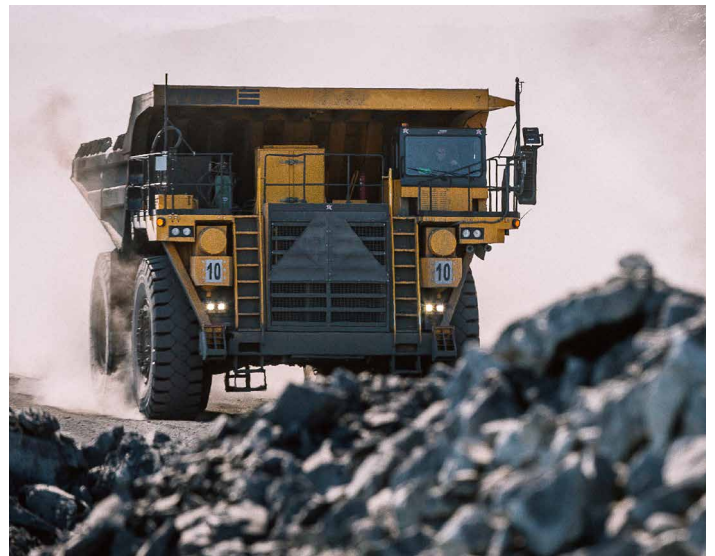


Explorer to Producer: Australia's Mining Regeneration

A report by RSM on Australia's modern miners

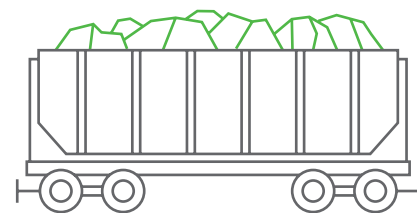




CONTENTS

| | |
|---|----|
| Introduction | 3 |
| Australia's mining regeneration | 4 |
| Quantity <i>and</i> quality | 4 |
| A golden return | 6 |
| Gold Road Resources' Gruyere discovery provides golden path for new producer | 8 |
| Karl Simich's faith vindicated as Sandfire arrives on global mining stage | 9 |
| Issues and trends | 11 |
| Growth prospects give Image Resources the look of emerging sands leader | 14 |
| Social pact | 16 |
| Net green | 16 |
| Juukan Gorge fall-out | 17 |
| A new road | 18 |
| Green and bold | 18 |
| Lithium producer Pilbara Minerals is a mining champion for a new era | 20 |
| Technology | 22 |
| Conclusion | 23 |
| References | 24 |

INTRODUCTION



Australia's rejuvenated exploration and remodelled mid-tier mining space

As a so-called mature mining country, Australia was in the early part of this century apparently falling behind other parts of the world in terms of its attractiveness to mineral explorers and investors. The cost of finding and developing new deposits and mines was too high, comparatively, and significant new discoveries that were being made by Australian companies were being made offshore.

Australia's previous generation of world class mid-tier miners, led by the likes of WMC, MIM Holdings and Normandy Mining, had been taken out by multinational majors. They seemed unlikely to be replaced in a hurry.

The lack of new-discovery impetus at home, to reinvigorate interest and investment in Australia's seemingly moribund mining sector, was pointing to declining rates of gold, nickel, copper and even iron ore reserve replacement and ultimately production.

Then the world, and Australia's place in it, changed.

China's appetite for steel-making materials exploded in the 2000s, followed by demand for other commodities, particularly copper.

Battery minerals for suddenly ubiquitous smart phones became flavour of the month, then the century as modelling of future electric vehicle battery and renewable energy storage demand became more credible and visible.

Australia rediscovered its golden roots in the 2000s. But it wasn't until the period immediately following the world's worst ever financial system meltdown in the 2008-09 Global Financial Crisis (GFC), that four small gold companies with a combined market worth well below \$2 billion signalled their intent to lead the regeneration of Australia's gold sector by starting or buying mines that would underpin their rise to international prominence.

In October 2021 the same businesses had a combined market value of more than \$20 billion, having peaked about a year earlier north of \$30 billion.

The leaders – Northern Star-Saracen, Evolution Mining and Regis Resources – poured money into exploration between 2010 and 2020, growing reserves as they bought and sold assets to upgrade their portfolios. Their success, and recognition in public markets, fired interest in other companies.

Aspiration returned to the Australian gold space: Gold Road Resources, Alkane Resources, Ramelius Resources,

Silver Lake Resources, Westgold Resources and others stepped up and into the mid-tier void.

Gold companies dominate a list of 16 companies that transitioned from 'explorer' to 'producer' in Australia in the past decade or so.

In total, more than \$750 million was poured into exploration and studies by foundation projects that cost more than \$13.3 billion to develop by these companies. This investment was led by the circa-\$11 billion that went into making Hancock Prospecting and its cornerstone Roy Hill project in north-west Western Australia (WA) one of the world's largest individual iron ore mines. But it also produced new world-class lithium, rare earths and copper mines.

Around this more mature set of companies that have made the transition from explorer to producer, at least a dozen more companies have embarked down the same road. The 'new-gen' explorers planning to commence flagship projects in the next two to four years have upped the ante with exploration/study spending of more than \$600 million to put over \$3 billion worth of projects into the development pipeline.

At feasibility-study metal and mineral prices, this next wave of projects will generate close to \$3.5 billion of annual revenues.

Longer term, Australia's established miner ranks have been swelled by the likes of IGO, Western Areas and OZ Minerals, while another company that shifted status from explorer to producer in the first decade of this century virtually bypassed the mid-tier and went straight to the major shelf: Fortescue Metals Group.

Australia's "new force in iron ore" is a global powerhouse with a current market value around \$50 billion.

FMG leads the 40 or so companies in Australia that have moved out of the sea of small explorers into the relatively rare producer space in the past 20 years.

The pace of change, the range of issues faced by Australia's new generation of exploration and development companies on their journey to production, and the outlook for the sector, are all explored in this report. It also looks at the developments and trends altering Australia's mineral exploration and development landscape – from advanced technologies to new economic and community expectations.



AUSTRALIA'S MINING REGENERATION

Quantity and quality

Australia has seen a critical rebirth of its mineral exploration and mining industry in the first 20 years of the 21st century.

New Australian-domiciled miners of global stature – with multi billion dollar market values – have emerged. Mineral reserves and infrastructure to sustain the competitiveness of these enterprises long term have been established.

Research and analysis by Melbourne-based MinEx Consulting indicated Australia's share of annual global mineral exploration expenditure doubled from 8% to 16% between 2015 and 2020.

China's voracious appetite for commodities, helpful capital markets and interest rates, and stable domestic investment settings have provided strong tailwinds.

There has been a shift in exploration and mine development investment back to "safe" jurisdictions such as Australia, a thematic that has helped propel the country's rejuvenated mining sector.

Exploration success has been vital to building and maintaining momentum. Brownfield discoveries under modest ground cover, near to established processing, power and transport infrastructure, have produced significant in-ground and enterprise value.

New greenfield finds have been rarer though significant enough to shift industry thinking on vast tracts of Australia.

MinEx suggests Australia accounted for 12% of global exploration spend and 15% of all discoveries over the past decade. Between 2010–19, 168 "significant" discoveries were made in Australia: three of these were tier-1 (long-life, low-cost with a net present value above US\$1 billion) and a further 10 tier-2 (NPV in the US\$200 to \$1 billion range).

"Roughly two thirds of global discoveries in the last decade have been made by small ASX listed mineral exploration companies who are willing to take the risk and drill," said Mr Warren Pearce, Chief Executive Officer of the Association of Mining and Exploration Companies."

Internationally, the mining "exploration supercycle" between 2002 and 2012 saw a spending peak above US\$35 billion in 2012, according to MinEx data that includes exploration spending for bulk commodities such as iron ore and coal.

American investment bank Bernstein's analysis of non-ferrous mineral exploration expenditure data indicates that between 1997 and 2020, Australia (US\$26.46 billion) trailed only Canada (\$36.61 billion) with its share of the cumulative mineral exploration spend over the period. Latin America and Africa, as a whole, took 26% and 15%, respectively of the cumulative outlay. However, Canada (16%) and Australia (14%) were the standout individual countries.

Since 2010, 16 Australian companies with cornerstone projects in the country have transitioned from mineral exploration to production, nine of them gold companies.

The 13 public companies that remained independently active at the start of November 2021 had a combined stock market value of \$31.31 billion.

Including Hancock Prospecting and its Roy Hill iron ore mine, 14 explorers that became producers in the past decade remain independently active. The group has combined annual metals and mineral sales revenue of more than \$12.8 billion and cumulative net profit after tax of at least \$1.5 billion this year.

The 16 companies spent more than \$750 million on exploration and studies, then more than \$13.3 billion of development capex, to take flagship projects through to production.

Some of those projects were built on discoveries made in previous decades.

Eight of the 16 companies developed deposits found since 2000. Discovery-to-production took an average of 8.5 years. Sandfire Resources at DeGrussa (three years) and Pilbara Minerals at Pilgangoora (four years), both in Western Australia, were the standouts.

By 2020 Australia led the world with its US\$1.37 billion mineral exploration investment, ahead of Canada and the USA, according to Bernstein.

New "company-making" deposits are currently being defined in Australia.

"DeGrussa's remarkable progress from discovery in April 2009 through resource drill-out, feasibility, financing and construction and development – just over three years from discovery drillhole to first production – has set new benchmarks for the efficient development of resources in Western Australia."
– Sandfire Resources

"To take the Pilgangoora project from its first drillhole through to commissioning in under four years is simply outstanding. It's not very often you find a resource of its scale and quality. You take this, add some very talented, dedicated and passionate people, and you have a world-class project that will now be one of the biggest hard rock lithium suppliers in the world." – Pilbara Minerals

Gold and copper have remained the dominant search targets of mineral explorers globally over the past 20 years.

According to numbers crunched by Bernstein, between 1997–2020 US\$90 billion of worldwide mineral exploration spend was aimed at finding more of the yellow metal: \$4.3 billion in 2020 alone. Australia accounted for 14% of the longer-term expenditure, rising to 19% in 2020 when it surpassed Canada's 18% share.

More than 22 million tonnes of copper worth over US\$220 billion is consumed annually worldwide, putting it behind only iron and aluminium among major metal markets. The search for the red metal in Australia is currently gaining momentum in South Australia, New South Wales and Western Australia.

Of the estimated \$41 billion expended in the hunt for new copper resources between 1997–2020, Australia attracted 10% and the USA 9%. Latin America, as a region, drew 38%. In 2020, the US moved up to 14% (of the \$1.8 billion spent), with Australia at 10% and Latin America 42%.

Data also suggests 14% of the estimated US\$10.5 billion spent on zinc exploration between 1997–2020 was directed at projects in Australia, while 27% of the \$10.8 billion nickel exploration spend for the period came Down Under. Leading nickel-focused Australian company Western Areas

(US\$221.6 million) and diversified mid-cap IGO (\$170.7 million) – both of which emerged as producers in the past 20 years – were among the top 12 nickel explorers in the world between 1997–2020.

Australia and Australian companies have been prominent in lithium and rare earths exploration.

Four projects developed since 2009 have become producers, an average 4.75 years after discovery.

In the earlier decade between 2000–2009, Australia saw a further 10 companies transition from 'explorer' to 'producer'; investing at least \$250 million on exploration and studies, and \$5.72 billion of development capital, on foundation projects today producing more than \$34 billion of annual revenues and \$15 billion of net profits after tax (NPAT).

The seven Australia-domiciled and listed miners still active from that period – including iron ore colossus Fortescue Metals Group – have a combined market value exceeding \$63 billion.

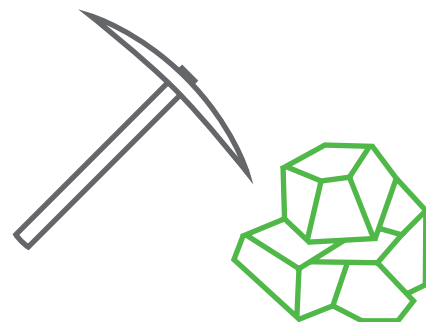
At least a further 12 Australian companies with new cornerstone projects in the country are positioned to attain producer status by 2025.

Those companies currently have \$3.13 billion of project pre-development capital outlined in studies, having poured more than \$600 million into exploration.

The nominal value of gold, copper, nickel, platinum group elements, rare earths and industrial miners to come from those new projects currently exceeds \$3.4 billion, with results of ongoing exploration and further studies still to come.

Eighteen of the 38 Australian companies that either switched from explorer to producer between 2001–2021, or are in the process of making that shift, on the back of projects within Australia, are gold-focused.

Three are nickel, three rare earths, three iron ore, three are copper and two are lithium focused.



Independent research group, Benchmark Mineral Intelligence, has predicted a four-fold expansion of lithium demand between 2018 and 2025 to meet an “exponential rise in battery demand” from the growing electric vehicle (EV) market. It suggests growth is being driven by high environmental targets and strong incentives to encourage the transition away from traditional petrol and diesel-based internal combustion engines to cleaner and greener EVs. AutoNation Inc, the largest auto retailing chain in the US, predicts that by 2030 EVs could account for 15–20% of new vehicle sales in the country. One of America’s big investment banks, Goldman Sachs, has forecast the lithium market could triple in size by 2025, based purely on EV demand, with every 1% rise in EV market share equating to a circa-70,000 tpa jump in lithium demand.

“[Lithium’s] unique properties ideally position it for portable energy storage applications that will be a key enabler of the electric car revolution and replace gasoline as the primary source of transportation fuel.”

– Goldman Sachs, December 2015

Western Australia is the world’s major hard-rock producer of lithium.

Between 2010–2020 an estimated US\$1.5 billion has been expended on the search for new lithium resources, 38% of it in Latin America, 15% in the US, 14% in Australia and 11% in Canada. The tempo is, not surprisingly, rising; the direction changing. In 2020 an estimated 29% of the C\$200 million of lithium exploration expenditure went into projects in the US; 16% in Australia.

Canada (31%) and Australia (20%) have been primary individual rare earth (RE) target jurisdictions for an estimated US\$1.2 billion of exploration investment between 2010–2020. Africa accounted for 15% of the total. ASX-listed Arafura Resources (US\$79.6 million), Northern Minerals (\$50.6 million) and Hastings Technology Metals (\$33.3 million) have been among the 12 most active RE explorers in the world in that time.

“Critical minerals, which include lithium, rare earths among 26 different minerals that have defence and battery applications, have become an increasingly key Government focus over the last three years,” said Mr Warren Pearce, Chief Executive Officer of the Association of Mining and Exploration Companies.

The Commonwealth Government delivered a Critical Mineral Strategy 2022 that will be resilient, reliable and secure supply chains of these critical minerals for Australian use. The Government has also invested \$200m for the Critical Minerals Accelerator Initiative, with \$50 million to support research and development announced in the Commonwealth Budget 2022–23, these form part of a

package of measures that will help unlock the potential of Australia’s critical minerals sector.

“It is expected that the combination of Government attention and red-hot market demand will lead to sustained growth in the exploration and development of these minerals in Australia.”

A golden return

As noted, nearly half the companies that have successfully transitioned from exploration to production in Australia in the past 20 years have been focused on gold.

Nearly all of them have had foundation projects in Western Australia.

After hitting a highpoint of 238 tonnes in 1997, WA gold production declined by 48% over the following 10 years. However, output has been rising since 2011, propelling national production to a new record 327 tonnes, worth about \$27 billion in 2020.

In mid-2020 UK-based Arlington Group Asset Management said WA was “arguably the epicentre of a developing global exploration boom fuelled by an all-time-high Australian dollar gold price and significant new gold discoveries”.

According to MinEx Consulting, about 400 deposits containing at least 100,000 ounces of gold were found worldwide between 2010–2020: 15% of them in Australia and 12% in Canada. “In recent years there has been a strong move back to established (low-risk) countries ... Over the last decade Australia and Canada made up 28% of all gold exploration expenditures,” MinEx says.

Australia attracted an estimated US\$900 million and Canada \$1 billion of the \$4.8 billion expended worldwide on gold exploration in 2020.

Brownfield exploration success and generally shallow resource definition has contributed to below average discovery costs (per ounce) for a number of the companies that have moved from exploration to production status in Australia in the past decade.

Larger-scale, greenfield, world-class discoveries and resource definition by Gold Road Resources and De Grey Mining have involved expenditures more in line with the global markers for resources outlined in the past decade (\$100–150 million), while Bellevue Gold’s brownfield success at its namesake project in Western Australia has necessitated spending of a similar order.

MinEx says while significant new gold finds in Western Australia are “still being made under shallow cover”, the sector is seeing the average depth of discoveries continually increasing. The firm says the average depth of newly defined gold ounces around the world doubled from 41m in 1985 to 82m in 2019. Increasing depth means more metres drilled and higher costs per resource ounce: \$45/oz in 2020 versus the 1980–89 average of \$15/oz, “and rising by \$10/oz per decade”.

"It's not that there is no gold left in Australia, far from it. But the opportunities are now much deeper. Thanks to amazing advances in technology, we have never been so well-placed to find those large, high-grade orebodies lurking deeper in the earth's crust."

– Bill Beament, former executive chairman, Northern Star Resources

"It is getting tougher, but they're still out there. What we're constantly looking at is new technical frontiers. Whether it's drilling deeper or identifying new methods to discover orebodies. If I can use the analogy of the oil industry, they've gone from exploring on the ground to exploring in the ocean and to exploring deeper in the ocean."

– Duncan Gibbs, CEO, Gold Road Resources

De Grey Mining's 2019 Hemi gold discovery and maiden 6.8 million ounce resource – extending its Mallina project gold resource to 8.4 million ounces at the time of writing – cemented the reputation of Western Australia's Pilbara region as an emerging global gold province. Previously, Gold Road's Gruyere (8.8 million ounces) and AngloGold Ashanti's Tropicana (7.9 million ounces) have been Australia's largest 21st century gold finds. The race is now on between the project owners to establish the country's first new 10 million ounce gold project in the current era.

Greenfield exploration success in the Pilbara and on the Yamarna and Tropicana belts has opened up exciting new frontiers for the state's gold industry and fired the interest of investors.

A leading Australian securities broker said after a COVID pandemic shutdown of markets early in 2020, the June and September quarters saw circa \$3.5 billion raised domestically by Australian mineral explorers and producers – the most in any six month period for more than a decade.

The average cash balance of ASX-listed explorers at the end of September 2020 was the highest on record.

According to Argonaut Securities, the funds are "being put to work with exploration programs ramping up".

"Notable programs include De Grey's \$83 million over 12 months, Gold Road's \$26 million for 2020, Chalice Mining's \$22 million [in 2020] and Pantoro's 100,000m [of drilling] in 2021. Department of Mines work applications for exploration in Western Australia for July and August 2020 were both over 300, versus the five-year average of 195."

Australia's Golden State has not been the sole focus of investors', and explorers', ardour. As Hedley Widdup of Lion Selection notes, the discovery of extremely high-grade gold at Fosterville in Victoria has seen possibly the largest

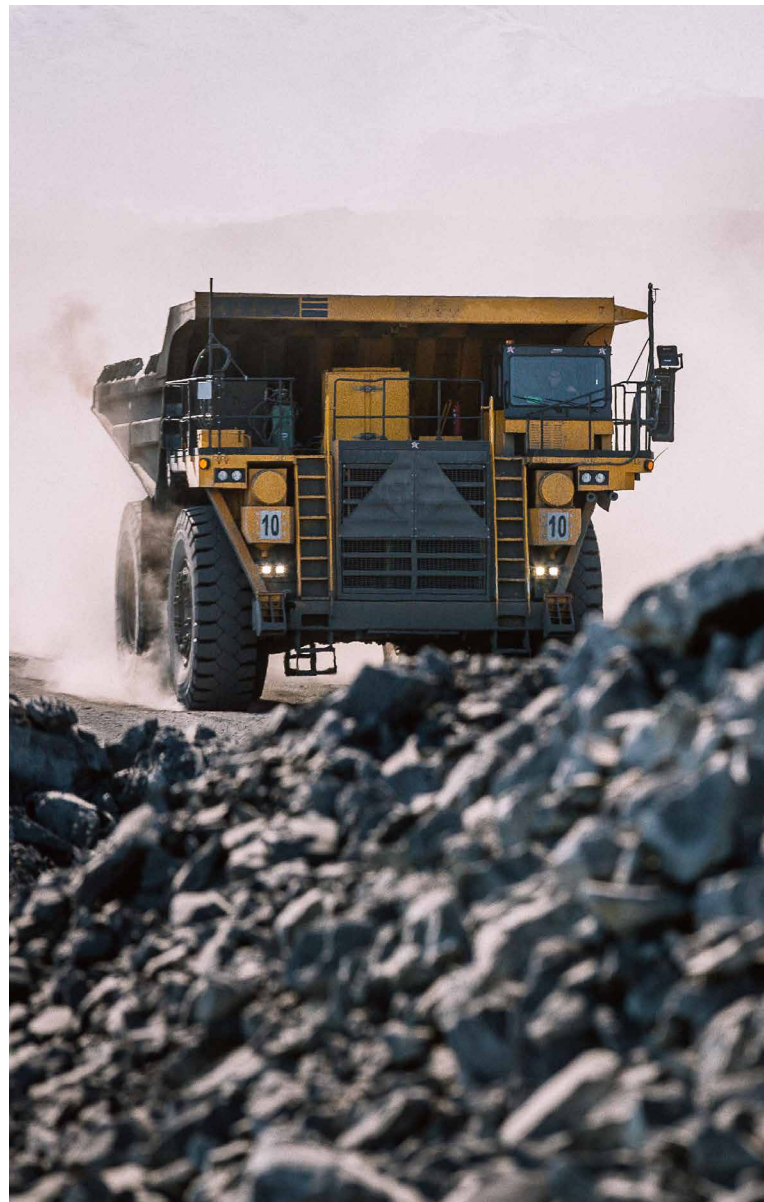
investment rush for Victorian gold exploration since the 1850s.

Australian Bureau of Statistics data shows minerals exploration expenditure in Victoria rose 35% year-on-year to \$183.8 million in 2020–21. Successful tenderers in October 2021 for new blocks of ground in the state's historically rich north central goldfields region, Kirkland Lake Gold and S2 Resources, agreed to spend \$100 million over five years on exploration.

The Geological Survey of Victoria estimates there may be up to 75 million ounces of gold yet to be found in the central and north central Victorian goldfields. This compares with the 80 million ounces of gold mined in the area over nearly 170 years.

"It's exceptional, the geology in Victoria, and it's grabbed people's attention globally."

– John Landmark, corporate affairs vice-president, Kirkland Lake Gold





SPOTLIGHT ON GOLD ROAD RESOURCES: Gold Road Resources' Gruyere discovery provides golden path for new producer

Gold Road Resources' 2013 Gruyere discovery was one of the few tier-one gold finds in the world in the past 10 years. Rarer still are those that made it into production in the same decade. "The probability of making discoveries can actually be higher in some other jurisdictions ... but if you make a discovery in Western Australia, there is a high probability that you can then realise the development stage," says Gold Road CEO, Duncan Gibbs.

Gibbs, a former AngloGold Ashanti senior manager who led the company's development of the world-class Tropicana gold project in WA, joined Gold Road in 2018 as the company was making its transition from explorer-developer to producer in a 50-50 alliance with Gold Fields. First gold was poured in mid 2019. The partnership brought an experienced mine operator into the fold, but Gold Road was also evolving. "It's a massive undertaking to build any mine and you're building a lot of business capability across a wide range of areas to really make that transition from being a pure exploration company with a market cap of maybe sub-\$100 million into a billion dollar company if you're successful," Gibbs says.

Gruyere's smooth road from discovery to production owed much to the 2016 JV formation and resulting large scale capital injection into the \$620 million project; the deposit uniformity and scale and relative simplicity of the mining and processing plans; and the host jurisdiction's well-honed regulatory processes.

The homogeneity and low waste-to-ore ratio of the plus-6.5 million ounce orebody, which offered up consistent grade, an appetising circa-9200 ounces per vertical metre, and tasty oxide and fresh-rock metallurgy, contributed to the project's compelling economics. Its size and quality belied what had been a decade long, needle in a haystack search in what was seen as a frontier region for exploration.

"Exploration is getting more challenging," says Gibbs. "We're generally working in relatively mature terranes.

"But if you look at the recent [major new mineral deposit] successes, they have tended to be in new areas.

"Gruyere, Tropicana, DeGrussa, Nova – they are all in previously under-explored, or poorly explored, terranes. That does highlight to me one of the important trends and that is these really big new mines ... are coming about where people have not looked before.

"De Grey, now, have rewritten the story book on the Pilbara. I think the Paterson [region] is another kind of story. Telfer for a while there was viewed as the only deposit in the Paterson. The discoveries now being made under thick cover, such as Winu and Havieron, mean that [area] is now pretty hot acreage for exploration.

"Each project has its own features that help set development timelines. One of the factors for Gruyere was it was a relatively simple orebody. [Gold Road was] quick

to drill it out [and] it had fairly compelling economics fairly early on. So the clear strategy was to get on and do this."

A key challenge for Gold Road and other companies, such as Sandfire Resources, that have built a platform as a new mining company on a high quality cornerstone asset, is to add scale through further exploration success and, invariably, acquisitions.

"We're in one of the most obvious places in the world to go looking for mines, and gold is one of the core commodities in WA, but that also means it's a highly competitive environment," Gibbs says.

"There are a lot of companies out there looking for the next gold mine.

"One of the competitive advantages we have is the position we hold in the Yamarna greenstone belt – about 4000 square kilometres of one of the least explored greenstone belts out there.

"To some extent it's also one of our disadvantages because we're working with a lot less data than there is on some of the other greenstone belts. Our last 2–3 years have actually been spent building a lot of fundamental datasets to help us get to the right spots to drill."

Gibbs says current labour pool shortages – not an uncommon development in his 20-plus years in the

industry – are a prominent industry thematic. He sees a return to open borders post-COVID as one solution. "That will wash through in the next couple of years and I think we'll come back to a more normal environment," he says.

"The other issue I think is broadly the whole issue of expectations in the ESG space for mining companies – in fact all companies – is escalating all the time, and we're having a far wider discussion now.

"We're juggling more issues and society's expectations around how we manage the environment and that plethora of issues is growing all the time.

"Again, though, I think we have an advantage here.

"While individual projects have their own challenges, by and large there are fairly well-defined pathways from discovery to development and operation, and you've got supportive government, basically supportive communities – the people in WA get the fact that mining is a key contributor to the state and a lot of people are either directly or indirectly employed by the industry – and we've got a depth of skills and knowledge that is not common around the world.

"It's quite a different proposition to going into some African nations, or parts of Asia, etc, where you just don't have that. It doesn't mean you can't do work there. It's just a lot easier when all those resources are in your backyard."

SPOTLIGHT ON SANDFIRE RESOURCES:

Karl Simich's faith vindicated as Sandfire arrives on global mining stage

Karl Simich knew after his first week in mining where his future would be. Thirty-five years later, he says he's never felt more passionate about the industry and what lies ahead.

The CEO of Sandfire Resources since 2009 spent much of the second half of 2021 piecing together a deal that positions the company to become a leading, globally-diversified copper producer. Sandfire's US\$1.865 billion acquisition of Spain's Minas de Aguas Tenidas SA (MATSA) from Mubadala Investment Company and Trafigura gives it a long-term production profile that surpasses that of \$9.6 billion ASX-listed copper leader, OZ Minerals – a company with a market value more than three times Sandfire's at the time of writing.

Along with its dominant land position and development project in southern Africa's Kalahari Desert region, the Black Butte copper project in Montana, USA, and its still prominent presence in the Doolgunna-Bryah Basin district that produced its fabulous cornerstone DeGrussa copper-gold discovery, Sandfire now boasts the kind of red metal

price exposure and exploration upside that's traditionally been the domain of large North American-listed entities.

Yet Simich says full backing for the company's recent US\$1.2 billion equity raising in support of the MATSA acquisition came from Australian and New Zealand investors – on the day the deal was announced. Demand ran more than 50% over the book limit. "We didn't have time to go to Hong Kong and Singapore, and London and the US weren't awake yet. So we didn't go to Toronto or Denver or Boston or New York or London: we didn't go to the biggest capital markets of the world," Simich says.

He says while a buoyant fund-raising environment and particularly bullish outlook for copper mean the market appetite for transformative transactions such as the Sandfire-MATSA deal is possibly at unprecedented levels across the globe, the scale and speed of the response to Sandfire's new equity offering reinforced his long-term faith in the local market and the ASX as a mining financing platform.



"One of the most powerful things for Australian junior resource companies I think has been having access to a really healthy, vibrant, deep securities exchange," Simich says.

"I think it's probably the best exchange, dollar for dollar, in the world, in terms of risk capital for resources. I'm not saying Toronto doesn't have us covered in terms of the depth of funding available, but it's a more challenging market compliance-wise. The Australian market is actually much more user-friendly.

"I'm not a [mining] technician, I'm very much a commercial and financial person. Part of the allure for me getting into this business was the opportunity it affords to potentially use a combination of different skillsets and do the hard work to potentially get an outcome, and then the ability to take risks and get access to an environment that backs risk-taking.

"The ASX offers a great risk-sharing mechanism, and environment, with people able to make judgments about the level of risk they want to take on, in common with others of a similar mindset.

"It encourages a belief that if you put some good ideas together and convey a message to people, and if you're compliant with the laws, you can raise money.

"We were able to raise greater than our market capitalisation in funds for the acquisition in Spain, effectively in a day. If we were a London-listed or Canadian-listed company it wouldn't have been possible to do that.

"Someone told me it's [MATSA deal] the largest all-cash transaction done by an Australian mining company. I find it hard to believe, but if it is I'll take it."

As this research paper has highlighted, Sandfire has been integral to the regeneration and repopulation of Australia's mid-tier mining space over the past 10-15 years.

Its major copper-gold discovery in an under-explored part of Western Australia, its rapid project delivery, and subsequent leveraging of its success and reputation to build a quality international portfolio of assets, have made Sandfire one of the most watched companies in the country's junior-to-mid-tier mining arena in the past decade.

Simich, a CA who joined a struggling junior exploration company around the time of the 1987 Wall Street market crash, says circa-20 year old Sandfire had probably pumped tens of millions of dollars into exploration in WA and other parts of Australia before it found DeGrussa – and perhaps \$150 million into the greater Doolgunna area in the hunt for

a repeat since the DeGrussa discovery in 2009. That's in addition to the circa \$100 million drill-out of the DeGrussa resource post-discovery.

So, high stakes for rewards that include massive escalation in company values on the back of DeGrussa-like success.

"Having confidence in the system is at the very root of it all," Simich says.

"Being able to remain confident that if you're making these medium-to-long-term decisions that things aren't going to change unless they are for a very good reason, and they've been properly argued and debated, and then there is a process towards a reasonable outcome. Instead of having quick and dramatic changes that can occur and we've seen occur in other parts of the world."

Australia remains arguably the world leader in terms of regulatory and permitting efficiency which, coupled with its undoubted latent prospectivity, means competition for ground and assets remains intense, according to Simich. Hence Sandfire has had to cast the net widely to build on its Australian base.

"We're evolving from being pretty much a locally domiciled, small to mid cap company that's had wonderful success with a project to becoming a global resources company operating in multiple jurisdictions that are all quite different from each other, and focusing our attention on what we believe, certainly in the short to medium term, are future-facing minerals and metals. We also need to keep nimble and have greater dexterity and flexibility operating in multiple places using an overarching strategic core hub and then fully resourced decentralised operating projects.

"We're embracing the challenge to be a global business, working in multiple jurisdictions, with different cultures. Those unique regional cultural differences are important and we want to allow them to shine through. But what sits in behind, in terms of the deep-rooted values and culture of the organisation, is also vital.

"We have been doing a lot of work in the business internally to hone those values, and the culture, and to get alignment on those across the business. Then I think what you start to create is not just a business but a bit of a movement ... it's a growing, living organism with a whole bunch of people doing things that are all aligned, all working together, and it happens to have the corporate veil over the top of it.

"That to me is where you start to get more exceptional things happening than what would be the standard fare."



ISSUES AND TRENDS

Australia, and particularly states that have traditionally attracted the bulk of the country's mineral exploration expenditure, Western Australia and South Australia, have consistently ranked highly in global surveys measuring investment attractiveness and (lower) risk levels. The popular Fraser Institute survey out of Canada ranked Western Australia the fourth best jurisdiction in the world in its latest (2020) survey. Surprisingly, US states with much longer permitting cycles ranked higher.

"Considering both policy and mineral potential, Australia is the most attractive region in the world for mining investment," the institute said early in 2021. "Western Australia (4th) and South Australia (7th) appeared in the global top 10 on the Investment Attractiveness Index in this year's survey."

Companies that have transitioned from being explorers to producers in Australia over the past decade have benefited from some of the best discovery-to-commissioning timelines seen anywhere in the world in that period.

Three discoveries made since 2010 have become mines an average 5.3 years after the first significant drill hits. Maiden resources posted in the same period (six) have supported production within 5.7 years.

Breaking a long-term global mining industry pattern of production delays and cost overruns, 90% of projects delivered by new producers in Australia in the past 10 years have been on time and three-quarters of the projects hit their original capex budgets.

"There are very few mining projects anywhere in the world today which can lay claim to having moved from discovery drillhole to first sale in the space of just three years. When the average length of time required to develop new resource projects is now seven to eight years, this is a truly remarkable achievement which has set new benchmarks for the mining industry in Western Australia." – Derek La Ferla, chairman, Sandfire Resources, at the official opening of DeGrussa in August, 2013

However, travel and workplace restrictions and supply chain disruptions related to the COVID pandemic are now casting a shadow over new projects.

Interruptions to free flows of skilled workers and professionals within Australia, and from outside the country, are exacerbating some existing personnel shortages. Analysis of long-term data has also suggested reduced numbers of geoscience and engineering professionals coming into the industry from tertiary institutions, coupled with an exodus of experienced people and escalating demand from a more vibrant domestic mining industry, is putting increased pressure on the industry's capacity to make important new discoveries, build projects and mines that meet required technical, regulatory and societal mandates – including ESG investment provisos – and operate and maintain capital-intensive enterprises competitively.

Worker and skills shortages are by far the biggest current and future challenge for the industry identified by participants.

Attracting and retaining the "best and brightest" is a fundamental test for an industry traditionally lacking diversity and fidelity through commodity price cycles. Loss of institutional geoscientific and engineering education and training capacity is a rising concern.

The Australian Institute of Geoscientists (AIG) says up to one-third of the country's geoscientists are approaching a retirement window this decade. Their potential exit will create skill gaps unlikely to be filled by new entrants passing current university courses seen to be lacking suitable cornerstone mineralogy, petrology, structural geology and tectonics qualification standards.

According to AIG president, Andrew Waltho: "The profession faces very real challenges of attracting talented students in sufficient numbers to maintain and build a longer-term resource of well trained, highly skilled geoscience professionals. Geological knowledge is central to this. Rather than a simple collection of faces, facts and figures, geology studies need to instil an understanding of the complex systems that are continually interacting to shape our planet and its environment, and the understanding needed to foster sustainable use of the Earth's resources.



This year alone, the country's **mineral and energy resource sector** is forecast to generate **\$296 billion** in export earnings (about 10% of GDP) and will no doubt be key to powering Australia's recovery from the tumultuous economics of the COVID-19 era.

Most students today receive their first exposure to geology at university. Students who entered university to pursue studies in another area of science become aware of the exciting and challenging nature of Earth systems and how geology integrates aspects of chemistry, physics and other sciences to develop this understanding. However, a number of Australian universities are moving away from offering geology courses, favouring instead broader Earth science programs that exclude the specialised subjects that allow graduates to observe and interpret features that are the product of some of the most significant processes shaping our planet. The question now emerging therefore, with the move towards more generalised Earth science university courses, is the suitability of education provided by these studies."

Writing about "Australia's unfolding geoscience malady" in September 2021, a group of senior Melbourne and Canberra geoscience university professors and the head of the School of Earth Sciences in Melbourne, said even before the COVID-19 pandemic student enrolment in geoscience majors was in decline across Australia, despite increasing demand from diverse geoscience industry sectors. While undergraduate enrolment appeared anecdotally to be rebounding in Western Australia following a post 2016 revival of the mining industry, student numbers in the south were not high enough to "ensure their viability".

"In 2020, 17,300 university jobs were lost across Australia. A federal decision to cut funding for earth and environmental science courses by 29% has only compounded the situation," the geoscience professors wrote.

"At the University of Newcastle, the geology major was dropped completely. In total, seven of the 21 Australian

geoscience departments have been hit with substantive reductions in staffing and curriculum offerings in the past few years, and many others have suffered smaller reductions. Although faults in Australian geoscience education predate COVID-19, the significant financial pressure inflicted upon Australian universities as a result has catalysed its rapid fragmentation. More casualties are likely to come as the Australian university sector is forecast to lose up to \$19 billion (US\$13.7 billion) between 2020 and 2023 because of the collapse of international student revenue.

"Perhaps more than any other developed nation, Australia's wealth and prosperity depend on its geoscience expertise. This year alone, the country's mineral and energy resource sector is forecast to generate \$296 billion in export earnings (about 10% of GDP) and will no doubt be key to powering Australia's recovery from the tumultuous economics of the COVID-19 era. The nation's ability to sustainably secure food, energy, and water is also reliant on the capacity of its geoscientists to discover, manage, and responsibly use its natural resources.

"It must be made clear that contrary to many inaccurate public perceptions, the expertise and capabilities of the mining and petroleum industries will play a fundamental role in the global fight against climate change. Simply put, without meeting the fivefold increase in demand for critical minerals and sequestering 190 billion metric tons of carbon dioxide into sedimentary basins, we will fail to reach the Paris Agreement carbon neutrality targets. However, economic geology courses should be accompanied by interdisciplinary lessons on environmental and mining ethics, which could form a more substantive component of classes on Earth resources."

Personnel shortages increase cost pressure through the available labour pool.

In mid-2021, research commissioned by the Chamber of Minerals and Energy WA (CME) indicated the state's burgeoning – and isolated – mining and resources sector might require 40,000 additional workers by mid-2023. The work identified a “peak [potential] shortage” out to 2025 of as many as 33,000 workers.

According to CME chief executive Paul Everingham, government stimulus spending on eastern Australia infrastructure and construction projects is creating increased competition for available skilled workers. While progressive opening up of international borders and travel may relieve some of the strain on skilled personnel supply in the near term, Western Australia, which has by far the largest latent demand for resources labour, remained isolated through early 2022.

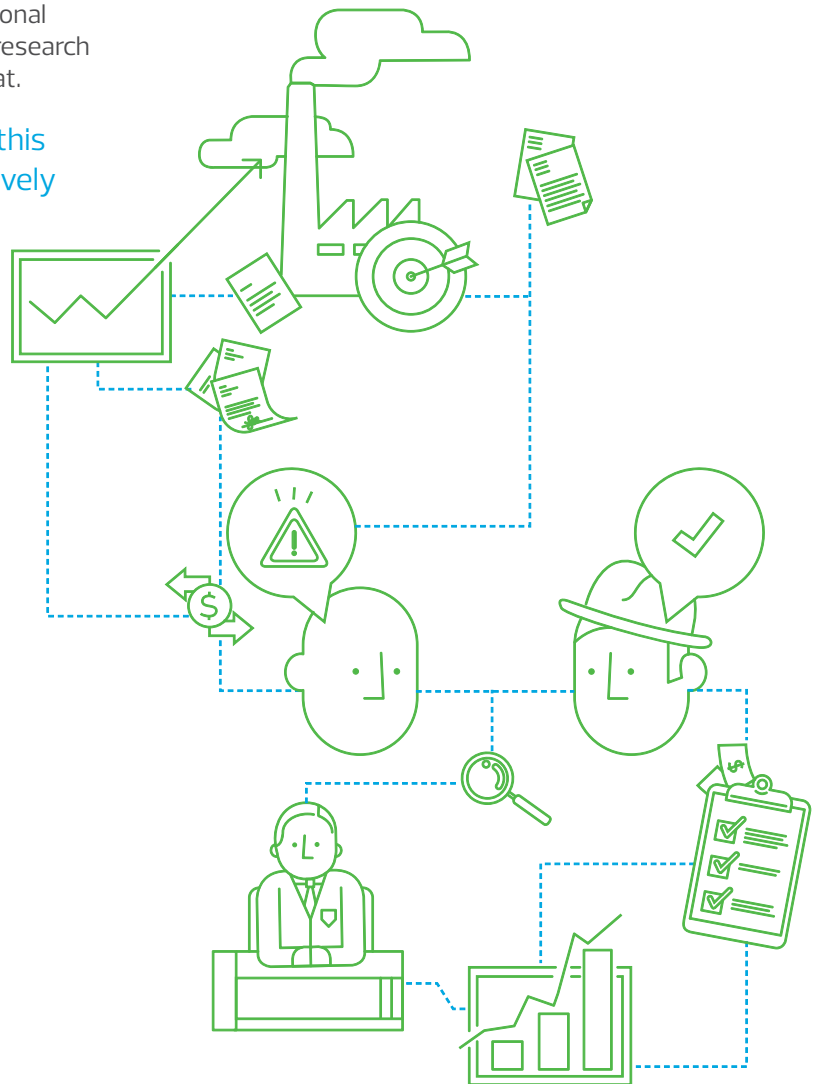
Everingham said: “When we last released workforce modelling in August 2020 our sector had a positive outlook coming out of the worst of COVID-19 restrictions and we predicted then a need for an extra 8000 operational workers in the following 18 months – but this new research shows the situation is far more challenging than that.

“There are many factors contributing to this worsening skills shortage, which collectively equate to a perfect storm.”
– Chamber of Minerals and Energy WA CEO, Paul Everingham

“From a WA mining and resources sector perspective, we have an unusual situation where shutdown work will remain unseasonably high in the short term to make up for lost time, and in parallel, operational and construction work is projected to grow strongly over the next two years on the back of strong commodity prices. Unlike previous construction-led growth periods for our sector, where up to 1000 people a week were moving to WA for work, there are now strong employment prospects in the Eastern States for people if they choose to stay at home. And, of course, international skilled migration was all but halted because of the COVID-19 pandemic.

The CME report highlighted looming “acute” shortages of engineers, metallurgists, underground surveyors, geologists and geophysicists, auto electricians, diesel and mechanical fitters, boiler makers, welders and drillers.

Everingham said: “In our sector alone, there are \$140 billion of projects currently in the pipeline – opportunities that won't be fully realised unless we can gain access to the right people with the right skills at the right time. As this report makes clear, we simply aren't going to be able to address our workforce needs within the talent pool that is currently available in WA or, indeed, the country. Therefore, it is essential government leans in with a forward-looking plan on skills migration where it is in the national interest, and obviously is safe to do so. It's a complex situation given COVID-19 and the incredible economic rebound in WA and around most parts of the country. But there is a clear need to explore ways we can access international markets to bring in workers with targeted and vital skills, while continuing to ensure the health and safety of the community.”





SPOTLIGHT ON IMAGE RESOURCES: Growth prospects give Image Resources the look of emerging sands leader

Australia has most of the world's defined zircon and rutile and about one-third of known ilmenite resources, but a very small producers club. Newest member Image Resources has ambitions to be a global mid-tier miner and managing director Patrick Mutz says, in this pursuit, the company has a few advantages over international peers at a similar stage of their development.

One key advantage is geography.

"In general terms Australia is open to mining and has one of the best established frameworks to allow miners to make investments with certainty, and for investors to have confidence that the processes companies are using are protective of their investment, as the company advances into production," says Mutz, who has guided three mining projects into production in Australia in the past two decades.

"Moreover, Western Australia's framework is the cream of the crop, no question.

"This is the most supportive state perhaps in the world for a mining company that is focused on doing the right thing by their investors. It is absolutely not easy, and there are no guarantees. However, if you have a good deposit and plan – including financing – and you follow all of the written and unwritten rules of the game, and you meet the myriad of requirements placed on mining companies, there is a good chance you can make it happen and be successful."

Making it happen is what Image did in December 2018, when it started commercial production of zircon-rich heavy mineral concentrate at Boonanarring in WA's North Perth Basin, about 80km north of Perth. Since then, the company has completed early repayment of its debt, paid an inaugural dividend to shareholders in 2020 and accumulated \$50 million of cash to help fund future growth.

Now it has a pipeline of development opportunities, strong customer relationships and favourable product-pricing tailwinds. Recent zircon, rutile and ilmenite supply disruptions, mostly in parts of Africa, coupled with robust demand from China and other markets, has served to reduce user inventories, increase demand and keep prices very buoyant and rising throughout 2021 and into 2022.

Many potential new sources of supply have significant question marks regarding permitting and/or approval timelines.

"I love the idea that we're able to focus on mining within WA and in fact stay in the area we're currently focused on, in the North Perth Basin, with all our current growth initiatives," Mutz says.

"There are many advantages to be working in this historically proven mineral sands mining district. ASX sector leader Iluka Resources and US-based Tronox have been in this area for many years and are still actively mining there. We joined them in 2018 and plan to remain in the area for many years to come."

Mutz says being about one hour out of the WA capital, Perth, in a well populated section of the coastal strip between Perth and Mid-west regional centre Geraldton, is a key advantage for Image as it looks to grow in a tight domestic labour market.

"Because our operation is just over an hour north of Perth there is no mining camp per se," he says.

"We have people from the local area, principally, and the rest from Perth – roughly 50% local and 50% from further afield – but everybody drives to work in the morning and goes back home at the end of the day. It tends to be a very attractive work-life balance situation for people who've previously been in mining camps and working fly-in, fly-out.

"The last 12 months or so the job market has certainly heated up. It is much more challenging today to fill new positions, and some of our people are being attracted away by some of the bigger companies with the offer of higher salaries. We're doing what we can to remain competitive, but certainly when we do lose an employee today it takes longer to replace them. Having our mining operation close to Perth works in our favour.

"I also think that as a successful, profitable mining company, that is now debt free and has paid an inaugural dividend to shareholders, and with a published growth strategy in place, Image is an employer of choice for many candidates.

"There are advantages and disadvantages to being a smaller company. Being a smaller company means we are nimble and can make decisions fairly quickly, and employees at all levels have a greater opportunity to influence the decision-making processes and therefore our success. So we tend to attract people who are creative and are not reluctant to wear multiple hats.

"Since we established ourselves as a credible developer and operator we've been very focused and transparent about our growth strategy. Growing a company from a single operation into multiple operations can be an exciting adventure. Our ambitions are to grow from a single operation to a second, third or even more operations going at one time. Realisation of our growth strategy means our employee numbers [currently 65 plus some 120 contractors] will have to grow substantially. This also means more opportunities for our current employees.

"We have already started growing our development team."

Mutz says significant challenges for companies transitioning from explorer to producer include establishing and building a high-quality team with the appropriate operating experience, knowledge and skills required to be a successful mining company. It is imperative to recognise that the skill-sets and experience necessary to build and maintain a successful operating company are different than the skills and experience necessary to build a successful exploration company. It also means attracting more and different shareholders that are not just discovery-focused.

Image got a major boost from its 2016 sale and purchase agreement with Murray Zircon that brought Mutz and other experienced operators, as well as an offtake agreement and all of the equipment necessary to transition from advanced explorer to mine operator.

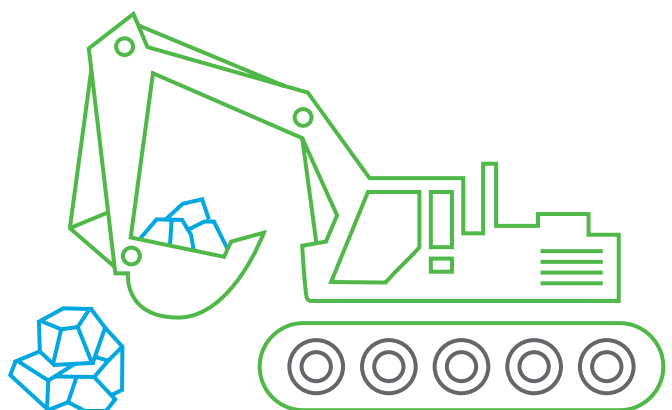
Mutz says the circa \$200 million company is now "priced on our profitability".

"We're not big enough yet for the big [financial] houses to pick us up, as a producer, because we're not in the right market-cap bracket to be attractive to the superfund groups and bigger institutions. And we're no longer attractive to the moms and pops on the speculative and retail side because it's now more about the longer term and about dividends," he says.

"So we're finding our way into the kind of investors that understand and support a longer term growth cycle and that are willing to wait the extra time necessary to achieve that growth, and in the mean-time, return dividends to shareholders.

"It's a very interesting and challenging space we find ourselves in.

"The good news for Image is our short and medium-term growth plans may be largely self-funded. In addition, we believe that now that we are a profitable going concern, we will be able to attract low interest debt from major banks to further our growth ambitions."





SOCIAL PACT

Mining companies, including Australia's new generation of mineral producers, have embraced sustainability reporting and are arguably leading the way internationally with increasing levels of granularity in environment, social and governance (ESG) disclosure.

The industry is slowly starting to see some uniformity in emissions, water-use, safety, diversity, staff turnover and basic governance reporting. Transparency is becoming more than a buzzword. Established miners are publishing internal ESG scorecards. Increasingly, they are being scored independently by external groups.

Global "sustainable investment" is now reported to exceed US\$35 trillion globally. Off a low base, net inflows into Asian ESG funds hit a new peak of US\$62 billion in December 2020, according to Morningstar.

While many companies cite concerns about creeping ESG regulatory and compliance costs there is little doubt the industry as a whole is becoming far more responsive to social pressures and dictates, and understands the value of the social licence that underpins permissions to extract and sell minerals.

Mining, is by its nature, resource-intensive and it disturbs the natural environment. The ESG issue, too, is inherently two-sided. "A broad increase in ESG scrutiny could present a challenge to the sector's earnings, multiples, and access to financing," says one large investment bank. "On the other side of the coin, though, lots of mined materials are needed to power a zero-carbon world, and mining delivers other ESG benefits."

One bank estimate put the total industry capital expenditure needed to supply just the incremental demand from electrical vehicles and renewables at US\$71 billion over the next decade.

The capex will be channelled into key enablers of wider electric vehicle adoption, including nickel, lithium, cobalt, magnesium and graphite, and also the infrastructure connected to the build-out of green electricity, such as copper and aluminium.

Net green

One of the most successful Australian exploration-to-production stories of the past decade, Pilbara Minerals, is currently looking to double and then perhaps triple its spodumene lithium concentrate production over the next five years, and also sees a path towards "net-zero emissions lithium". Chairman Tony Kiernan says: "Having cemented our status as one of the world's biggest suppliers of lithium raw materials over the past 12 months, we are conscious more than ever of our role in driving the global green energy revolution. In keeping with this status, we are working to develop a best-in-class climate strategy with a focus on minimising our impact, and mitigating the potential financial and operational risks of climate change, while maintaining a focus on worker health and safety and building upon our strong culture."

Pilbara Minerals CEO Ken Brinsden says an "exciting and transformational period for us by any measure" progressed within the broader context of "an unwavering – indeed, increasing – focus on our sustainability practices".

"Our pathway to achieving net zero emissions (Scope 1 and 2) in the decade commencing 2040 has been mapped and while it is challenging, we are up for it because it is an essential part of the global role we play," Brinsden says.

According to an American investment bank, most large miners have over the past year or so converged on a 30% reduction target in GHG emissions by 2030, with an ambition to be net zero by 2050. "With a couple of exceptions, this only applies to Scope 1 and Scope 2 emissions, not the Scope 3 emissions which are out of the companies' direct control," the bank says. "It is notable that even management teams which have historically had a more sceptical view on lofty, longer-term GHG reduction targets – arguably for good reason given the paths to these targets isn't always clear – have faced investor pressure to commit to them."

Perhaps emblematic of change in this area in the mining industry is one of the companies that is among the next generation of explorers ready to transition to production in Australia, Bellevue Gold.

The company's managing director, Stephen Parsons, says alongside continued exploration success and development of one of the world's highest-grade new underground gold mines in Western Australia, Bellevue Gold is "committed to operating sustainably, and it aims to be Australia's most profitable green-and-gold miner".

This means the company aims to position itself as the lowest greenhouse-gas emitter on a per ounce basis on the Australian Securities Exchange, with the lowest total Scope 1 emissions of any major off-grid gold mine in Australia. For the same carbon emissions, Bellevue is forecasting it can produce 3.6 ounces of gold compared with 1 ounce for the average Australian gold mine.

"Our vision, mission and PACE core values have been established and are now translating to real differences across the environmental, social and governance matters at Bellevue Gold," Parsons says. "During 2020, the decision was made to release a standalone Sustainability Report and align to the United Nations Sustainable Development Goals with a view to also adopt the recommendations of the Task Force on Climate related Financial Disclosures prior to production.

"Bellevue Gold's 2020 Sustainability Report was the first sustainability report published by an Australian resources development company before releasing a feasibility study or generating revenue.

"Responding to investors, Bellevue Gold is investing in sustainability because this is the right thing to do, and we believe that we can be industry leaders. Additionally, we are investing time in sustainability and data collection in order to respond to investor expectations, such as those publicly espoused by BlackRock Inc. Societal trends are demanding greater focus on sustainability, especially on climate change, employee diversity and modern slavery. During the last year, we have had focused questions from major international investors and Bellevue Gold recognises these demands and will continue to increase its disclosure as further policy initiatives are rolled out on the company's pathway to production."

"Bellevue Gold's 2020 Sustainability Report was the first sustainability report published by an Australian resources development company before releasing a feasibility study or generating revenue."

Other key ESG themes dominating mining boardrooms, media channels and investor calculations in a period of surging mineral exploration investment in Australia and regeneration of the country's mineral project pipeline, are exposure to the "right" commodities, traditional owner engagement, executive remuneration, and workforce and board diversity.

While thermal coal is a significant source of greenhouse gas emissions and electricity generated from thermal coal is not seen to have a place in a net zero world, various forecasters have global coal-power output falling by only 10–12% by 2040. However, funds and institutional investors are dumping companies judged to have too high an exposure to thermal coal and other fossil fuels, and Western listed miners have been rushing to the exit door to protect share values.

As has been highlighted in this report, gold, iron ore, nickel, lithium and copper have been the commodities that have attracted most attention and investment from Australia-focused explorers in the past 20 years. The market narrative around these metals has changed since 2010 and will likely continue to evolve.

One of the first companies to transition from exploration to production with an Australian cornerstone asset in the past decade, Sandfire Resources, delivered its first copper in the second half of 2013 – a time when prices for Goldman Sachs' "most preferred base metals exposure" were being driven by "late-stage construction demand... copper wiring and pipes that are installed after the basic structure is built", particularly in China.

China is still sucking in about one-quarter of the world's refined copper, but in the early part of the 2020–2030 decade the red metal is experiencing "surging demand due to its essential role as a critical metal in green technologies", according to Sandfire managing director and CEO, Karl Simich.

"Demand for many future facing metals is projected to surge over the next two decades, particularly as the world moves to 2050 carbon emissions targets. Green demand for copper is forecast to increase by 600% from 1 million tonnes in 2020 – just 3% of total global consumption – to 5.4Mt in 2030 [16% of total consumption]," Simich says.

"Despite this accelerating demand outlook, global mine supply remains structurally challenged due to declining discoveries and mine grades. This presents an exceptional opportunity for companies such as Sandfire with a high-quality copper development pipeline and a commitment to maintaining strong governance, environmental and social standards.

"All three countries in which Sandfire has major assets – Australia, Botswana and the United States – are part of the Energy Resource Governance Initiative group that aims to foster a just and sustainable energy transition and address associated supply-chain vulnerabilities."

Juukan Gorge fall-out

Mining major Rio Tinto's destruction of ancient rock shelters in Juukan Gorge, in Western Australia's Pilbara region, in May 2020 while it was developing its Brockman 4 iron ore mine sparked a parliamentary review of the state's Aboriginal Heritage Act 1972 and ultimately tabling of a new Aboriginal Cultural Heritage Bill designed to enable recognised traditional landowners to better protect cultural heritage sites.

Senior management changes at Rio Tinto amid widespread public condemnation of its actions preceded delivery of the Aboriginal Cultural Heritage Bill 2020, which was accepted cautiously by the mining industry in WA in November 2021.

According to the CEO of the Association of Mining and Exploration Companies (AMEC), Warren Pearce: "If enacted, this Bill will bring an end to Section 18 clearance processes and will set a new standard for the protection of cultural heritage in Western Australia. The Bill sets an extremely high standard for engagement and agreement making between our industry and traditional owners. And while it will apply to all industries, the mining and exploration industry will clearly be the one most affected by the changes."

Chamber of Minerals and Energy of WA chief, Paul Everingham said: "It's been well-documented that the existing Aboriginal Heritage Act 1972 is outdated and no longer meets community expectations, yet previous attempts at reform have failed. Introduction of this new legislation is an opportunity for WA to deliver the most modern and robust framework for Aboriginal cultural heritage management in Australia, and be truly world-leading. This latest iteration of the Aboriginal Cultural Heritage Bill is one that WA's mining and resources sector can work with. That said, this new framework will require significant adjustment from all stakeholders. Change of this scale is complex, and the challenge ahead to deliver on the potential set out in the Bill should not be underestimated."

Feedback from mining companies based in Australia and elsewhere suggests Rio Tinto's (then) legal mining act in the Pilbara will continue to have widespread consequences for the industry, including higher levels of government and community scrutiny, elevated costs and potentially longer time horizons for project development, and increased investor awareness and scrutiny.

"Even where project development may be feasible, the consultation periods with communities impacted by mining activities is likely to get longer rather than shorter," one piece of commentary suggested.

However, the enhanced level of public examination and political power of indigenous communities should mean mining companies exercise greater caution, and prudence, even in jurisdictions where political will to protect indigenous communities is lacking.

A new road

Gold Road Resources, co-developer and deliverer of Australia's only significant new greenfield gold mine of the past decade, became a producer in 2019 with the start of Gruyere in WA.

CEO Duncan Gibbs says the company prepared its first "stand-alone sustainability report" on the back of a review of the "sustainability context, trends, and material sustainability issues that may affect Gold Road and our stakeholders".

The report was a "step towards our vision to become an ESG leader within the gold mining sector" that included a core emphasis on workforce engagement and diversity. Gold Road said 97% workforce participation in its 2020 Employee Engagement and Culture Survey, up 4% on the previous year, was "well above industry benchmarks".

"The biggest improvements in employee engagement related to following through on commitments to protect the environment (88%), being able to meet career objectives (83%), and trust in the leadership team (83%)," the company reported.

Gold Road said it was "above the industry average of 18% for female employees" with its 30.4% female participation rate at the end of 2020. Female board representation rose to 33% with 50% of non executive directors being women.

The Gruyere mining operation, owned 50-50 by Gold Road and Gold Fields, had 503 employees at the end of 2020 – 164 Gruyere employees and 339 contractors – with an average 8% indigenous and 15% female workforce participation. Four indigenous-owned businesses were supporting the mining operation.

Duncan Gibbs says amid the challenges presented by COVID and the start-up of a major new mine, the company had commenced its "sustainability journey". The company had a "specific intent to elevate ESG as an integral part of our performance framework across the organisation, which includes the recent establishment of a Board Risk and ESG Committee".

"We continue to have an ESG gateway qualifying hurdle, established in 2019, and specific annual sustainability objectives that directly link executive and senior management performance and remuneration to ESG through the Short-Term Incentive plans.

"In 2021, we are developing a formal sustainability strategy including targets and will continue to report on our progress annually."

Taking the baton from Gold Road on the next line of new Australian gold-mine developers, Bellevue Gold expects to employ up to 380 people at its proposed operation.

Managing director Stephen Parsons indicated that shaping a new company's culture had probably never been more important to retaining existing skilled employees and attracting new ones. "With the mining and resource sector currently experiencing a boom, skills shortages are being experienced in Western Australia," he says. "Now more than ever employees have an opportunity to be selective about their next role and career move and the type of organisation they want to work for. We believe our main competitive advantage lies with our people, and we don't take for granted how lucky we are to have such a dedicated workforce of employees whose personal values align to our core company values of ... passion, accountability, community and excellence."

Green and bold

"We've found all the easy stuff", has become a popular refrain in Australian mining industry circles, yet a common rejoinder is: "You've got to drill it to know what is really there".

Novo Resources managing director Mike Spreadborough says the company spent about \$45 million between 2010 and 2020 on its 13,000-to-14,000 square kilometres of Western Australia's Pilbara region, where it now has a producing gold operation at Beaton's Creek near Nullagine. It had barely scratched the surface of a region he considers under-explored for gold and base metals. "That ground we're playing with is super immature in terms of exploration," says Spreadborough, who has been in senior operational and management roles in the Australian mining industry for more than 25 years and was chief operating officer at Sandfire Resources as it ramped up production at DeGrussa in Western Australia. "We're looking in places for copper and nickel and some of those tenements have really had nothing done there. It's the same with some of the gold areas – they've just had no work done."

Spreadborough points to WA's Paterson Province, which hosts the exciting Havieron and Winu copper and gold discoveries of Newcrest Mining/Greatland Gold and Rio Tinto, respectively, and the state's Fraser Range district, home of the Nova nickel-copper-cobalt operation owned by IGO, as being similarly under-explored. He cites IGO, which has a \$65 million exploration budget for FY2022, as a standout greenfield explorer in Australia.

Elsewhere, parts of the vast Gawler Craton in South Australia, western New South Wales, sections of Victoria's historically rich goldfields that have been effectively quarantined from modern exploration, and remote eastern parts of the Northern Territory, are all seeing elevated levels of search activity courtesy of increased spending by cashed up, larger mining companies, and many juniors that found capital raising conditions in Australia favourable in 2020 and the first half of 2021.

While heavy brownfield exploration spending around established plants and infrastructure continues to account for the lion's share of new investment, greenfield activity has clearly lifted on the back of discoveries such as Nova,

Gruyere and DeGrussa, and then in more recent times by world-class finds at Hemi (De Grey Mining) in the Pilbara, Havieron and Winu, Oak Dam (BHP) and Elizabeth Creek (Coda Minerals), Boda (Alkane Resources) in New South Wales, and Julimar (Chalice) in WA.

De Grey and its Hemi discovery present a remarkable example of how quickly perceptions of an area, and a project, can change on the back of heavy, purposeful drilling.

The company's 2019 annual report did not mention Hemi.

"Our 100% owned tenement package is well located within 80km south of Port Hedland and comprises approximately 1,500 square kilometres of what we firmly believe will be a major new gold province of Western Australia," De Grey reported hopefully at the time.

"The Mallina Basin is the largest Archaean sedimentary basin by strike extent and volume and is interpreted to be controlled by large deep-seated mantle tapping structures that allow primary gold rich fluids to flow into the basin. This underlying deep-seated mantle tapping architecture creates an excellent fluid pathway and the complex folding and shearing history provides excellent structural traps for gold mineralisation in the various shear zones, anticlinal structures and associated intrusions.

"The shear zone style of gold mineralisation is well documented with defined resources including the Withnell, Wingina, Mt Berghaus and Mallina deposits which occur as generally steep sub vertical lodes within large regional scale shear zones. This style of mineralisation forms the largest portion of the current known resources [1.7 million ounces at Mallina].

"To date only 10% of the 200km-plus of shear zones and new intrusion-related targets have been drill tested in any detail, with most of that drilling less than 150m from surface. A significant aircore drilling program is underway

across these highly prospective structures with the aim of further new and substantial discoveries."

De Grey said north-east trending shear structures and sanukitoid intrusions in the Mallina Basin correlated well with similar gold large regional scale structures in the WA's gold-rich Yilgarn Craton – suggesting the gold mineralisation of the Pilbara "is very similar in age, geometry, host rocks and alteration styles as many of the gold deposits mined throughout the Kalgoorlie to Wiluna region".

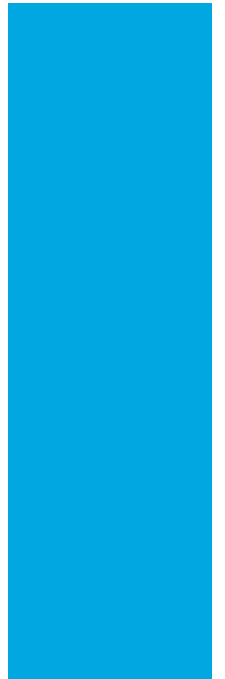
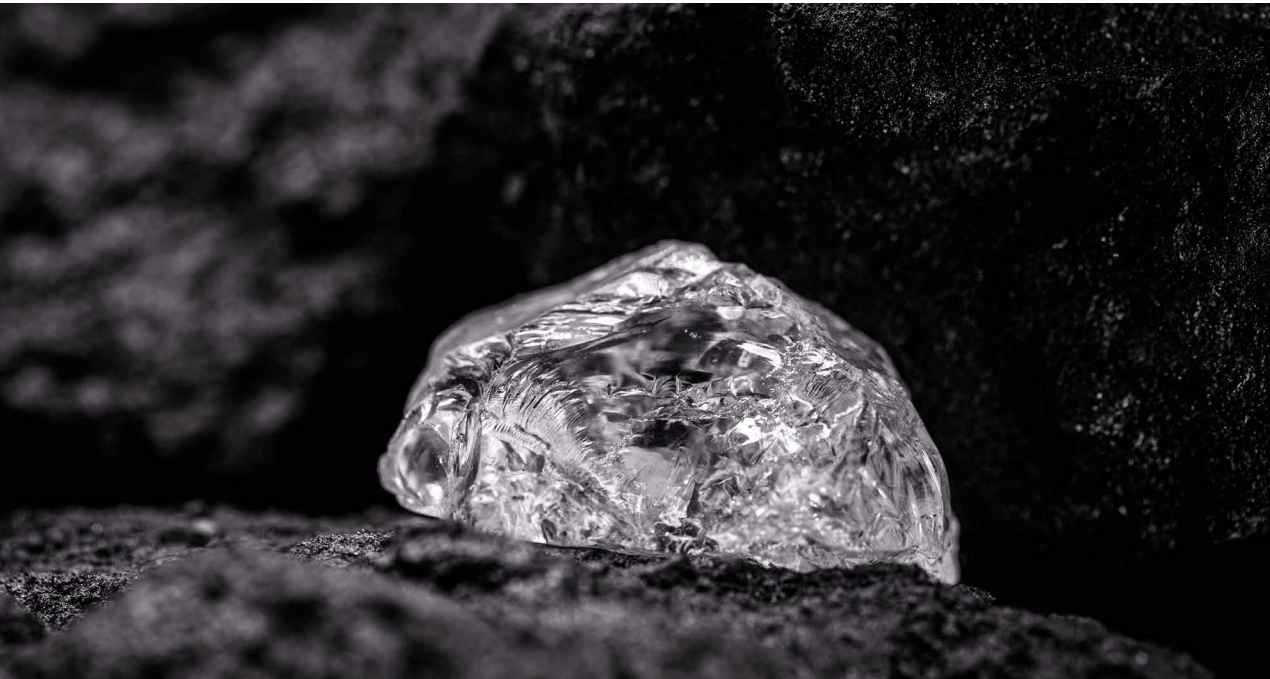
Fast-forward to September 2021 and De Grey managing director Glenn Jardine says his first full year at the helm of the junior saw more than 400,000m of drilling with up to 12 rigs feed results into resource calculations including 6.8Moz for Hemi and 9Moz for the Mallina camp.

"Our ability to rapidly deploy drilling assets at these discoveries has allowed us to find gold at \$8.50 per ounce for 6.8 million ounces at a rate of 450,000 ounces per month since the first RC hole at Hemi back in February 2020," Jardine says.

"We expect to continue to grow the Hemi resource through the next 12 months. To expect a similar rate of growth as last year may be ambitious, but I note recent Diucon and Eagle exploration results continue to add resources rapidly whilst all other Hemi deposits – Aquila, Brolga, Crow and Falcon – remain open at depth and in most directions.

"There is a high level of confidence within the board and management that the exploration drilling will continue for many years to come, supported eventually by the likely tier one production profile of Hemi."

According to Jardine, as well as metallurgy, environmental, hydrology and geotechnical work to support completion of a prefeasibility study in 2022, De Grey's corporate strategy aimed to use its IP knowledge to identify intrusion-style mineralisation targets within its project area and the greater Pilbara region.



SPOTLIGHT ON PILBARA MINERALS:

Lithium producer Pilbara Minerals is a mining champion for a new era

Australia's mid-tier mining space has been re-energised in the early part of the 21st century. Lithium producer Pilbara Minerals is emblematic of the change, in more ways than one.

The company spent about \$400 million exploring for, then developing, a world-class hard-rock lithium and tantalite deposit at Pilgangoora in Western Australia's mineral-rich Pilbara region. That development sequence took only four years and Pilbara Minerals shipped its first spodumene concentrate in 2018. A sharp dip in lithium pricing created both hardship and opportunity for the company and now, as a long-term rising demand cycle pushes prices higher, Pilbara Minerals is making its bid for heavyweight status in the world's new energy market.

CEO Ken Brinsden says the world has fundamentally changed in the short time it has taken Pilbara Minerals to become a leader in the fast-growing battery raw materials industry.

"We were lucky enough to catch what you might call the first wave of battery raw material euphoria and that helped a lot in creating the environment that allows you to raise the money to ultimately build a mine," Brinsden says.

"The steps you have to take in between, the exploration, engineering and so forth, mean there is a lot of money to be spent – \$100 million, for argument's sake – before you

even have a project. You need a cycle to be working in your favour otherwise you're just not going to get that type of money. And you might be carrying a \$100 million market cap, which was probably where Pilbara Minerals roughly was when it had a dream about lithium.

"You're not going to raise the money unless the market wants you to succeed. So we were lucky enough to be at the front of that bow wave.

"In total it was actually about \$400 million worth of equity that we raised to get to production.

"Then we had about another \$100 million that supported the build and the working capital. That debt component was still very, very hard because at the time the banks weren't interested in lithium raw materials. They just saw huge risks: a single market in China, and limited price transparency.

"The banking world has turned a corner in respect of lithium raw materials and concepts around green money. It means that financing now is very different to what it was five years ago. I think that's actually a relatively recent phenomenon and the turning point was really COVID."

Massive government stimulus spending has "woken a lot of people up" to the scale of the new energy mobility and infrastructure transformation occurring around the world – no longer just in China – according to Brinsden. Private investment and bank finance is being directed at

new energy opportunities, and the world's awakening has extended to a growing realisation that raw materials – lithium, copper, nickel and other minerals – are needed to reset and sustain the new-energy economy.

Pilbara Minerals' \$200 million acquisition of Altura Mining, which didn't make it through the lithium price plunge in 2019–2020, gave it neighbouring infrastructure and resources that, combined with the company's existing operations hub, provide a ramp to annual production of one million tonnes or more of high-grade lithium concentrate, which would triple current output.

"From 2014 through to 2018 it was pretty much a China story in the battery raw materials space. They'd stimulated their battery economy. It set up a huge wave of growth, but it was very China-centric. Now the rest of the world has switched onto the electrification theme and the demand is very strong ex-China. That is very different compared with where we were historically."

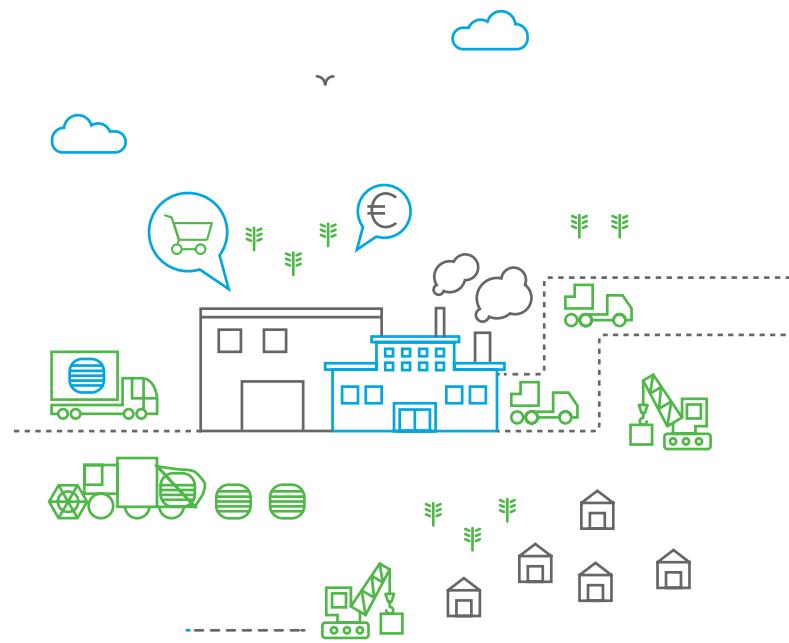
Brinsden thinks Pilbara Minerals sits in a "privileged position" among its peers; leveraging the riches of a world-class minerals province, established infrastructure, a strong domestic mining supply and services base, and a robust and reliable regulatory framework. "I also think we are in a privileged position in the Pilbara because the traditional owners there are well versed in mining and understanding mining companies and due process. They are rightly protective of their traditional lands. In which case we should be prepared to be flexible, accommodating, and absolutely above all demonstrating respect for the position that they take with regard to us working on their land.

As long as you treat them with respect as a company then there is no reason to believe that ultimately they won't be supportive of you working on their land. And that's why, again, I'd say we are privileged."

Despite rising concerns about labour, Brinsden also sees advantage in an environment in which more people are joining the dots between the new energy economy and producers of the materials it needs to flourish.

"We were worried about the restart of the former Altura operations because we knew we had to recruit a lot more people. The labour market is hot at the moment and we were thinking we may not get the people," he says.

"As it turned out we probably shouldn't have worried about it as much as we did because what we found is we're getting refugees from the coal industry, even to a certain extent from iron ore. And the perception that we're a solution provider – mining the lithium for electric-vehicle batteries – is a factor. It is really worth something and we've seen that in the number and the quality of the candidates we've been able to attract.



"Over the last three years the two big acronyms that have dominated the mining and mineral exploration conversation have been COVID-19 and ESG. ESG has been elevated by financiers globally into discussions earlier and earlier in the mine cycle. We are now talking with members about implementing ESG reporting in the pre-discovery phase," said Warren Pearce, Chief Executive Officer of the Association of Mining and Exploration Companies.



TECHNOLOGY

Game-changing technologies:

- **Computing power**
- **Cheaper, better geophysics and geochemistry**
- **Data integration and visualisation tools**
- **In-field assaying/analytical tools**
- **Deep drilling technology**
- **AI and machine learning**
- **Drones**

IGO's managing director Peter Bradford says the company's focus is on applying the latest science and technology to generate new targets and discoveries.

Major near-surface discoveries such as Hemi and Julimar aside, Bradford says a major challenge for IGO and the industry is the need to explore deeper. "To meet that challenge what we've done is explore in some very large areas. We're exploring under cover, with anything from 20-to-150m of sand that we have to look through to understand what the geology is doing. We're adopting all of the latest geophysical and geochemical tools to do that: I think it's fair to say that we are fast followers. Geophysics, especially electromagnetic, has been a strong suit of IGOs for many years, and at various times we've been fast followers or have been leading edge, and have been developing EM technology in-house in collaboration with some of the academic institutions.

"Where we see ourselves being going forward is exactly that again – be at the forefront of involving new tools for the understanding of EM," Bradford says. "The other area where we've been an early adopter is with 3D seismic as it relates to trying to better understand ground-fill systems. 3D seismic is something that has been used in the oil and gas industry for a very long time, and used very successfully, but in hard rock situations we haven't seen a lot of it until quite recently. Back in 2008 IGO first used it at our Long mine, and that was one of the very first instances of 3D seismic used in a hard rock environment. We've gone on to use it at both Tropicana and Nova, and at Nova last year, we carried out the largest single 3D seismic survey ever undertaken in Australia."

Certain technologies are seen as vital enablers for the exploration sector as search activity is trained increasingly on deeper domains and blind targets.

Advances in the effectiveness of baseline geophysical surveys are seen as a key industry development by many Australian companies that have transitioned from exploration to production over the past decade. The cost of generating and analysing geophysics data has also been steadily decreasing. A shift to drone-based geophysical surveying that is expected to gain momentum over the next few years could have a further significant impact on costs associated with traditional airborne surveys as well as having a profound effect on exploration over difficult terranes.

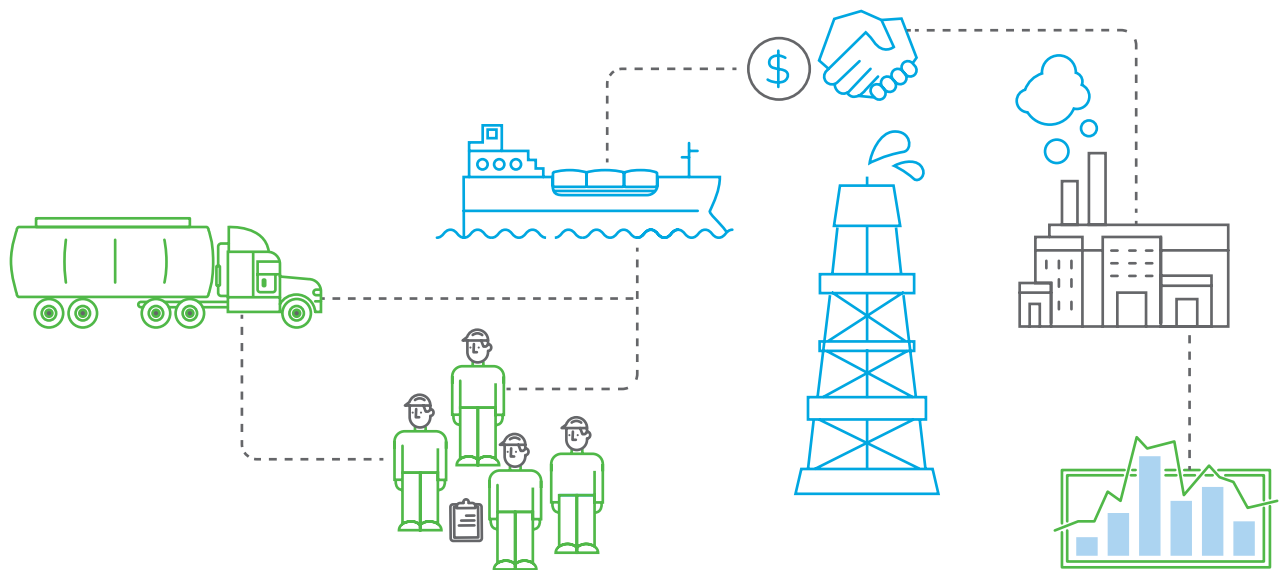
The ability to combine and crunch vast amounts of geology, remote sensing, geochemistry, gravity, aeromagnetic and radiometric, and regional structural data, on mobile computers is another area of rapid advancement identified by most companies as a "game-changer" for modern exploration. Computing power has grown exponentially over the past 20 years.

Artificial intelligence and machine learning, properly applied, can now offer faster, more valuable insights.

"I think the technology is improving immensely – higher power, better resolution and improved computing power," said a geologist who requested anonymity. "Data acquisition in metals is coming into line with what they do in oil and gas in some respects which is a good thing. Technology like Hi-Seis for 3D seismic and Orexplora for 3D core visualisation are amazing and weren't around that long ago.

"Having said that you can have all the power you want but it's the geological understanding which is more important. Challenging old ideas on gold deposits has led to the discovery of lots of new areas. Look at Kirkland Lake Gold's Swan Zone discovery, De Grey with gold in sanukitoids, Northern Star Resources with gold in the granites in the Yandal Belt near Jundee, and Bellevue Gold's new lodes.

"Geological understanding has been the key and that has also grown immeasurably over the past 10 years or so."



CONCLUSION

Twenty years of regenerative investment in Australia's mining industry has seen the birth of new heavyweight and mid-tier global miners, strengthening of the country's credentials as a mature but still highly prospective mineral exploration jurisdiction, and significant expansion of its "critical minerals" reserves.

In the past decade alone, the industry's "stellar" contribution to the national accounts has included \$2.1 trillion of resources export revenue, \$246 billion of mining wages and a staggering 21% of Australia's GDP growth in the period. The latest Minerals Council of Australia* report card also shows mining contributed \$132 billion in company taxes and \$106 billion in royalties from significant capital investments in regional and remote Australia over the past decade. MCA data suggests more than 50,000 new jobs have been created in the industry in the past five years. Perhaps more importantly, as mining companies pitch to a new generation of workers, full-time adult total earnings in mining averaged \$144,000 in 2021, compared to \$94,000 across all industries.

And as government policy makers focus increasingly on the settings needed to foster higher levels of downstream battery and new-energy mineral processing, sections of Australia's \$114 billion * mining equipment, technology and services (METS) sector are already helping – with technology and IP – to find and develop the next generation of mines.

A largely unsung pillar of the country's 21st century mining rebuild, the METS sector has added a significant layer of economic value (circa 200,000 direct jobs) while contributing technology and products that have been integral to consistent productivity and safety gains at Australia's mines in the past decade.

Carl Di Lorenzo, a partner at RSM Australia and member of RSM's resources team, says the nexus between Australia's

nascent new energy minerals sector and a world-class domestic technology and services base could become a key theme in the next chapter of the country's economic story.

"As this report highlights, the basis of Australia's success over the past 20 years has been very much around gold and iron ore," Di Lorenzo says. "It would be tough for these traditional resources to replicate the sustained growth over the next 20 years and it is likely investors will shift capital, resources and technical expertise to the greener, energy-generating and storage minerals.

"The METS sector is definitely key to finding more resources. However, I think the intersection of tech and battery minerals will occur across more than the discovery level. Lithium and other battery minerals are inputs into many of the products the world is demanding more of. They include the products miners will use to decarbonise and digitalise: to improve efficiency and modernise in line with all the important elements of today's ESG [environment, social, governance] zeitgeist."

Craig Amos, a partner at RSM Australia agreed the transition of mining and broader society to new energy and renewable sources, and the prominence of battery minerals, were likely to "make a very big impact on the industry over the next 10 years".

He says Australia's foundations are unique.

"Australia does offer one of the best sovereign risk settings in the world.

"We have a jurisdictional framework that is in sync with the mining industry and a country which, on a relative basis, offers a high degree of political and socioeconomic stability.

"And we have mentioned the advancement of technology and processes, where Australia is at the leading edge of productivity-enhancing work methods and safety."

REFERENCES

Note: Unless otherwise stated, all dollar references are in AUD

*Various company annual reports, presentations and interviews.

*Western Australian 2021 – 2022 budget submission, Association of Mining and Exploration Companies.

*Trends in Gold Exploration, Richard Schodde, MinEx Consulting, May 2021.

*Assessing Long Term Exploration and Discovery Performance for Key Minerals in Australia, Richard Schodde, MinEx Consulting, November 2020.

*Best Undeveloped Projects 2020, Argonaut Securities.

*Aurum Analytics – Australian & New Zealand Quarterly Gold Report, various.

*Australia's Unfolding Geoscience Malady, September 2021, Samuel Boone and Mark Quigley, University of Melbourne; Peter Betts, Monash University; Meghan Miller, Australian National University; Tim Rawling, AuScope, National Collaborative Research Infrastructure Strategy Program for Geosciences.

*Minerals and energy: Major development projects – October 2010 listing, ABARE.

*Bernstein Global Metals & Mining Exploration, March 2021.

*Fraser Institute Annual Survey of Mining Companies 2020.

*Gold and climate change: The energy transition, World Gold Council, December 2020.

*Roy Hill: How much is too much? Reducing the regulatory burden, October 2019.

*Chamber of Minerals & Energy WA 2011 annual report.

*Chamber of Minerals & Energy WA 2020–21 annual report.

*www.minerals.org.au/news/mining-underpins-budget-and-australia%E2%80%99s-prosperity

*Austmine 2020 National METS survey.

THE POWER OF BEING UNDERSTOOD AUDIT | TAX | CONSULTING

RSM Australia Pty Ltd is a member of the RSM network and trades as RSM. RSM is the trading name used by the members of the RSM network.

Each member of the RSM network is an independent accounting and consulting firm each of which practices in its own right. The RSM network is not itself a separate legal entity of any description in any jurisdiction.

The RSM network is administered by RSM International Limited, a company registered in England and Wales (company number 4040598) whose registered office is at 50 Cannon Street, 2nd Floor, London EC4N 6JJ.

The brand and trademark RSM and other intellectual property rights used by members of the network are owned by RSM International Association, an association governed by article 60 et seq of the Civil Code of Switzerland whose seat is in Zug.

© RSM International Association

rsm.com.au

Liability limited by a scheme approved under professional standards legislation

Celebrating
100
Years
Est.1922 in Australia

**RSM**