pressure on the industry and its role in the economy and society presented major challenges. At that point, the industry said: unless we do something about our role in society and how we function, we're going to lose our licence to operate.

It was Bob Wilson at Rio Tinto (co-founder of the International Council on Mining & Metals – ICMM) who did an amazing job aiding the industry's repositioning to think about its role in, and relationship to, society. At the same time, China started showing up on the radar, and there was great scepticism about its role in the global resources arena. Previously, China would enter the market for two or three years then disappear – so how much capacity do you build when the longevity of their presence is so uncertain?

In the early 2000s, it became apparent that not only was China's presence real, it was sustaining. It had been visible before, but with uncertainty about its market longevity. What was telling was seeing all commodity prices rising simultaneously – here was a major economy growing rapidly and driving demand growth for most major commodities.

In the first few years of the 2000s, the issue of the BRICs (Brazil, Russia, India and China) emerged and we began thinking about our business differently – what if China and India and other developing countries moved into the middle-class and followed the trajectory of mineral consumption we'd seen in the US, western Europe, Japan and South Korea as their middle classes emerged following World War II?

I spoke to this at an MMC function in 2004. I said: "you may not know or think that the world is changing in terms of resources, but if it is, what does that look like in terms of demand for the next 30 to 50 years?"

It was a turning point – the first time a mining executive had openly presented such an optimistic possibility after decades of lack-lustre resources demand. I didn't say it would happen, but we need to think about if it does happen.

The numbers were such that we could never meet the demand that China and India moving into the middle-class would bring. When I joined

BHP, its market valuation was US$12 billion. When I left in 2008, it was US$240 billion. Mining, previously an after-thought in consumer and financial markets, in a short period became recognised as a critical industry across the world – and a great investment.

At my first BHP news conference, a reporter asked why I'd joined an old, forgotten, has-been industry instead of a computer or internet business. I said: "without what we do, none of the other things happen. You need us. We are across every part of the modern economy."

There's no case in the world's history where an economy moved from subsistence to middle-class without natural resources. General Electric's slogan was: "we bring good things to life" – that's what we do in mining (they just stole the idea!)

In the first nine months of 2003, it became clear that China was consistently entering the market and creating a whole new demand push across the commodity spectrum. We now had to focus on the growing needs of our customers, the governments who controlled access to resources, the communities adjacent to our operations and our overall global impact. It created the need for significant changes in the company's management structure. We also needed to attract bright young people to "yesterday's business."

We focused on our role in serving our customers and assisting communities adjacent to our operations by creating jobs, developing infrastructure, and bringing education and health care to the community. It attracted young people who appreciated that we based our business on a strong set of values, and that we made a difference to our communities and our customers.

Given our operating and financial successes, the challenge was how to rationally allocate the funds we generated. Should we invest it back into the business or return it to shareholders? BHP was highly disciplined and did both. The industry had to assess – having earned the confidence of investors, governments and communities – how to put money to work in reasonable ways, and how to keep investors happy by not wasting capital. It worked well until 2008-09 when the industry became sloppy in putting money to work. This triggered a loss of shareholder confidence in boards and boards' lack of confidence in management teams. Hard-earned respect from the financial community eroded. This created a whole set of challenges that are still being worked through today.

Casting forward, now is as complex a time as I've ever seen. The industry still must identify and produce the materials necessary

for modern life, but do so in an increasing complex environment. Confidence in the industry is still being rebuilt as society, shareholders, boards and management teams redefine the role the mining industry plays in the global landscape.

A key to the future will be increased communication and transparency that will better inform all parties in this complex discussion. We all want the world to be a better place for our children. With this goal and willingness to work together with shared understanding and a constructive approach, we can get there.

20 | 05

SCOTT HAND
Inco

Congratulations to the Melbourne Mining Club on its 20th anniversary. I remember, well, speaking at the club in 2005.

As I look back, 2005 turned out to be the beginning of a major restructuring of the mining industry, particularly in Canada, where I am living today.

I joined Inco way back in 1973. In those days, Inco was the dominant nickel producer in the world, but with the increased importance of the LME and the entry of new producers, Inco had to compete just like all others in the mining industry.

I was a New York lawyer before joining Inco, but I had little interest spending my career filing documents with the SEC. I had spent two years in President John F Kennedy's Peace Corps in the 1960s in the hinterlands of Ethiopia. I wanted an international career and did I ever get it with my 34 years with Inco!

You might wonder how a lawyer came to be the CEO of Inco. I said that perhaps I was such a lousy lawyer, Inco had to find something else for me to do. So a lot of "on the job" training at Inco's mines and plants around the world, and negotiating deals in places like Indonesia, Labrador and New Caledonia, to name a few, allowed me to make some meaningful contributions to Inco.

When I look back at my years in the industry, there were very good times followed by some very challenging times. And it was not just business cycles, but some important events which hit us hard. To name a couple:

- the oil crisis of 1976, when OPEC decided to hike the oil prices fourfold. It killed a nickel project we were building in Guatemala and the mining industry overall was challenged by higher energy prices; and
- the breakdown of the USSR in 1991-92, and metals flooded into the West. For nickel, it was like a 25% increase in supply in less than a year. At Inco, we struggled mightily, but survived.

But then China opened up and their leaders decided to build a major economy, and we in the mining business began to see China and other countries in Asia as the "promised land" whether it was iron ore, coal, nickel, copper – you name it.

Things looked pretty good in 2005, but by 2008, many mid-sized mining companies – WMC, Inco, Falconbridge, Alcan, Phelps Dodge, Xstrata – disappeared in perhaps the biggest takeover wave in the history of our industry.

It started with BHP's acquisition of WMC in 2005, topping a bid for WMC by Xstrata.

In 2005, my company agreed to buy Falconbridge to consolidate the Sudbury, Ontario mining complex, but it was not to be as other mining companies – Xstrata, Teck, Phelps Dodge and Vale – joined the fray and Inco was bought by Brazilian-based Vale for US$19 billion. Inco was trading in the $20s before the takeover fight began – it sold for $84 a share.

Xstrata then bought Falconbridge, Rio bought Alcan, Freeport bought Phelps Dodge and then Glencore bought Xstrata.

Then came yet another crisis in 2007 – the Global Financial Crisis – and it soon looked like the takeovers were made at the top of the market. Shareholders rebelled and the majors went through some tough times.

In Canada, there were complaints about the "hollowing out" of the mining industry with the Canadian Government taking no action to stop the takeovers. True, but Inco shareholders, along with shareholders at Falconbridge and Alcan, laughed all the way to the bank.

The result – a consolidation of the industry with the majors – Rio Tinto, BHP, Anglo American, Vale and Glencore. And, of course in gold, Barrick and Newmont.

The industry has moved on – China demand has continued to be strong. Indeed, in spite of the worldwide COVID crisis, mineral exports to China have held up reasonably well and metals prices have recovered. And, of course, gold has hit records.

As we look to the future, new sources of demand are arriving - most notably with electric vehicles (EVs) which will use substantial amounts of nickel, cobalt and other materials (in the battery) and copper (in the electric motor system).

And medium-sized companies – such as HudBay, Lundin, Nexa, Capstone – continue to grow. Entrepreneurs like Andrew Forrest AO and Robert Friedland have become important players in the industry. And, of course, Chinese Government companies have been all over Africa and South America.

Indonesia is an interesting example of a country becoming a major nickel producer – on the way to being the largest country source of nickel production in the world, requiring further metals processing in the country and taking control of existing nickel producers – resource nationalism.

When I spoke to the Melbourne Mining Club in 2005, I stressed the importance of being a good neighbour. I think I learned from my Peace Corps experience to be sensitive to the needs and concerns of the local communities. It was key to Inco's success at Voisey's Bay in Labrador. As CEO of Inco, I listened first-hand (no pun intended) to the concerns of the Inuit and Innu people in Labrador.

Today, we talk of the importance of ESG – environmental, social and corporate governance. Not just because it is the right thing to do, but because our investors are insisting on it. We have a way to go – witness the dam tailings failures in Brazil, the destruction of Aboriginal caves in Australia and the recent major oil spill in Northern Siberia – but we're making good progress.

For me, life after Inco has kept me in the industry, but in a different way. Rather than retire to a big house in a warm place to play golf, I went into the mining venture business, fortunately with more successes than failures. I'm involved in a growing copper mine in Morocco. At Inco, when I was CEO, we had some 11,000 employees. My copper mine in Morocco has 100. Many challenges to be sure, but fun and rewarding.

I'm fortunate to still have a continuing connection with Australia with my board service at Karora Resources and its growing gold mining operations near Kalgoorlie in WA. Karora attracted big press in 2018 with its much-heralded Father's Day gold discovery.

My time in the mining industry has been great and I've enjoyed meeting and getting to know people all around the world. Were there challenges to overcome? Yes indeed.

As I often said, you needed a stainless steel stomach (hopefully with a lot of nickel) to survive, but survive we did. And we saw prosperity too.

My best to another 20 years plus for the Melbourne Mining Club!

20 | 06

DON LINDSAY
Teck Resources
(formerly Teck Cominco)

In 2005, I addressed a group of geologists in Townsville on the theme of mining as "A Licence to Dream." That sentiment hasn't, and won't, change. All miners dream about the next exploration hole and what it might reveal.

There are two types of geologists: good ones work hard for long hours, are observant, solid with detail, and highly analytical. But great geologists are passionate about their projects. They jump up and down and leave their footprints on my desk. The "licence to dream" is pervasive. It drives us and draws people to the industry. When we're old and looking back, we won't regret this. It's characteristic of the industry and won't change. And the broad interconnections, collaborations and friendships of like-minded mining people globally – from Cape Town to Miami to Vancouver and Melbourne – will remain important.

"For greater social acceptance, mining must give back more to communities in which it operates."

Looking back 20 years, the industry consolidation and "value stretch" that occurred across 2003-08 remain a dominant element in how today's industry operates. Combined, it was a notable event in the industry's structure, ending up with five goliaths at the top[1] in "mineral wars" – the rest a step-change below. It was neither a good thing nor a bad thing, but a necessary thing.

It provided for strengthened balance sheets for companies to be able to undertake big projects and align with the technology-driven investment world as asset gathering accelerated and institutions became trillion-dollar entities. Investors needed bigger positions. They needed liquidity in those public companies, so the companies needed to get bigger – for the size of investment required plus the size of the investment vehicles. That five-year phase (2003-08) really set up a series of behaviours for the balance of the following years.

It became difficult for companies to grow because they were so big that to do anything meaningful they had to bet on even bigger projects. They allocated capital too quickly. It caused over-supply and led to the industry's poor reputation as stewards of capital. While brownfield extensions were easier to execute, elsewhere there were project execution "disasters" that scared investors away.

Ultimately, there was a downturn from 2012 to 2016, with copper prices alone declining for five consecutive years. There had been growth for growth's sake, overlooking shareholder returns. CEOs perceived that to be successful they had to show growth, and at any cost. The goliaths competed on tonnes produced instead of dollars, and the broader industry paid the price for it. It's now better disciplined. The open question for the next 20 years is: will value over volume prevail?

As for the future? Mining has always been innovative. In the past two decades, new technologies really started to ramp up and the next 20 years will be the golden age of technology: big data analytics, digitisation, real-time sensor monitoring and automation. Teck has hired 180 digital engineers from places like Google, Microsoft and MIT. They live and work in downtown Vancouver, but travel the world (when they can) – from Alaska to Chile

1. Anglo American, BHP, Rio Tinto, Vale and Xstrata.

to Beijing – to make a huge difference in how our business runs.

There will be fewer people located at mine sites and more highly-skilled technologists operating remotely. At Teck's US$5 billion QB2 copper project in Chile, 32 autonomous trucks will be controlled from Santiago, hundreds of kilometres from the mine site and 10,500 kilometres from Vancouver. These kinds of developments attract people to mining. For new university grads, it's now a cool industry.

For greater social acceptance, mining must give back more to communities in which it operates. Two decades ago, the industry was under pressure to reduce its footprint. Mining practices have advanced, the industry is now proactive. There's an improved approach to biodiversity, and to tabling mine closure timelines and rehabilitation before seeking permits to proceed. Interactions with indigenous communities are vital. Teck has more than 80 agreements with indigenous peoples from Alaska to Chile. At Teck's Red Dog zinc mine in Alaska, the workforce comprises 55 per cent local indigenous peoples.

In the coming 20 years, new-generation miners will start from a better place. The rise of NGOs, full disclosure and active ESG practices, coupled with institutional investor pressure, will ensure this. Mining's demographics will change to favour younger people, and progress already made with gender parity will accelerate; the whole cultural dynamic will change to the point where this is the norm and a non-issue.

Post-GFC, exploration efforts diminished and have since recovered. But grades are declining and there are few big exploration finds – all the easy stuff has been found. Technology has improved enormously and rapidly, and miners have found resources that are "out-of-sight" given advances in seismic surveying, geophysical techniques and aeromagnetics. There won't be big company consolidations but, rather, selective investments and go-aheads to develop mines.

This is the road to increased production, not large-scale mergers.

Twenty years on, China will likely be the major global power. It's committed to climate change and will drive the next iteration of carbon capture. Minerals and commodity demand will increasingly come from India, Vietnam and the emerging markets. The world will need more tonnes of metals, and mining will need alternative energy-generation sources to produce them.

Mining is vital to the low-carbon and high-tech economy – even the "cloud" is made of metals, particularly copper. Remember, everything we use in our lives comes from one of only two sources: if you can't grow it, you have to mine it.

20 | 07

also 2002, 2004

LEIGH CLIFFORD AO
Rio Tinto

“. . . we must be innovative, open to new ways and allowed to be lightning quick when we see the opportunities. . . ”

In mining, as in other businesses, every generation will think they face unique challenges. So it’s worth pointing out, for instance, that one of the great environmental contributions made by the Australian industry was undertaken by Zinc Corporation in Broken Hill in the 1930s. They committed to re-vegetating vast swathes of the surrounding country which had been denuded of trees to feed the mines and smelters in the 50 years before.

This was a pioneering environmental and community relations program – as good as anything in any industry for the time – and it marked the birth of a genuinely socially responsible industry in Australia.

Of course, mining is an extractive industry, but it’s always so much more. The key to it has always been the industry’s ability to bring new ideas and technology to bear. In the 1970s in Broken Hill, we still had hand-held rock drills and the occasional square set timber stope.

At the same time, over the other side of the continent in the Pilbara, Hamersley Iron pushed technology to its limit with the heavy-haul railroad over hundreds of kilometres. Our predecessors would be staggered at the role technology is now playing; remote-controlled trucks, trains and drills in open cuts and remote-controlled and even automated loaders underground, to name a few.

Since time immemorial, mineral exploration has been about locating outcrops or signs of them. Charles Rasp at Broken Hill epitomised this. But that all changed with Australia’s Olympic Dam, a blind discovery guided by geological theory and knowhow.

For a time, we thought in Australia that our great deposits were already found. The tremendous resources we located in the 1950s and 1960s would never be repeated. People thought the same about Victoria’s goldfields for over a century. Yet all around the country, we are seeing new gold discoveries – often encompassing new technology, new thinking and top environmental standards.

Although our markets are truly global, we often worry about our dependence on a particular market. Are we too dependent now on China, just like we were dependent on the Japanese steel mills and power utilities in the 1970s?

The Japanese clearly thought they were too dependent on us. After the strikes in the Pilbara in the 1970s, they encouraged the Brazilian iron ore industry and Carajás was constructed. The Japanese steel mills responded to industrial problems in our Bowen Basin and Hunter Valley mines by financing some very average coking coal in Canada. Over-supply reduced coal prices – to Australia’s cost.

China will do what it can to diversify away from dependence on Australian iron ore and coking coal. The fact is that capital is flexible. Companies will go anywhere where there is a commercial opportunity. But there are huge markets for competitive suppliers, and we’ll find them in the industrialising economies of South-East and Southern Asia – just like we found them in South Korea and Taiwan.

Our industry has demonstrated extraordinary resilience and adaptability. We've always had a problem explaining what we do and how significant we are to the nation. Despite this, we must keep talking about our businesses, the jobs we create and what we contribute to the nation.

Remember, most Australians have never seen a mine.

We've overcome the challenges we experience because we have continued to attract talented people who see that our industry can provide them with great careers. We've also been able to promise that in progressing these careers, they can make a difference.

Some time back, "making a difference" was all about playing a role in national development. It started with the copper found in Moonta (South Australia) and coal in New South Wales. Mining made great towns and cities: Kalgoorlie, Broken Hill, Ballarat, Bendigo, Rockhampton, Mt Isa, Mackay – and the financial opportunities that sprang from them. Mining opened regions and underpinned Australia's balance of trade. This is still the case, and even more so in recent decades.

Now, the story is the electrification and decarbonisation of the world.

Australia has the metals needed within its reach: copper, lithium, nickel, rare earths. The next generation can make a difference with these and other critical inputs – and they'll have great careers in the process.

As always for Australia, it's an oft-unnerving challenge to keep it all in balance. Have world class regulation by all means – our industry needs it because we need the community legitimacy that goes with it. But we must be innovative, open to new ways and allowed to be lightning quick when we see the opportunities which are always there. It's a great time for our industry. We are making a difference.

20 | 08

also 2004, 2021

OWEN HEGARTY OAM
Oxiana
(EMR Capital, 29Metals)

> *“Given the likely demand in world economic forecast, a tightening of mineral supply looks inevitable.”*

The coming years promise to be among the most demanding in the long history of the minerals industry – and quite possibly, the most rewarding.

Demand is likely to be strong. The challenge will be our capacity to supply.

Events are aligning that will see unprecedented demand for an extraordinary array of minerals – traditional materials like steel and copper, new-wave materials to create the batteries to power electric vehicles and more obscure products like rare earths for uses that are only now being discovered.

Demand for traditional minerals like iron and copper has been high for decades, initially sparked by the industrialisation of Japan and South Korea, but then morphing into the apparently insatiable appetite from China. It has long been expected that Chinese demand would begin to moderate, but recent forecasts from the Middle Kingdom call that into question: latest official forecasts suggest China’s economy will double in the next 15 years.

Supplying that prodigious need would seem a challenge in itself, but it is going to be exacerbated by parallel demand from India (and Bangladesh, Pakistan and the whole Indian sub-continent) and from Indonesia and South-East Asia as well as from Central Asia (inspired by the multi-trillion dollar Belt and Road initiative). Plus Africa’s exploding populations.

India alone is expected to become the world’s third biggest economy by 2050 and Indonesia is climbing the ranks.

It is not hard to foresee a time when four of the world’s five biggest economies (including Japan) are in Asia. Most will be net importers of metals.

Exploding demand across so many commodities and so many continents is probably unparalleled. Meeting new demand on that scale at the same time as meeting a near-doubling of Chinese demand seems likely to deplete even the world’s great deposits.

The pipeline of world-class discoveries does not currently seem adequate to meet the shortfall.

I say “currently,” because discovery is historically closely connected (albeit lagged) to exploration, and the mining behemoths on whom large-scale development will largely depend are financially strong and well placed to accelerate their efforts. Many have, in recent years, strengthened their ties with promising exploration juniors.

So, we can expect some upturn in discoveries, but sufficient?

I do not under-rate the capacity of our industry leaders to rise to the challenge – we have some really great leaders and the pool is growing – but the task is formidable.

Much the same can be said about development, although here the challenges multiply. The direct physical challenges (greater depth, lower grades, greater ore complexity) are generally being met, albeit at a cost.

Automation, ever-expanding scale (remember when we thought 30-tonne dump trucks were giants?), nano-technology and improved data handling are all playing a part. You have only to look at the handling improvements in the Pilbara to get a sense of what is possible – now, let alone in the future. Technology is a great source of comfort. The frightening scale of future volumes should not daunt us.

But the human challenges continue to grow.

For those of us in the industry, it is tempting to bridle against the unrelenting growth of regulation, but in truth a large part of it is inevitable. More and more humans inhabit the planet and they consume more and more minerals. The potential for conflict grows constantly (and hence so does further regulation). I do not foresee a great change in that in the near future.

Notwithstanding all those challenges, recent history gives us one big cause for hope: incremental improvements in mining technology and knowledge.

These are already delivering spectacular benefits.

To take examples from our own EMR camp in Australia, two established mines have recently made sizeable additions to reserves without extensive greenfields exploration. Capricorn Copper, a site in the Mt Isa copper belt which has been mined sporadically for more than a century, has delivered a program to produce more copper – for many more years. That will almost certainly be boosted by greenfields discoveries, but the core program is based on systematic assessment of historic information. Painstaking improvements in understanding the nature and structure of deposits are reaping huge benefits.

Similarly, Golden Grove in WA, a site already worked for around 30 years, has delivered resource and production plans that could take it out another 30 years.

Most spectacular of all is Ravenswood Gold, south of Townsville, which was already a boom town in 1895 when Banjo Patterson was penning a ditty about a drowned swagman and so immortalising the phrase Waltzing Matilda. Over those 125 years, it has produced four million ounces of gold. It was long thought to be past its glory days, but rigorous reassessment, using modern understanding, has resulted in a program to produce a staggering four million further ounces – equivalent to 125 years of past production – over the next 15 years. An historic relic is now one of the most exciting projects in Australia, set to become Queensland's biggest gold mine.

These examples are by no means unique. There are many examples of modern technologies boosting the reserves of historic mines – enough give hope that the prodigious output needed to meet that expected demand may yet be met, at least in the medium term.

It is easy to forget how steady incremental improvements can quickly equate to step-change progress – whether that be in resources volumes, in mining, in processing practices, in energy efficiency or in capital and labour productivity generally.

Another area of improvement which bodes well for the future has been the industry's embrace of ESG – environmental, social and governance principles, policies and performance. This is manifesting itself in much-improved relations between mining companies, governments and host communities.

Our obligations are not simply defined by the royalty agreements struck with central or provincial governments; agreements which do not always translate into direct benefits for local populations.

Modern approaches, which see ESG measures as more a partnership with the local community, are building stronger bonds. These can include such simple measures as policies that ensure everything possible is sourced locally. This spreads the benefits throughout the town and helps build it into a regional supply and administrative centre – with the additional benefit of providing a cushion against the day mining begins to decline. ESG can be more than a legal obligation – a genuine bridge to long term sustainability. That is the ultimate goal.

Given the likely demand inherent in world economic forecasts, a tightening of mineral supply looks inevitable. Technology can help bridge the gap, but the sheer volumes of metals required seem sure to test the capacity of the exploration and development pipeline.

I helped popularise the phrase "stronger for longer" 25 years ago to describe an Asia-driven world economy. We could then barely have foreseen that China's growth would continue at the same hectic pace beyond the year 2040, or that India, Indonesia and the rest of South-East and Central Asia would join the dash.

Neither the Global Financial Crisis nor COVID seem to have seriously slowed progress.

A global minerals shortage now looks a very real possibility – or opportunity.

20 | 09

ANDREW FORREST AO
Fortescue Metals Group

“Mining is – and will continue to be – a major employer, but in different ways.”

Recent experience has clearly demonstrated the importance of the mining industry to Australia’s economy. The opportunity we now have is to tell the story of our broader community integration, the impact of our decisions and investments and, at the highest level, how our actions and what we stand for are understood.

We’re as essential as the health sector is to the overall health of society, and to maintain our sustainability, it’s up to us to better explain what the industry does and how we contribute to addressing our planet’s biggest challenges.

We need to be seen as the defenders of the environment, defenders of remote communities and as citizens of the global community that younger generations can look to and say: “I’d like to be like them.” We don’t have that now. If they knew that mining is community focused, is environmentally sensitive, is at the cutting edge of archaeology and anthropological heritage – and makes mistakes but learns from them – then younger generations would say: “That’s an industry I want to join.” Mining is among the most-advanced industries technologically and is always innovating to see how it can do what it does better.

It requires a great deal of patience when you’re exploring, acquiring tenements and even thinking of building a mine. Your Number One role should be making sure that once the business model is in place, you’re communicating that model and its impact on – and positive effects to – the community. And you must be completely certain from an independent scientific perspective about returning the country you’ve mined to its former state or better (it might be different, but not worse) right from the outset.

Three things the mining industry has got right are:

- its acceptance and adoption of advancing technology;
- developing a strong community identity; and
- as a result of these two things – supplying the global community with its needs to progress from the developing to the advanced world.

Three opportunities where mining can clearly improve are:

- taking the community with it on the mining journey;
- being sensitive to the environment and all stakeholders; and
- effectively communicating our business worldwide.

Turning to technology, and Fortescue Metals Group continues to be a global leader in automation; an example of companies being judged more on their actions, not words. That said, humans will always make better decisions than machines, but machines will make more reliable decisions. If there’s a repetitive set of actions needing a repetitive set of decisions, then machines do that better. In any unpredictable environment, I’d always rely on human judgement.

Mining is – and will continue to be – a major employer, but in different ways. Economies reliant on manual labour have the highest unemployment rates. Economies that have embraced technology have the lowest rates. At Fortescue, we used to employ 8,000 people, and now we’re almost fully automated we employ 15,000. We need more people as we become more efficient, keep growing the business and reduce costs.

Those costs have gone from $57/tonne to $12.78/tonne via a flywheel of improvements and technological innovations.

There's no one hero or hero technology, but thousands of innovations and technologies that have incrementally reduced costs. Our innovation projects have provided significant development opportunities, with more than 3,000 team members trained to work with autonomous haulage.

Further, we have our Trade Up program to take workers out of trucks and mines, and provide them with an accredited pathway to a trade qualification. And this program has a large representation of Aboriginal people, especially women. If you're employing from within your community, taking extra steps to establish training centres and integrating employment from your local community, that's a strong pathway to building a sustainable operation.

It's the employment opportunities and the ability to communicate these to the communities within which you operate that create a positive social, physical and economic environment that, in turn, leads to long-term sustainability. An accounting mentality alone is not workable.

Fortescue is a significant employer in Argentina and Ecuador. In these countries – and everywhere we operate – we instil 10 values that drive culture and foster local sustainability and empowerment. We can predict and promote independent decision-making in these locations because our local employees understand our motives and values. Under no circumstances do they countenance the breaking of our cultural values. They embody a credo that is culturally mandated – not an imposed, legally binding employment condition.

When I started Fortescue with 30 employees, a leader at BHP told me I'd need a BHP-style system to operate. He questioned what I'd do with 3,000 people on the payroll. My reply was that we would – and now do – have systems to support our 10 values, not the other way around.

Finally, and most importantly, our industry must join the global battle to defeat climate change. Fortescue has committed to achieve carbon neutrality by 2030, and to do that we are turning our energy sources to renewables. Across our operations in the Pilbara, we use 650 million litres of diesel annually, and this will increase to over one billion litres if we don't make a systemic shift. So now we're committed to demonstrating green hydrogen in global-scale environments, as we eliminate fossil fuels from our own supply chains on our journey to be a major clean and renewable energy exporter.

Mining is a fantastic industry with massive potential to be a world leader in environment, in technology, community development and heritage. And it is in the strongest position to be the world leader in converting heavy industry over to purely renewable green energy. It's up to our leaders to make all of this potential a reality.

20 | 10

INÉS SCOTLAND
Citadel Resources Group

“Decarbonisation will be pivotal. While technological advances are inevitable and happening, they’re a long way from being universal, and they’re costly.”

During the past two decades, mining hasn’t prepared its positioning for the future. Historically, it has been considered to be in the “grubby business of digging holes.” Over this course, and even recently, there have been a number of environmental catastrophes.

But as we know, mining has evolved – and continues to evolve – quickly and adopt new technologies, such as sensors and GPS-guided driverless vehicles and other mine-based automations. This is well known within the industry but, as in the past, it hasn’t been well communicated to the wider audience.

Talk to 20-year-olds today, particularly outside Australia because Australians are quite knowledgeable about mining compared to the rest of the world, and they see miners as people in boots, wearing hard hats and driving big trucks. There’s not been any global communication that mining has moved far beyond this.

Mining must reposition itself as part of the solution rather than as part of the problem. It needs to be communicating to people that renewable energy is fantastic, but that mining is a key input to its development. And that as responsible miners, we’re doing great things internally to make sure that we are a part of that renewables story.

So, people need to understand what mining contributes: we can move to renewable energy, but you can’t make use of renewable energy without us being able to provide the inputs. Kids pick up and use a smartphone, but have no understanding about its origins. Two or more decades ago, the Minerals Council of Australia made an advertisement highlighting that all society used was mined, manufactured or grown. To make the point, the ad featured a house being stripped to show how little was left without mining’s inputs.

That message continues to need being broadcast, but via modern mechanisms – targeted global education campaigns on social media platforms and new smartphones carrying data about the mineral products they contain.

Mining’s social licence to operate will be an increasingly big deal against a “not-in-my-backyard” syndrome – and “my backyard” is increasing in size and location globally. Licence to operate had always been a big issue for mining companies, but I think it’s going to become more of an issue until the industry is seen as more of a solution.

Attracting younger people to the mining industry will be a huge challenge. As Big Bank and Big Tech companies now make up the majority of the market indices around the world and – of course – financial institutions’ investment portfolios, mining companies are a small percentage in the top 500. So, if you’re a young maths guru chasing an enticing career, are you likely to join a major miner? Probably not, you’re

looking to the Big Techs – Tesla, Google or Amazon, among others. You're not thinking about a career in mining. A career in mining covers a diverse range of professions, trades and skills, and offers the opportunity to make a difference both at the local community and global levels.

Financing for exploration and project development will remain difficult. As global investment funds search for sustainable development credentials, this will prove problematic and tricky – particularly for smaller companies that can't utilise sophisticated environmental offset products and adopt leading edge technologies.

What challenges lie ahead? Securing your social licence to operate and reputation will be foremost. Mines will increasingly be opposed globally, with social action against new mines. Yet opponents don't understand the consequences of this: there needs to be a decoupling of wants and needs, and the reality of what provides the resources to fulfil them.

China's mining push will be significant. It operates under a markedly different paradigm to other nations, with different commercial and legal structures under "China Inc" – and it's not a commercially-listed company. It will mine where major miners will not go, and engage with local governments and operate on financial bases that multi-national mining companies will not sanction.

Decarbonisation will be pivotal. While technological advances are inevitable and happening, they're a long way from being universal, and they're costly. They will be built into mines yet-to-be-discovered and developed. The big question for miners with short-term budget horizons is: at what stage do they commit to large capital expenditures, and at what stage does it pay off?

The investment community will continue to push hard on mining to operate within environmental parameters in a decarbonising world.

Look at The Sovereign Wealth Fund of Norway for example – the world's largest – which continues to sell off investments in companies producing carbon emissions. Other ethical and "green" funds are also launching new environmentally-based investment products which exclude mining companies.

Where miners face a shrinking capital pool, it follows that production supply will be constrained. Mining is an increasingly capital-intensive business, but for fund managers, mining equities can be higher risk without the associated reward. Yet mining remains a key part of the technology solutions for reducing the carbon footprint and generating renewable energies. That's the dilemma.

20 | 10

also Melbourne 2008

TOM ALBANESE
Rio Tinto

> *“With demand growth continuing, commodity prices will move higher. Capital returns to miners will move higher. Balance sheets will be improved. Dividends are likely to be higher and more consistent. Everyone will like this except host governments.”*

We are amidst three potential – and disruptive – cusps of change. In the first, the commodities demand profile is changing. It’s not like when China will rise and all boats will rise with it. Some will rise, some could remain anchored. And some – like oil and gas and coal – would sink. It’s a winners-and-losers type scenario.

In the second “winds of change” setting, we’re moving beyond a benign post-Cold War type scenario where trade restrictions were not a barrier, and there was a period of co-operation and collaboration. The current situation is going to be a far more complicated phase.

In the third, what we thought was the mining sector’s ability to meet society’s and investors’ expectations is going to be challenged – there are greater demands from all aspects of society, and all industry is being pressed to make influential and effective low-carbon changes. Decarbonisation, while it has been on-radar for some time, has moved from a second-order issue to a first-order issue.

Many of these are parts of trends we witnessed at the start of the 21st century, particularly the changes associated with China’s economic rise 15 years ago and its allied “demand shock” as everyone tried to supply its growing needs at the same time.

Environmental and social governance (ESG) – despite having been on mining’s agenda for the past 20 years – is speeding up. Its overlay will make it harder for miners to develop new mines, given the tighter demands of permitting and matching – or bettering – all stakeholders’ expectations.

We have also witnessed a “changing of the guard” in the US Administration, the rise of social and cultural issues including the Black Lives Matter movement, and the social media dynamic in which it has crossed the tipping point to lead the mainstream media rather than the other way around.

Resource nationalism, closely linked to licence to operate, is an issue that emerges during times of prosperity for miners with onlooking governments seeking a share of the gains by applying increased fiscal pressure. As and when it emerges, it’s likely to impose an added burden on companies opting to operate in developing countries. It will also be a greater risk in OECD countries. In Australia, for example, it may have the potential to rekindle the Resources Super Profits Tax debate of 2010-11.

Among the profound sea-changes for mining has been industry innovation (which has been a progression for the past 20 years) and it will continue apace. For example, 10 years ago Rio Tinto was making inroads on automation at mine sites and remote operating centres – activities now ever more on the agenda given the COVID-19 pandemic-induced “work-from-home” movement.

We’re just beginning to see the effects of this on mining. There’s been a fundamental shift under the pandemic; it’s been the catalyst for another generation of innovation.

While there’s still a long way to go for such things as artificial intelligence, the changes will be better for well-heeled investors and the well-

educated, technologically-advanced industry professionals, and the changes will be worse for those less well-educated workers who will be left behind.

Access to capital, coupled with ESG considerations, are expected to lead to a more delayed supply response to the demand shock hereon, given the world's ongoing and growing needs for vital metals. It will be as profound as the demand shock of 15 years ago under China's industrialisation. Coupled with the secular trend of 2.5 billion people wanting to rise to middle-class status, commodities demand will become turbo-charged.

For big miners with existing facilities that can readily be ramped-up, meeting their share of the demand will be achievable. For junior miners, attempting to build new mines will not readily attract investors and risk "spooking the horses."

As part of the mantra surrounding "green steel," there is a growing number of companies increasingly focusing on reducing Scope Three emissions under the Paris Accord. Steel mills will more diligently price carbon in their value-in-use thinking, preferring higher-grade products, while focusing on mitigation technologies such as carbon capture and sequestration and, eventually, hydrogen. This is a good sign on the path to achievable carbon-emission targets.

With demand growth continuing, commodity prices will move higher. Capital returns to miners will move higher. Balance sheets will be improved. Dividends are likely to be higher and more consistent. Everyone will like this except host governments. The question is: who pays for the fiscal stimulus measures introduced by governments around the world in the wake of the pandemic?

All of the changes that face mining are part of the industry's long cycles during the past 200-year history of booms and busts. Periods of rising commodity prices always lead to supply and demand responses, and subsequent price declines. Cycles will still be with us.

There were key phases of investment in the 1980s, the 2000s and now in the decade just past, typically punctuated by industry consolidation. The investment future for mining will not change, and its important role in a decarbonising world will only increase.

LYN COLLINS

KingGee
KingGee

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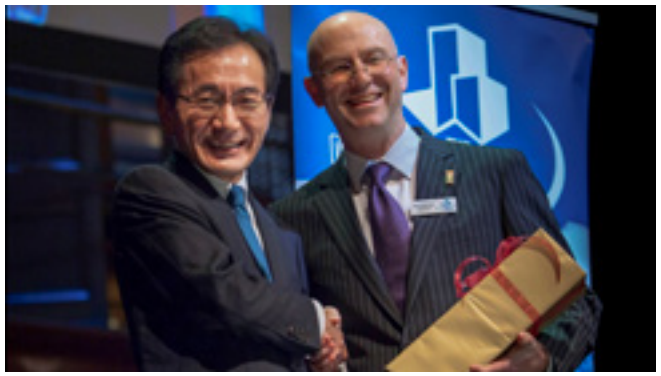
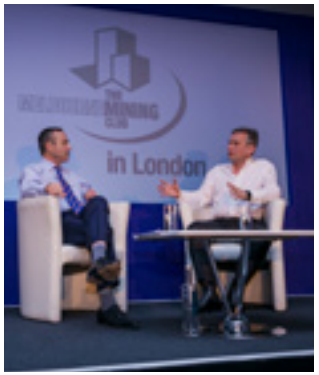
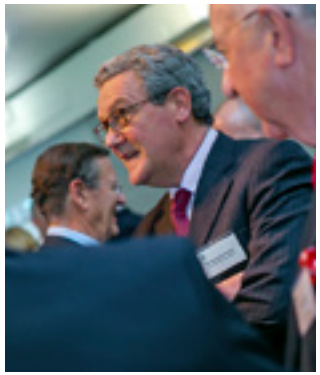
From the podium



Across the seas





20 | 11

DIEGO HERNÁNDEZ
CODELCO

“The COVID-19 pandemic has forced us again to change strategy and adopt innovation as the Number One tool to improve operating costs.”

For good reasons, our mining industry – both in Chile and broadly across the world – is conservative. It is capital intensive. Investments take time to execute and materialise, and at the same time generate significant returns on capital. We therefore cannot risk innovation if we are not 100 per cent sure of its success. A failure in our business can have major consequences.

I’ve seen failures in projects because technology was not fully-proven on an industrial scale, and in others because the relevant jurisdiction was not mature enough to follow the rules agreed in advance. Hence, the industry needs, by necessity, to remain highly conservative.

In the past 30 years in Chile, we built a strong operating benchmark in creating mines. Because of this, we maintained the Number One position in terms of copper production: mining in Chile generates 50 per cent of exports, 10-12 per cent of national GDP and between 20 and 30 per cent of investment; it generates about 28 per cent of world copper production and comprises about 30 per cent of global copper reserves.

From 1991 to 2004, Chile’s annual copper production was lifted from 1.6 million tonnes to 5.3 million tonnes due to expenditure, in nominal terms, of more than US$42 billion. Then from 2004 to 2019, we invested even more than this, yet annual production only increased to 5.8 million tonnes.

Why? Because mines became mature and ore grades decreased. But we remained competitive and enjoyed the benefits of the super cycle due to our focus on production; with high prices, increasing production volumes is the best strategy. But when the cycle ended in 2015-16, we were slow to react because the paradigm changed and we needed to focus on protecting operating margins. We did react, and about two years ago cash costs peaked and operating conditions improved.

The COVID-19 pandemic has forced us again to change strategy and adopt innovation as the Number One tool to improve operating costs. We were forced to adopt different working practices (about which we were resolute in adopting before the pandemic) within and across companies, trade unions, and government and mining authorities.

Mining’s safety culture has improved and is continuing to improve. Indeed, this has contributed to greater sanitary controls due to the disciplines imposed by the pandemic and this is now embedded in Chile’s – and indeed the world’s – mining industries.

All stakeholders understood they had to work together for the collective health of our workers and communities, and to ensure the chain of payments. They were flexible in reacting and working together, and we ensured the required operating protocols were in place to maintain operating continuity without disruption, despite the pandemic’s effects.

This has prepared Chile for the next cycle (which could last 10 or 20 years) and our operating benchmarks will continue to make us world-competitive. In Chile – and

around the world – mining companies must, under all circumstances, introduce and embrace new technologies, rationalise their organisations and improve their decision-making processes in order to ensure medium- and long-term competitiveness.

Governments also need to look after their respective mining industries and understand the importance of their scale over the long term. Mining is far more than a large taxpayer to be milked by government.

By the end of 2022, Chile will have a new Constitution, and our aim is to protect what we have in terms of mining as the economic activity and national wealth generator.

Coupled with this, there needs to be integration with local communities – "integrated mining" – that can cement the importance of mining investments made by both government and private investors for local benefits.

Copper's future is positive. There will not be a die-off in copper mines, despite reduced capacity to invest in the short term. Demand – and therefore prices – notwithstanding the effects of the pandemic and China's initial pull-back from the copper market, will hold up given the red metal's myriad uses. And copper has a major role to play in mitigating climate change across renewable energy, electrification and environmental imperatives.

The move to "green copper" is one such advance towards reducing copper-related carbons emissions. Mining consumes one-third of Chile's coal-fired and hydro-generated power, but its dependence on imported coal and coal-fired power plants must, and will, change. The country's high levels of solar radiation and deserts lend themselves to solar and wind power generation, and increasingly new power contracts will be struck with the providers of these.

Between now and 2022, the pandemic's effects on supply and demand will remain, so mining will stagnate in the sense that it will not grow.

In the short term, there will be less focus on new exploration and more on brownfield operations, and the extension of mine life. Rather than seeking to mine at greater depth and search for higher-grade ores, companies will be more selective about grades, and in due course greenfield projects will start to increase in pace.

20 | 11

CYNTHIA CARROLL
Anglo American

"As we drive towards increasing productivity and deploy more technology, we must manage the trade-off between automation and local labour employment."

We live in uncertain times. Geopolitics has become predominant in the past five years. The COVID-19 pandemic is having a substantial impact on mining and on the demand side, in particular.

We're a long way from the super cycle, but from 2015 up to the pandemic's emergence there was general recovery in commodity prices, fuelled by global economic growth. Commodity markets are now disproportionally affected by China while we've also seen recent, significant slowing of its GDP.

What does the "new world" of mining embody? The major change in the past decade has been the realisation and recognition that profitability and sustainability from ESG standpoints are intrinsically linked.

In the past decade operating timelines extended, while "overnight" returns on capital abated. Returns for operators, businesses and commodities are lower, and take longer to deliver. "Stronger for longer" is perhaps no longer the norm.

Greater time is needed to identify, acquire and utilise mine resources. They're diminishing. The resources needed to mine – particularly water – are critical. Given that a substantial percentage of mining activity is in water-stressed regions, water is now the common denominator that dictates whether miners can produce, expand or open new mines.

Dependence on reliable energy supplies is vital, along with reducing carbon footprints and searching for renewables. Miners must be proactive. Globally, companies are implementing renewable energy projects: Anglo American installed a photo-voltaic plant over a tailings pond at its Los Bronces operation in Chile; Rio Tinto is sourcing wind power to support its Kennecott copper mine in the US. While the uptake and intensity of solar- and wind-generated energy usage are not extreme, the progress is positive.

Biodiversity and land management are prominent, given increased pressure from governments and NGOs. At Anglo American, we instituted a program to enhance biodiversity at all our mines. Others need to follow suit.

Resource nationalism is a common theme that's risen in the past decade in Africa, Asia and South America. It's come in various forms, albeit greater royalties and taxes, land acquisition, local-content rules, equity stakes for governments, beneficiation or outright expropriation.

Orebody quality has been declining in critical metals which has translated into cost increases – in some cases exponentially. Copper grades globally have declined for a long time and the size of mineable resources has shrunk. There are fewer, accessible orebodies.

Capital allocation is ever-critical. Governments don't have the funds to develop the necessary infrastructure to support expansion of existing mines or develop greenfield sites. The responsibility for power, railways and ports falls to miners. This increases operating costs and reduces the bottom line.

As resources become harder and more expensive to access, miners must assess alternative sources of materials to complement supply. The Japanese have been urban mining – reusing and recycling – for years. It's spreading globally.

Before the 2007-08 Global Financial Crisis, capital allocation was unconstrained.

It's now highly constrained. Miners remain under extreme pressure to curb their spending practices. Consequently, we'll experience a squeeze on the minerals that society needs, given the challenging nature of where mines and resources are located and how they're developed.

The labour talent pool is changing, in many places with misalignment of expectations vis-a-vis increased labour costs. Wages may have aligned with global standards, but productivity hasn't moved in tandem. It's ever-more challenging to offset rising costs.

Competition for capable people is increasing, especially given the march of new technologies. It remains fierce. Miners must broaden their talent bases and proactively employ women at all levels.

Granting of permits to operate and develop mines is onerous. It takes time. Legal and permitting costs are increasing. Environmental clearances are harder to secure; a situation mired by environmental disasters such as the 2019 dam burst at the Brumadinho mine in Brazil. Greater controls, more-frequent audits and increased scrutiny are the new rules.

ESG has changed rapidly and is now more uniform around the world. Given mining's complexities, we need alignment between stakeholders to secure licence to operate. We need equitable engagement with communities that's sustainable and supportable for decades ahead. We need to connect with host governments to establish level playing fields and predictable regulations and policies.

We must all achieve zero harm. People come first. We must protect everyone on site. As we drive towards increasing productivity and deploy more technology, we must manage the trade-off between automation and local labour employment.

Technology is the fourth industrial revolution in transforming our industry, generating smaller environmental footprints, reducing water needs, mining more accurately using artificial intelligence, and deploying autonomous and electric-powered machinery and drone technology. In 10-20 years, mines may be smaller, more self-contained.

The top-down company narrative and tone is changing. Company leaders more regularly discuss social value, societal input and social capital. Discrete ESG elements aren't of mining's making, but the focus on ESG is.

Today, investors actively drive improvements in ESG performance across all industries. Ethical investors such as the Church of England have successfully led the call for international standards on tailings governance. Investors piled pressure on Rio Tinto to act following the blasting of Aboriginal heritage caves in Western Australia's Pilbara. Such is society's pressures on our industry.

These dynamics will create conditions for sustainability to become a competitive element in mining in the next five to 10 years. Those that perform well on sustainability, ESG and climate change initiatives will gain better access to capital, their shares will outperform their peers, they'll attract

greater talent and be better placed to maintain their licence to operate.

Proactively, constructively engaging with communities is crucial. A greenfield or operating site has always been about enhancing communities and regions so they're better off economically and sustainably from our presence. It's a balancing act – addressing training of local people for mining and non-mining jobs; long-term sustainability of communities from water, energy, land-use and biodiversity standpoints; investment in community infrastructure and education; and "partnering" with communities.

For future miners, it's about reputations being challenged. Mining must inform people about what it creates and gives back to society.

My outlook is bullish: the world needs our commodities, minerals and metals. But this comes with substantial and constant scrutiny.

Against a backdrop of perceptions of mining as an old, dangerous, polluting and destructive industry, we now see an industry emerging that's vital to the low-carbon economy, safer, more environmentally protective and leading technological innovation. Miners must do their part to apply world-class practices while creating value for their shareholders and the broader community.

20 | 12

IVAN GLASENBERG
Glencore

"Reading demand correctly is a judgement call. It requires not placing downward pressure and cannibalising the prices of commodities you already produce."

Mining has been generous to the global demand for commodities. The world needs the commodities that our industry supplies. What our industry has not done is focus on ensuring it earned the right return when supplying that demand. That's why the sector trades at poor price-earnings multiples – a maximum of 4-5-times – while other industries trade at much larger multiples. The tech industry is a good example of this.

When China's economic boom emerged in 2002, this led to a huge demand for commodities. The industry did everything possible to feed that demand and subsequently over-supplied it. We invested close to US$1 trillion in capital and shareholders' money in developing new mines at the top of the cycle. Today, few of these mines are yet to deliver a decent return. That is the history of mining since 2000.

Years ago, I tried to encourage Warren Buffett to invest in Glencore. "No," he said. "I don't like your industry." He said we produce generic and unbranded products, and as soon as demand is strong we dig new, bigger and better holes somewhere else and over-supply markets.

When we took Glencore public in 2011, the questions we kept getting asked were "when will you build a new mine, where's your growth coming from – show us your bubble charts, you have depleting assets, how will you replace them?"

It is now changing. We all were burnt in 2008 and 2015. We have not yet fully recovered the trust of investors as responsible stewards of capital, but we are on the way. Mining by definition is a business that slowly depletes its asset base. At some point, those assets will need to be replenished.

What is starting to re-focus the industry is companies adopting a "value over volume" approach. This should boost returns and earnings multiples. However, China as consumer of half the world's commodities has already foreseen this. The country wants to become less reliant on commodities such as iron ore from Brazil and Australia, and seek to develop its own supply as it is doing with nickel from Indonesia, copper/cobalt from Africa and, potentially, iron ore from Guinea. China will start to become less reliant on the traditional miners for its commodities.

Reading demand correctly is a judgement call. It requires not placing downward pressure and cannibalising the prices of commodities you already produce. This is crucial: think commercially, not as production engineers, assess market demand and supply before building new mines, and ensure you find the right balance between re-investment and shareholder returns.

The reality is that to meet the goals of the 2016 Paris Agreement will require a significant increase in the supply of "green metals" – for example: copper, nickel and cobalt. Increasing mine supply will be challenging.

It will involve accessing future resources in more challenging locations, often lacking key infrastructure, and ensuring we build and maintain our social licence to operate. We may get to a situation where new supply won't come from traditional miners – not because they don't want big growth projects, but because they simply don't have them.

Mining's other challenge is to tackle its emissions footprint, primarily Scope Three carbon emissions. This is a real area of focus for investors who are placing significant pressure on the industry to tackle these emissions.

Glencore has been a feature of the global commodities industry for nearly half a century, growing from a physical trader of metals, minerals and oil, into one of the world's largest and most-integrated natural resources companies. Today, the business, with its portfolio of commodities and activities, is uniquely positioned for the expected resource needs of the future. We are ready to support the transition to a low-carbon economy and realise our stated ambition of achieving net zero total emissions by 2050.

20 | 12

NICK HOLLAND
Gold Fields

"Given the paucity of money available to miners – gold miners in particular – there will be more industry consolidation."

Just over eight years ago at the Melbourne Mining Club, I outlined the central issues facing the mining industry. Many of these remain valid.

The issue then was growth for growth's sake – ounces for ounces sake, undertaking massive projects, being the biggest producer – with few miners making substantial money for their shareholders and poor capital-allocation decisions, despite robust access to capital.

The ability to fund big projects was more feasible given the number of dedicated gold (and metal) funds. In the past five years, we've experienced the rise of the indexed funds tracking baskets of underlying investments; these now comprise 35 per cent of our share register compared with about 12 per cent six years ago. These funds track performance of relevant indices (for example, the FTSE 100), so companies must be far more prudent with their capital investment decisions.

Consequently, most big-scale mining projects won't proceed on one-owner or one-company bases, but on consortium or joint-venture bases due to funding availability. This is compounded by investors seeking yield. Across the world, yield has dried up with interest rates at zero or negative, and bond markets unattractive. As such, investors want gold and other miners to pay dividends – they don't want expenditure on a growing production basis.

It echoes my 2012 view: you've got to be making money through the industry's cycles. It's all well to make money when the gold price is US$2,000/ounce, but can you make money at US$1,100 or US$1,200/ounce? That's been well-nigh impossible not only for gold, but also for copper and iron ore producers. When prices fall, they're all in trouble – they restructure, lay off people and think rapidly about changing strategy. Why? Miners must prepare themselves for the downward path in these cycles. It's truer today than in the past.

Given the paucity of money available to miners – gold miners in particular – there will be more industry consolidation. It will be more nuanced compared with the "big-bang" mergers of 20 years ago, with larger companies buying up intermediate and smaller companies. There's logic in this given the dearth of exploration across mining for the past 20 to 30 years, and companies can't catch up on this hiatus.

Big companies may circumvent this problem by buying their smaller counterparts. I retain a jaundiced view on big-bang mergers – they create "massive monsters" and to keep these monsters maintaining production levels is nigh on impossible.

So we get back to the same problem: investors buy these companies for growth and cash flow, and to maintain production these companies need to retain far more of their profit and not direct it all to shareholder dividends. Shareholders won't wait longer than 3-5 years while a mine is being built and income forecasts are achieved. They want returns in the short run. That's made our jobs even harder.

Investors remain highly cautious. During big run-ups in the gold price (I've seen two such cycles in 25 years) costs follow rapidly. Cut-off grades get reduced, companies start mining more marginal material, and in short order costs rise by the same percentage as the gold price.

Investors ask if the gold price will reflect in the bottom line. Or, are you going to mine low-grade ore, and costs rocket and we get inflation and heavier taxes on profits? Gold equities haven't responded fully to the recent gold price; they're lagging the price pick-up. That's why investors carefully watch the bottom line: will companies buy assets at much higher prices that don't make returns at lower prices, will there be increased dividends, or are they catching up on lack of expenditure made in the past 5-10 years? That's the dilemma.

Miners need to keep costs under control, be disciplined in cut-off grades, increase profits and dividends, and not let balance sheets get over-geared as they did 10 years ago. I highlighted this in 2012. If the gold price rises, investors want to see company valuations, cash flows and – ultimately – share price improvements.

The future? Environmental and social governance issues remain fundamental. Companies must be run professionally and transparently. We cannot be extractive alone and we must move to a more circular mindset. It's "integrated thinking," achieving superior returns while ensuring we do all the right things like thinking about mine closures even before we develop new mines – to focus on the lifecycle of operations and concurrently mitigate risks and costs and add community value. We have to be integrated into communities and environments where we work. For investors and society at large, it is a case of "we won't reward you if you get it right, but we'll penalise you if you don't."

To achieve higher health and safety outcomes, we must utilise big data technology and remote working to remove people from the orebody. There will be fewer people on site, but more highly-skilled people. This is a generational journey, despite advances already made in mine automation.

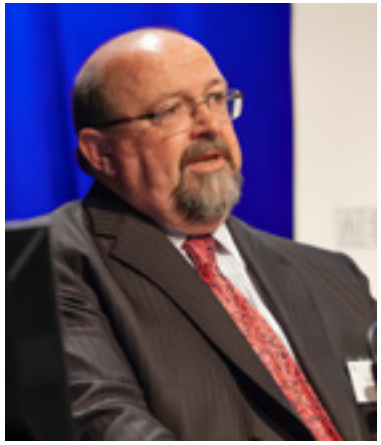
Industry leaders must better articulate mining's value to the world. Its positioning for the future needs to be on a broader platform to better understand its endowment of existing resources that allow it to create value for customers, end-consumers, governments, affected communities and – naturally – shareholders.

Mining needs to take full advantage of its licence to innovate and remain a major part of the world's future.

20 | 13

also 2007

IAN SMITH
Orica
(Newcrest Mining)



“. . .there are too many apologists for what mining does and doesn’t do well. It’s a fundamental industry. We should be proud of, and celebrate, it – not make excuses for it.”

After 45 years in mining, I still believe the industry doesn’t sufficiently train its technical people nor does it adequately promote the positives that resource development brings.

I completed a finance degree before deciding to be a mining engineer, beginning a cadetship with CRA at Broken Hill. I was lucky – the University of NSW had a campus there, so I worked mornings underground and studied in the afternoons. I learned about the physical aspects of mining and – in tandem – the theory of engineering mining.

The cadetship system covered surveying, geology, ventilation, geo-mechanics, mine planning and more. Things have changed. In my time, the three great training centres were Broken Hill, Mt Isa and Kalgoorlie. They housed highly-practical people with long tenures in mining and were well-grounded across a range of technical mining essentials. Once I graduated, I knew about the technical aspects of mining engineering and the practicalities of being involved with, and running, a mine.

Active engagement on mine sites and getting theoretical education training had an osmotic effect. It gave me a great foundation. Today’s trainees and tertiary graduates don’t get the chance to acquire a thorough technical background to become in-depth mining engineers.

Through the 1980s – a time of contract mining, highly unionised mines and fundamental change in the Australian workforce – shift bosses, superintendents, senior engineers and production managers had to communicate with all workers and not simply manage from the top down. It schooled me in industrial relations, communication and change management. This overall education enabled me to advance through various company ranks, from cadet to CEO status. I feel sorry for younger people who don’t get this type of grounding before being released into management ranks.

At that top end of the scale, some leaders stay on too long. CEOs shouldn’t hold office beyond 5-7 years. Being a board member was the less-inspiring side of mining to me, and spurring on board teams was onerous. Mining is all about “having a go.” Corporate culture needs an additional element that allows people to do this. Being community-aware is also important. Roxby Downs was the last big mining town built in Australia before the advent of fly-in-fly-out, with a population of 4,300 people and 800 kids in the one primary school. I lived and worked there; not only did I learn more about mining, I learned about the importance of community.

As a general observation, miners have forgotten that the basis of wealth should be exploration (and success therefrom). A greater exploration focus is needed – note how few exploration geologists are directors of the world’s biggest miners. Executive managements are transfixed on corporate finances and cost-cutting as the road to wealth in mining, and this isn’t the only case.

Think of the late Roy Woodall AO, a great explorationist and geologist, and one of Western Mining Corporation’s “group of six” credited with discovering

the multi-mineral Olympic Dam deposit. He embedded the exploration culture at WMC. Think of Bob Adams at Rio Tinto, the strategist behind its dual listing, its investment in Grasberg and its early investment in Escondida. He was a transactional man with insights into how miners could add value and make money. Both men understood mentoring, and both championed exploration and development.

Elsewhere, there are too many apologists for what mining does and doesn't do well. It's a fundamental industry. We should be proud of, and celebrate, it – not make excuses for it. On balance, it houses far more positives than negatives. Urbanisation is more destructive than mining, yet few comment on this.

The intensification of capital application clearly leads mining's incremental change, but 20 per cent of assets in mining generate 80 per cent of the value. So yes, safety and incremental productivity improvements are great – everyone's doing it – but the fundamental value equation is unearthing the best deposits – nothing makes up for grade. You can have clever people and throw lots of capital at existing deposits, but with (new) highest-grade deposits and the easiest mining methods, you'll make more money than anyone else. It's common sense, so why don't companies pursue this?

When did a major miner last find a deposit that changed its bottom line? Aside from smaller explorers, we don't see today's CEOs getting excited about finding and developing new, big deposits to fundamentally change their bottom lines. They improve existing deposits, but not create them: incrementalism versus step change. For example, at Newcrest Mining, we applied a distinctive approach in adopting block caving, hiring in requisite expertise. We created an orebody people thought would be a ho-hum at best. This type of step change sets up companies. Exploration is in the same mould.

About 80 per cent of Australia's metalliferous-bearing material remains "under cover." Application of advanced geophysics now allows miners to "see" down beyond 400 metres, so there's potential for a whole suite of new discoveries.

Mining's long-term – 50 years plus – approach requires greater source data developed with government sponsorship, an improved structure for access to ground with miners compelled to properly drill out prospects, mine development processes to proceed faster, access to base data and the imprimatur to act on it, and a "true union" between mining and government to facilitate base exploration.

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also Melbourne 2008

MARK CUTIFANI
Anglo American (Anglo Gold Ashanti)

"Given a 20 or 30 year life-of-mine, we can help create a life-of-community for 100 years. It's a licence to innovate and be part of the future."

For the past 30 years, my positioning for the mining industry has been its need to operate on a much-broader platform. We don't tell our story in terms of what mining means to – and, importantly, what it does for – the world.

With the advent of the COVID-19 pandemic, it struck me that many people don't appreciate how the world works. When lockdowns occurred, we asked politicians what they would lock down. The answer: "everything."

Would they turn off the power stations? "No." Do you need water? "Yes." How will people be fed? Most people don't keep three weeks advance food. "Some shops will stay open." We traced the conversation back to farming, fertilisers and the daily things that make society function – to get fed, get medicine and so on. At the end, the conclusion was: "that's 70 per cent of essential activities that will have to keep going every day." I said "yes."

So, when we ask what mining does for the world, the answers range from "digging holes and making a mess" to "we can't exist without it because of what it delivers."

Some context: the extractive sector produces 10 per cent of global GDP. Add the revenues that support and service industries derive from working with mining and there's another 10 per cent. Then there's our contribution to agriculture via fertilisers and materials used to generate farm produce and double productivity.

We generate products essential to build houses, for steel fabrication and for metals-based products for solar energy hardware. Apportioning mining's contribution to these fundamentals adds a further 25 per cent to global GDP. The total is 45 per cent. Mining's outsiders don't appreciate that mining's output makes their lives possible. Getting that message out to the broader population will start a very different conversation.

In a speech in Cape Town in 2019, I explained that to transfer out of thermal coal, the industry would have to deliver more copper, nickel and all the base products needed to support the solar energy, hydrogen and wind-generation sectors. Many of the coal-transition proponents in the audience hadn't made that connection.

As mining engineers and industry leaders, we must articulate what mining means to society and the world. I'm the first to admit that having an "extractives mentality" across sections of society is one-sided. We can't view mining without considering making a better planet. World Materials Forum[1] data shows that we produce twice the amount of sustainable products from mining than can be maintained in the long term. The world can't sustain this rate and continue to evolve and improve.

We must recycle more and move from an extractives mindset to a circular mindset.

1. The World Materials Forum is a non-profit organisation convened to share knowledge about the economic, political, social and environmental implications of global resource use. It aims to elevate on the agendas of policy-makers and business leaders the issues of global resource consumption and resource productivity.

All humanity must understand the role of extractives and how vital they are in making society work. I don't advocate unbridled mining, but to articulate mining's place in the big picture and its essential role in the planet's future.

Mining disturbs less than 0.5 per cent of the earth's surface and drives 45 per cent of the global economy. The agricultural sector uses 40 per cent of the earth's surface and has a devastating impact on climate change. The products of mining actually help reverse that impact. We don't hear the criticism of agriculture that we do for mining, yet mining helps ensure that for land dedicated to agriculture, we seek to minimise that footprint.

Addressing climate change requires more carbon sinks and producing more food from less land to bring the world into balance. We can't simply stop activity to achieve this. We need greater productivity from agriculture which, in turn, means mining products become more important.

Because we use so little land, we affect about one per cent of the global population. That impact is nonetheless significant.

For me a mine – a hole properly engineered – is a beautiful thing. For people living alongside, it's a major irritant. We must fulfil our environmental and social governance undertakings, our licence to operate, pay local royalties and partner with communities. We must stop being engineers working to Maslow's hierarchy of needs[2] and lecturing communities about what they need, and hear what they want.

Mining delivers infrastructure, transport, skills and financial capacity. We must apply these to local communities' benefits as they see it, not as we think they should see it. And in continuing our activities ask: "what can we do to help you create your community's future?" A mine with a 25-year mine life wants to proceed; in return it must build energy infrastructure, bring water, develop roads and create employment.

This provides the chance to turn subsistence living into commercial agriculture and help communities diversify their commercial bases. Given a 20 or 30 year life-of-mine, we can help create a life-of-community for 100 years. It's a licence to innovate and be part of the future.

For example, Anglo American has committed to creating five jobs off-site for every on-site job. If we don't create opportunities where we work, people don't want us there.

We can – must – assess our role in regional economies, invest in and connect with them. Regional collaboration in development is central to miners of the future.

For the past century we've mined the same way as always. But we've changed. We're still changing. With "future smart" mining, the next 100 years will be far different. The conversations might be tough and ugly, but we can't just keep getting bigger. We must change the fundamentals, continually embrace advancing technology for mining and processing, and simultaneously reduce our physical, environmental, energy, water and carbon footprints.

2. Maslow's hierarchy of needs is a psychological theory of motivation expounded by US psychologist Abraham Maslow in 1943. It holds that five categories of human needs dictate individual behaviours: physiological, safety, love and belonging, esteem, and self-actualisation needs.

20 | 14

CHUCK JEANNES
Goldcorp

“We need to learn not to fall under the spell of always maximising NPV when it means shortening mine life.”

The major themes of the past 20 years were largely consistent between diversified miners and gold companies, driven primarily by a dramatic increase in commodity prices from 2000 for most of the ensuing two decades.

For the diversifieds, price appreciation was driven by the growth of China’s economy. Drivers of the gold price are more complex, but the similarity is that both sectors were eager to grow their businesses to supply enhanced demand, using increasing revenues and equity valuations to acquire new reserves and build new mines.

The gold industry exploded in the 2000s in an unparalleled way. I always recall Barrick Gold’s discovery of the Goldstrike mine[1] in Nevada in the 1990s. All of a sudden, shareholders in this tiny, relatively unknown company became immensely wealthy as Barrick stepped into a 50-million ounce deposit. A new and large group of investors became interested in gold equities, dramatically changing the business.

Looking back at gold stocks in the 1980s and 1990s, the companies worldwide were fairly staid, consistent performers, valuations were modest and volatility was not pronounced. But with greater money chasing these companies came massive valuation and volatility increases, and many new entrants. That’s when gold companies – and this has lasted 20 years – began trading at significant multiples to net asset values.

Investors saw that if they invested in companies that might grow, either by acquisition or exploration success, they might achieve a “10- or 20-bagger” – a massive return on investment. As a result, investors willingly paid premiums for stock in order to gain optionality on growth.

The rush among investors, combined with increasing gold prices, meant there was more funding available for companies to explore, acquire and provide investors with the opportunity for significant success. That was the start of exciting times for the gold business. After a run in the gold price from 2000-02 to 2010-11, the enthusiasm was moderated by declining prices for a while, but the overall trend has been higher over two decades.

So the fundamental investment thesis for gold and base metals over this period has been sound, driving tremendous growth in the overall capitalisation of the mining sector. That’s the good story. The bad news is that when prices rise, you have to act in the moment – and the view in “the moment” was to grow aggressively because prices were moving higher. We all did that and, without exception, we suffered by overpaying for assets, with the benefit of hindsight informed by moderating metals prices, or by trying to build too many projects simultaneously, which drove scarcities of materials and talent, and thus cost overruns and delays in the delivery of projects as promised.

Miners compete for scarce natural resources. When they’re discovered, there is

1. Barrick acquired Goldstrike in 1986, and up to 2018 it produced 44.4 million ounces of gold.

naturally strong competition for those assets – and that drives up valuations. We're owned by shareholders and we're obliged to listen to them, but shareholders have shorter-term horizons than the investments that business itself demands. It takes six to 10 years or more to identify a resource, undertake feasibilities, build and commence operation of a mine.

While prices are rising, shareholders demand growth – increased exposure to the commodity in which they have invested. When prices fall, they understandably demand greater capital discipline, with returns of capital to shareholders rather than funding growth projects.

Growth becomes a bad word, but the reality is that in all cycles, growth is the primary determinant of share value. No-one buys a stock with the hope of flat revenue and earnings, and in a business where we don't control the price of our product, the primary way to increase value is to produces more ounces.

The challenge is that when we're all chasing growth simultaneously, we can make bad decisions. It's not growth per se that's the problem; it's the poor execution of a growth strategy that can derail a company. We need to make sound decisions, focusing on quality assets no matter where we are in the price cycle and, most importantly, have the right people to properly execute projects. Mining is a science-driven business to grow successfully and we need highly-educated and experienced people.

Miners can also iron out booms-busts by being more disciplined about the types of assets they acquire and how they build them. We need to learn not to fall under the spell of always maximising NPV (net present value) when it means shortening mine life.

Given the nature of the price cycles in our business, it's better to have a 15-year mine producing 100,000 ounces a year than a 7.5-year mine with 200,000 ounces a year. A key valuation metric should be how many times you can recover your capital investment over the course of a mine life. The higher that number is, the more likely you'll hit the good price cycles and deliver strong returns. Such discipline will also reduce overall capital spending, maximising shareholder returns.

The future? Mining doesn't get enough credit for its cutting-edge work in applying new technologies to an old business. The general public doesn't appreciate how high-tech our business is and instead views us as a low-tech "dinosaur" industry. We must keep educating about what we do. We are responsible stewards of the environment, our safety performance continues to dramatically improve, we greatly benefit the health and welfare of the communities where we operate, and our industry is highly-focused on the key issues of diversity and climate change. We need to redouble our efforts, be better about not just doing these things, but also communicating our successes.

Ultimately, miners dig holes in the ground and that can be perceived as negatively affecting the Earth, so we must mitigate that impact to the fullest extent possible and be excellent at providing overall benefits to society.

In the next 10 to 20 years, the mining industry will be much more efficient in the market place. An increasing percentage of revenues will be required for the quality work necessary to tackle issues such as enhanced environmental protection, achieving and maintaining social licence to operate, and decarbonisation.

Fewer but larger mines will be developed by fewer companies. Small exploration companies and their high-risk investments will always play an important role in discovering new deposits, but larger companies will increasingly dominate the project development and operations side of the business.

Overall, the future is bright for our industry as society will continue to require the metals we produce, and we will do a good job of delivering them in a profitable and sustainable manner.

20 | 15
also 2018

ALBERTO CALDERON
Orica

“We’ll never again see a China phenomenon. But globally we’ll see steady growth. Companies will be more prudent, have a greater focus on costs, and apply restraint to avoid over-supply.”

I’ve lived through the booms and busts and the long-term growth of mining. It’s always been important for Australia and, of course, the world. Nobody, however, anticipated the rise of China that led to redefining of mining around the world. No-one dreamed China could put together and sustain such economic growth.

China’s annual growth rate was 10-11 per cent for several years. It became the prime customer for the majority of the world’s consumption – half the world’s copper, aluminium, coal and iron ore output. Its growth removed supply bottlenecks and led to the building of ports, airports and roads. So, when I attended the inaugural MMC function in London in 2007 (speaker: CVRD’s José Carlos Martins) we were in boom years, with Australia’s BHP becoming the then third-largest company in the world (behind Exxon and Apple). That was driven by China’s growth.

Iron ore took off during China’s first phase of development. The need for steel naturally meant an increased demand for thermal and metallurgical coal. That was the first really big revolution. The fastest-growing entity in iron ore wasn’t BHP, Rio Tinto or Vale – which struggled to keep up with the pace of demand – it was China. It grew from producing 100 million tonnes to 800-900 million tonnes of steel annually. It was remarkable over a short timeframe.

Then came the 2007-08 Global Financial Crisis, followed in 2015 (when I first addressed the MMC) by China’s credit bubble that led the imposition of policies to restrain growth. This caused a steep slowdown which, in turn, created concerns for China’s major customers. China is now moving into its second phase of development. History has shown us that in this phase, steel tends to become less important, and at some point its consumption will actually decrease. On the other hand, as China transitions into this second phase, it’s expected that middle-income earners will demand whitegoods, cars and communications – all creating increasing demand for copper, nickel and aluminium.

Australia has benefited enormously from the scarcity of iron ore and the price at US$200/tonne instead of US$70/tonne, but it is a temporary windfall. What mining companies understand – and Australia must begin to grasp – is that the world’s growth will move to other commodities that are no longer dominated by Australia, as has been the case for iron ore.

I addressed the MMC again in 2018 regarding global warming and the much-needed technological development of renewable energy sources. There is no doubt that at some point, likely around 2050, the world will have moved to net zero carbon status.

Nevertheless, the technology doesn’t exist today that would enable that transition as swiftly as many of us would like. For as long as there is no competitive way of storing energy for months, some sort of non-renewable resources will still be needed because there is a technical limit to renewables.

World forecasters on energy trends suggest renewables might represent about 50 per cent of global energy generated by 2035, with the balance flowing from gas and

nuclear sources. So we still need some form of reliable energy; in Asian countries lacking natural resources, there will be ongoing dependence on thermal coal. These are necessary transition energy sources if we want to keep the lights on while the requisite technology is developed.

The technology used in today's batteries doesn't offer competitive storage. They never will. By 2040-50, we will have competitive storage. I'm confident mining companies will find the way forward in the next 20 years, and the larger companies will be best placed to do this. Orica, for example, has committed to a 40 per cent reduction in nitrogen oxide gas emissions by 2030. While this is rapid, most companies will be able to do this without breaking the bank.

Miners have learnt the lessons of over-supply and are now far more thoughtful about capital expenditure. There will be more brownfield expansions, fewer greenfield projects, more mine optimisation and de-bottlenecking. Scarcities of iron ore, copper, nickel, cobalt and aluminium are known. For the biggest mainstream commodities, things will be fine: there is insufficient copper in the world so there will be scarcity in the next decade, and projects not yet started will have to come on stream.

For smaller, newer commodities there may be scarcities. Rare earth minerals attract great hype; perhaps they're not so rare. Overall, miners must be careful about understanding the size of world markets relative to how scarce the relevant commodities are.

We'll never again see a China phenomenon. But globally we'll see steady growth. Companies will be more prudent, have a greater focus on costs, and apply restraint to avoid over-supply. This won't change. Large companies that are able to have or find large resources of copper will be winners. It's difficult to find good, large-scale copper deposits (it would be rare to find another Escondida), but those companies that can't or don't will miss a beautiful opportunity when copper's scarcity bites the market.

All of the above is necessary, but not sufficient. It is safety that keeps all miners awake at night. It should. We've got better at it, but it's not perfect. Events such as the Brumadinho dam disaster in Brazil in 2019 with multiple fatalities should never happen. In an industry where workers lives are so paramount, there must be an absolute commitment to safety. This is doable: responsible mining should ensure that it has processes in place that if followed all of the time, they will ensure zero harm.

20 | 16

DAVID HARQUAIL
Franco-Nevada

"The key challenge for the mining industry for the next 20 years is finding and developing the next generation of mining camps."

A highlight during my term as CEO of Franco-Nevada was the opportunity to address the Melbourne Mining Club (MMC) in early 2016. I'm honoured to have the MMC request my views on the past 20 years for our industry and the outlook for the next two decades.

Since my Melbourne talk, I have had the benefit of further opportunities to broaden some of my original perspectives. One of these was the opportunity to chair the World Gold Council (WGC) from 2017-2020. Its members include the world's leading gold mining companies.

The WGC has become the world's most-effective commodity market-development organisation. Its authoritative research has made it respected by policy makers and central banks around the world. It has helped modernise market infrastructure and it has developed new gold investment products such as the gold exchange traded funds (ETFs). Most importantly, the WGC has allowed the gold industry to speak with one voice and initiate collective actions. In 2019, this was highlighted by the member companies of the WGC adopting the Responsible Gold Mining Principles (RGMPs).[1]

This highlights one of the themes in my 2016 talk when I spoke about the changing ownership of public mining companies. Twenty years ago, retail investors, pension funds and specialised resources funds dominated share registries. Today, it's generalist and index funds.

With this shift has come an increased focus on capital allocations, returns and environmental, social and governance (ESG) criteria. Adoption of the RGMPs by the gold mining industry is just one example of the industry responding to the needs of its new owners. Hereon, there is no doubt that public mining companies will need to juggle ever-increasing demands from a multitude of stakeholders.

One of the continuing dangers of generalist investing is the lack of appreciation of the need to risk-adjust mining returns and how much more cyclical mining is relative to other sectors. Managements and boards are pressured by generalists to financially engineer shorter-term returns through leverage and share buy-backs.

The experience of 2015-16 demonstrated why this was a bad idea for even the largest of the diversified miners. Moving forward, managements and boards will have to educate their generalist investors on the need for appropriate longer-term capital structures with a strong component of permanent capital.

The other challenge for even the larger public mining companies is staying relevant to the generalist investor community. This requires not only competitive returns to other sectors of the market, but also competing with new investing alternatives or business models in the mining

1. The WGC's 51 Responsible Gold Mining Principles comprise a new framework setting out clear expectations for consumers, investors and the downstream gold supply chain as to what constitutes responsible gold mining.

business. These include the commodity and equity ETFs, the royalty and streaming companies and – increasingly – private equity.

Franco-Nevada is a royalty company and is among new business models in the mining business, recognised by generalist investors as "the gold investment that works" or as "a gold ETF on steroids." It has also partnered with mining to provide capital on terms that are less-dilutive, less-invasive and more permanent than other forms of capital.

The key challenge for the mining industry for the next 20 years is finding and developing the next generation of mining camps. Unfortunately, the past two decades have shown that mining has been geologically more restricted and is getting less efficient at greenfield exploration. Brownfield exploration has been a temporary solution, but is delivering increasingly diminishing returns. The need for renewed greenfield exploration is inevitable.

Five years ago, I made a financial commitment to Laurentian University in Sudbury, Ontario, to fund its Mineral Exploration Research Centre (MERC). It's the collaborative research arm of the generously-named Harquail School of Earth Sciences. Why Laurentian and Sudbury? It is a university that is in a "mining camp" connected to a cluster of industry and government research activities. It is one of the largest exploration-focused, hard-rock geology schools in the world, with 86 Masters and PhDs collaboratively undertaking geological research.

MERC was able to leverage my commitment with more than C$100 million in research funding and it is now (2021) mid-way into a project called Metal Earth that aims to improve greenfield targeting. These large collaborative science projects are more appropriate for government and academia to fund, but the opportunity is there for industry to leverage this work.

The discovery of orebodies has the biggest multiplier effect in the creation of new wealth for society. Society can argue about how to share the wealth, but the orebodies need to be discovered first. For the next 20 years, this will be our industry's greatest challenge.

20 | 16

MIKE HENRY
BHP
(formerly BHP-Billiton)

> *"Investors and the broader public have higher expectations for corporates, and the response to unmet expectations is now fast and furious."*

When I moved to Australia in 1999, it was an exciting time in mining. Consolidation was seeing smaller players fall by the wayside and bigger players taking increased stakes in assets they held. Some Australian companies had become, or were becoming, multi-national in nature (for example, the CRA-RIO merger in 1995), and in 2001 BHP merged with Billiton plc. It was a dynamic period.

It would be easy to look at mining then and now, and question whether much has changed. Indigenous rights and heritage, and climate change were already well on BHP's agenda. There was a big focus on the environment. In late 1998, the Federal Government also pulled together a Resources Strategy[1] laying out the opportunities for resources and the advantages Australia wanted to create.

Heading into the China boom, there was particular opportunity to grow value via increased production. As the following 15 years played out, it was hard to get things wrong in resources. Some companies made more mis-steps than others, but if you were in the industry and in the right commodities, you were most likely going to do well. As a result of this environment, there was less focus on strategic differentiation between companies.

The challenges ahead will be different in respect of where the value opportunities lie.

With China's growth (while still significant) slowing, returns will be less defined by a demand-driven super cycle, and more by companies that demonstrate year-in-year-out operational excellence, continuous improvement, competitive advantage through technology and higher margins.

Without a doubt, over the next 10 to 30 years there will be some commodities that will be winners and some commodities where the risks are skewed to the downside. Ensuring you've got the right exposures in your portfolio and that you're leveraged to the bigger trends unfolding around us will be important as well.

BHP analysis indicates that as the world takes more aggressive action on climate change, a number of the commodities we produce stand to benefit from this action. I've been clear on wanting to increase our options to grow further in future-facing commodities – copper, nickel and potash foremost among them.

The growth over the past 20 years in focus on issues such as climate change, indigenous cultural heritage, water stewardship, biodiversity and community engagement has created new challenges (and opportunities) for mining. Investors and the broader public have higher expectations for corporates, and the response to unmet expectations is now fast and furious.

The growing public commitment to operating responsibly should be welcomed. However, the faster that alignment on expectations and standards can be achieved, the better.

1. In 1998, the Australian Federal Government released a Resources Policy Statement that provided a strategic framework for the nation's minerals and petroleum sectors to set world standards of performance to maximise investment and competitiveness.

In today's rapidly-evolving environment, there are many individual positions being taken, that – given enough time – will trend towards the right ESG solutions, but the reality is that on some issues the world doesn't have enough time to learn just through trial and error.

For instance, divestment of companies that hold fossil fuels could simply drive unsustainable assets off grid and into the hands of those who are less committed to ESG and transparency.

For companies to operate effectively against this backdrop, maintain support from their broader stakeholders and continue to secure opportunities and create value, they must be led in different ways and relate differently to those around them than in the past.

The concept of licence to operate implies doing what's necessary to maintain support, with the possible connotation being "but no more." It's seen as somewhat of a trade-off between creating value for shareholders versus generating value for everybody else.

That's a limiting concept and approach to leadership. Companies able to think about generating mutual value for all can create outstanding shareholder returns and outcomes for stakeholders beyond the shareholder base.

That tension will give rise to new ways of doing business and allow us to grow the total contribution a company can make to society beyond the ways we have traditionally focused on.

But for the world to achieve its ambition of addressing climate change, continue to grow the global economy and lift living standards, it requires a greater commodity-intensive effort than most people recognise.

For example, in a Paris-aligned, 1.5 degree scenario, the world will need twice as much copper and four times as much nickel over the next 30 years than it did in the past 30 years. So, commodity production will need to continue to grow.

At the same time, the rate of discovery and development of large new deposits is declining. When they are found, it's harder to get projects up and running than it was in the past, and often the deposits are deeper or lower-grade, posing further challenges.

Globally, we are also seeing increasing expectations for the industry and faster convergence between jurisdictions than in the past.

Companies that can overcome the technical challenges, and have an approach to leadership and engagement that allows them to navigate the complex stakeholder dynamics, and have a superior track record on ESG and the way they go about dealing with it, will be the winners in the coming two decades.

Commodities are essential for the functioning of the world – full stop. To achieve ongoing economic growth, improve living standards and – importantly – the energy transition, we will need even more production of resources.

This needs to be achieved in the face of an increasingly complex and dynamic operating environment.

I believe there will be a natural advantage that accrues towards large, sophisticated companies that demonstrate the technical and cultural capability required to meet these challenges.

20 | 16
also London 2017

GRAHAM KERR
South32

"It has become clear that social licence to operate and ESG are no longer separate issues for investors – they must be integrated into business strategies and plans."

At South32, we have had a clear purpose since day one and that's to make a difference by developing natural resources, improving people's lives now and for generations to come. We are trusted by our owners and partners to realise the potential of their resources. When mining is done well, it provides great opportunities and helps to lift people out of poverty.

Mining has evolved in many ways in the past few decades and so, too, has the way we engage with the people and communities in the places where we operate. I expect to see that evolution continuing as we move towards a greener, low-carbon future. We've already seen huge advances in technology that are contributing to a safe, cleaner and more productive industry.

Even as we see huge leaps forward, there are still incidents that set mining back. The Samarco and Brumadinho tailings dam collapses in Brazil, each causing multiple fatalities, were unacceptable and put mining on the back foot, as did the destruction at Juukan Gorge. These events overshadow some of the great work carried out in mining and show we've still got a lot of work to do as an industry.

We must learn from these events as we plan for the future, ensuring safety remains at the core of everything we do, while at the same time working to protect our environment for future generations. We must collaborate to set global, industry-wide standards to cultivate and ensure best-practice. Societal expectations continue to evolve at a rapid rate and it's critical that we keep pace.

Through mining, I've been fortunate to have worked around the globe, witnessing first-hand how mining can impact people's lives for the better. I was fortunate to work at the Ekati diamond mine in Canada's Northwest Territories when it was being built, and later I managed the business. It operated in a pristine environment and we hired people from the First Nations community that was struggling with significant social issues.

Ten to 15 years into the mine life, children of those first people hired returned to the communities, having been sponsored through school and university. That's the real difference mining makes – it can be done sustainably, and in a way that enriches people's lives for the long-term.

That's why the industry has a responsibility to continue talking about the benefits it delivers. Raising awareness about the end-uses of mined commodities is critical – these resources are in the cars we drive, the houses we live in and the technology we use to communicate. They play a critical role in life today and we need to demonstrate that when we produce minerals and metals in a sustainable, carbon-friendly way, with minimal impact, it's good for the world.

Looking to the future, the mining industry must engage differently. Miners need to demonstrate through the value chain how they make a positive impact. In the past, the focus was on issues such

as education, water supply and community support. Now, there's scrutiny of the whole value chain – from greenhouse gas emissions, to product stewardship and modern slavery impacts that may enter the supply chain. It's more multi-dimensional than five, 10 or 15 years ago.

The way the mining industry engages has already changed significantly. There's greater transparency, greater alignment with ICMM principles guiding what we do, and granular detail around mine standards.

At South32, it comes back to our purpose. We've worked hard to earn the trust of our communities, governments, customers, shareholders and people. We don't ever take that trust for granted and we are committed to engaging with all our stakeholders.

Shareholders are now expecting more from companies at an ESG level, from how mining benefits local communities, to climate change and emission targets. It has become clear that social licence to operate and ESG are no longer separate issues for investors – they must be integrated into business strategies and plans. This focus and transparency will only increase into the future.

At South32, our strategy is based around the global transition to a low-carbon future. We are reshaping our portfolio to have a bias towards base metals which will be in even greater demand in greener economies. We are focused on decarbonising our existing operations, securing green energy and designing growth projects to be carbon-neutral and use low-carbon technology. Already, we are seeing the cost of renewables decreasing at an exponential rate and the technology for batteries is also rapidly evolving. Batteries will develop to become smaller and more powerful over time.

The world needs commodities and our industry must continue to invest in exploration to ensure future supply. South32 has a pipeline of opportunities we are investing in through the drill bit that may become the mines of the future. Australia needs to be globally competitive to attract exploration dollars. Governments must support investment in mining, ensure fiscal stability, a competitive tax regime and title tenure to foster the environment for ongoing investment.

Mining is an essential part of our future, and I believe when done well, it can deliver prosperity and opportunities to many.

20 | 17

IVÁN ARRIAGADA
Antofagasta

“. . . we must imbed and fully integrate social value creation into our culture and capital allocation framework.”

Our industry has changed a lot in the past 20 years. When I first joined the industry, success was almost solely dependent on the quality and quantity of the orebody, with a small fraction depending on sustainability-related issues including relationships with host communities.

Today, that has changed, with much of the change taking place over the last decade. For the mining industry to be a trusted and sustainable industry, its legitimacy depends on the ability to create social value for its various stakeholders alongside financial value for its shareholders.

What do I mean by social value?

For Antofagasta, social value is delivered through our purpose – to develop mining for a better future. This means recognising that to gain legitimacy, mining needs to move in step with societal expectations on critical issues such as responsible sourcing, supply chain integrity, protection of human rights and environmental stewardship.

This ensures that we are operating in a way that benefits all stakeholders, especially the communities near our operations. It also means that we should no longer think about a social licence to operate, as if this gets granted and then we can continue as we want, but instead we must imbed and fully integrate social value creation into our culture and capital allocation framework.

I am proud of the work that we have done at Antofagasta so far to advance our contribution to social value. We are continuously developing talent and increasing the diversity of our workforce, particularly as it relates to female participation and bringing in the next generation through our apprenticeship and graduate programs. We are redoubling our efforts to work with the communities near where we operate, including partnering with them on heritage protection initiatives, community development projects and their participation in development plans. In 2020, we committed to adopting the Copper Mark standard as a further step in demonstrating that our copper has been produced responsibly.

These steps are part of a broader, long-term plan to ensure our mines and the way in which we operate them create true social value for all our stakeholders.

Our commitment to value creation is strongly intertwined with where we operate – Chile. The growth of the mining industry in Chile has been led by copper, especially in the earlier years, and is today still integral to the nation’s prosperity, representing 10-12 percent of GDP and accounting for about 50 percent of exports.

The revenue generated from mining and related activities over the years has made an important contribution to funding essential services in Chile such as education, health care and infrastructure, and has helped Chile develop from an emerging market to a member of the OECD.

During the pandemic, our industry's contribution has been important in assisting the Chilean Government in saving lives and protecting livelihoods as it has continued to operate safely throughout the period.

Climate change is another vital challenge for which Chile is taking leadership, targeting zero carbon emissions by 2050. The country is investing heavily in renewable energy, electro-mobility and hydrogen research solutions, among others. And the Chilean copper industry is responding by providing the world with a third of the copper it requires and by working towards its goal of responsibly producing "green copper" from renewable energy sources.

This role is fundamental – right now – for Chile and the mining industry. As with many of my peers, I feel the urgency to act on the issue of climate change and I know that this sentiment is a collective one, shared by many globally.

Beyond taking responsibility for our own emissions and water use (things that society expects of us), we as an industry need to look beyond our own borders and boardrooms, and address climate issues head on.

A recent World Bank study set out that the global move to renewables will increase demand for many metals including copper; a metal which is essential to the construction of wind farms, solar panels and electric vehicles – all of which require significantly more copper than their conventional alternatives. As such, the copper industry is a key enabler for the low-carbon economy and vital for this fight against climate change.

With this need comes responsibility. What happens now, and how we behave, is key to the future of the success and acceptability of our industry.

We need to be both flexible and resilient. We have an opportunity to build a strong societal foundation based on the global need for copper, making sure to balance the financial, social and environmental impacts with our stakeholders, and at the same time have the governance and transparent structures necessary to support us.

We must continue to work closely together to share our innovative thinking, entrepreneurial spirit and safety-first attitude (which has come to define our industry) as we look to apply those skills and our knowledge to the challenges of our time, and help the world transition quickly and responsibly to a low-carbon reality.

20 | 18

ANDREW COLE
OZ Minerals

“Arguably, we are in prime position to lead all sectors in the minimisation of our operational footprints, our carbon emissions and the way we work with people . . .”

In our world of constant change, a resource company cannot stand still.

We cannot choose to ignore all that is evolving around us nor the growing demands being placed on us.

We need transformational change to be successful and use strategies that are different to those used over the past few decades – moving beyond just reacting to threats and instead, seeing opportunities to get ahead of compliance and create our own agenda that not only respects stakeholder expectations, but creates value for all of them.

For OZ Minerals, being a modern mining company is key to realising this.

The safety of people is non-negotiable. This is not unique to OZ Minerals – nearly every resource company would hold this to be THE priority amongst all others.

In pursuit of safety and measuring outcomes, a compliance bureaucracy of quite some complexity has been created; a robust, complicated approach motivated by our pursuit of zero harm.

This has been the solution to safeguard people in the challenging conditions in which we operate – and we got very good at it as an industry.

While this has helped to significantly reduce workplace injuries, it came with the price of being consumed by our own – often self-imposed – regulations, policies, standards and procedures, and being trapped in a “compliance mindset.”

What has protected us so far has also morphed into something that discourages agility and discretionary effort; that encourages herd mentality rather than independent thinking, as we are in constant vigil about making mistakes and being non-compliant.

That is not to say that compliance should be completely done away with. However, people need to be allowed the space to own their work, challenge existing practices, find better ways to do things and make mistakes to learn, and demonstrate the true (not just financial) value that resource companies can generate.

Mining has traditionally been deemed a “necessary evil” – an industry that generates economic benefit, but also one that damages our environment and uses people as tools to exploit our primary assets – the mineral resource. It is an industry that has a significant footprint on people and the planet.

For us, this means a big responsibility and an equally big opportunity for our work to make a positive impact beyond just maximising today’s share price.

Arguably, we are in prime position to lead all sectors in the minimisation of our operational footprints, our carbon emissions and the way we work with people, given our technical nous and ability to determine how inclusive we are in going about what we do.

We see this as our way forward. This cannot be done through regulation.

We see our chance to enable transformative change in responsible consumption and production, quality education, economic growth and improving people’s lives.

We at OZ Minerals predominantly mine copper, an important mineral for the renewables industry and the future of our planet. We are also implementing renewable energy in our operations.

We aspire towards minimising water use and adding value when we do, emitting zero Scope 1 emissions and systemically reducing Scope 2 & 3 emissions across our value chain, and consuming and producing in a way that generates zero net waste and creates value for ALL our stakeholders.

We prioritise sustainable local procurement and employment, and our social contribution programs seek to build enduring partnerships that are aligned with, and supportive of, community aspirations. We help create sustainable local businesses, and train people to build collective capability. We are also committed to working with land-connected peoples in protecting their culture and heritage.

Our purpose – going beyond what's possible to make lives better – reflects our belief that our work into the future needs to be about contributing to society through innovation, commitment to a healthy environment and generating economic opportunity for all.

We are on a journey of working towards our purpose. It is complex. It requires iteration, dedication and commitment, and is built on organisational culture – not regulations, policies, standards and procedures. But we recognise that it is the daily and incremental changes, and challenging ourselves to do better each and every day, that will help to make a difference.

20 | 19

ELIZABETH GAINES
Fortescue Metals Group

"The business sector is in a privileged position to take the lead and tackle the challenges associated with climate change . . ."

Firstly, congratulations to the Melbourne Mining Club for achieving this impressive milestone. Twenty years is a significant accomplishment for a renowned organisation that has been a strong advocate for the Australian resources sector.

Fortescue's journey dates back 17 years, when our Founder and Chairman Dr Andrew Forrest AO started the company. During this time, we have discovered and developed major iron ore deposits and constructed some of the most globally significant mines, establishing ourselves as a world class company.

From the outset, Andrew recognised that China was preparing for huge growth and saw an opportunity for Fortescue to supply the growing demand for iron ore. Today, Australia's resource sector is the powerhouse of our economy. However, this hasn't come without challenges.

Fast forward to 2020, and I think we would all agree, it was a year like no other, and one we hope we never have to experience again. I've been particularly proud of our industry's response to COVID-19, and when I say "industry," I mean that in the broadest possible sense – our contractors, suppliers, local businesses and communities.

We banded together to manage industry-wide issues, we shared best practice, we cared for our most vulnerable and we formed a united front.

Significantly, we clearly demonstrated that Australia is a reliable supplier of commodities to global markets and we sustained our strong contribution to the West Australian and national economy.

Australia's trading success is built on strong partnerships and now, more than ever, it is important that we maintain good relations with existing trade markets.

Business must continue to influence the critical policy debates that will impact our future success, and the most critical of these is our Australia-China relationship.

While COVID-19 has presented a range of challenges and uncertainties in 2020 (and into 2021), we cannot lose sight of broader issues that we must address, and at the top of that list is climate change. The United Nations has said that this is a critical decade for emissions reductions.

The business sector is in a privileged position to take the lead and tackle the challenges associated with climate change, and as the world looks to a low carbon future, we need to ensure Australia capitalises on the opportunities from renewable energy.

In 2020, Fortescue announced an industry leading target to be net zero operational emissions by 2040, underpinned by a pathway to decarbonisation through practical initiatives.

Further to investing in our operations, we are progressing with plans to develop hydrogen technologies, building on our existing supply chain capabilities to position Australia at the forefront of the establishment of a bulk export market for hydrogen and meeting the needs of key prospective markets like Japan, Korea and China.

Hydrogen is just one example of how we can build partnerships and trading relationships that can open new opportunities and markets as our economy grows over the next 20 years.

Fortescue was founded with the belief that communities should benefit from our success, and empowering thriving communities is part of our DNA.

I believe training and education are the building blocks to driving sustainable change in people's lives, careers and communities and as we move forward, there is a significant opportunity to train our people with the breadth and depth of skills our future economy needs.

While technology and automation will be an important part of our future workforce, this shouldn't come at the risk of jobs. At Fortescue, we have successfully rolled out autonomous haulage across our operations, and this project has seen 3,000 people trained in autonomy – from driving in autonomous zones, through to managing our mine control systems. And every team member who was impacted by the introduction of autonomy was offered the opportunity to upskill themselves to take on new roles within the company.

From the outset, it has been our vision to empower Aboriginal people to bring about generational change through training, employment and business development opportunities. By continuing to work in partnership with our Native Title partners, we will build on our track record of providing economic opportunity to Aboriginal people.

COVID-19 has brought home the benefits of working flexibly and remotely, and the significant opportunity for people to have a city job, while living in the country. And the benefits are considerable – de-congested cities, increased population and vibrancy of our regions, and improved work/life balance for families, to name a few.

The mining industry has long contributed to our regional communities, but for our regions to thrive and attract individuals and families from our cities, we need to see significant investment in our regional communities such as public transport infrastructure.

We should be excited about the opportunities for the mining industry to lead. By keeping our values at the heart of everything we do, we will continue to ensure the safety of our people.

Our success will be built on relationships – with our communities, traditional custodians, customers, team members and shareholders. As we look ahead, we will be guided by our values and our unwavering focus on safety and family, and we will continue to work closely with our industry peers.

Once again, my sincere congratulations to the Melbourne Mining Club for their 20-year milestone. Here's to 20 more!

20 | 20

PETER BRADFORD
IGO

> *"Failure to invest and innovate to meet the demands of clean energy markets, whether for renewable energy applications or electric vehicles, could incentivise substitution."*

Over recent decades, the improvements in mining technology and economies of scale have allowed mining production to expand significantly. However, grade profiles have fallen, and investment in exploration and discovery to replace reserves has not identified the future supply necessary to meet ever-increasing demand for metals due to the increasing global population, the development of emerging economies and – most recently – the acceleration of the global transition towards clean energy in the face of climate change.

Decarbonisation and the transition to clean energy will be highly disruptive, with both being winners and losers. For those metals critical to enabling clean energy, disruptive, increasing demand combined with under-investment in exploration and discovery and development over recent decades, is likely to create a super cycle of under-supply and elevated pricing not imagined until recently.

This dynamic will likely act as a catalyst for increased exploration and discovery, as well as innovation across all aspects of the supply chain to explore deeper, under cover and at lower cost, to rethink mining and processing to reduce our footprint, and to unlock opportunities to combine upstream and downstream processing activities to increase efficiency, reduce waste and create more value.

Failure to invest and innovate to meet the demands of clean energy markets, whether for renewable energy applications or electric vehicles, could incentivise substitution. For instance, under-supply of those metals critical to electric vehicle (EV) batteries could incentivise EV manufacturers to accelerate R&D efforts to design new types of batteries and find a different way of manufacturing them without the traditional commodities. Alternatively, the lack of supply and higher prices will significantly hamper the adoption of new technologies to the point where targeted decarbonisation milestones won't be reached.

The root of these issues stems from lack of investment by the mining industry. Many mining companies have prioritised brownfield expansions to tap into existing resources, while neglecting the critical investments required in greenfield and generative exploration. In many ways, this is understandable given investment markets have demonstrated little appetite for this type of exploration activity, and instead favour lower-risk brownfield activity; perhaps if investors shift their perception of exploration, to view it through the same lens that investors in the pharmaceutical sector view R&D.

These investors understand the risk of taking a new drug from R&D through to commercialisation, and the significant reward that is available should a company be successful. Exploration in the mining industry is no different, and is vital if the industry is to deliver the mines of the future.

Our industry's under-investment in exploration and discovery over recent years has arisen due to a short-term perspective on the allocation of capital for the mid- to large-size mining companies, and an inability (until very recently) for the juniors, who have traditionally driven much of the entrepreneurial exploration activity, to attract investment capital. The key then is for the mid-tiers – who have largely ignored exploration (greenfield exploration in particular) in favour of focusing on mining

deeper within existing deposits and brownfield drilling around these deposits until they become more marginal – to lift their game.

The other key opportunity for our industry is to do more than simply mine; to unlock greater value via vertical integration. Currently, each stage of mining and processing tries to find a neat book-end at which to transfer product to the next stage in the supply chain. The big opportunity is for industry to leverage its strengths in innovation to find ways to make our industry more efficient by thinking and acting as part of an integrated manufacturing stream.

We recently did this at a micro-level to assess converting nickel sulphide concentrate into battery-grade nickel sulphate, thereby removing the requirement for 2-3 stages of processing (ie smelting, refining and then conversion to battery-grade nickel sulphate). By itself, this innovation is a great step forward, but could be taken further.

Rather than crystallising a battery-grade nickel sulphate product in a solid form for shipment to market, where it would be re-dissolved and then re-crystallised to make cathode precursor chemicals, liquid nickel sulphate solution could be pumped over the fence to a co-located cathode precursor process. This more-integrated, end-to-end process would potentially unlock greater value.

Why wouldn't people do this? It's all about where the markets are, whether it makes more sense to ship nickel sulphate rather than make cathode precursors in Australia and ship those. There are perceptions of what miners are good at versus what are downstream processors' capabilities. And there are market perceptions that pigeon-hole the respective capabilities of different jurisdictions.

Australia has the potential to become a more complex and therefore sustainable nation by moving away from the "dig it and ship it" mentality and move downstream to unlock greater value for Australia from our resources. The risk is that if we don't, we will not have the economic diversification to sustain our way of life when the resources ultimately run out.

From an ESG perspective, mining today is undoubtedly doing a far better job than 10, 20 or 40 years ago. What we are yet to do well is successfully communicate to society the importance of mining, how well mining is conducted today, and the degree to which our impact on people, communities and the environment is reduced as well as the immense efforts mining companies are making to ensure their licence to operate.

The proposition around decarbonisation, metals for EVs and new-generation batteries allows us the opportunity for a "brand refresh" to capitalise on our good work and deliver a totally different value proposition to society.

The way to do this, is for mining companies nationally and globally to get with the same program; to better articulate mining's value proposition – why mining is important –and ensure that contribution is understood. Mining needs to be, and needs to be seen to be, a part of the solution, not the problem.

20 | 21
also 2017

SANDEEP BISWAS
Newcrest Mining

"The biggest change in recent years, and certainly into the future, is the growing importance of ESG matters to investors, governments, communities and civil society."

One of the things that drives me relentlessly as an individual and, by definition, Newcrest is the safety of our people.

Mining has come a long way since my earliest working days at Mt Isa. Safety was always mentioned, but not to today's extent. With the word "safety" now comes genuine care, concern, and work systems and processes that really dig deep – whether it's a behavioural system, standard-of-work system or process safety (which mining has adopted from the oil and chemical industries).

As an industry, we have suffered in the past because we haven't moved uniformly across all geographies in pursuit of safety.

Unfortunately, our industry is judged by the lowest common denominator. It doesn't matter what our record is on average; the poorer examples – safety or otherwise – always drag the whole industry down and attract commentary and media coverage.

Now the industry is moving forward together to take on this challenge. I am pleased to see that the International Council on Mining & Metals, the World Gold Council, the Minerals Council of Australia and other institutions have safety firmly on their agendas, focusing on the key things they want to work on and enabling sharing of what has successfully worked for the industry.

Before I joined Newcrest, there was on average one fatality a year, and four fatalities occurred over a 21-month period after I arrived. I was devastated by these, as were all people at Newcrest with, of course, the deepest devastation experienced by the families and friends of those who died. Things had to change in order for there to be no more fatalities, and our safety transformation plan was formulated. Now we're close to six years fatality-free.

This safer workplace flows from our NewSafe program, which focuses on cultural change, team ownership and building safety leadership at all levels. It is the best behaviour-based safety program I've seen in 40 years of mining. It's also driven by our Critical Controls program and our Process safety program.

Technology has played a big part in safety and will play an even bigger role in all areas – from systems for monitoring people's health and fatigue to keep them safe, through to automation, artificial intelligence, ground-control systems and safe design to name just a few areas. Collaboration between industry players will be a key enabler of faster implementation of these technologies.

The biggest change in recent years, and certainly into the future, is the growing importance of ESG matters to investors, governments, communities and civil society.

With the benefit of hindsight, mining has not moved as quickly as it could have to embrace the challenge of greenhouse gas emissions. Decarbonisation imperatives were not fully appreciated and mining was caught relatively unprepared. As an industry, we're now playing catch-up, and we are doing so at speed.

For example, at Newcrest, our Cadia site is one of the largest coal-fired electricity consumers in New South Wales. We have recently entered into a power purchase agreement which, when coupled with anticipated decarbonisation of electricity generation in the State, is expected to reduce our total energy intensity per tonne of ore treated by about 20 per cent. Fossil fuels will continue as part of the power supply, but our ultimate goal is to power Cadia from renewable sources.

The advantages also are that technology is catching up on our expectations. Once battery technology becomes economically viable at scale, we will be able to increasingly utilise solar and wind power without the need for a fossil-fuel firming power.

We can now technically convert all our vehicles to non-diesel power – it's just a question of duration and economic viability of battery pack lives. At our Red Chris mine in Canada, the major power source is hydro-electricity, which means our focus can be reduction of on-site emissions that are predominantly diesel-fuel based.

A further challenge is attracting the right people. We need the best people right from the front line – from among graduates and all levels of the industry – to make this a reality.

All aspects of the mining business are high tech and can offer people rewarding careers across multiple disciplines. While historically we haven't marketed this well and we made short-term decisions such as cutting back on graduate and apprenticeship intakes during downturns, we recognise that we must now adopt a significantly different approach.

We must be far more strategic in our thinking to attract and engage young minds to lead us forward. Automation can take us only so far. We need core technological and technical skills, and we need the right people joining our industry and across management and technical ranks.

We want people in mining for the right reasons. We need to say "come and join us" – we have the intent, will and resources to make meaningful changes in areas vital to younger generations. The new generations, and not only them, want purpose: it's not about a job but a greater purpose.

As an industry insider, I think we tick all the boxes for any young person with a purpose to make a difference, but we have to earn their trust. I see signs that this is changing and younger generations increasingly want to be a part of mining to make a difference.

Part of the talent search embodies securing diversity of thought, opinions and ideas to generate innovations and creativity to carry the industry forward. Inclusion is the priority in getting that diversity of thought – only through genuine inclusion comes genuine diversity. We need people from all walks of life, technical and non-technical, creative, numerate, from different genders, ethnic, socio-economic and cultural backgrounds.

Societal expectations and social licence mean there's far more demand – as there should be – in terms of contributions we make to develop local communities, their education standards and their countries. Ultimately, we must deliver shareholder returns, but how we do it is increasingly important.

We're under high scrutiny – locally and globally. There are many good things we do. We have a great story and we do add value. We've got to work harder at doing things better and communicating them so that the world at large can truly appreciate how much good comes from our industry.

Keynote Speakers – Melbourne

2001

August	WMC, Chairman, Sir Arvi Parbo AC
October	Rio Tinto Australia, Managing Director, Barry Cusack
December	Newcrest Mining, Chairman, Ian Johnson

2002

February	Normandy Mining, Chairman & CEO, Robert Champion de Crespigny
April	ICMM, Secretary General, Jay Hair
June	WMC, CEO, Hugh Morgan AC
August	Rio Tinto, Chief Executive, Leigh Clifford AO
October	BHP Billiton, CEO, Brian Gilbertson
December	Christmas: Past, Present & Future – Panel discussion

2003

February	MIM Holdings, Managing Director, Vince Gauci
April	Pasminco, CEO, Greig Gailey
June	WMC, CEO, Andrew Michelmore AO
August	Newmont Mining, President, Pierre Lassonde
October	Woodside Petroleum, Former CEO, John Akehurst
December	Gold Fields, CEO, Ian Cockerill

2004

February	Oxiana, Managing Director, Owen Hegarty OAM
April	Newcrest Mining, Managing Director, Tony Palmer
June	Ivanhoe Mines, Founder and Chair, Robert Friedland
August	Alcoa and past chair London Metal Exchange, John Pizzey
September	Rio Tinto, Chief Executive, Leigh Clifford AO
November	BHP Billiton, CEO, Chip Goodyear
December	Victorian Miners – Panel discussion

2005

February	Minara Resources, Managing Director & CEO, Peter Johnston
April	Inco, Chairman & CEO, Scott Hand
June	Federal Minister for Industry, Tourism & Resources, The Hon Ian Macfarlane MP
August	Iluka Resources, Managing Director & CEO, Mike Folwell
October	Falconbridge, CEO, Derek Pannell
December	The Chinese Ambassador to Australia, Madam Fu Ying

2006

February	Jubilee Mines, Executive Chairman, Kerry Harmanis
April	Macarthur Coal, Managing Director, Ken Talbot
June	CVRD, Executive Director of Ferrous Minerals, José Carlos Martins
August	Teck Cominco, President & CEO, Don Lindsay
October	Barrick Gold Corporation, President & CEO, Greg Wilkins
December	Alcan Bauxite & Aluminium, President & CEO, Jacynthe Côté

2007

February	Zinifex, Managing Director & CEO, Greig Gailey
May	Rio Tinto, Chief Executive, Leigh Clifford AO
June	Newcrest Mining, CEO, Ian Smith
August	Alumina, CEO, John Marlay
October	Lihir Gold, CEO, Arthur Hood
December	Energy Resources of Australia, CEO, Chris Salisbury

2008

February	Oxiana, Managing Director & CEO, Owen Hegarty OAM
April	Zinifex, Managing Director & CEO, Andrew Michelmore AO
June	BHP Billiton, CEO, Marius Kloppers
August	Anglo Gold Ashanti, CEO, Mark Cutifani
October	Rio Tinto, Chief Executive, Tom Albanese
December	All I want for Christmas – Panel discussion

2009

February	Fortescue Metals Group, CEO, Andrew Forrest AO
April	Federal Minister for Resources & Energy, The Hon Martin Ferguson AM MP
June	Sino Gold, President & CEO, Jake Klein
August	Leighton Holdings, Chief Executive, Wal King
October 2	Newmont Mining, President & CEO, Richard O'Brien
October 22	BHP Billiton, Chairman, Don Argus AC

2010

February	Santos, Managing Director & CEO, David Knox
April	UC Rusal, CEO, Oleg Deripaska
June	OZ Minerals, Managing Director & CEO, Terry Burgess
August	Atlas Iron, Managing Director, David Flanagan
October	Citadel Resource Group, Managing Director & CEO, Inés Scotland
December	Rio Tinto Iron Ore, Executive Director & Chief Executive, Sam Walsh AO

2011

February	Iluka Resources, Managing Director, David Robb
May	BHP Billiton, Chairman, Jac Nasser AC
June	WesTrac, Managing Director, Jim Walker
August	Codelco, President & CEO, Diego Hernández
October	Bechtel Corporation, Chairman & CEO, Riley Bechtel
December	Ivanhoe Mines, Founder and CEO, Robert Friedland

2012

February	Newcrest Mining, Managing Director & CEO, Greg Robinson
March	Sandvik, President & CEO, Olof Faxander
July	Gold Fields, CEO, Nick Holland
August	Minmetals Resources (MMG), CEO, Andrew Michelmore AO
October	Peabody Energy, Executive Chairman, Gregory H. Boyce
December	Perseus Mining, Managing Director, Mark Calderwood

2013

February	IAMGOLD Corporation, President & CEO, Steven JJ Letwin
April	Orica, CEO, Ian Smith
July	Arrium, Managing Director & CEO, Andrew Roberts
August	China Mining Association, Executive Vice President, Jiahua Wang
October	Beach Energy, Managing Director, Reg Nelson
December	Minerals Council of Australia, CEO, Mitch Hooke AM

2014

February	CITIC Pacific, President, Jijing Zhang
April	Vale, CEO, Murilo Ferreira
July	Worley Parsons, CEO, Andrew Wood
August	Newmont Mining, President & CEO, Gary Goldberg
October	Goldcorp, President & CEO, Chuck Jeannes
December	Northern Star Resources, Managing Director, Bill Beament

2015

February	Rio Tinto, Chief Executive, Diamonds & Minerals, Alan Davies
April	Mitsui & Co. Australia, Chair & CEO, Yasushi Takahashi
June	Glencore, Head of Global Coal Assets, Peter Freyberg
August	Orica, CEO, Alberto Calderon
October	Barrick Gold Corporation, Co-President, Jim Gowans
December	OceanaGold, Managing Director & CEO, Mick Wilkes

2016

February	Franco-Nevada, President & CEO, David Harquail
April	BHP Billiton, President Operations Minerals Australia, Mike Henry
June	South32, CEO, Graham Kerr
August	Shell Australia, Chairman, Andrew Smith
October	Evolution Mining, Executive Chairman, Jake Klein
November	Rio Tinto, Chief Executive, Jean-Sébastien Jacques

2017

February	Newcrest Mining, Managing Director & CEO, Sandeep Biswas
April	Aurizon, Managing Director & CEO, Andrew Harding
June	BHP, Chief Commercial Officer, Arnoud Balhuizen
August	Antofagasta, CEO, Iván Arriagada
October	MMG, CEO, Jerry Jiao
December	BHP, CEO, Andrew Mackenzie

2018

February	Orica, CEO, Alberto Calderon
April	Pilbara Minerals, Managing Director & CEO, Ken Brinsden
June	Oz Minerals, Managing Director & CEO, Andrew Cole
August	Kirkland Lake Gold, President & CEO, Tony Makuch
November	Woodside Energy, Managing Director & CEO, Peter Coleman
December	Federal Minister for Resources and Northern Australia, The Hon Matthew Canavan MP

2019

February	Shell Australia, Chair, Zoe Yujnovich
May 2	Future of Mining Finance – Panel discussion
May 30	St Barbara, Managing Director & CEO, Bob Vassie
August	China Molybdenum, Executive Chairman, Steele Li
October	Fortescue Metals Group, CEO, Elizabeth Gaines
December	Alumina, CEO, Mike Ferraro

2020

February	IGO Ltd, Managing Director & CEO, Peter Bradford

2021

March	Victoria – from the inside – Panel discussion
April	Newcrest Mining, Managing Director & CEO, Sandeep Biswas
July	EMR Capital, Executive Chairman and Chairman, 29Metals, Owen Hegarty OAM

Keynote Speakers – Offshore

2007		
	London	José Carlos Martins, Companhia Vale do Rio Doce (CVRD)
2008		
	London	Marius Kloppers, BHP Billiton
2009		
	London	Mick Davis, Xstrata
2010		
	London	Tom Albanese, Rio Tinto
	Shanghai	Zhou Zhongshu, China Minmetals Tom Albanese, Rio Tinto
2011		
	London	Cynthia Carroll, Anglo American
2012		
	London	Ivan Glasenberg, Glencore International
2013		
	London	Andrew Mackenzie, BHP Billiton
	Beijing	Sam Walsh AO, Rio Tinto Xiong Weiping, Chinalco
2014		
	London	Mark Cutifani, Anglo American
	Jakarta	Tony Manini, Tigers Realm Group
2015		
	London	Sam Walsh AO, Rio Tinto
2016		
	London	Andrew Michelmore AO, MMG
2017		
	London	Graham Kerr, South32
2018		
	London	Jean-Sébastien Jacques, Rio Tinto
2019		
	London	Richard Adkerson, Freeport-McMoRan

Cutting Edge Series

THE MELBOURNE MINING CLUB

2003

March	Austminex, Bendigo Mining, MPI Mines
May	Beach Petroleum, Perseverance Corporation, Sedimentary Holdings
July	Austindo Resources, Ballarat Goldfields, Essential Petroleum
August	Reliance Mining, Triako Resources, Australian Worldwide Exploration
November	Allegiance Mining, Indophil Resources, Range River Gold

2004

March	Goldstar Resources, Lafayette Mining, MacArthur Coal
May	Beaconsfield Gold, Eastern Star Gas, Golden Cross Resources
July	AIM Resources, Bass Strait Oil Company, Nexus Energy
October	Alexander Resources, Cazaly Resources, Highlands Pacific

2005

March	AGD Mining, Hillgrove Resources, Tanami Gold
May	Copper Strike, Leviathan Resources, Straits Resources
July	Gallery Gold, Stellar Resources, TasGold
September	Croesus Mining, Karoon Gas, Kentor Gold, Mineral Deposits
November	Indophil Resources, Panaegis Gold Mines, Purus Energy

2006

March	Alliance Resources, Heemskirk Consolidated, Image Resources
May	Cullen Resources, Essential Petroleum Resources, Gateway Mining
July	Pan Australian Resources, Range River Gold, Toro Energy
September	Cobar Consolidated Resources, Stellar Resources, Tawana Resources
November	Perseverance Corporation, Royalco Resources, SMC Gold

2007

March	Ball Metals, Castlemaine Goldfields, Southern Uranium
May	Crescent Gold, Mosaic Oil, Panaegis Gold Mines
July	Encounter Resources, Queensland Ores, St Barbara
September	Copper Strike, Dart Mining, Mutiny Gold
November	Citigold Corporation, Pluton Resources, Rex Minerals

2008

March	Albidon Resources, Indophil Resources, Tectonic Resources
May	Metminco, Regis Resources, Silver Lake Resources
July	Mineral Sands, Reed Resources, Rey Resources
September	Citadel Resources Group, Heemskirk Consolidated, Stellar Resources
November	GBM Resources, Hot Rock, Synergy Metals

2009

March	Bendigo Mining, Highlands Pacific, Scimitar Resources
May	Beaconsfield Gold, Mineral Deposits, Niplats Australia
July	Catalpa Resources, Minemakers, Range River Gold
September	Emmerson Resources, St Barbara, Toro Energy
November	Dragon Mining, Kentor Gold, Saracen Mineral Holdings

2010

March	A-Cap Resources, Drummond Gold, Silver Swan Group
May	Castlemaine Goldfields, Ironclad Mining, Rex Minerals
July	BCD Resources, Liberty Resources, Manas Resources
September	Minotaur Resources, Molopo Energy, White Energy Company
November	Golden Rim Resources, Metminco, White Rock Minerals

2011

March	Aura Energy, Cobar Consolidated Resources, Navarre Minerals
May	Adamus Resources, Mindoro Resources, Royal Resources
July	Bass Metals, Dampier Gold, Energy Ventures
September	Blackthorn Resources, Encounter Resources, Queensland Mining Corporation
November	Catalyst Metals, Crusader Resources, Kimberley Metals

2012

March	Chesser Resources, Dart Mining, King Island Scheelite
May	Kidman Resources, Octagonal Resources, Royalco Resources
July	A1 Consolidated Gold, Gunson Resources, Tigers Realm Coal
September	Ambassador Oil & Gas, Drake Resources, TBG
November	Sumatra Copper & Gold, Syrah Resources, Thor Mining

2013

March	Heemskirk Consolidated, Oroya Mining, Robust Resources
May	Altona Mining, Orion Gold, World Titanium Resources
July	Potash West, Stanmore Coal, Unity Mining
September	DSDBI (Victorian Government), MinEx, Navarre Minerals
November	Lakes Oil, FAR, Middle Island

2014

March	Centrex Metals, Image Resources, Sovereign Gold
May	Anchor Resources, Rimfire Pacific, Reward Minerals
July	GeoPacifc Resources, OceanaGold, Petrel Energy
September	Karoon Gas, Metals of Africa, Stavely Minerals
November	Emmerson Resources, Minotaur Resources, Western Areas

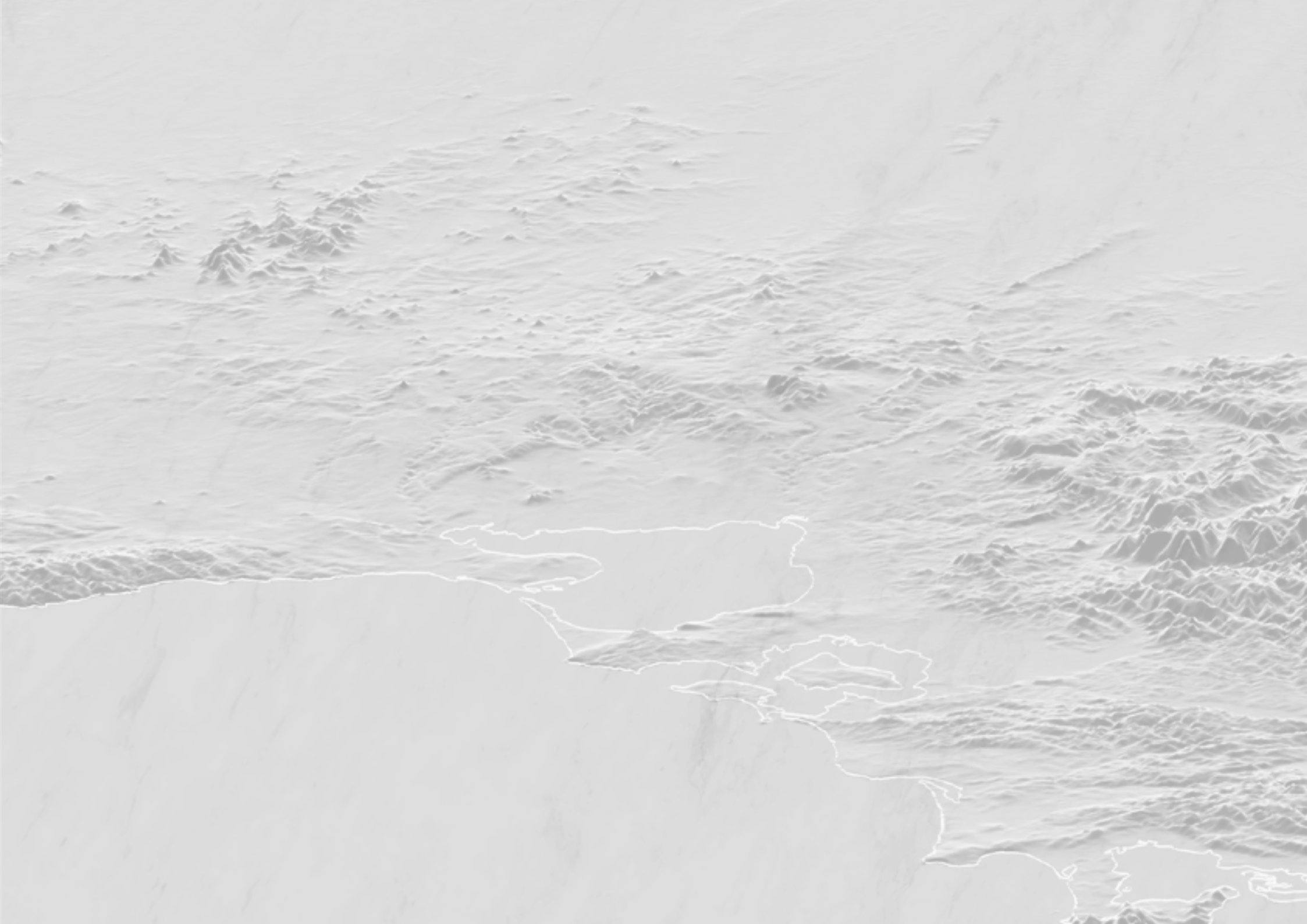
Cutting Edge Series

2015	
March	Aurelia Metals, Highlands Pacific, Panoramic Resources
May	Toro Energy, Wolf Minerals, Marenica Energy
July	African Energy, Avalon Minerals, Rex Minerals
September	Metalicity, Metro Mining, Ramelius Resources
November	Independence Group, Alligator Energy, Highfield Resources

2016	
March	FAR, Havilah Resources, Silver Lake Resources
May	Doray Minerals, CleanTeq Holdings, St Barbara
July	Vimy Resources, Orocobre, Kidman Resources
September	Mineral Deposits, Black Rock Mining, Broken Hill Prospecting
November	Brockman Mining, Magnetic Resources, Troy Resources

2017	
March	White Rock Minerals, Aurelia Metals, Cooper Energy
May	Mandalay Resources, Navarre Minerals, Geological Survey of Victoria
July	Geo Pacific Resources, Egan Street Resources, Verdant Minerals
September	Alderan Resources, Antipa Minerals, Stavely Minerals
November	Nusantara Resources, Kirkland Lake Gold, Red River Resources

2018	
March	Lithium Power International, Macphersons Resources, New Century Resources
May	Image Resources, Nagambie Resources, Renascor Resources
July	Cassini Resources, Kasbah Resources, West Wits Mining
September	Kin Mining, Sheffield Resources, Sipa Resources
October	Chalice Gold Mines, Heron Resources, Ramelius Resources

2019	
March	Golden Rim Resources, Kalamazoo Resources, Kalium Lakes
May	Bellevue Gold, Prodigy Gold, Speciality Metals, Xanadu Mines
July	Boss Resources, Carawine Resources, Gold Road Resources
September	King Island Scheelite, Nickel Mines, Peel Mining
November	Rex Minerals, Superior Lake Resources, White Rock Minerals

2021	
March	Red River Resources, Lion Selection Group, Stavely Minerals
May	Jervois Mining, Aura Energy, North Stawell Minerals
July	Investigator Resources, Kirkland Lake Gold, Red 5