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GLOBAL BUSINESS REPORTS

Western Australia Mining 2017

PRE-RELEASE
EDITION

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Dear Readers,

For the past few months we have had the chance to study the WA mining landscape in order to provide an enriching analysis of the industry for our report. Our final editorial will be released in the Engineering & Mining Journal's September 2017 edition, and this pre-release contains an overview of the research we have conducted on WA's mining environment thus far.

With a recent change of government and a new mining minister, WA is experiencing a slight level of uncertainty, but this is not perturbing for an industry that maintains a bullish attitude despite challenging terrain, remote areas and tumultuous mining cycles. Though the state was shaken by the global mining downturn in past years, new investments are re-appearing and a general sentiment of moving towards the sector's natural equilibrium can be felt.

As a highly diversified state, WA has projects ranging across precious metals, base metals, mineral sands and even diamonds. With various commodities such as iron ore and gold experiencing positive growth over the course of the last few months, the landscape is inevitably improving, however gradually. Global interest in new commodities, such as lithium, graphite and cobalt, is emerging at a pace and Australian risk-takers are front in line to develop projects that will address this need.

As countries including China, the UAE and Russia construct new nuclear power plants, the long-term vision for uranium displays some cause for optimism. Yet the medium-term for the commodity remains highly challenging with an over-supply in the market. A recovery in uranium prices is necessary in order for WA investments to be secured. Though Chinese investments in the country might soften given the global political environment, European interests will carry on, funneled primarily through London, as well as Japanese conglomerates targeting WA's diversified landscape.

As global innovation leaders, WA is implementing the latest technologies and equipment, working hard to diminish human factor risks through wireless applications and automation. Service providers are fighting a race against time to provide the best solutions for IoT, big data and data lake management, while consulting firms are developing the latest strategies to protect clients from cyber-security breaches. PwC's latest 'Game of Threats' allows C-level executives and board members to act as both hackers and company defenders through real-life situation gamification, emphasizing the growing need for companies to always be alert and prepared.

Always ready to face new challenges, WA companies are well known for expanding their operations internationally, with restored optimism in regions like West Africa. With a solid regulatory framework, strong infrastructure and highly trained professionals, WA remains a great place to invest in for the mining sector.

We would like to thank all the companies that have taken the time to provide their insights of the market in order for GBR to create this report. We trust you will enjoy it.

Alice Pascoletti, Project Director
Elisa Iannacone, Journalist
Lindsay Davis, Journalist



**WESTERN
AUSTRALIA**

2017 Pre-release

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This research has been conducted by Alice Pascoletti, Elisa Iannacone and Lindsay Davis.

If you would you or your company would like to be part of the final report on Western Australia, please contact apascoletti@gbreports.com

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Break of day RC Drilling. Photo courtesy of Musgrave.

The Lay of the Land:

Politics and Regulations in WA

In a regional election this March, WA overwhelmingly voted to put the Australian Labor Party back at the helm of the state parliament for the first time in nearly a decade. Traditionally, the incumbent Liberal party has been viewed as the champion of the mining industry and the fiscal agenda that the mining sector can expect from a new government preparing to tackle the state's rising debt level largely remains to be guessed at. However, in a region where mining is deeply embedded not just as a vital economic institution, but a cultural one, there seems to be a shared belief that the regulatory landscape will remain relatively undisturbed by the shuffling in government. Perhaps the most incendiary campaign topic with relevance to mining arose from a proposal by the WA National Party, which introduced a highly controversial mining tax that, if it had passed, would have hit majors Rio Tinto and BHP Billiton with a A\$5 levy for every tonne (mt) of iron ore mined. Reg Howard-Smith, chief executive of The Chamber of Minerals and Energy

of Western Australia (CME), explained that the tax had raised concerns both nationally and internationally. "Chinese and Japanese companies have spoken out for the first time regarding the proposal because it goes to the heart of our sovereign risk. We are regarded as a low-risk location when it comes to the protection of investment funds, but if we make a unilateral change, which is not by agreement, this creates a major issue within the sector," he said.

The CME led an aggressive A\$2 million media campaign countering the National's proposal that seems to have resonated with the electorate and the newly-elected Labor leadership has indicated that it will not consider implementing the tax. As signs of another upswing continue to emerge on the horizon, the resource-rich WA can continue to focus its energies on what it knows best: re-sources. "Minerals industry professionals in WA are lucky to operate in one of the world's leading mining jurisdictions. With many of the world's largest mining companies operat-

ing in the state and a world-class regulatory regime, WA provides tremendous opportunities," said Colin Moorhead, CEO of the Australasian Institute of Mining and Metallurgy (AusIMM).

The Fraser Institute's annual assessment of 104 mining districts around the world consistently ranks WA as a top destination and the state took third in the 2016 survey after Saskatchewan and Manitoba, respectively. The Canadian-based research organization compiles its overall Investment Attractiveness Index through a combination of factors, including geological attractiveness and perception towards public policy. In comparison to other Australian states and territories, particularly New South Wales and Victoria, WA's permitting and environmental approvals processes continually garner praise from the industry. Globally speaking, navigating WA's regulatory framework also proves a painless procedure. Weighing his experiences operating in Australia and other stable jurisdictions worldwide, Mark Bennett, CEO at S2 Resources, commends the efficiency of the WA government. "As a mining state, the government apparatus and all its agencies truly understand what needs to be done in the permitting process," he said.

Approximately 85% of WA's land mass is either claimed under native title or subject to a native title application and negotiations between indigenous peoples and mining companies are an area in which multiple stakeholders believe policy could be improved. A 2017 report jointly produced by Curtin University and the University of Western Australia found significant shortcomings in the agreement-making process that limit the equality of outcomes in terms of socioeconomic benefits for aboriginal peoples. "The timeline for mining companies to negotiate with indigenous groups could be streamlined so as to ensure that jobs and benefits can flow through to indigenous communities in a more timely manner," said James Richards, executive chairman at Poz Minerals.

Besides its wealth of resources and an outstanding regulatory framework, Jerko Zuvela, managing director of Argosy Minerals, outlines the intangible value of being a WA-based company. "WA is a mining state and the people understand the importance of investing in junior mining companies. Sourcing funding here is easier than other jurisdictions and we have a strong network of investors in Perth[...]It is built into our psyche as a mining state that with higher risks come higher rewards," he said.

Reg Howard-Smith

Chief Executive,
The Chamber of Minerals and Energy of Western Australia (CME)



"Automation is absolutely critical. To maintain a competitive advantage, we need to be the best in the world, and that is where automation becomes extremely important."

What are some of CME's key near-term priorities for the Mining Sector?

Our most immediate priority revolves around the National Party's mining tax proposal, which strongly impacts BHP and Rio Tinto. If it were successful, the implications would be wide-spread, causing concern both nationally and internationally. Chinese and Japanese companies have spoken out for the first time regarding the proposal because it goes to the heart of our sovereign risk. We are regarded as a low-risk location when it comes to the protection of investment funds. But if we make a unilateral change, which is not by agreement, this creates a major issue within the sector. Smaller and mid-cap companies often need to raise funds internationally, and would be affected. These funds could dry-up, given that international finance is very fluid, and it could easily flow into other jurisdictions very quickly. This is a major concern.

With the rise in iron-ore prices, can we still expect to see a continued diversification towards lithium, uranium and mineral sands in WA?

We mine in the excess of 50 different minerals in Australia. Certainly lithium will be a strong focus, given that we have been mining and exporting it for 25 years, have one of the largest lithium mines in the world, and new lithium operations are coming up. We will see at least one lithium processing plant being built here in WA and there is the possibility we might see one more. It remains, nonetheless, a very competitive world. We are also finally seeing some movement within the rare earths sector, where Northern Minerals will be building a pilot plant. WA is a very mature mineral sands province, having mined it for over sixty years. Price challenges are there, but hopefully we will see the mineral sands industry continue for many years to come given its environmentally friendly impact.

There are more nuclear power plants being constructed today than at any other time in our history, with 62 being built at the moment. As we move to reduce the carbon footprint in the world, an increase in nuclear will rise, along with the demand for uranium, despite the current challenges.

Australia is considered a leader in technological innovation for the industry. What kinds of changes can we expect to see within the automation realm moving forward?

Automation is absolutely critical. To maintain a competitive advantage, we need to be the best in the world, and that is where automation becomes extremely important. We see most automation advances in things like shipping, rail and logistics. There is a tendency to eliminate unsafe jobs, taking human factors out of the equation where there is a potential risk. Safety is a major consideration with automation as well, where more wireless and remote operations are starting to emerge. Certainly automation will indeed, over time, result in decreased employment numbers, but it will mostly change jobs rather than eliminate them completely. People will need to maintain and control trucks with a higher-skilled level. That is where the growth is, given that the number of mechanics responsible for an automated truck are more.

In which ways does CME push for an equitable workforce within the industry?

The mining industry has a perception of being made for 'big tough blokes', but we are trying to change that. We believe that an equitable workforce is indispensable for success, and our current priorities are focused on female and aboriginal workers. CME is a major catalyst for gender equity within the sector. Although only about 20% of the industry is made up of women, Western Australia has one of the highest percentages of women in the mining and oil and gas workforces in the world. We always strive to create an environment that encourages women to join the sector and create events in order to carry this forward. Though there is yet much work to be done, the mining industry is one of the largest employers of Aboriginal Australians compared to other private sector or government entities. We have evolved to a sophisticated system in which we can see Aboriginal Australians in middle and senior management positions within the industry. Many of our projects are located on traditional lands, so engagement with Aboriginal people has always been paramount. We are talking about people who have had land access for thousands of years, and we have to respect that.

51%
of Australia's resources
projects under construction
or committed are in WA.

WA has over
900
operating mine sites

Approximately **1/4**
of the world's population is
within the same time zone
as WA.

Exploration in WA

The need for greenfields rises

The wheels are certainly set in motion for the development of new projects in WA, yet the need for greenfield exploration is becoming more pressing. After the discovery of the Nova nickel-deposit by Sirius Resources, now S2 Resources, the junior segment is battling for the discovery of Australia's next Tier 1 deposit with silent competitiveness. Though most of the state's focus is placed on brownfield operations, vast areas of undercover land remains untouched. It is here that many players have decided to participate. "We have not even scratched the surface of the vast areas in the Great Sandy Desert," said Richard Bennet, managing director of Strike Drilling. Whether a renaissance in greenfield exploration in WA is coming or not, the determining factor in the short-term will be financial. Spending money wisely has always been

paramount to juniors, but it becomes an even more crucial ingredient for successful greenfield operations. "When there is limited funding, discipline comes into play. One can spend a lot of time trying to prove oneself right when the evidence objectively suggests the opposite. It takes clear analysis and determination to know which project should advance," said Will Robinson, managing director at Encounter Resources. In the longer term, it is clear that major producers will reach a point at which the need for new deposits will be essential and the only choice will be to undertake the role themselves or work alongside other explorers. In the words of George Bauk, managing director and CEO of Northern Minerals: "The state's mineral potential has yet to be uncovered." The West Australian Department of Mines and Petroleum (DMP) supports greenfield

exploration through incentives that fund up to 50% of drilling expenditures. Many companies have benefited from the Exploration Development Incentive (EDI), which is a tax offset credit made available by the Commonwealth Government. "It represents about A\$300 million worth of exploration drilling and should generate about \$1 billion in economic activity," said Graham Short, national policy manager at AMEC. The call for applications is once every year. "Especially when testing a brand new or greenfield target, it makes it a lot easier to undertake the risk," said Ian Mulholland, managing director of Rox Resources. Service providers in WA have struggled with the demands for lower costs while also encountering heightened safety standards with less skilled workers. Many went out of business in the past few months while at-



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"Over 300 drill rigs have gone into liquidation in the last four years; it is definitely a tough market out there for service providers."

Peter Jacobs, senior vice president, Foraco Asia Pacific



tempting to navigate the challenges. "Over 300 drill rigs have gone into liquidation in the last four years; it is definitely a tough market out there for service providers," said Peter Jacobs, senior vice president of Foraco Asia Pacific.

Drill-ready targets are often unavailable even for majors that are ready to invest, given the budgets restraints that occurred in past years. "The pickup in the market will come from juniors, if they can get access to funding," added Jacobs.

The trend in which juniors would take themselves through back-door listings made primarily with tech companies has slowly reversed with a spike in junior IPOs since Q4 2016. The influx of capital entering the market from East-coast retail investors and superannuation funds is a reflection of the changes in commodity prices. "That money has sat on the sidelines for a while, but needs to go somewhere. There is a large speculative appetite in Australia, much more so than in the UK," said Sherif Andrawes, chairman of BDO.

Financial entities, such as the Commonwealth Bank, are on the lookout for projects that have strong assets and display resilience to commodity price fluctuations. It is their recommended strategy to become involved with companies at a DFS stage in order to understand capital requirements and create adequate funding structures. "The importance of the commercial structure to the financing highlights the need for clients to engage with potential financiers at an early stage to ensure that commercial agreements and technical studies will ultimately meet bankability standards," said Grant Willis, managing director at Commonwealth Bank and global head of natural resources.

The lessons learned from the WA mining boom have led to a certain level of conservatism. "Even now when you speak to gold companies, people are cautious. Many are preserving capital or paying dividends. Some gold CEOs are selling equity because the growth to come is not as good as the one that has already been," said Adrian Arundell, director of Azure Capital. "We are moving towards a more sustained market rather than an escalated out of control boom, which is better," he added.

"There is a large speculative appetite in Australia, much more so than in the UK."

Sherif Andrawes, chairman, BDO



Gold

Global uncertainty prompts price stability

A resurgence in the price of gold has prompted confidence in the investment opportunities afforded by several projects across WA. While the sustainability of current rates is debatable, many in the industry maintain that fundamental demand for gold remains very strong, increasingly from their East Asian neighbors rather than traditional North American and European markets. Mike Dunbar, managing director at Gascoyne Resources, outlined why now is an especially exciting time for gold projects: “Five years ago, Australia was seen as a high operating cost destination yet the country has completely turned around. We are now a lower-cost jurisdiction than most and I would go as far as to say that there has never been a better time to develop a gold mine in Australia.”

The stability of the jurisdiction aids in de-risking WA projects in comparison to other similarly prospective regions such as West Africa. As a result, a reinvigorated push towards greenfield exploration of gold in WA can be discerned by a 14.6% (A\$23.2m) increase in expenditure during the December 2016 quarter. Bruno Seneque, managing director of Tyranna Resources, described how the impact of rising gold prices has translated to opportunities for explorers: “We can see that now it is gold’s time to stabilize, produce profitable returns, and attract investors. Importantly, we are starting to see investment interest trickle down from the producers to the explorers.” Larger producers are implementing programs to enhance the value of existing operations. The Tropicana gold mine, owned 70% by AngloGold Ashanti and 30% by IGO, had an initial nameplate capacity of 5.8 million tonnes per annum (mt/y). However, by investing incremental capital into the processing plant and demonstrating that the reserves continue below the existing resource through a drilling campaign, Peter Bradford, managing director and CEO at IGO says the project is now running at a rate of 7.5 million mt/y. Dialing up the exploration expenditure in the region represents the company’s next objective. “Given that Tropicana represents a new type of gold mineralization in Australia in an unexplored belt, there is significant opportunity to find either the next Tropicana or satellite deposits that can feed into the centralized processing facility,” he said.

Many of WA’s largest gold production sites sit within under-explored or greenfield belts, providing efficient exploration opportunities through the consolidation of land holdings and joint ventures. The Gruyere gold project, the largest undeveloped gold deposit in Australia, with 6.2 million ounces, sits in one such belt. Gold Road Resources sold 50% of the Gruyere asset to Gold Fields in November 2016, and now boasts Australia’s largest greenfields exploration budget in 2017, including A\$22 million of their own capital and a total spend of A\$30 million with contributions from JV partners. Gold Fields intends to geographically concentrate its exploration around its initial discovery of the high-grade system at Central Bore. The company’s managing director and CEO Ian Murray explained the advantage of taking this approach: “We hold 5,000 square kilometers of tenements, so the most cost-efficient exploration we can do is on the Yamarna Belt where we also have the best geological knowledge.”

Middle Island Resources has taken a multifaceted approach that involves systematically exploring both greenfield and brownfield targets within its Sandstone project tenements in WA. The company began life in West Africa, but a number of factors influenced the company’s decision to reorient its attention to the exploration potential back home in WA. “We were able to raise Australian dollars and spend them in US equivalent in West Africa, which would go a long way,” managing director Rick Yeates. “However this situation has reversed and Australian dollars do not go nearly as far in West Africa, which was one of the reasons we looked to shift our focus back to Australia.”

While the commodity is particularly susceptible to marketplace fluctuations, the political uncertainties looming across all four corners of the globe seem to ensure a degree of long term security. Nevertheless, Dunbar insists that resilience to any gold price fluctuation is a necessary ingredient to the success of a project. The company’s Dalgara project in WA has resources of 29.6 million tonnes and results from the feasibility study suggest competitive all-in sustaining costs. “Strong projects will always be able to withstand the whole cost cycle rather than just the high price cycle,” said Dunbar.



Middle Island
RESOURCES LIMITED

EXPLORING GOLDEN FRONTIERS

Middle Island Resources Limited (ASX:MDI) is a gold exploration and development company focused on the Sandstone Project in Western Australia and the Reo Project in Burkina Faso, West Africa.

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


Empowering
People



Unlocking
Value

 Tropicana Joint Venture
(AGG 70% / IGO 30%)

 IGO Managed Tenure

Nova

Base Metals & Rare Earths

Keeping a steady course despite volatility

Iron ore has plunged into a bear market, affecting WA's most valuable commodity, which accounts for nearly A\$50 billion of the mineral sector's total sales. Despite the downturn, iron ore resources continue to grow throughout the state. The nickel market remains volatile, with a recent environmental clampdown in the Philippines that saw 23 mines lose their mining permits and close. Though this presents some optimism for WA's nickel companies, Indonesia's easing of their nickel laterite ore export ban will also have an impact on the market. "Some sources are suggesting that over 6 million tonnes (mt) could be exported within the next 12 months, or 100,000 mt of contained nickel in ore might come back onto the market," said Michael Rodriguez, COO of Poseidon Nickel. To ease nickel's potential medium-term weakness, companies such as Poseidon Nickel are considering diversifying into other commodities such as gold and lithium to offset nickel prices. A possible increase in nickel pig iron (NPI) exports is attributed to political uncertainty around the globe with a stronger focus on ethical production. "NPI production costs will inevitably rise due to increased environmental compliance; this is beneficial for sulphide producers," said Richard Bevan, mining director at Cassini Resources.

The company's West Musgrave project will benefit from the limited number of large-scale sulphide projects going online.

With a rise in stainless steel production in China, the nickel market is evolving and companies are finding ways to cut out steps to reach consumers directly. "Some producers, such as Western Areas, recently began selling their product directly to stainless steel producers. [...] There will be changes in secondary processing and other providers and consumers coming into the market," added Bevan.

Western Areas accounted for 14% of Australia's total nickel production in 2015-2016, with Nickel West (BHP Billiton) and Minara Resources (Glencore) producing 28% each, and First Quantum accounting for 16%. "Things are looking good for nickel sulfides, but we have to see a contraction in the sup-

ply of nickel laterite for the price to improve," said Ian Mulholland, managing director of Rox Resources.

Despite the unpredictability of the nickel and base metal landscape, certain projects are leaping forward. Discovered by the former Sirius Resources in 2012, and later acquired by Independence Group (IGO) in 2015, the Nova project was taken into production in October 2016. "Globally speaking, there are few projects that go from discovery to production in this kind of timeframe. We are still progressing the development underground and expect to have it fully ramped up to capacity by the September quarter of 2017," said Peter Bradford, managing director and CEO at IGO.

Over the course of 10 years, the project will produce 26,000 mt/y of nickel, 11,500 mt/y of copper, and about 1,000 mt/y of cobalt.

Copper discoveries are still being made in WA, but the previous downturn in the industry led to limited exploration globally, which will likely lead to a shortage in the market. "Copper is the bell weather of the commodity cycles — once the copper price is rising,

economic activity is increasing. We have seen an uptake in the copper price and there is, or will be, an undersupply given the downturn during which there have been no real exploration advances," said Rob Bills, managing director and CEO of Emmerson Resources.

A general sentiment that a longer term vision is necessary in the industry is prevalent. "In the Western world, companies are driven by revenue and shorter time horizons," said George Bauk, managing director and CEO of Northern Minerals, a company focused on rare earths, particularly dysprosium, used to produce NdDyFeB permanent magnets. "The Chinese are involved in all of the most active rare earth companies outside of China."

Given WA's position as a leading state for the industry worldwide, there is a sentiment that not enough has been done for future projects to emerge. "It will probably take another upturn for majors to realize that they will not be able to simply buy junior companies for deposits, because the juniors have not yet found them," said Robert Waugh, managing director of Musgrave Minerals.

"Things are looking good for nickel sulfides, but we have to see a contraction in the supply of nickel laterite for the price to improve."

Ian Mulholland,
managing director,
Rox Resources



Globally speaking, there are few projects that go from discovery to production in this kind of timeframe. We are still progressing the development underground and expect to have it fully ramped up to capacity by the September quarter of 2017."

Peter Bradford,
managing director and CEO, IGO



Lithium, Uranium, Graphite, and Cobalt

The trend takes hold in WA

The worldwide buzz around renewable energy has engendered rising enthusiasm for lithium, uranium, graphite and cobalt in a WA mining community that is eager to join the race. The state has significant reserves of the resources and is abound with exciting projects both at home and abroad. Various trends in the tech and energy industries are fueling the intensified demand for cobalt, lithium, and graphite, which are all complementary in the production of lithium ion batteries. Matthew Painter, CEO of Perth-based Ardea Resources, believes the inevitability of electric cars will prove most significant in propelling demand. “Phones and computers both play a role, but the true driving force in the next few years will be the complete electrification of the auto industry over time. By 2021, pretty much every car maker has said they want a range of electrified vehicles — full electrics and various degrees of hybrids.”

All stages of the value chain have felt the pull towards these commodities, not least testing and metallurgical services. Rick Murphy,

CEO at Nagrom, said that 50% of the company’s business now comes from lithium. Jon Landau, senior VP at Bureau Veritas has also seen the need to meet a surge in demand for commodity-specific capabilities. “We have achieved this through developing methods to identify and extract lithium, and by using our expertise in graphitic analysis to help with onsite services,” he said.

Although no uranium mines are currently in production in the state, five projects have been granted the necessary environmental approvals to move forward with development once the market turns. Brian Reilly, managing director at Cameco, highlights the fact that Australia’s potential as a producer of the resource has yet to be recognized. “As a nation, Australia hosts over 30% of economically recoverable global uranium resources, which is a significant competitive advantage, yet we supply only about 10% of global production,” he said.

Roughly 50% of known worldwide cobalt reserves are located in the Democratic Republic of the Congo (DRC), which currently leads global production. Australia holds the second largest reserves of the resource, occurring mainly in lateritic nickel deposits. However, the nation has yet to fully recognize its production potential, producing only around 4% of the global market in 2016. Ardea Resources owns the seventh largest cobalt deposit in the world and the largest located within a stable jurisdiction. Boasting 386,400 mt of contained cobalt metal, CEO Painter expects the company’s Kalgoorlie nickel project deposit will prove invaluable in supporting the burgeoning demand for the resource, in no small part because of its location in WA. “Understanding the provenance of material is increasingly important given the ethical issues arising from sourcing cobalt in some underdeveloped countries,” he said. “Amnesty International has highlighted some of the problems with child labor and unsafe work practices in the DRC. The only solutions are to clean up the supply lines or for people to source their material somewhere else.” The lithium battery is somewhat of a misnomer given that there are much larger quantities of several different minerals that comprise the end product. For example, a multiplier of six to 10 times more graphite is required in the production process. While there is no shortage of graphite in terms of global supply, the mineralogy and metallurgy of the resource are critical in determining for which market the resource is suitable. “Not all graphites are created equally,” said Tom Revy, managing director at the newly formed BlackEarth Minerals. “It should not be treated as a single commodity, market, or development process,” he added.

Three types of graphite occur in nature and each has distinctive markets for which it is best suited. The most rare of the three is vein, or lump graphite, which has a competitive edge because of its high quality in complement to low processing and recovery costs.



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However, it is almost exclusively mined in Sri Lanka. Amorphous graphite is a finer, particle-oriented variety and is used largely in refractory markets. China, which currently produces the largest proportion of the world's graphite, has increasingly geared itself towards amorphous production. Flake graphite demands a premium of nearly four times the price of amorphous graphite because of its suitability for the battery market. The demand for this high-grade product has driven several companies in the junior sector to search for flake graphite, which serves the broadest range of uses. Given the flood of interest in the resource, explorers such as BlackEarth are keen to secure attractive off-take agreements for their projects before the market saturates. "Through BlackEarth Mineral's Madagascar project, we are examining the potential to service the battery market because we will be able to leverage the networks that have already been established through Lithium Australia from an off-take perspective," said Revy.

The race for lithium has garnered particular interest in Australia because the nation is particularly well endowed with the resource. WA is home to the world's largest hard rock deposit of lithium at the Greenbushes project held by Talison Lithium Australia that has been in operation since 1985 and produces spodumene concentrate at a rate of 450,000 mt/y. In addition to exploration projects throughout the state, companies such as Lithium Australia have capitalized on the increasing demand for technology that will expedite the lithium processing supply chain. Currently, Chinese converters introduce a significant bottleneck in delivering the resource to end-users through domination of the necessary chemical conversion process. Lithium Australia's Sileach™ process has received grant money from both the WA and national governments to develop the capacity to process lithium on a commercial scale. "We need to bear in mind that at the moment Australia produces 40% of the world's lithium out of a single mine that uses very traditional technologies to process material," said Adrian Griffin, managing director at Lithium Australia.

While Australia's lithium-bearing minerals are predominantly obtained from hard rock sources; concentrates of the resource may also be derived from hydrothermal brines and evaporites. Ground water solutions can contain around 200 - 4,000 mg/l of dissolved lithium salts, and represent around 66% of the world's reserves. This type of deposit is considered an attractive exploration target because of lower capital requirements and faster production pro-

"As a nation, Australia hosts over 30% of economically recoverable global uranium resources, which is a significant competitive advantage, yet we supply only about 10% of global production."

Brian Reilly,
managing director,
Cameco



"Not all graphites are created equally [...] It should not be treated as a single commodity, market, or development process."

Tom Revy,
managing director,
BlackEarth Minerals



cesses. These are generally found in vast, barren salt flats in regions like Chile, Argentina, and in the Himalayas of China. WA-based junior Argosy Minerals has taken advantage of the lower associated costs of brine lithium by capitalizing on exploration opportunities abroad. Wanting to take advantage of the huge demand for the commodity coming from Chinese battery manufacturing facilities, the company has fast-tracked its Rincon project in Argentina "Plants are being constructed that do not have adequate supply or off-take arrangements, however the support provided by the Chinese government for electrical vehicles all contribute to the sense that there is a tidal wave of interest in the sector," said Jerko Zuvela, MD of the company.

Rincon Lithium project in Argentina. Photo courtesy of Argosy Minerals.





Potash

Awakening WA's SOP potential



LAKE WELLS POTASH PROJECT

**Access to infrastructure
Very strong potassium grades**

Located 300 kilometres from the Eastern Goldfields rail head at Leonora, the Lake Wells Potash Project is being developed to produce the premium fertiliser Sulphate of Potash (SOP), contained within the brines. Targetting both the domestic and overseas demand for this essential plant macro-nutrient, the Lake Wells Potash Project's location, access to infrastructure, and robust Scoping Study financial model all speak to the merits of what will be Australia's first SOP project development.

ASX: APC
australianpotash.com.au

Russia and Canada dominate the international potash market, yet WA is in a position where it could play an important role in the international production of sulphate of potash (SOP). "If all SOP projects in-country get going, Australia will become the largest SOP producing country in the world outside of China," said Matt Shackleton, executive chairman of Australian Potash.

The challenges faced are large CapEx expenditures required for the projects to move forward. "Our project can be started with a modest CapEx, at A\$175 million. Reward Minerals' startup CapEx is A\$320 million, and Agrimin's is A\$336 million," added Shackleton.

The difference between muriate of potash (MOP) and SOP is important. Whereas the first can generally be sourced in deposits with millions of tonnes and 95% of global production takes place within three countries, the latter comes in smaller quantities and is very hard to find. Australian Potash's Lake Wells project intends to convert MOP into SOP to increase their potential organically. Given the sulphate present in their brine, they are able to mix MOP with water in the crystallization circuit to generate SOP. This cuts down costs incredibly by contrast to the mannheim process which is used in Germany and avoids the hydrochloric acid residue all together.

The rate at which potassium chloride mines are being developed has increased in an already over-supplied market with a select few entities controlling the supply. "There are people outside the cartel-dominated entities, like the Germans and the Spaniards, who are also developing MOP. This means more will come into the market and the price will either remain or fall," explained Shackleton.

Whereas MOP contains both potassium and chlorine, SOP contains potassium and sulphate. Certain plants are chlorine intolerant, and therefore benefit from sulphate-based fertilizers. "With a middle class estimated to be three billion people in seven years time, the SOP industry in China, has gone from zero to being the largest producer of SOP by a factor of three in 15 years," he added.

Demand for potassium is bound to rise given a rapidly increasing global population. "Fertilizer is necessary given that the world's population is forecast to grow 30-40% in the next 30 years," said Patrick McManus, managing director of Parkway Minerals.

The company is presently focused on the Dandaragan Trough, for which they are looking for a JV partner to further develop their large resource of phosphate and potash. How much of a role WA plays in upcoming years within this field will be strongly tied to investment opportunities.

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**Matt Shackleton, executive chairman,
Australian Potash**

Services

Innovation and Technology: The increasing role of big data and cyber security

As a globally recognized hub for mining innovation, WA's capital city of Perth is home to much of the most cutting-edge technological research in the industry. In terms of equipment, tools such as robotic drilling arms, remotely operated drones, and self-driving trucks are undoubtedly beginning to play an important part in driving the industry towards embracing the benefits of 21st century technologies. "Technological advances have played a significant role in expanding the ore bodies of a number of mines across WA and Australia – a key to expanding the resource and life of the project," said Mike Edwards, managing director at Latitude Consolidated Limited. "In particular, new modeling techniques and software to outline ore bodies are allowing companies to source more information for data systems," he added.

Big data represents an area of huge potential beginning to take form in terms of improving the efficiency of the sector's operations and several consultancies and service providers are at the forefront of capitalizing on those opportunities. AMC Consultants' new Online Mining Intelligence service allows companies to gain a more comprehensive understanding of their operations. "Mining companies collect an incredible amount of data. All of that information can be accumulated and in real-time be used to assess the productivity of activities in order to identify areas of excellence or inefficiencies," said Martin Staples, director at AMC.

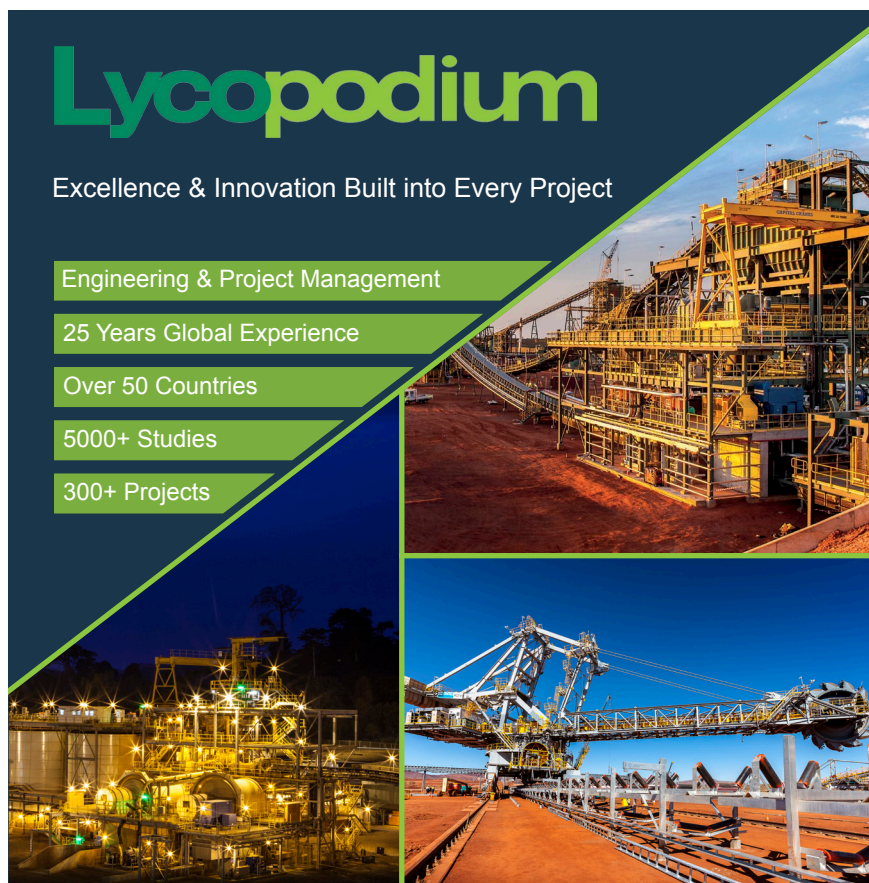
Functions ranging from managing back-office financial transactions to monitoring geoscientific data to enhancing the production capacity of large-scale mines are opportunities for companies to add substantial value to their projects. Software proprietors such as Expedio, acQuire, and LandTrack Systems provide packages that comprehensively address that need. Laura Groves, managing director of Expedio, expounds the importance of expertly managing and assessing that data. "Accurate and reliable resource data is a critical foundation for every resource company's

project development. The reporting standards for data management compliance in Australia and many other countries are becoming more stringent as the industry now recognizes the importance of data veracity," she said.

While the opportunities around harnessing data are enormous, there are also risks to be considered that many in the industry believe are currently underplayed. The growing body of web-based applications and digital tools utilized across the value chain implies the increasing relevance of cyber security. "The current understanding of the exposure that this creates is shallow and there is significantly more work to be done to comprehend how that data may be used and accessed and so how it must be protected," said Scott Grimley, Oceania mining & metals leader at EY.

In that vein, PwC runs a simulated gaming exercise called the 'Game of Threats' that encourages companies to consider the importance of a multifaceted strategy in defending against cyber attacks. In the game, participants are provided a mock limited budget and must decide whether to allocate it on educating its people, purchasing equipment and tools, or receiving advice and ongoing monitoring of attacks.

Justin Eve, mining leader at PwC, warns that mid-tier miners should not disregard the increasing role of cyber security to their operations. "The threat to operational technology systems, and therefore to safety and production, is real," he said. "This is not an IT issue; it is a strategic business imperative for miners to secure their assets."



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The complex block features the Lycopodium logo in green and white. Below the logo is the tagline "Excellence & Innovation Built into Every Project". A list of five key statistics is presented in green boxes with white text. The background of the block is a collage of mining-related images, including a large industrial structure under construction, a night view of a mine with lights, and a close-up of mining machinery.

New Frontiers

Embracing risk abroad

Perth might be one of the most isolated cities in the world, but many companies choose to operate from WA's capital city because of the ease of doing business. "The greatest challenge of operating in Perth is geographical in the context of a global business. There are good connections out of Perth into Africa but it is still a long way to anywhere," said Peter De Leo, Managing director of Lycopodium.

Companies looking to operate in Africa have found benefits in terms of skilled labor given that the lessons learned from navigating the vast WA landscape are transferrable to the African environment. "The advantage of working out of Perth is that the Australian engineering and construction fraternity has a total can-do attitude. We have been working for the last 25 years in logistically challenging and remote areas," added De Leo.

Perhaps one of the greater challenges facing companies looking to the African continent is that it is not yet fully understood by the Australian market. Rick Yeates, managing director of Middle Island Resources, reflects on the way that the company was greatly impacted by the ebola outbreak in West Africa. "Though this has improved substantially, Africa is often treated as a

"We are fortunate to have the largest cyber security & forensics and digital trust teams for professional services firms in Perth. In fact, Perth is home to the center of excellence for the region, and our teams support hubs in Singapore and beyond."

Justin Eve, mining leader, PwC



single country—if something happens in one country, regardless of how far away it may be, everyone gets painted or tainted with that brush," he said.

The general sentiment on West Africa has certainly evolved and many Australian companies and investors are turning to the region again. Gold prices have played a strong role in this shift given the area's historical gold-producing capacity, particularly along the Birimian Greenstone Belt. Whether or not the political landscape will aid the industry is yet to be determined. Jeff Quartermaine, executive officer and managing director of Perseus Mining, explained: "When operating in West Africa, things can change quickly so we want to

maintain a spread of risk, both political and technical. We have been a single mine operation for some time and if something were to happen to that mine, we would encounter problems. A secondary revenue source is therefore vital to achieving a reliable income stream."

With a general positivity hovering throughout the Mining INDABA at Cape Town this year, transactions are meant to increase. "Last year there was more of a feeling that people were merely talking about things, but this year the general sentiment is that deals will come to fruition," said Sherif Andrawes, chairman of BDO. "We are gradually witnessing a rise in confidence within the market and therefore I expect Africa's relevance to increase again."

Companies looking at more stable jurisdictions have turned to Europe and the Americas. Service providers, such as Byrnedcut, have started to position themselves within Latin America to be ready to serve the market as more underground mines appear in Peru, Colombia and Ecuador. As the fastest growing region in the world, servicing Asia is also of great importance to WA. A two-way street of Asian companies operating projects within the state, as well as national companies operating in Asia has emerged. It is safe to say that the miners of WA are operating around the globe and will continue to do so. In the words of Mark Bennett, CEO of S2 Resources: "Australians are risk-takers. The Australian mentality is a gambling mentality: we love having a roll of the dice."

Reo project in Burkina Faso. Photo courtesy of Middle Island Resources.



Concluding Thoughts:

A new era in mining presents new labor challenges and opportunities

The cyclical nature of the mining industry in WA presents a significant perennial challenge for one of the sector's most valuable assets: its people. Colin Moorhead, CEO of the Australasian Institute of Mining and Metallurgy (AusIMM) elaborated on the disproportionate impact that the most recent downturn has had on WA-based mining professionals. "While there are signs that the prospects of the mining industry are beginning to improve, many minerals industry professionals in Australia and WA continue to feel the impact of high unemployment and low commodity prices," he said.

The global trend towards automation across all industries suggest that machines will continue to take the jobs once performed by human labor and WA's recent increase in production has not necessarily

translated to high employment rates. "Mining did not lead the way in automation. In fact, being a conservative industry, it was slower than many others, but it is surely catching up now, which will cause more jobs to disappear," said John Downing, MD of the recruitment firm Downing Teal.

Nonetheless, technological advance has also created new voids within the industry that must be filled by individuals attuned to the benefits — and risks — of the Digital Age. Justin Eve with PwC foresees a fundamental shift in the structural organization of companies to adequately address the growing need for integrated IT expertise. "Companies need to have more technology savvy people and more diverse thinking structures — people that understand digital impact and are comfortable with it," he said.

Many companies, such as Independence Group (IGO), have already been making strides towards accomplishing this. "IGO has been trialing embedded programmers in the organization so that we have the capacity to write code ourselves and better leverage the information required for and between proprietary packages," said Peter Bradford, the company's CEO and managing director.

There seems to be a shared sense that a degree of dexterity is necessary to navigate both the challenges and opportunities of the 21st century commodities marketplace. Subsequently, 'nimble' might be the best buzzword to define the zeitgeist of what is arguably a new era in the WA mining industry — an era that has seen enough booms and busts to maintain a steady strategic head while recognizing the need to forge forward in terms of exploration and innovation.



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