

Commodities bulletin: metals and minerals

Keeping you up to date on the legal issues
affecting the commodities industry in Africa



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DRC: The kingdom of cobalt

The push to become electric

When Tesla first introduced the Roadster in 2008, it took the car manufacturing industry by surprise. Although the lithium-ion technology used to power the Roadster was known, it wasn't expected to be operational for another ten years.

What is more surprising though is the speed in which the uptake of electric vehicles ("**EVs**") has gained momentum. Fast-forward ten years and three million electric vehicles later, the electric vehicle revolution is in its element:

- Nations are setting deadlines by which they will become electrified:
 - | The UK announced that it will ban the sale of cars with internal combustion engines from 2040
 - | Norway, one of the countries leading the charge in EVs, stated that all new cars must have zero emissions by 2025
 - | In April 2018, China introduced the dual credit policy which imposes compulsory fuel consumption targets and EV production targets on vehicle manufacturers – a policy introduced to support the two million annual sale target of electric and gasoline-electric hybrid vehicles by 2020
- Countries are uniting with the aim of speeding up the distribution of EVs by 2030. The EV30@30 campaign, supported by, amongst others, China, the UK, Canada, Norway, Sweden and Denmark - most of the key EV players - has targeted the creation of at least 30 per cent new EV sales by 2030
- Car manufacturers, by the droves, are promising to electrify:
 - | Toyota stated that its whole line up will be electric by 2025
 - | Volvo announced that all models introduced after 2019 will either be hybrids or all-electric
 - | General Motors has indicated that it will introduce 20 new all-electric vehicles by 2020
 - | Ford announced it would increase its planned investments in EVs to US\$11 billion by 2022 and have 40 hybrid and fully electric vehicles in its model line-up

Whether the driver behind electrification is ecological, political, ideological or financial (the views behind the uptake in momentum vary greatly), how achievable are the goals which have been set?

Cobalt – the blood diamond of the electric vehicle

Lithium-ion batteries currently dominate electric vehicle development. In its most simplified form, the battery relies on four key components: the cathode, the anode, a separator and a liquid electrolyte. As Mike Zimmerman, CEO of Ionic Materials, succinctly described in an article for the Financial Times, the cathode is coated in a processed metal oxide which contains, in most cases, lithium, cobalt, nickel and manganese. When the battery is discharged, lithium ions flow to the cathode generating a flow of electrons and electricity. When the battery is recharged, they flow back to the anode which is normally made of graphite.

As electric vehicle popularity has intensified, the demand for the elements and minerals required to create lithium-ion batteries has surged – particularly the demand for cobalt.

Cobalt is the element which stabilizes the battery materials and stops the battery from overheating. In essence, cobalt is the safety element of the cathode. Given that safety is an absolute in EVs, the demand for cobalt has grown exponentially over the last two years. In 2017, the global demand for cobalt was ~105,000 MT and is estimated to reach ~250,000 MT by 2030, but can supply meet inflated demand?

According to the Cobalt Institute, Cobalt is not considered to be a particularly rare metal and is ranked 32nd in global abundance. Global cobalt reserves are anticipated to be in the region of 7.1 million MT; 3.5 million MT of which are located across the copper belt in the Democratic Republic of Congo (the “DRC”); 1.2 million MT in Australia and 500,000 MT in Cuba. Table 1 below sets out a more detailed breakdown of the ten largest cobalt reserves.

Table 1

Country	Anticipated cobalt reserves (MT)	Approximate 2017 cobalt production (MT)
DRC	3,500,000	64,000
Australia	1,200,000	5,000
Cuba	500,000	4,200
Philippines	280,000	4,000
Zambia	270,000	2,900
Canada	250,000	4,300
Russia	250,000	5,600
Madagascar	150,000	3,800
Papua New Guinea	55,000	3,200
New Caledonia	Unknown	2,800

Data from U.S. Geological Survey: Mineral Commodity Summary 2018

Despite the high levels of anticipated cobalt reserves, there is a genuine concern that supply will not be able to meet the anticipated demand. First, cobalt is not mined like lithium. It is a by-product of mining copper and nickel and therefore supplies of cobalt are ‘relatively constrained’. If the copper and/or nickel market suffer from low prices and thus demand, then there will be a correlating impact on cobalt. Secondly, the primary location for cobalt, the DRC, is a country marred in bribery, corruption and unethical practices, particularly in the mining industry, which seriously hinders businesses operating in the country. With cobalt producers coming under heightened scrutiny by international stakeholders and financiers and being required to demonstrate that exposures are being managed appropriately, the ability to be able to continue operating in the DRC may well be called into question.

Mining in the DRC

The DRC, the second largest country in Africa, is bestowed with extraordinary mineral wealth with significant reserves of cobalt, copper, diamond, tantalum, tin and gold. When the DRC gained independence in 1960, it was the second most industrialized country in Africa (after South Africa) and boasted one of the most thriving mining sectors in the world. The DRC's lucrative mineral assets ought to have been the stepping stone for the DRC on to the developing world stage, instead, greed and power threw the DRC into decades of civil war, corruption, human rights violations (child labour) and political instability which has resulted in a mining industry falling well below international ethical and compliance standards.

Although a compliance minefield, the DRC's precarious situation seems to have done little to detract the large, international mining houses and artisanal and small-scale mining companies from investing further into the DRC, particularly in the copper/cobalt space. In 2017, Glencore, the world's largest cobalt mining company, increased its presence in the DRC through the acquisition of the Fleurette Group's stakes in Mutanda Mining and Katanga Mining. In the same year, China Molybdenum acquired an indirect majority interest in the Tenke Fungurume mine from Freeport Cobalt for US\$2.65 billion. Earlier this year, Trafigura signed a three-year offtake agreement with Shalina Resources and its DRC subsidiary, Chemaf, for all of its cobalt hydroxide production.

To some extent, the continued investment in the DRC is of little surprise. Whilst the demand for cobalt is so high, there is little alternative but to continue mining in the DRC. In 2017, the DRC produced 64,000 MT of cobalt which accounted for approximately 58% of global production that year. No other country comes close to competing with these volumes of cobalt. Russia, the second largest cobalt producer, only managed to produce 5,600 MT in 2017. Until the necessity for cobalt in the battery is removed, the DRC is going to remain a key priority for the international mining sector.

So, what are the alternatives to cobalt?

Given the cost of cobalt, the quagmire of ethical and geopolitical issues surrounding the DRC and China's increasing stronghold over existing cobalt production streams, the race is now on to cut out cobalt dependency in EV batteries with Tesla and Panasonic leading the charge.

In June 2018, Elon Musk announced that Tesla uses: *"less than 3% cobalt in our batteries & will use none in next gen"*, a statement which was supported by Kenji Tamura, who heads up Panasonic's automotive battery business. Tesla has long been a proponent of nickel-cobalt-aluminium ("**NCA**") technology developed by Panasonic in Japan, a formula which already uses a much lower percentage of cobalt than the majority of the EV industry which uses a nickel-cobalt-manganese ("**NCM**") formulation. Reducing cobalt to zero is certainly not going to be easy, particularly as they will come with a considerable fire risk and require expensive monitoring technology.

Battery researchers are testing materials like manganese and iron as alternatives in a form which is known as a 'rock salt structure'. The rock salt cathodes don't yet have the same high energy density as cobalt or nickel, but are being used in some smaller electronic devices.

One other alternative being looked at is solid state batteries. Solid state batteries replace the liquid electrolyte in the battery – the part which generally catches fire – with a solid polymer material. Toyota, Mercedes-Benz and Dyson as well as a number of start-ups, such as Ionic Materials (a company backed by, amongst others, Renault, Nissan, Mitsubishi, Hyundai and Total), are just some of the companies working on this technology. However, the technology is not expected to be on the market until 2025.

Conclusion

Although alternatives to the lithium-ion battery are being heavily investigated, it seems that cobalt will be an integral element of the battery for the near future. Given the expected demand for cobalt, it also appears that an exit from the DRC is impossible. Companies will no doubt look to other cobalt producing countries for supplies, but the reality is, the low levels of cobalt currently capable of being produced in these countries will just not be able to meet demand (see Table 1 above) and any new projects will take at least three to five years to achieve production. Instead, a more diligent and responsible approach to cobalt mining in the DRC needs to be adopted. For example,

- programmes, such as China's Responsible Cobalt Initiative, are being created to address social and environmental risks in the cobalt supply chain. Already 28 members have signed up to the campaign including Apple, Daimler, Volvo and Sony
- blockchain technology is being developed to try to track cobalt's journey from artisanal mines through to the final product, giving manufacturers certainty that the cobalt has not been mined by children
- direct purchases of cobalt from miners are being considered by a number of international corporates, including Apple, in an attempt to cut out the unscrupulous "middle-man" – unfortunately, in most cases, government officials. This is an approach which a number of NGOs have adopted, particularly in Africa, once it became apparent that large portions of their funding were unaccounted for

Will these initiatives be sufficient to overcome the intrinsic levels of corruption and unethical practices currently plaguing the cobalt mining industry? The simple answer is no. These initiatives may provide a pathway by which international corporations can navigate a more responsible approach whilst they remain present in the DRC, but it will take a drastic shake-up of the existing governmental institutions before the DRC can even begin to emerge from its current situation.

As such, DRC cobalt will remain a controversial thorn in the side of the EV industry for years to come – assuming their predictions for increased EV demand are correct, of course.



South Africa: Lonmin's dramas continue

Just as it looked as though the takeover of Lonmin by Sibanye-Stillwater was on track for completion, another spanner was thrown into the works in the form of the South African Mining Forum ("**SAMF**").

On 18 September 2018, the South African Competition Commission submitted a conditional recommendation to the Competition Tribunal to approve the takeover of Lonmin by Sibanye-Stillwater (for an aggregate GBP285 million (more than R5 billion)). According to Sibanye-Stillwater, the Competition Commission determined that the proposed acquisition of Lonmin (the third-largest platinum miner in the world behind Anglo American Platinum and Impala Platinum) was: "*unlikely to substantially prevent or lessen competition in any of the markets affected by the proposed merger*". Although completion of the transaction remains subject to the satisfaction or waiver of various conditions precedent (including the approval of the Competition Tribunal which, as a separate note, has been asked by the AMCU to veto the merger to avoid 10,000 potential job losses), the Competition Commission's decision was a positive step in the right direction for the transaction.

The conditions imposed on the parties included a requirement to mitigate the impact of retrenchments, and for Sibanye-Stillwater to honour Lonmin's current and future social and labour plan ("**SLP**") and continue to support transformation in the mining industry. It is that SLP which has become the focal point of the new claims brought against Lonmin by the SAMF.

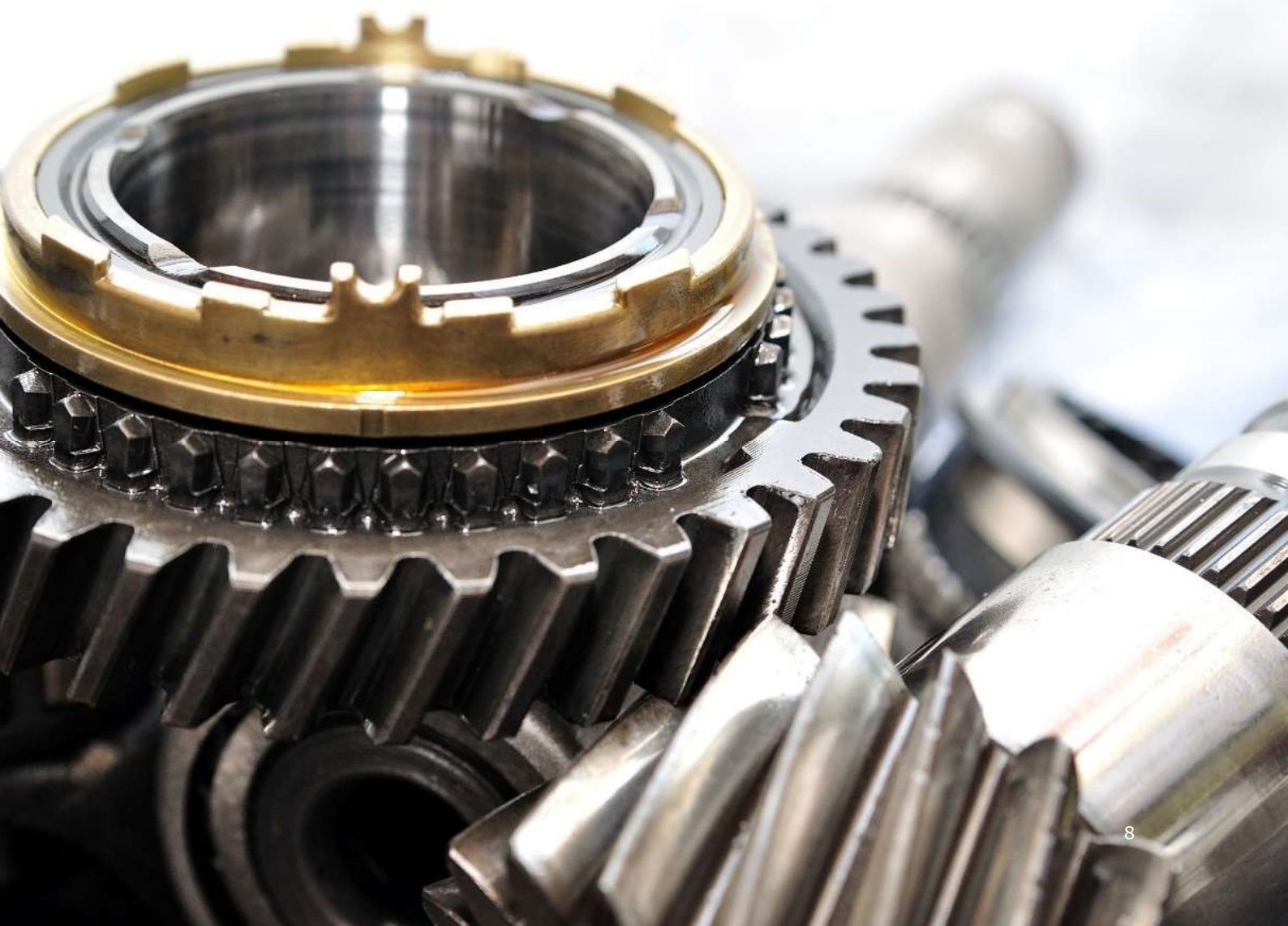
The SAMF presented its case against Lonmin to the North West High Court in Mahikeng on 23 October 2018, alleging that Lonmin had not met its commitments under its SLP. The SAMF called for the suspension of Lonmin's mining licence (as well as Eastern Platinum's and Western Platinum's mining licences (two entities controlled by Lonmin)) and an interdict preventing Lonmin from transferring its Marikana mineral rights until it has implemented its SLP, which would block the takeover by Sibanye-Stillwater. The SAMF's argument centred around Lonmin's failure to provide the schools, housing, health care facilities and other infrastructure indicated in its 2014 SLP which resulted in mine workers and the surrounding communities living in atrocious conditions, with many miners living in informal settlements.

Lonmin acknowledged that, due to radically deteriorating economic conditions, the full SLP had not been implemented, but that a great deal of money, nevertheless, had been spent on achieving the objectives set out in the SLP plan. Lonmin cited that R170 million had been spent in 2014 on various programmes; R306 million in 2015 on various upliftment programmes and R6.3 billion on BEE procurement; a further R205 million on upliftment programmes and R5.6 billion on BEE procurement in 2016. Lonmin's legal counsel has openly stated that the SAMF's application is: "*incompetent, vexatious and must fail*". The High Court has reserved judgment on this claim at this time.

What the case has done though is raise further concerns about South Africa's weak PGM market. The case publicly exposed Lonmin's "*precarious and parlous financial position*" and highlighted its aggregate R49 billion loss over the last four years.

This follows Impala Platinum's recent announcement of its controversial restructuring plans for its Rustenburg operations which includes the retrenchment of ~13,000 jobs over the next two years, which stems from the notable drop in Implats' market capitalization over the last year from R27 billion in June 2017 to R15 billion in June 2018. PwC's annual report: "*SA Mine 10th Edition: Highlighting trends in SA mining industry*", issued on 2 October 2018, further highlights the overall continued struggle of South Africa's PGM market. Of the companies analysed, the PGM market capitalization dropped a further 5% (following its 21% market capitalization drop in 2016) attributed mainly to the struggle with Rand prices compared to costs.

What does this mean for the South African PGM market? Will the PGM sector enter a period of consolidation with a wave of mergers and takeovers akin to the proposed Sibanye-Stillwater/Lonmin takeover? Will struggling PGM companies opt for liquidation? Or will mining companies restructure their platinum portfolio in an attempt to reduce costs? It worked for Anglo American Platinum (which dispensed with its costly, deep, underground mines and focused on its less costly and less complex Mogalakwena open pit platinum mine in Limpopo) and it seems to be the approach adopted by Platinum Group Metals Ltd (which chose to sell off the Maseve Mine earlier this year and concentrate on the Waterberg PGM project, a shallow large-scale PGM resource in the Bushveld Complex, Limpopo), so perhaps it could work for others.



Mali: potential sale of Sadiola Mine

On 5 November 2018, AngloGold Ashanti Ltd announced that it, and its joint venture partner, IAMGOLD, are considering a potential divestment of their joint interest in the Sadiola gold mine in the Kayes region in southwestern Mali. The Sadiola mine is a joint venture between AngloGold (41%), IAMGOLD (41%) and the Government of Mali (18%), and has been operating since 1996. The mine has multiple open-pits and is nearing the end of its economic life on the oxide mineral resource.

The decision to consider a potential divestment appears to stem from the fact that the parties have failed to reach an agreement with the Malian Government with regards to the Sadiola sulphides project, a project which seeks to enable the plant to process sulphide ore. Approval of the project is needed to avoid the operations from entering a phase of suspended exploitation (care and maintenance) once stockpiles are exhausted (expected mid-2019).

The announcement was made in AngloGold's 2018 Q3 market update report which stated that: "a process [has been initiated] to identify third parties that may be interested in acquiring their collective interests in Sadiola. The process is at a very preliminary stage and there is no certainty of its outcome."

The announcement coincided with a statement by Kelvin Dushnisky, CEO of AngloGold, that AngloGold was looking to streamline its 14-mine portfolio and "[focus] on assets that had 'critical mass' and offered 'optionality'".

Africa-wide: rare earths – ‘the seeds of technology’

Introduction

Ask any person who went to school in the 20th century (who is not majoring in science) to list the Lanthanide elements and I would hedge my bets that the majority would draw a blank. Back in my days of studying the periodic table, much greater focus was given to the dominant industrial elements and their respective properties: the malleability and strength of iron, the conductivity of copper, the ease in which magnesium ignites and the reflective nature of aluminium etc. The 17 rare earth elements (the 15 lanthanides plus scandium and yttrium) were mentioned in passing, at best. Move forward a century into a technologically dependent world, and a high school child's chemistry education is likely to be very different.

What are the rare earth elements and what are they used for?

The rare earth elements are: cerium (Ce), dysprosium (Dy), erbium (Er), europium (Eu), gadolinium (Ga), holmium (Ho), lanthanum (La), lutetium (Lu), neodymium (Nd), praseodymium (Pr), promethium (Pm), samarium (Sm), terbium (Tb), thulium (Tm) and ytterbium (Yb) (together, the “**Lanthanides**”), scandium (Sc) and yttrium (Y).

With the exception of promethium (the radioactive element), ironically, none of these elements are particularly rare. The rarity comes in their singular form. The rare earths (“**REs**”) are not found as individual elements in the earth's crust. Instead, they are grouped together, predominantly in bastnaesite and monazite deposits, and are difficult (and expensive) to separate.

The REs exhibit a range of special properties which are vital for many modern-day technologies and clean “green” technologies including magnets, lasers, satellites, headphones, nuclear reactors, lamps, bulbs, microwave filters, batteries, hybrid vehicles, colorant and contrast agents, smart phones, cameras, computer parts, catalytic converters, x-ray machines, wind turbines, medical equipment, space craft and precision guided weapons. A smart phone alone uses a minimum of nine different REs to manufacture the colour screen, phone circuitry, glass polishing, speakers and vibration unit. The Department of Natural Resources & Mines in Queensland describes the REs as the “*vitamins required for the shift from a carbon-based economy to the new 21st century electron economy*”.

Already, the 21st century has experienced a technological boom. Driven initially by society's need for speedier communication and immediate access to information, smart phones, smart TVs, computers and laptops are now common place in the home, work place and schools. As the demand for smaller, lighter versions of these day to day items increases, it paves the way for the next wave of technological advancement in the form of nanotechnology. Asides from communication, society's shift in interest towards alternative fuel and clean energy systems, electrification and biotechnologies, will require technology to advance at an unprecedented rate. As the development of technology increases in society, so too will society's understanding of and need for rare earth elements.

Where are rare earths located?

According to 2018 estimates by the U.S. Geological Survey, the worldwide reserves of REs are approximately 120 million metric tonnes (MT), more than 87% of which are concentrated in four countries in the world: China (44,000,000 MT), Brazil (22,000,000 MT), Vietnam (22,000,000 MT) and Russia (18,000,000 MT). It is China alone though which dominates the rare earth production industry, producing 105,000 MT of REs last year which

accounted for more than 80% of global supply. The second and third largest producers were Australia and Russia producing 20,000 MT and 3,000 MT respectively.

Given that world reserves of rare earths are not concentrated in China, how has China managed to create such a dominant market position?

China's dominance of the RE market only really started at the turn of the century. Prior to that, the central players in the RE market were: India and Brazil (for the first half of the 20th century), South Africa (through its Steenkampskraal mine) (throughout the 1950s and early 60s) and the United States of America (through its Mountain Pass RE mine in California) (dominating the RE market throughout the 1960s up to the mid-1990s).

It wasn't until 1986 that China first appeared on the global radar when China's Bayan Obo mine's production of rare earth oxide ("REO") surpassed the US' Mountain Pass mine's output. Initially designated an iron deposit, the mining of REs was merely a by-product of the Bayan Obo mine until it became evident that REs were both an essential and strategic resource in a technologically advancing world.

For over 50 years, the Chinese Government has heavily invested in technological innovations through R&D programmes in order to place itself as a strategic player throughout the rare earth supply chain. China's advancement programme coincided with the closure of the Mountain Pass mine in 2002, in response to both environmental restrictions and lower prices for REs which left limited competition in the market. Incidentally, in 2005, the state-owned Chinese oil company, CNOOC Group, nearly acquired Mountain Pass (indirectly through the acquisition of American oil company Unocal, which owned Molycorp (prior to its bankruptcy) which in turn owned Mountain Pass), but the US government intervened, and the sale was prevented. Had the sale gone through, China would have acquired control of a significant RE reserve outside of China which would have given it almost monopoly control over current and future global RE supplies.

As rare earth prices surged in 2010 and China began to reduce exports to secure more supply for domestic use, China's stranglehold on the rare earth industry started to become apparent. By 2011, REs were identified as a 'strategic resource' by the National Development and Reform Commission (China's economic planning body) and by 2015, the Chinese Ministry of Industry and Information Technology revealed an ambitious 5-year plan for RE production and market share for its domestic industry, whereby domestic production of REs was set to increase by 15% per annum and exportation of RE raw materials was set to decrease from 57% to 30% by 2020.



Africa's future role in the rare earths global market

Undoubtedly, China's long-term vision and forward planning has secured its dominant position in the RE market. As global demand for REs is anticipated to reach 210,000 MT by 2025 (a significant increase from the estimated global consumption levels (referenced by Adamas Intelligence) of between 120,000 MT and 150,000 MT in 2015), there is a very real concern that China's dominance could dictate price in the event that few new deposits are developed outside of China in the near future.

The environmental impact, heightened costs of operating RE mines (extraction costs, toxic waste costs etc) and limited historical global interest in REs previously discouraged heavy investment into this industry. With increased demand and value in REs, mining companies are now actively investigating the available opportunities on a global scale. Following the initial price surge in REs back in 2010, exploration programmes began in Australia, Russia, Canada, India, Thailand, Vietnam and Brazil and production is now underway. Focus is now shifting to mineral-rich Africa where a number of RE deposits have been identified.

At present, the Gakara mine in Burundi owned and operated by Rainbow Rare Earths (an LSE-listed company) is the only producing mine in Africa. Its in-situ grades range from 47-67% total rare earth oxide ("TREO"), making the Gakara mine one of the world's richest rare earth deposits. Production commenced in December 2017 and the grade of TREO has consistently ranged between 59% and 64%. Rainbow rare earths had targeted full production of 5,000 MT per annum by end of 2018 (400 MT per month), but this has been delayed to later in 2019. Current targets are between 250 MT and 300 MT of TREO per month.

Aside from the Gakara mine, significant RE resources have been identified in Angola, Kenya, Madagascar, Malawi, Mozambique, Namibia, South Africa, Tanzania and Zambia. Seven of these identified projects appear to be relatively advanced and capable of achieving initial production within the next two to five years. Table 1 below sets out the key details of these RE projects and their current status.

A number of other sizeable deposits have also been identified in Africa, the exploratory and testing phases of which have been significantly progressed, however, due to various stumbling blocks, the projects have either been: (i) delayed indefinitely (as is the case for the Wigu Hill Project and the Ngualla Project in Tanzania which are currently at a standstill due to the recent changes to Tanzania's mining laws and the revocation / non-issuance of licences to foreign companies); (ii) halted as a result of environmental disputes (such as Tantalus' TREM project in Madagascar); or (iii) discontinued seemingly due to cost of funding (such as Frontier's Zandkopsdrift deposit in South Africa. There is little insight into the discontinuation of this project (which has proven reserves amounting to 14.93 million MT at a grade of 2.21% TREO for 331,000 MT of contained rare earth oxide), save that Frontier was de-listed from the TSX and, as recently as 15 August 2018, its ordinary shares were deleted from Other OTC).

One of the most noteworthy RE deposits to have been identified (but halted) in Africa is the Mrima Hill deposit in Kenya. In September 2013, Pacific Wildcat Resources Corporation declared an indicated resource of 48.7 million MT at 4.40% TREO for 2.15 million MT of contained rare earth oxide, making it one of the largest mineral deposits in Africa. The project stalled due to a lengthy dispute over the revocation of a 21-year special mining licence for the Mrima Hill deposit allegedly granted to Cortec Mining Kenya Limited (an indirect 70% subsidiary of Pacific Wildcat) in 2013. As of 22 October 2018, an award was granted in favour of the Kenyan Government on the basis that *"the licence was void ab initio for illegality and did not exist as a matter of law"*. Pacific Wildcat has stated that it is considering grounds for a possible annulment application.

None of these obstacles will come as any great surprise to mining companies who encounter variants of these issues around the globe. It is hopeful that Tanzania will make steps towards re-opening its doors to the foreign mining community, following the appointment of the Mining Commission in April 2018; and it will be interesting to see: (i) whether, notwithstanding its indicated resource size, the Mrima Hill project will go ahead (whether under Pacific Wildcat's direction or otherwise) given the fact that Mrima Hill site is a gazetted forest area and home to a number of rare species; and (ii) whether there is any renewed interest in South Africa's Zandkopsdrift deposit given its size and the increased demand for rare earths. Irrespective of these obstacles though, with the Gakara mine already in operation and the projects listed in Table 1 below nearing production, assuming everything continues to run smoothly, Africa will be well placed to compete with China in the RE production space in a few years' time. It is the interim period, however, which is causing some concern.

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Country	Deposit	Owners	Classification	Ore tonnes (millions)	Grade (%)	Contained REO (MT)	Project status
Angola*	Longonjo (NdPr)	Pensana Metals Ltd (formerly Rift Valley Resources Ltd) (ASX-listed)	Estimated	44.7	2.5	Unknown	<ul style="list-style-type: none"> August 2018: 9,000m drilling programme commenced Jan 2019: further drilling to commence July 2019: Expected to update resource
Malawi	Kangankunde Carbonatite Complex	Pensana Metals Ltd (formerly Rift Valley Resources Ltd) (ASX-listed)	Inferred	2.53	4.24	107,000	<ul style="list-style-type: none"> Sept 2018: ownership dispute settled and consent order providing for the issuance of a new EPL to Michael Saner Oct 2018: Lindian Resources (who has a staged option agreement to acquire 75% interest in the mind) commenced due diligence Q1 2019: drilling estimated to commence
Malawi	Songwe Caronatite Complex	Mkango Resources (TSX-listed)	Indicated	13.2	1.62	213,000	2018: Latest drilling results announced
			Inferred	18.6	1.38	256,000	2019: Focus on feasibility study, resource update and publication of the NI 43-101 technical report
	Songew Mineral Reserves		Probable	8.48	1.6	136,000	Fundraising to commence latter half of 2019 (Talaxis, Mkango's strategic partner, expected to invest GBP 7 million)
Namibia	Lofdal	Namibia Critical Metals Inc (TSX-listed)	Indicated	2.88	1.94	52,200	2018: Advanced, 43-101 resource and PEA completed, mining licence pending
			Inferred	3.28	0.27	8,973	
South Africa	Glenover (stockpiles)	Galileo Resources Plc	Inferred	2.69	1.94	52,200	Prospecting phase complete
	Glenover (in situ ore)		Indicated	7.41	2.2	163,000	2018: SAHRA reviewing application for mining right (awaiting environmental reports and amended HIA)
	Glenover (in situ ore)		Inferred	0.27	2.16	5,830	
South Africa	Steenkampskraal	Steenkampskraal Holdings	Measured	0.085	19.5	16,580	Mining Works Programme and Environmental Management Programme approved and mineralogical characterisation of the ore and the major metallurgical tests completed
			Indicated	0.474	14.1	66,800	
			Inferred	0.06	10.4	6,240	
	Steenkampskraal		Indicated	0.046	7.2	3,312	<ul style="list-style-type: none"> H1 2019: expected completion of feasibility study H2 2019: expected start of financial raise (approx. US\$500 million) Ramp up: end of 2020 at the earliest (more likely 2021)
Zambia**	Nkombwa Carbonatite Complex	Vast Resources PLC (AIM-listed) (49.6%) and Kilimire International Ltd (50.4%)	Indicated	3.25	1.59	Unknown	2016: Maiden JORC Compliant Resource estimate completed
			Inferred	18.58	1.1	Unknown	<ul style="list-style-type: none"> 2017/2018: Mineral testing Delay in progress has raised concerns of Muchanga province

+ Data ascertained from Rare Earth Deposits of Africa by R.E. Harmer and P.A.M. Nex, Department of Exploration Geology, Rhodes University

* Angola: Data ascertained from Rift Valley Resources Ltd JORC Mineral Resource Estimate (MRE) Report published on 26 September 2017

** Zambia: Data ascertained from Vast Resources Plc JORC Mineral Resource Estimate (MRE) Report published on 12 October 2016

Conclusion

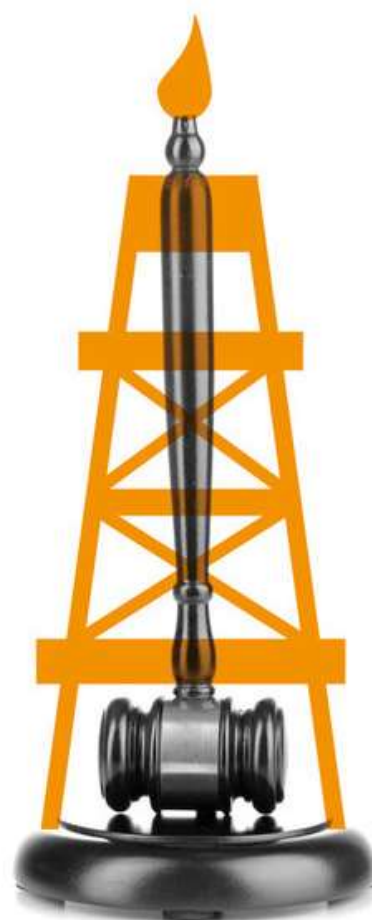
China's dominance over the world's rare earths market is unlikely to change any time soon. The US Government's recent decision to remove rare earths from the list of about US\$200 billion of Chinese goods now subject to tariffs, speaks volumes as to the US' anticipated reliance on China for REs in the immediate future (in 2017, 78% of REs imported into the US came from China). Projects which are up and running elsewhere in the globe (such as Lynas Corporation's Mt. Weld Project in Western Australia and IREL's rare earth projects throughout India) produce, at present, much lower volumes of rare earths than China's Bayan Obo mine, and prospective projects across the African continent have a few years to go before they reach full production phase.

As for controlling prices, with the demand for rare earths in the technology and clean energy industries anticipated to increase significantly over the next five years, arguably China could seek to artificially limit supply and move prices as Saudi Arabia and OPEC did with crude oil. Global concerns have already been raised following the Chinese Ministry of Industry and Information Technology ("MIIT")'s announcement at the end of October 2018 of a lower than anticipated second half quota for smelting and separation of rare earths. MIIT has argued that the full year quota of 115,000 MT remains the same, but due to a delay in issuing the quota for the first half of the year, rather than the usual 50/50 split, the first half of the year accounted for 60% of the allocated quota, hence the reduced quota for the second half of the year. Western analysts are invariably more sceptical. Adamas Intelligence has suggested, amongst other things, that the first half quota increase related to a legitimisation of previous black-market production (rather than increased production) and, as such production was largely consumed domestically, the tighter quotas would probably lead to higher prices.

Whatever the real reason behind the lowering of the second half quota, controlling price movement of a market requires more than just the holding of a dominant position. Amongst other things, China would need to gain a firmer grip on the existing illegal production and smuggling of rare earths which run riot in the Chinese rare earths industry (and which, consequently, undermine the ability to set prices). According to the state-controlled China Securities Journal, MIIT has recently launched a month special inspection to crackdown on illegal mining, excess production, smuggling and environmental violations. There is also speculation amongst the global market that China's future RE production may be insufficient to meet future domestic demand (particularly in the neodymium oxide space) never mind global demand, which could result in China looking beyond its borders, and competing with the rest of the world, for RE supplies.

The fear of China being able to manipulate a shortfall in rare earths (more so than the reality) is also likely to spur foreign manufacturers into accelerating the development of new technologies to reduce their reliance on rare earths and/or to look for alternative sources of rare earth materials, e.g. through "urban mining" (namely the recycling of raw materials from electrical and electronic waste) to meet demand. These alternatives alone won't be enough to satisfy the increased demand for REs driven by the technology boom, but they may be able to offset some of the demand whilst new and existing RE projects (outside of China) ramp up production levels.

Given the unprecedented rate at which technology is anticipated to advance over the next few years, much attention will continue to be placed on these 17 unfamiliar elements by governments and corporates alike, so much so that their rarity will only be in their name.



Africa-wide: the diamond industry leads the way in industrial-scale blockchain technology

Diamond mining is woven into the history of Africa. Based on data collected by the Kimberley Process Certification Scheme ("**KPCS**"), of the 150,900,000 carats (30,180kg) of diamonds mined in 2017 (with a total value of US\$14.125 billion), roughly 45% of those diamonds (67,000,000 carats (13,400kg) with a total value of US\$7.697 billion) originated from 17 of the 54 African countries including: Botswana, Angola, Namibia, South Africa, Lesotho, Zimbabwe and the Democratic Republic of Congo, making Africa, as a whole, the largest producer of diamonds globally.

Africa's diamond mining and distribution industry is not without its controversy though. Concerns relating to the sale of blood diamonds (also known as conflict diamonds), violence in diamond mines, human rights abuses, unsafe working conditions, environmental devastation and diamond smuggling, are just some of the widely publicized contentious issues which have hampered the industry for multiple decades.

Historically, a number of measures have been put in place in an attempt to alleviate these concerns. In 2003, the Kimberley Process was established to increase transparency and accountability throughout the rough diamond industry value chain and eliminate trade in conflict diamonds. The Kimberley Process is a binding agreement that imposes extensive requirements on each of the 81 global participants. The visible evidence is the KPCS which both safeguards the shipment of rough diamonds and certifies them as conflict free.

Whilst the Kimberley Process has undoubtedly resulted in a significant reduction of trade in conflict diamonds, it is still estimated that 0.2% of rough diamonds in the market are conflict diamonds. More importantly though, whilst the Kimberley Process

seeks to eradicate the trade of conflict diamonds (defined as: "*rough diamonds used to finance wars against governments around the world*"), it has failed to address other key concerns endemic to the African diamond industry, namely, human rights abuses, worker exploitation and environmental degradation. In addition, as there is no requirement to trace diamonds to their mine of origin, diamond smuggling (in order to obtain conflict free certification) has remained rife within the industry.



The diamond industry is now making a concerted effort to move to a more transparent system using blockchain technology.

At the end of 2017, De Beers announced that, together with the BCG Digital Group, it would be developing the first collaborative, industry-focused blockchain technology initiative ("**Tracr**") to securely track diamonds throughout the entire value chain. By using blockchain technology, an individual diamond, when first mined, can be uniquely identified and catalogued on a digital ledger. Information relating to the diamond's country of origin and specific mine of origin would also be recorded on the digital ledger. Once a diamond is identified, each stage of that diamond's journey to the consumer can be digitally recorded (in an encrypted and secure manner) as a "block" of data which in turn links to the previous "block" of data forming a chain of digital information. So, for example, if a diamond is mined from the Damtshaa mine in Botswana and sold in the UK, that diamond's blockchain would record in separate (but linked) blocks, amongst other things, that diamond's logistical movements to the sorting facility, the sightholders or accredited buyers purchasing the rough diamonds, shipment of the diamond to an identified diamond cutter, details of the trader involved with the sale of the diamond to the retailer and ultimately the sale to the final consumer.



Given that the digital ledger is not maintained or controlled by a single entity, but rather by a community of computer networks, deleting and/or tampering with any data entry becomes an impossibility (as it creates a new data entry on the digital ledger), making the digital ledger a certifiable public ledger which the consumer can use to verify the history of his/her diamond.

Tracr's pilot programme commenced in January 2018, and by May 2018, De Beers announced that, through Tracr, it had successfully tracked 100 high-value diamonds (now over 200 high-value diamonds) along the full value chain, which represented: *"the first time a diamond's journey had been digitally tracked from mine to retail"*. A growing list of industry leaders have adopted Tracr throughout the piloting phase including: Diacore, Diarough, KGK Group, Rosy Blue NV, Venus Jewel, Signet Jewelers and, most recently, De Beers' main competitor, Alrosa.

This is not the first appearance of blockchain technology in the diamond industry though. In 2015, Everledger introduced its traceability platform for the diamond and jewellery industry, with its Diamond Time-Lapse Protocol initiative following in 2017 (a digital historical ledger tracking the movement of diamonds with real time date, akin to Tracr). Everledger claims to have encrypted the provenance of over 2 million diamonds since its incorporation. IBM, along with Asahi Refining, Helzberg Diamonds, LeachGarner, The Richline Group and UL, have also recently launched the TrustChain initiative, the first cross-industry initiative to use blockchain technology to track and authenticate diamonds, precious metals and jewellery throughout the supply chain.

The difference with Tracr, says Feriel Zerouki, De Beers' Senior Vice President, international relations and ethical initiatives, at the JCK Las Vegas trade event 2018, is that De Beers wants Tracr to be an industry-wide initiative, that will, eventually, be governed by an independent foundation. *"The ultimate vision for Tracr is it will be the diamond industry's traceability solution. In order for that to happen, it can't be just one player. It needs all miners to participate, including artisanal miners."*

So, could blockchain be the answer to addressing the full range of problems which the diamond industry faces?

From the perspective of eradicating the sale of conflict diamonds, although blockchain is at a relatively early stage of development, the technology is a significant step in the right direction and a welcome complement to the existing schemes and policies. For the blockchain platforms to succeed, focus on obtaining the buy-in from all major players across the supply chain of the diamond industry is imperative. This will require global entities to not only get themselves comfortable with the concept of blockchain, but also the uncertain regulatory framework surrounding blockchain which is still under development.

However, even with the buy-in of the major players, the involvement of small scale and artisanal miners is also vital for the blockchain platform to succeed. This, in turn, will require more fundamental issues, such as infrastructure and education, to be addressed, so that miners: (i) in remote areas of Africa who have limited connectivity can access the blockchain platform to record their respective “blocks” of data; and (ii) can be taught how to use the technology. Advancement of existing technology will also be required to enable diamonds of all sizes to be traced. At present, Tracr, for example, can only track a rough diamond of 2 carats and above. Although not necessarily the primary focus of the existing diamond blockchain platforms, blockchain technology should also be capable of addressing the wider ethical issues associated with the diamond industry, such as child labour and environmental degradation. Dorae Inc. is already in the process of piloting its own blockchain technology in the DRC across the cobalt and coltan sector, specifically targeted at eradicating child labour for which the industry is renowned.

Given the rate at which blockchain technology is developing, none of the technological hurdles seem unsurmountable given time. The real hurdles for success remain the political and economic climates in which these platforms are intended to be used. Government support and recognition of the technology will be required, as well as investment into the infrastructure which will ultimately grant access to the technology to enable its successful application.

Blockchain technology alone is not capable of solving a myriad of problems which the diamond industry faces. It is a vital step towards reducing the problems and overtime, as blockchain technology develops, its role in eliminating child labour and corruption, amongst other things, from the supply chain will increase, but it will not make existing schemes, such as the KPCS, redundant. Corruption, illegal trade and human rights abuses still need to be tackled on multiple fronts if the diamond industry is to be cleaned up. A widening of the Kimberley regulations’ definition of “conflict diamonds” to incorporate the use of child labour or violations of international humanitarian law (a proposal strongly supported by the World Diamond Council and the Civil Society Coalition at the 2018 Plenary Session of the Kimberley Process), is just one example of how the wider ethical issues endemic to the diamond industry can start to be addressed.



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