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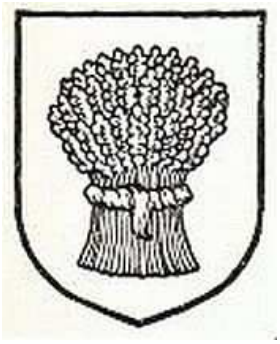

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Thinkpiece

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Critical Metals:

Back on the Political Agenda

January 2020

Critical Metals

Back on the Agenda

- + **The rhetoric of the "Trade War" has produced a collateral benefit in focusing attention back onto the vulnerability of the West to Chinese machinations in metals**
- + **Critical metals, and the cultivation of alternative sources thereto, has become a more generalized topic of conversation, if not action**
- + **Attention focused specifically on Rare Earths but the scope of the risk is much wider**
- + **Government sponsored surveys around the world have given substance to the fears, starting with the BGS Risk list in 2011**
- + **The overhang from China's FANYA debacle seems to have been cleared, lifting a cloud hanging over a swathe of minor critical metals**
- ✘ **Many critical metals are trading near multi-year lows**
- ✘ **Suspicions of Chinese price manipulation/suppression exists around Rare Earths, Tungsten, Vanadium and Antimony**
- ✘ **Lithium (and battery metals in general) has been buffeted by collapsing Chinese demand for EVs**
- ✘ **Various governmental critical metals lists are not as nimble as one would want them to be in catching trends**

Critical Metals – Their Latest Day in the Sun

Every once in a while the mining community gets a frisson from one of their favourite metals being mentioned in a television series or movie. A few years back Samarium got exposure from being a strong subtheme in a series of *House of Cards*. The fact that it was out of context and misrepresented as to its uses and criticality did not matter with the old adage that "there is no such thing as bad publicity" coming into play. More recently the second series of *Jack Ryan* has pushed Tantalum into the public eye and the technical underpinnings of what was being said about the metal seemed relatively spot on.

If concerns about criticality have reached Hollywood then there may be hope for us yet. In this review we shall look at the situation as 2019 transitions into a new decade.

Trumped

Quite a lot of the kudos for that must also go to the Trump Administration which has stumbled into an

area it knows little about technically but that was ripe for action after, for many years, having been a victim of globalisation's imperative for "cheap at any price".

The BGS "Starting Gun" in the Criticality Race

Criticality and Chinese dominance have become popular themes in the last couple of years and, dare we say it, with the British Geological Survey's first Criticality ranking in 2011 (in the midst of the Rare Earth boom) adding significant fuel to the fire.

BGS - Risk Rankings

2015

Element	Symbol	Criticality	Main Supplier
Rare Earths	Lanthanides	9.5	China
Antimony	Sb	9.0	China
Bismuth	Bi	8.8	China
Germanium	Ge	8.6	China
Vanadium	V	8.6	China
Gallium	Ga	8.6	China
Strontium	Sr	8.3	China
Tungsten	W	8.1	China
Molybdenum	Mo	8.1	Mexico
Cobalt	Co	8.1	DRC
Indium	In	8.1	China
Arsenic	As	7.9	China
Magnesium	Mg	7.6	China
PGEs	Pl, Pt, Rh	7.6	Sth Africa
Lithium	Li	7.6	Australia
Barium	Ba	7.6	China
Carbon (Graphite)	C	7.4	China
Beryllium	Be	7.1	USA
Silver	Ag	7.1	Mexico
Cadmium	Cd	7.1	China
Tantalum	Ta	7.1	Rwanda
Rhenium	Re	6.5	Chile
Selenium	Se	6.9	Japan
Mercury	Hg	6.9	China
Fluorine	F	6.9	China

All attempts at ranking criticality are bound to run into criticism with different pundits and different

economies perceiving different needs. Moreover circumstances change, as we shall expound on later with regard to Cesium. In our perception Tungsten is not as critical as it was due to numerous non-Chinese developments in the pipeline.

Of all the Criticality lists the BGS one was the only one giving scoring to the metals and then producing degrees of risk to supply. Moreover it gives the impression of being focused upon which metals are at risk (largely from China dominance, though unstated) rather than saying (as the JOGMEC list does) that certain metals are critical for a specific (i.e. Japan's) economy. The BGS list had a more universal appeal.

The main iterations of this list have been 2011 and 2015. We recently met with the BGS team and we bemoaned the lack of an update. This they ascribed to a lack of funding resources to undertake an update. They said that, in fact, they had been amongst the biggest contributors to the more recent EU Criticality list. However that list we find less granular. For now the BGS Risk rankings remain the most useful gauge of the threat to specialty metals supplies as we move into a new decade.

Stoking the Popular Fires

How "popular" is popular though? The financial media chattering about China dominance is one thing but it when the average householder gets concerned that the issue really becomes popular. Giving a recent speech on Erbium and 5G we noted that few if any of the public ever knew that the jump from black & white TVs to colour TVs was made possible by Europium and behind that lay the Mountain Pass mine. Equally the new 5G technology seems to come out of the ether, literally, and thus it is not a good idea to ask too many questions about what metals make it happen because one would find out that (notwithstanding Huawei's involvement) the REE component in 5G largely is China-sourced or China-processed. Oops!

Critical Minerals	US (2019)	EU (2017)	Japan
Antimony	X	X	X
Arsenic	X		
Barytes	X	X	
Bauxite	X		
Beryllium	X	X	
Bismuth	X	X	
Borate		X	
Cesium	X		
Chromium	X		X
Cobalt	X	X	X
Coking coal	X	X	
Fluorspar	X	X	
Gallium	X	X	X
Germanium	X	X	X
Graphite	X	X	X
Hafnium	X	X	
Helium	X	X	
Indium	X	X	X
Lithium	X		X

Alarm bells though have been ringing in the corporate suites (of Germany and South Korea, more than Detroit) about the vulnerability of the EV "revolution" to Chinese machinations and that has set off a furious hunt for non-Chinese supply chains. Curiously though, the European list does not include Lithium amongst the critical metals, though this is probably predicated upon its

upstream supplies being mainly from "friendly" sources such as Australia, Argentina and Chile. But with China being the principal midstream processor, can one be so blithely dismissive of the criticality of Lithium?

Critical Minerals	US (2019)	EU (2017)	Japan
Magnesium	X	X	X
Manganese	X		X
Natural graphite		X	
Natural rubber		X	
Niobium	X	X	X
Phosphate rock/Phosphorus		X	X
Platinum-group elements	X	X	X
Potash	X		
Rare Earth Elements	X	X	X
Rhenium	X		X
Rubidium	X		
Scandium	X	X	
Silicon metal		X	
Strontium	X		
Tantalum	X	X	X
Tellurium	X		
Tin	X		
Titanium	X		X
Tungsten	X	X	X
Uranium	X		
Vanadium	X	X	X
Zirconium	X		X

Mouthing platitudes on criticality is not the same as doing something and hunting is not catching as industrial end users still do not want to get their hands dirty mining in exotic locales. This might besmirch their "green" credentials. Neither do they want to dip into their own pockets to fish out filthy lucre to fund down-and-out mining companies struggling to keep body and soul together. This is proving to be an asymmetrical meshing of needs and wants that is rather fatal to getting projects on the road.

The various surveys that followed on the heels of the original BGS Criticality rankings now reinforce the sheer number of metals at risk, though as one can see below each agency producing these lists has differing views of the criticality of different metals within their remit.

We can note from the lists above that the US regards most metals as having some degree of criticality. This may be more a matter of international semantics as to what the word "critical" actually implies. Some are saying that this means a meta is vital to an economy (which of course iron ore is to every economy) but others are interpreting it as being that the supply is in some way threatened or vulnerable. And the latter is where the China Factor is invoked. Europe meanwhile wants to fence-sit and pretends that it is not accusing the Chinese of wielding a big stick threatening EU industries (when really the Chinese are being threatening).

The BGS by using the word "Risk" did not mince its words. Everyone knew what it meant. Chinese dominance meant supply could be turned off.

Cesium – Shifting Risk

An interesting case study in how a metal blithely regarded as non-critical can change status is the recent development in Cesium. This is (or rather was) another mineral where the US totally dominated the

processing. The biggest application for the element is the production of Cesium Formate a very high value input to oil & gas drilling for lubricating brines.

Until December of 2018 the world's biggest player, with a sweeping dominance, was Cabot Corp's Specialty Fluids division. Then in a stroke of a pen and the passing of a cheque this asset flipped from the US to China without so much as an inflammatory tweet from Washington. That is the reason why Cesium does not figure in anyone's criticality rankings because these were backward looking to a time before the asset sale by Cabot.

The deal put US users of Cesium Formate in an invidious position of being entirely dependent upon the good graces of Sinomine, the new owners, going forward. The oil & gas industry were silent on the deal as either they didn't care or one might surmise that they decided they shouldn't rock the boat or they might find themselves off Sinomine's client list.

We would sustain that Cabot Corp has the right to sell its divisions when it so chooses but that it does NOT have the right to sell to whoever when it has long been allowed to enjoy a position of market dominance. Even in Australia, where supine acceptance of Chinese "creep' is long-established, the Foreign Investment Review Board (FIRB) would have had to put such a deal under the microscope, but in the US clearly it has just been waved through.

Cabot used as a rationale for its sale that it's long-established Tanco Mine in Manitoba, from which it produced the *pollucite* that Cesium is made from, was at its end of mine life. This was true but seemingly Cabot had been resting on its laurels here (something we would also accuse Materion of in the Beryllium space). How much effort had Cabot put into finding and developing a new source? Instead it had done an offtake deal with an Australian company, Pioneer Resources (PIO.ax) which had just developed a pollucite mine in Western Australia.

So Cabot's rationale was that the US dominance of Cesium should be abandoned because it didn't control a mine anymore. Meanwhile Cesium moved into critical mode without anyone batting an eyelid.

Rare Earths – A Blizzard of Fake News

One of the most disappointing aspects of the current revival of interest in the Rare Earth space has been the invasion (reactivation?) of sleeper cells of low-life carpetbaggers on the corporate side. Back in the old days we called it promotional lies or spin now its "fake news". The new nomenclature fits the genre well with even the BBC having been suckered into repeating what is pure puff on the supposed intentions of the US government with regard to the REE space.

As those of us who are rather long in the tooth know the US government has done exactly nothing since the first Rare Earth "boom" (or scare/panic) to defend US access to Rare Earths for strategic purposes. It has not built a stockpile and neither has it encouraged production domestically or by allies. While awareness has been heightened in recent times of the issue of US dependence there is no sign that the

US government is taking definitive action to remedy this deficiency nor does it have a strategy to do so.

Some home truths are required on this issue: The first is that NONE of the projects in the US (nor Canada) are even vaguely near to advancement towards production. All are in severely undercapitalized corporate vehicles and the management of the most vocally prominent of these are proven non-performers in the space. Those that have economic studies on their projects must confess that these are very out of date on both capex and operating cost aspects and utilize unrealistic outdated Rare Earth pricings to underpin their economics.

To make these projects even worthy of consideration a vast multiple of the cash resources available to these companies would be needed just to get development plans in order. The US government is not going to fund Feasibility Studies if the company does not have one already. In many cases an FS would require more exploration (infill drilling to upgrade the category of the resource) and to further compound the issue lower REE prices would result in changed cut-offs for resources/reserves which would likely slice the size of the deposits.

Without naming names there is a frenzy of misinformation going on. Journalists are falling heavily for this “fake news” in their desperation to cobble together a Rare Earth story. The same few names are popping up as “company spokespeople”. The stories with a focus of what the US Defence department might be doing are all unsourced and do not even come from official press releases. They are largely the output of Chinese Whisper-like accretion of candy floss. Even Reuters have been employed as patsies in this process which then gave credence to the BBC gushings.

The best comparison of what might happen is the Beryllium space. The Pentagon loves this mineral and as a result the US totally dominates the space. It pays one company (Materion) via the military-industrial complex to mine and process this key strategic metal. It does NOT fund mining at Spor Mountain nor does it (ostensibly) subsidise Materion (or its predecessor Brush-Wellman). It may overpay for the product as it is (indirectly) the prime customer but who knows what the real price of Beryllium is or could or should be?

The lesson here is that the US will maybe pay over the odds, it will maybe fund a stockpile but it will NOT fund a mine and the pipedreams and lifestyles of mining executives. Ask Molycorp how much support the US was prepared to offer to see US domestic REE production (and we might note that Mountain Pass is still semi-alive-and-kicking should the government feel inspired).

Outlook for 2020

We feel bullish for 2020 and the decade ahead as far as the West responding to the critical metals challenge. Quite a number of critical metals in our view have had their price suppressed by Chinese actions that have little to do with supply and demand and a lot to do with “metal machismo” or the

Chinese desire to be seen to be always in control of everything. As noted earlier, we see a smoking gun in China's hand on the negative down moves in the last 12 months of (at least) Vanadium, Tungsten, Rare Earths and Antimony.

We might summarise here a few critical metals and our view:

Indium & Bismuth: likely to remain torpid due to the overhang having moved from FANYA into the hands of some of the biggest producers in China

Antimony: The metal has survived the "Toxic Pajama Scare of 2019" with the realization that for fire retardants there is no better alternative. Chinese production situation is dire and worsening. Artisanal output will not suffice. Prices will continue to rise with a break above $7,000 per tonne likely in 2020

Tungsten: The APT price has finally ticked up after flatlining at the bottom through most of 2019. There was a FANYA overhang issue here also. With Santos leaving production and some other mines (e.g. Hemerdon) reviving the outlook in theory is for stable supply, but China has been sitting on the price to thwart extra capacity in the West. This has failed. Expect prices to reach $280-300 per MTU of APT in 2020.

Cobalt: Glencore is by far the best jockey in the Great Battery Metals Stakes, indeed better than the Chinese. It knows when to ease its horse back and when to make it run and the bookies alter the odds as it does so. Currently the race consists of Glencore pulling back Cobalt supplies to firm up the price. This worked in a moderate way but LME prices have retreated by nearly 10% since early November as apocalyptic Chinese EV sales statistics proved to be as dire as rumoured. No amount of Glencore machinations can make buyers get excited for EVs when the interest is just not there.

Glencore, as much as the Chinese, do not want a price spike because it would only revive the ambitions of the vast heaving mass of Cobalt wannabes on the TSX-V and elsewhere. What they fail to note is that none of this group (even with quadrupled Co prices) are interested in production.

Current prices are a far cry from those reigning at the start of 2019 when Cobalt was $55K per tonne versus $32.5K per tonne now. We would expect prices to clamber back above $35K again in 2020 but not above $40K.

Lithium: The problems in this space are many and varied. What started out as an amateurish analyst on Wall Street believing the pronouncements of the vast swarm of wannabes in 2017 claiming that their projects were real and going to reach fruition became a rout of all and sundry. This killed capital flows and ravaged stock prices and sent every project without a heavyweight partner into a semi-permanent deepfreeze. The worst was yet to come as Chinese EV uptake proved to be a chimera and the Chinese (as they tend to do) overbuilt the EV complex and demand came tumbling down in 2019. US consumers

expressed deafening disinterest in EVs and other Western autobuyers sat on their hands waiting to see how various tendencies played out. A bad year was topped off with Nemaska finally going under so Australia and Canada drew one-all in the Lithium Bankruptcy Stakes. We don't expect prices to firm much in 2020, i.e. more than 20% higher than where they are currently. The China situation is way worse than the government there is letting on.

Vanadium: One of the paradoxes of the VRB evolution is that at $30 per lb, the battery developers were complaining they needed $10 per lb Vanadium Pentoxide to be viable and yet with the metal back around $6-7 per lb there is no more sign of them snapping up supplies (or potential producing assets) than there was at its peak. The market has obsessed about what the Chinese "must do" about V percentages in rebar alloys and the reality is that the Chinese don't need to do anything. They have brutally manipulated this market with their on-again off-again pronouncements on this subject. So we have an infernal duopoly of the Chinese managing well, playing Whackamole) with the top of the market and Glencore furiously attempting to underpin the bottom end. The goldilocks number for V_2O_5 prices is somewhere between $12-15 per lb and frankly VRB manufacturers will need to cut their coat to this particular cloth and stop their whining… We expect V_2O_5 prices to rise above $10 and maybe as high as $12 during 2020.

Rare Earths: As noted Rare Earths are currently like a Carpetbaggers Convention. All the scum of the earth has bubbled to the surface here and we suspect it shall end in tears. Even one hitherto respectable Australian developer has been sucked into believing the hype emanating from Texas. Despite this sideshow the underlying trend for heavy Rare Earths (i.e. Dysprosium, Erbium & Terbium) is looking very good with the long overdue Burmese ban on exports to China of HREEs starting to bite. Of this group only Dy is somewhat captive to the flagging fortunes of China's EV industrial complex. The light Rare Earths are still adequately provisioned from internal Chinese sources and they can (for the moment) still use the "big stick" that dominance provides to beat non-Chinese wannabes into submission by employing the big stick. If the light Rare Earths move up more than 20% in 2020 we would be surprised but the potential for Dy and Er to rise as much as 50% is quite good.

Conclusion

The critical metals space is torn between two imperatives. One is the transitory issue of the supposed "Trade War" and the other is the rising demand for metals that have seen little to no development since before the Commodity Supercycle even began and are now seeing a secular decline in Chinese production due to over-production, exhaustion and environmental devastation. This makes for a rather dramatic tug of war.

First question is whether the genie set free by the "Trade War" of the Chinese threat to supplies will be put back in its bottle by an outbreak of love between the US and China. The "love" being the US industrial complex's addiction to cheap Chinese minerals. We doubt that the East Asians (i.e. Japan, Korea and Taiwan) and the Germans will be so easily lulled back into a false sense of security (of supply).

Opposing this is the legacy of underinvestment and the lack of capital markets' interest in specialty metals stories (beyond momentary pump-and-dumps) combined with the Chinese massive own goal in splurging its resource base in predatory pricing and, frankly, dumping over three decades.

Which one of these tendencies wins is the question. The second one is the more enduring and will definitely triumph in the long term with higher prices (even shortages) being the outcome.

All the chatter does not provide money for projects. Unfortunately it is only metal price spikes that seem to do so. The soaring price of Lithium and Cobalt in 2017 was a case in point and then the Vanadium surge of 2018. However the REE putsch of mid-2019 waxed and waned so fast that no party got any financings done before the brief window of opportunity slammed shut.

Less sexier metals never even get their day in the sun. Tellurium or Cesium could quadruple and it would not generate more than a muffled whisper in the trade journals. The same for individual Rare Earths where Erbium and Dysprosium for example had quite an OK time in 2019.

We are of the opinion that the critical "state" of the metals world will remain as long as the West is not self-sufficient in its supply of specialty metals. The Chinese have shown themselves to be malevolent players and that was while they had the whiphand in many metals. As they start to lose their grip the frustrations will start to rise, already we are starting to see some rancor in relations with Burma over neo-colonial resources policies being imposed by China on its neighbour. Then there are the persistent stories that the ouster of Evo Morales was aided by the Chinese being disgruntled by him kicking them off the Lithium concessions at the Salar de Uyuni in favour of European groups. Is this mere sparring or the first shots in a monumental struggle over the world's most crucial mineral resources?

In retrospect the "Trade War" of 2018-20 may be seen as the "phoney war" phase of a much bigger tussle over access to the world's scarce specialty metals resources.

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