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HALLGARTEN & COMPANY

Metals Review

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Tungsten

China's Grab Fails

Company	Ticker	Currency	Price	Mkt Cap mn	Stage	Call
Almonty Industries	AII.v	CAD	1.04	157.01	Producer	Long
Blackheath Resources	BHR.v	CAD	0.01	0.05	Ex-producer	Neutral
Happy Creek Mining	HPY.v	CAD	0.13	12.15	Exploration	Neutral
King Island Scheelite	KIS.ax	AUD	0.08	20.96	Ex-producer	Long
Ormonde Mining	ORM.L	GBP	4.10	15.03	Near-producer	Neutral
Northcliff Resources	NCF.to	CAD	0.07	12.16	Exploration	Neutral
PanEx Resources	DBGF.bb	USD	0.0047	U/K	Exploration	Neutral
Specialty Metals Intl	SEI.ax	AUD	0.03	16.65	Near-producer	Long
Thor Mining	THR.ax	AUD	0.017	12.39	Exploration	Long
W Resources	WRES.L	GBP	0.445	25.78	Near-producer	Neutral
Masan Resources	MSR	VND	18,300	16.46	Producer	Neutral

Tungsten

China's Grab Fails

- + The ranks of producers/developers have been brutally thinned out leaving only a few serious players in the space
- + The Tungsten space had a narrow escape from an attempt earlier in the decade by China to wipe out all non-Chinese miners and dominate the production of machine tools and drill bits
- + Tungsten prices firmed up nicely in the second half of 2017 and went higher into mid-2018
- + The price upturn gave impetus to restarting work on various stalled projects
- + China is expected to be a net Tungsten importer by the mid-2020s
- + Most developers have old mines they are rebooting. Greenfield projects remain largely unfinanceable
- × The APT price has retreated to below $300 and appears to be trapped in a holding pattern
- × Europe will still produce less than half of its own tungsten requirement of 16,000 tpa WO_3 by 2020
- × Quite a few projects claim to be moving forward to production raising the possibility of over-production
- × Raising money for Tungsten projects is still no easy task with tight financing conditions and little investor understanding of the metal's price dynamics

The Opportunity Escapes the Chinese

There was a brief shining moment at the turn of this current decade when it looked like all China's dreams and stratagems had come true… The theory goes that China made a grab for the global tool market. First sink the Tungsten prices and drive the few remaining non-Chinese producers to the wall, then hike the prices, restrict exports, force Western (mainly German or Swedish) players in the tool business to move plants to China or eat their lunch via predatory pricing and voila global domination of yet another niche.

However, the Chinese didn't count on meeting any resistance. The Western end-users in the tool space, breaking with orthodoxy, decided to pay more for "secure" Tungsten supplies than the "market" price which the Chinese set. This was accompanied by specified targeted support to up-and-coming players like Wolf Minerals and Almonty Industries. The support has manifested itself more recently with Wolfram Bergbau backing King Island Scheelite and now Chronimet backing Mt Carbine. The industry thus passed through the eye of the storm and has come to sunny (well, overcast) uplands and the Chinese strategy has lost its wheels. Our heart bleeds for them.

Devastation Wrought

In the most heated part of this battle for dominance the slumping price of the metal wreaked destruction upon the Tungsten exploration names AND the producers (with Malaga, North American Tungsten and Wolf Minerals succumbing to Administration). The explorers largely faded into mere shadows or repurposed their vehicles as something else. Meanwhile consolidators like Almonty Industries (one of our long favoured stocks) picked up failing producers as part of its global roll-up strategy and determined explorers made the sacrifices necessary to remain in the land of the living.

In this note we shall look at the implications for the Tungsten sub-space now that the metal's price shows a strong turn for the better.

Reading the Chinese Runes

In late March the Chinese news agency, Xinhua, published the first batch of rare earth and tungsten mining output quotas for this year with the first batch of mining output quota for Tungsten was set at 49,835 tonnes according to a circular jointly issued by the Ministry of Natural Resources and Ministry of Industry and Information Technology.

However, decades of excessive exploitation of the minerals, and not just in Rare Earths, have greatly damaged the environment. To curb environmental degradation and protect the resources, the country implemented a range of policies, including output caps, stricter emissions standards and a crackdown on illegal mining.

Those Cunning Germans

As the (potential) prime victims for a Chinese grab at the machine tools, drills and general tools market the Germans and the Swedes had a vested interest in seeing the Chinese kept from global domination of Tungsten mining. Through close cooperation with the upcoming producers and consolidators, the end-users managed to dodge the Chinese bullet and not at a particularly high price to themselves.

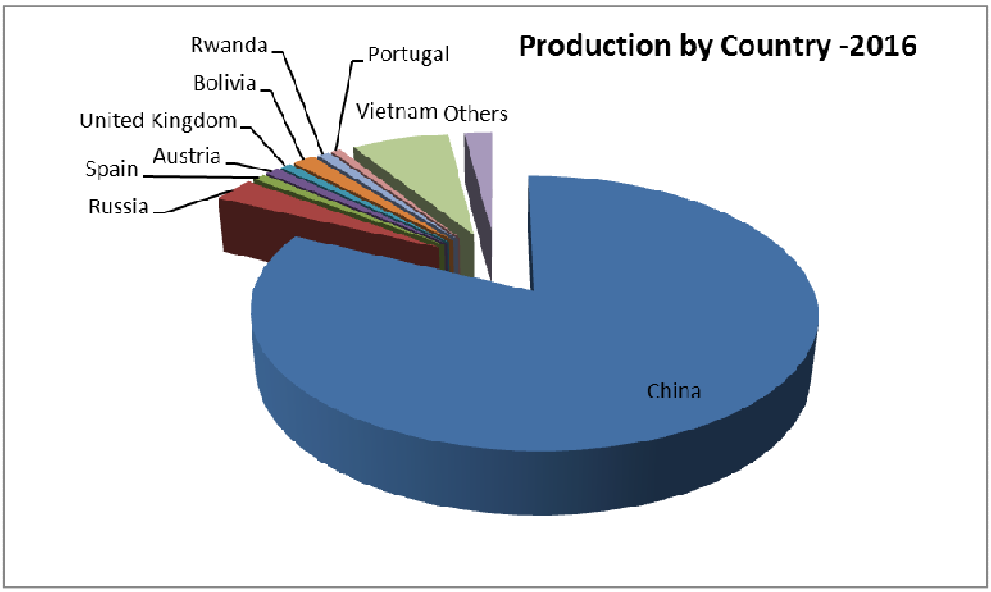
This shows that a symbiotic relationship can be developed between miners and users. Not that we ever doubted that…

It is also an interesting to contrast the European approach to the way in which the Japanese and Korean industrial sectors just rolled over and played dead in the face of Chinese onslaughts on their strategic industries. One can note though that some effort was made to try and "pick winners" such as Korea Zinc with Woulfe Mining and Sojitz acquiring Panasqueira, but both of those efforts ended in tears.

Shifting Production

In the past we have focused where production has been with some mentions of the stalled projects for the future (maybe). Now we can see that there is potentially a major sea-change in the balance between China and ROW, and where in the ROW the production comes from, particularly as China is expected to be a net Tungsten importer by the mid-2020s.

Countries that have faded long ago, like Australia and South Korea have the potential to become major producers, while some that produced in recent times, like Canada and Peru are totally sidelined, and major producers from further back, like Spain and Portugal, are getting a second wind. Indeed the latter two countries should dominate non-Chinese production from now for at least the next decade.



Source: USGS

This moving feast means that, besides China and Russia, other principal producing countries are Austria, Bolivia, Portugal, Spain, the UK, Rwanda and Vietnam whilst mines have closed in the last decade in Australia, Brazil, Canada, France, Japan, Peru, South Korea, Sweden, Thailand and the USA. The price slump post-2011 knocked players like Canada, Peru and Australia out of the running.

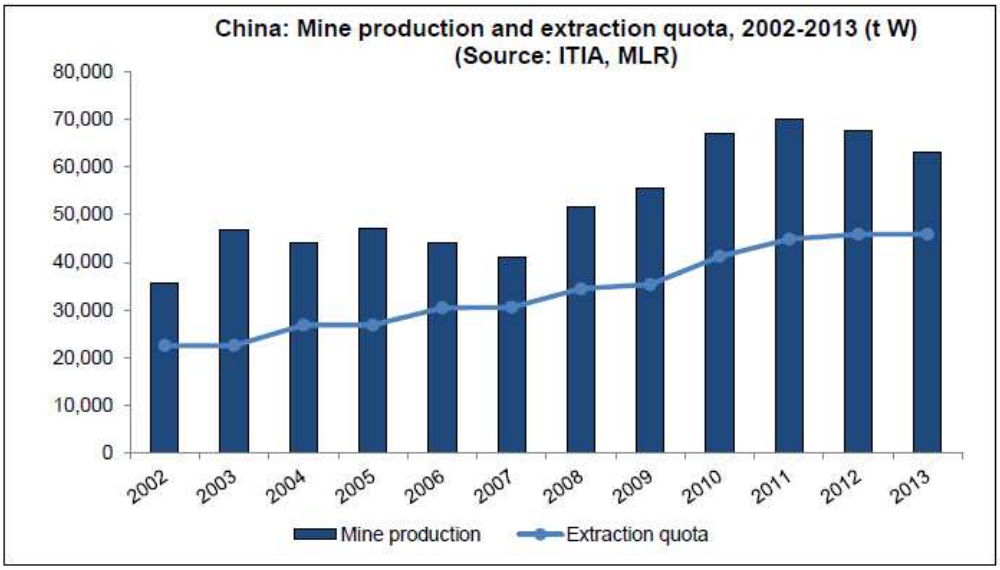
Vietnam's production doubled from 3,000 tpa in 2013 to 6,000 tpa in 2016. The Australian presence has reappeared again in a small way since 2016 with Almonty's Wolfram Camp mine there, but now that is shuttered and bigger players like the Dolphin project and niche ones, like Mt Carbine and maybe the more formative projects of Thor Mining, are starting to get back into contention.

The latest assessment of the USGS (from 2016) is that China has 61% of global Tungsten resources, Canada with 9% and Vietnam with has 3%. However, it is not which country currently has the resources that matters but the country that gets into production first. Thus Portugal currently has more going on in the Tungsten space than Canada does, while South Korea currently has no production but when Almonty get their Ssandong operation going there the country might account for 7% of global production and fully 50% of ex-China output. Curiously Korea does not figure in the ranking of major resource holders (despite its putative mine once being the world's largest).

Disciplining the Market

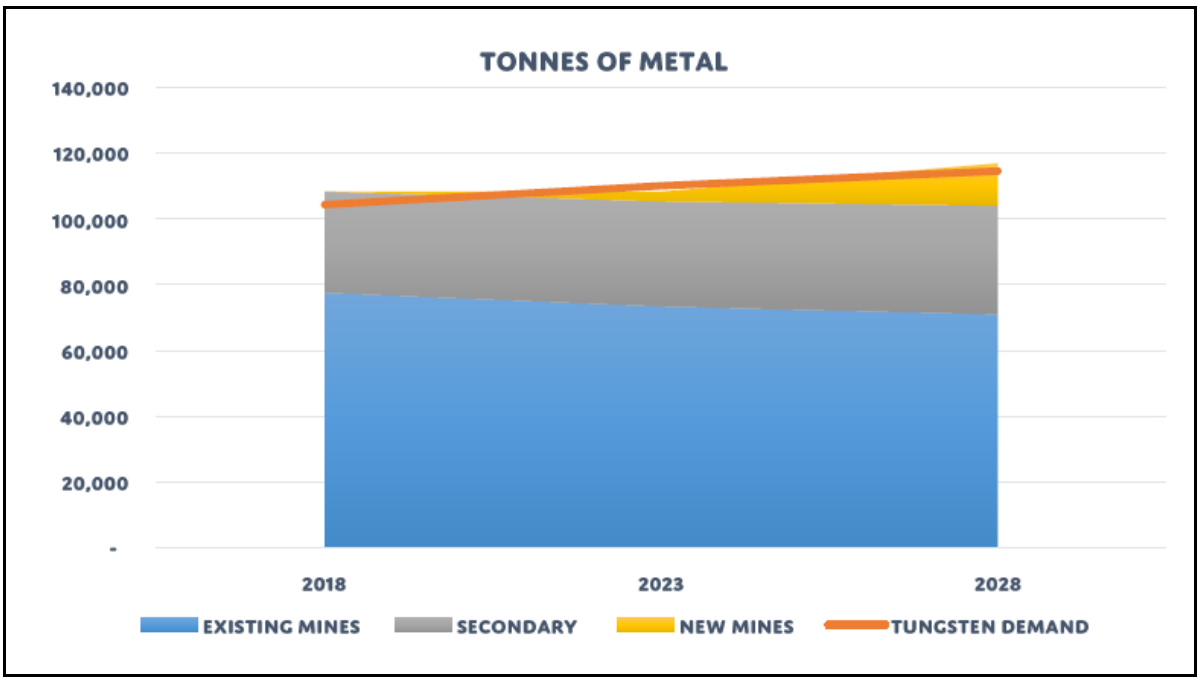
Just as in Rare Earths and other specialty metals the Chinese government, in the early part of this decade, curtailed mining programs and strongly "encouraged" downstream processing of concentrates to higher value added products such semi-finished and finished tungsten products. We might also note

that before the 2008 slump China had become a net importer of tungsten concentrates and scrap.



Source: Roskill

The chart above shows that China's production peaked in 2011 and then tailed off but have since picked up again. The extraction quotas that the Chinese imposed were regularly blown out by the producers (legal and illegal) but it was interesting to note how the gap narrowed.



Source: Northcliff

This narrowing was probably due to a measure, taken in early 2011, when China's Ministry of Land and Resources announced that authorities in the country had identified and ordered the clean-up of more

than 280 illegal mines in an effort to regulate the exploration of valuable minerals. The number of exploration licenses for minerals such as Rare Earths, Tungsten, Tin, and Antimony were reduced to 116 from 400 in eleven provinces and regions in the country via spot checks led by teams dispatched by the ministry. This campaign has aimed to end the supposedly illegal excavation of valuable minerals. These measures, ostensibly, were in an effort to conserve resources.

China also dominates world consumption, accounting for more than 55% of tungsten use in 2017. Other major consuming regions and countries are Europe, the USA, Japan and Russia. China has increasingly focused its tungsten industry on the production of value-added goods such as tungsten carbide and cemented carbide;

FANYA – China's Own Goal

APT was amongst the 14 traded non-ferrous specialty metals traded on this exchange, based in Kunming, Yunnan province, at its apogee between April 2011 and April 2015. Roskill has claimed that Fanya is "widely believed" to have contributed to the last tungsten price spike in 2012-2014, as a result of APT purchasing that ultimately led to the accumulation of large stocks and tungsten prices largely detached from macroeconomic trends and prices elsewhere in the world (and even China).

In July of 2015, Argus Metals had estimated that stocks of APT held by the exchange was 29,651 tonnes with prices on the exchange (showing how crazy it all was) being 258Yn per kg versus spot market prices of 110Yn per kg.

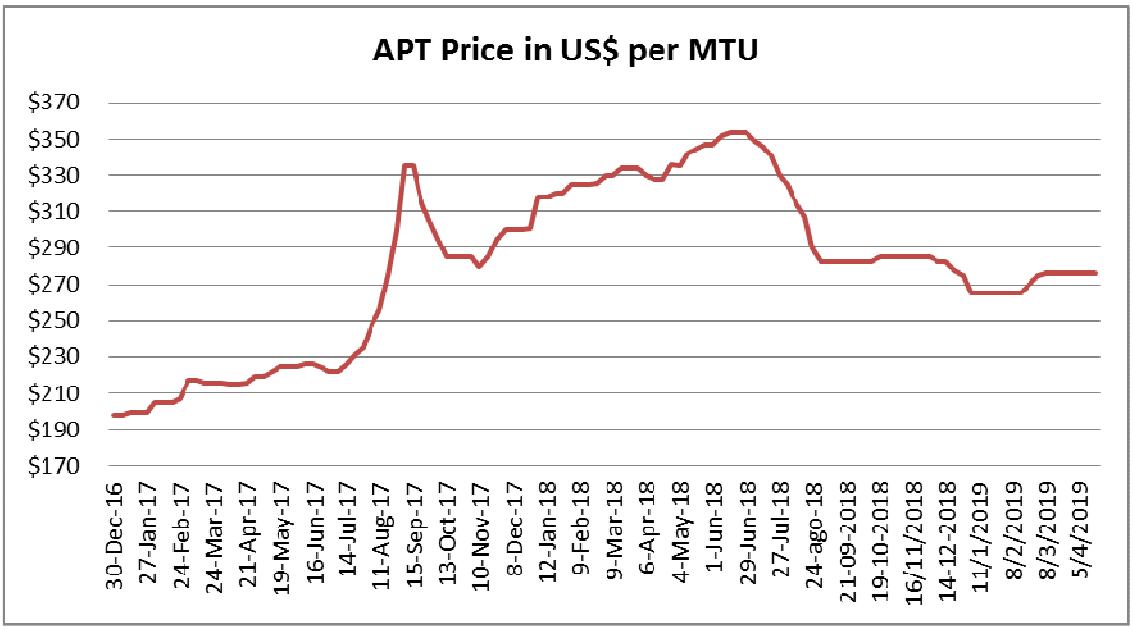
Since the exchange was frozen in mid-2016, there have been questions over how and when Fanya's reported 30kt of APT stocks will be released to the market. Reuters reported in late January that the court liquidators at the Kunming Intermediate People's Court would begin to sell off its stockpiles of some metals in order to pay off FANYA's creditors, though the court had not disclosed the information publicly on its website. However, according to a listing on the website of Taobao, a Chinese e-commerce platform, the metal sales were scheduled to take place on the Kunming court's official account on the auction section of Taobao from January 28 to January 29.

We had speculated at the time that maybe "the State" will buy the metals at the low price point and move it into the official strategic stockpiles. Investors should regard themselves as "taking one for the team" in that circumstance. If the APT stocks really were liquidated then they haven't had an appreciable effect on the price of APT this year. One could also speculate that the original stockpile numbers were wrong as falsification of warehouse inventories is like mother's milk to scamsters in the Chinese commodity sphere.

Pricing

As can be seen in this more recent chart on the following page, prices have retreated quite substantially from their mid-2018 highs and then stabilized around a level 30% higher than the level reigning during the long price slump.

What might also be noted is the relative stability of prices since August of 2018, with minimal change. This suggests the current players, both Chinese and Western, do not want to see price fluctuations.



Source: Almonty Industries

Early last year we had posited that APT prices would end 2018 around $345. We managed to pick the year's high but the price had substantially faded by year end when the price was a mere $275 per MTU of APT. Our latest projections are shown in the table below.

Tungsten APT Pricing Projections	MTU (US$)
2016	$198
2017	$301
2018	$265
2019e	$315
2020e	$335

This Time it Will Be Different?

Factors militating against a ramp up in production included:

- long lead times between exploration and new mine openings
- the steep rise in mine development and operating costs
- the very limited availability of high grade deposits (i.e. greater than 0.6% WO_3)

The result is that the pipeline of new projects is largely empty and even if potential mines were identified there would be little new significant supply expected over the next 3-4 years. Moreover

further price advances for tungsten concentrates and products would be necessary before any new major mining programs could stand a chance of gaining funding. As we have seen APT prices went off a cliff with the global slump of 2012 and any miners with aspirations to get into production ended up shelving plans for the duration of the slump. This only served to accentuate the China-dependency of the industrial users of Tungsten.

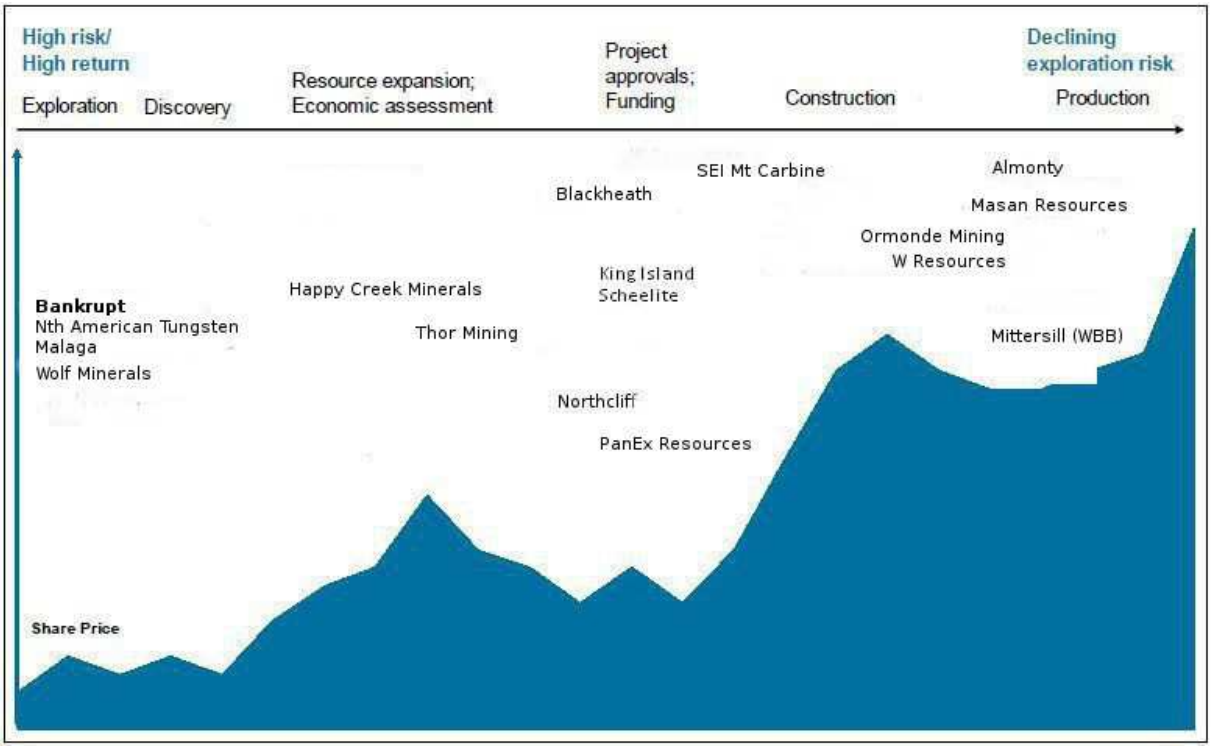
Almonty's survival and expansion has been encouraged by European machine tool makers prepared to pay over the "market" price for APT to ensure that Almonty survived and prospered as an alternative to the inevitable Chinese near-monopoly if it had gone under.

Scrap has been an issue with a high X factor in unknown levels of stocks awaiting the right price to be mobilized. Roskill has noted that there are reports of sizeable scrap stockpiles in the market as of April 2019, and the consultancy expects these to be consumed during the course of the year. In their opinion, APT prices are, therefore, expected to rise during 2Q19 and 3Q19, before falling back slightly in Q4.

Western machine tool makers are particularly vulnerable to supply disruptions as it is up against China, making a major push into the tool space and thus we might tactfully say that it would be to the benefit of Chinese toolmakers to have foreign competitors experience supply problems from the Chinese tungsten mines. If any investors doubt that that might happen then they would be naive indeed.

The Tungsten Lifecycle Chart

The Tungsten Lifecycle chart looks largely the same as at the start 2018 with just a few minor position changes. That said most of the developers have edged forward, some more than others.



The tough financing conditions mean that projects in the multi-hundreds of millions of dollars range for capex are likely to be left in the "too-hard" basket for ten years or more. This sidelines Mactung and Sisson. North American Tungsten has gone bust. Its big capex Mactung project in the Yukon was, bizarrely, acquired by the government of the Northwest Territories in late 2015. Its royalty is, strangely, owned by Strongbow Exploration. However, the capex and isolated location keep this project firmly in its box.

Mittersill, is the Austrian mine of **Wolfram Bergbau** (the vertically integrated player in the industry that has been controlled by Sandvik since 2009). The mine is said to produce 1,200 tpa of Tungsten.

Almonty's roll-up of brownfield projects have resulted in it dominating the production end of the chart and it has cleared out a number of long-standing names (e.g. **Woulfe Mining** and Sojitz). It is not just movement in one direction though. It has mothballed its Wolfram Camp mine in the Australian state of Queensland but has not put it for sale as it doesn't want any extra competitors. Its Los Santos near Salamanca in northwest Spain is not offer by any means but it's well past its peak. The company is now looking to Valtreixal (relatively nearby to pick up the baton at some point). Penasqueira in Portugal is now fully integrated and work has begun on Sangdong in South Korea. Almonty the only player that passes for a "major" in the Tungsten space.

Wolf Minerals fell into administration in 2018 a victim of too much debt, excessive capex upfront and a low grade. It may have renamed its Hemerdon mine as Drakelands but it was harder to get away from persistent problems than just changing the sign at the front gate of the mine. The £140 million project was officially opened in September 2015, becoming the first new British metal mine in 45 years and one of only two mines outside of China with production capacity greater than 3,000 tpa of tungsten in concentrate. However the opening coincided with the price slump in the metal and the mine then spent several years being put through the financial wringer. At the start of last year it looked like it might just pull through but that was not to be the case. It may yet reappear as a producer but original shareholders have been annihilated.

Specialty Metals International (**SEI.ax** - formerly Carbine Tungsten), which trades on the ASX under SEI, has finally secured the freehold of its Mt Carbine project via the acquisition of 100% of Mt Carbine Quarries Pty Ltd, an entity that owns and operates the Mt Carbine quarry and mining leases ML4867 and ML4919 in recent weeks. The most exciting part of this is the JV is with (yet again) a German group. The Joint Venture is held 50% each by:

- Mt Carbine Retreatment, a wholly owned subsidiary of Speciality Metals
- Cronimet Australia, a wholly owned subsidiary of Cronimet,

At the beginning there shall be production from the tailings anticipated to be 50 tonnes of WO_3 per month (5,000 metric tonne units or mtu's per month). Then the company shall move on to exploiting the resources still in the ground. One to watch, we suspect.

The prime challenger to Chinese dominance in the Tungsten space is actually in Vietnam. **Masan Resources Corporation**, listed on Hanoi's UPCoM exchange (UPCoM:MSR), is the largest producer of primary and mid-stream tungsten products outside of China. Its Nui Phao open-pit polymetallic mine, is

located approximately 85 km north-east of Hanoi in Thai Nguyen Province. The company acquired it in 2010 as a greenfield project and it was commissioned in 2013, showing that a short time frame to production is possible in this metal. Along with tungsten, the Nui Phao project is also said to contain economic deposits of Fluorspar, Bismuth and Copper. Fluorspar is one of the things that excites us these days also.

The process plant at Nui Phao is designed to treat 3,500,000 tons of ore to produce tungsten, copper, bismuth and fluorite concentrates.

W Resources (WRES.L) claims to be advancing rapidly to production with its reboot of the La Parilla mine. We were giving a talking to after our last Tungsten review did not tug the forelock to the potential of this property. However there is action here with a rather generous funding through the local government and the local savings bank having bolstered the warchest. The immediate priority at La Parrilla is to complete the commissioning of the Jig & Mill Plant which is underway in parallel with the completion of the large-scale Concentrator Plant. The company is currently undertaking blasting to establish the benches. First crushing of ore took place in December as part of the commissioning process for the crushing circuit. La Parilla looks like becoming a reality and not one that will overly upset the supply balance.

Ormonde Mining (ORM.L) is the developer of the Barruecopardo Tungsten Project in northwest Spain, in which it holds a 30% interest. The reduction in its position was due to through a US$99.7 million funding package agreed with Oaktree Capital Management (70% interest) in 2015.

Mine commissioning was targeted for 4Q18 but is currently ongoing. When fully operational expected production volumes are 260,000 mtus WO_3 (steady state) and will account for around 13% of non-Chinese global supply of tungsten concentrates in the company's estimation. We'd add the caveat that this is if China's production stays at current levels, as we suspect that shall start to fall increasing the shares of all non-Chinese producers.

Northcliff Resources (NCF.to) continues to put its ducks in order at the Sisson project in New Brunswick but without starting construction. However, the ducks are currently swimming around in circles.

The various Portuguese properties of **Blackheath Resources (BHR.v)**'s looked promising, particularly Covas, but nothing is happening on a mine build yet. Indeed the company sold some of its Portuguese assets to **PanEx Resources**, a seemingly South African company (DGBF.OTCBB) acquired the Borralha post-producer near Porto in May of 2018 and claims to be targeting recommencement of mining there. PanEx has the right to earn 90% by spending CAD$5mn or by taking the project to feasibility study, with a possibility to acquire the remaining 10 %. PanEx also holds the Vila Verde property in Portugal.

King Island Scheelite (KIS.ax) is a stock we have covered in standalone notes in the past. The Dolphin Tungsten Mine operated between 1917 and 1992, when it was closed due to extremely low tungsten prices, rather than a lack of reserves. Over the last few years, KIS has concentrated on optimising a redevelopment strategy for the Dolphin Tungsten Project. The current development plan envisages an 8-year open cut mine producing a concentrate. However. the mine reboot has been in somewhat of a holding pattern while prices were low and has gone through various iterations of design to deal with its proximity to the sea (as one can see from the photo below).

The project has a JORC 2012 compliant Mineral Reserves of 3.14mn tommes at a grade of 0.73% WO_3 (at 0.2% cut-off). The Mineral Resources, including the Mineral Reserves, total 9.6mn tonnes at a grade of 0.90% WO_3 (at 0.2% cut-off).

In early April, the company announced it had concluded an off-take agreement with Wolfram Bergbau (which has previously played fairy godmother to a number of European projects targeting Tungsten). The agreement was for a total of 140,000 MTUs of WO3 in concentrate to be delivered over a four-year period, based on take or pay principles. The off-take contract accounts for approximately 20% of proposed annual production from the Dolphin Mine.

At the start of May though the company published an "economic analysis" that revealed the project had a base NPV of AUD$153mn and internal rate of return of 46%. The financial modelling was based on an assumed operating cost of $127 per metric tonne unit of Tungsten produced, as calculated by independent consultants. Meanwhile, capital expenditure was estimated at $65 million, with a forecast 2.75-year payback.

However, shortly thereafter the management had to do a rather embarrassing *volte face* after the ASX demanded its retraction. We met with them this week and it looks like this project is moving full-steam ahead.

On the exploration side the ranks are thin indeed, and somewhat replicate the Rare Earth space. There is virtually no pipeline of exploration projects in the hands of pure explorers. Indeed most current

producers and developers have second projects (e.g. Almonty, W Resources) that they can eventually fund from cashflows while junior explorers must rely upon “the comfort of strangers”.

One of the few notable explorers is **Thor Mining** (listed on the IM and ASX under THR), which we wrote extensively upon in early 2018. Its project suite consists of the Molyhill (Tungsten-Molybdenum project in Australia’s Northern Territory and the Pilot Mountain Tungsten project in Nevada. Both are past producers, so even here there is not a reinvention of the wheel going on.

Is there a trend here? Well the number of serious TSX or TSX-V players is minimal. While Almonty’s primary listing is there, it is almost an aberration as those in Canada that understand the stock are few and far between. From having two major producers eight years ago (Malaga and North American Tungsten) and a bustling crowd of wannabes, the Tungsten space on the TSX has come to resemble a funerary chapel.

Risks

The risks for the Tungsten space in general. These are:

- The Tungsten price flatlines or declines further
- Ongoing difficult financing conditions
- Failure of the Tungsten story to reignite when mining market returns to general interest
- Weakened global industrial demand (particularly in tools) that would soften prices and volumes
- China skewing the market in some way to again create distortions in prices and trade patterns

Most of these risks are different sides of the same price prism, with the exception of the market’s perception/disinterest in Tungsten.

Financing remains difficult and dilutive when it takes place. The only way to harvest the more attractive price is to be in production and the only way to do that is to finance mine-builds/reactivations.

The FANYA debacle still lurks as a worry for some that there is an overhang of stocks of APT at the mercy of decisions of a court or liquidators in China. We suspect that inventories were maybe not as high as previously mooted and that they either may not still exist or some other “solution” to placing them has been found.

It could be said that the market is perversely supporting quite a number of serious Tungsten developers at the moment despite the flaccid price. The main consolation is that the promotorial class are not jumping on this bandwagon and creating new vehicles. Essentially the market has as many Tungsten developers in the pipeline as it needs for the foreseeable future.

Conclusion

After an untrammeled advance for twenty years, China is now grinding to a halt in its Grand Strategy. The classic mistake of overreaching has led to the current state of things. The Lithium situation is an interesting microcosm. While panic merchants would claim that China is corralling all the world’s LiB production, the more measured observers would note the Chinese have a lead but it comes at a price of

having paid too much too soon for exposure and then becoming solely dependent on their own EV push to retrospectively justify paying too much for exposure. Now the Japanese and South Koreans are arriving and picking up exposures at much lower prices before the music has even really begun at the global EV Ball. Who is the dumb player in this equation?

In Tungsten, another metal the Chinese tried to dominate to advance their machine tool industry, there is now a situation where industrial demand is making it harder for China to maintain low prices (to maintain its dominance). Moreover China's attempts to overrun the machine tool sector through its Tungsten dominance have put Western manufacturers of this equipment on notice that they need guaranteed non-Chinese supplies to evade predatory Chinese manouevres. The Europeans saw the danger and acted to ward it off.

For the first time since 2010 there now exists a window of opportunity for Tungsten developers to catch the attention of investors, as end users scramble to secure alternative, more reliable sources of supply. The broader economic recovery should lead to increased competition for Tungsten concentrates in the global market between Chinese and non-Chinese processors and consequently resulting in an improved price structure for Tungsten and its products.

However, another key moment has been reached. While before the question of the survival of Western production was in play, now the issue is whether the Chinese can keep the price at the current sub-Goldilocks level at which another 4-5 non-Chinese miners enter the fray and Chinese dominance is ended. Two or three more Iberian producers, plus Sangdong, should put *Peak* Chinese Tungsten behind us. Conspiracy theorists amongst us might see the eerily stable current level of APT pricing as yet another example of the "hidden hand" at work. At what point will the Chinese just abandon the struggle and sit back and "enjoy" higher pricing. Such a course though would require a change of mindset.

If they accept the inevitable then a rise in the price of APT to over $300, by the end of 2019, seems like a not too outrageous postulation.

Important disclosures

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