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Tin tops MIT list of metals most impacted by new technologies

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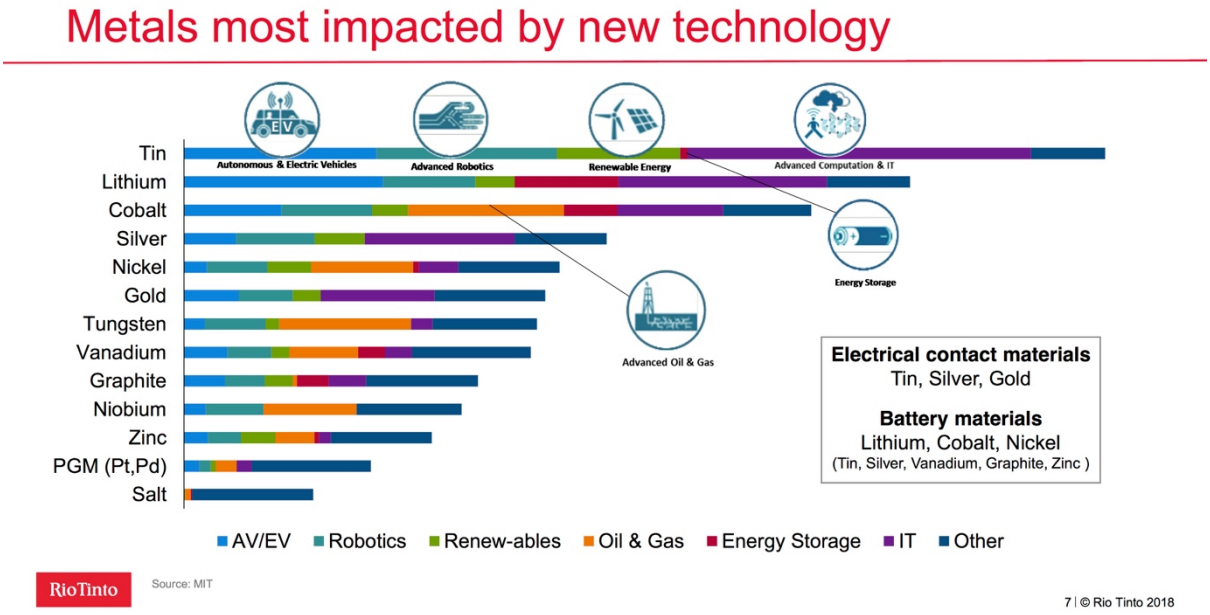
Rob Bruggeman, a former research analyst with more than a decade of experience with a boutique brokerage firm and a large bank-owned proprietary trading desk on Bay Street, has been blogging on his site Alpha Mining since 2017. He also invests his own capital and is a consultant to small-cap companies and investment funds. In a post earlier this week, Bruggeman confesses that he had thought tin was a "boring metal" used "predominantly for solder (yawn!), and for applying a thin, corrosion resistant layer on metal (a.k.a. tin-plating) (double yawn)."

But no longer.

Citing a study by the Massachusetts Institute of Technology (MIT) that examined which metals would be most impacted by new technologies, such as autonomous and electric vehicles, renewable energy, energy storage, and advanced computing and IT, tin headed the list.



"Never in my wildest dreams would I have expected tin to come out at the top of that list, edging out lithium and cobalt," Bruggeman writes on his blog. "This is the first time I've seen or heard anything about tin possibly becoming a hot metal."
After tin, the MIT study listed the following metals in order of importance: lithium, cobalt, silver, nickel, gold, tungsten, vanadium, graphite, niobium, zinc, PGM (platinum and palladium) and salt.

There aren't many tin companies, Bruggeman says, but he has put together a list of the ones listed in Canada, which include **Alphamin Resources**. (TSXV: AFM), **Strongbow Exploration** (TSXV: SBW), **Eurotin** (TSXV: TIN), and **Tinka Resources** (TSXV: TK).

"Alphamin is in the process of building a tin mine with some spectacular grades and expects to be producing in Q1 2019," Bruggeman says. "But, guess what? It is located in the DRC! So, between its undesirable geopolitical risk and being in the undesirable phase of building a mine, I personally will pass on Alphamin. However, if you are okay with the DRC, then take a closer look because Alphamin is a real company with a $194 million market cap and it looks destined to become a producer."

The Northern Miner did take a closer look at Alphamin. On its website, the company refers to its Bisie tin project in the eastern region of the DRC as one of the world's most significant tin deposits.

In a YouTube video posted on its website, Alphamin's CEO, Boris Kamstra, describes Bisie as the second-largest contained tin project in the world and four and a half times the grade of the next runner. "This is a truly industrial mine," he says. "We originally looked at trying to put in an open-cast mine, but the area we're in has quite big valleys in it … so to do it in a responsible manner would be tricky, because you'd have to dam up the whole valley, and given the rainfall, there is about a metre and a half per annum, that could get tricky. So the metrics, the safety aspects, and the economics of an open cast mine just didn't work."

The company plans to drive a simple decline until it hits the ore body, and then about 20 metres below the ore body, a spiral decline will follow it. Then the drives will go into the face, and it will be mined by a sub-level caving method, which the South African CEO says is ideally suited to the ore body.

The Mpama North deposit and the Mpama South target, about 1000 metres to the south, are located along a ridge in dense jungle.
At the Mpama North ore body, Alphamin has drilled up to about 230,000 tonnes of contained tin.

"The current mine plan is based on breaking into the circle, you've got to start somewhere … and we believe 230,000 tonnes of contained tin is a pretty good start," the CEO says in his video. "From that, the cash flows that are generated by this plant and project will be sufficient to explore and develop any of the other targets that we could find in the area."

Kamstra adds that if he "had to guess," Mpama North probably has 400,000 or 500,000 tonnes of contained tin. "We know it goes down. We know that this particular deposit plunges to the north, and we have every indication that it continues and actually improves," he says. "One of our greatest drill intersections was at 550 metres down … We got the most extraordinary results, in fact … that I asked the

geos to check it three times because I just couldn't believe the grade that they were reporting."
The company has some drill holes into its Mpama South target, and initial results have been similar to ones from Mpama North, Kamstra says. "We've got every indication that there is another ore body very similar to Mpama North at Mpama South," he says. "Further down the ridge, we have geochemical soil anomalies of tin and copper, which come together in this particular emplacement structure, and geophysics that have the same signature as Mpama North further down the ridge. So that's just on the Mpama ridge itself."

The project area, about 180 km northwest of Goma, the capital of North Kivu, and about 60 km northwest of Walikale, is covered with dense vegetation and no power is available from the national grid in the area. Power will have to be obtained from either diesel generators or hydro-electric generators.

"There has been an incredible amount of work done," Kamstra says. "We have filled about 40 km of diamond core hole … and to do that on a hill in the middle of the jungle in the middle of the DRC is an extraordinary feat, and to have done it converting drill metres to measured, indicated and inferred as efficiently as our team has been able to do, is mind-blowing."

The last mineral resource was based on drilling between July 2012 and November 2015 and was the company's fourth resource update.
Measured and indicated resources currently stand at 4.60 million tonnes grading 4.52% tin for 208,100 tonnes of contained tin. (The copper grade is 0.31%, zinc grade is 0.15%, lead grade is 0.010%, and silver grade is 2.7 grams silver per tonne.)

Inferred resources add 0.54 million tonnes grading 4.25% tin for 22,800 tonnes of tin. The inferred resource contains a copper grade of 0.16%, zinc (0.09%), lead (0.013%) and silver (1.4 grams). The resource estimate used a cut-off grade of 0.5% tin. Proven and probable reserves total 4.67 million tonnes grading 3.58% tin for 167,300 tonnes of contained tin.

The main vein zone, which accounts for 97% of the resource estimate, is on average about 9 metres thick, although it is narrower (less than 1 metre) at the margins and up to 22 metres thick in the central areas. The zones that occur several metres above and below the main zone are considerably narrower than the main vein zone and cover areas of between about 100 metres and 220 metres in the dip and strike directions, according to the March 2017 technical report.

The mine will produce a concentrate grading about 61% tin and the company says plant commissioning should start in the fourth quarter of this year, with production ramp-up in the first quarter of next year. It hopes to reach nameplate capacity in the second half of 2019.

Capex is estimated to be in the range of US$172 million. Last November, Alphamin secured a credit facility of US$80 million from a syndicate of lenders made up of

Sprott Private Resource Lending, Barak Fund and Tremont Master Holdings. The proceeds will be used to build the mine.
In January of this year, Alphamin raised about C$56 million issuing 175 million units at a price of 32¢ per unit. Alphamin owns 80.75% of the Bisie project. The Industrial Development Corporation (IDC) of South Africa owns 14.25% and the Government of the DRC has a non-dilutive 5% share. Private equity firm Denham Capital owns 44% of Alphamin.

Tin-bearing gossan was discovered on the Bisie ridge in 2002 and soon became the focus of large-scale artisanal mining. The deposit is a cassiterite-bearing stock-work or vein system adjacent and possibly distal to underlying source granite.
Highlights from drill holes at Mpama North feature 18 metres grading 1.70% tin, including 7.6 metres of 3.32% tin; 10.8 metres of 2.59% tin; and 17 metres of 2.27% tin, including 2.9 metres of 9.12% tin.

Intercepts from Mpama South feature 32.2 metres grading 0.76% tin, including 22.05 metres of 1.02% tin; 32.8 metres of 2.46% tin from 192.2 metres; and 1.65 metre grading 6.57% tin. Alphamin says its tin concentrate will be conflict-free.
The company's shares are trading at 30¢ and within the last year have varied in price from 25¢ to 43.5¢ per share. Alphamin has about 647 million common shares outstanding for a market cap of just over $194 million.

Another tin company, Strongbow Exploration, looks like a "decent tin play," Bruggeman says.

The company owns South Crofty, a fully permitted tin mine in Cornwall, England. A resource estimate in 2016 outlined an indicated resource of 1.66 million tonnes grading 1.81% tin for 30,000 tonnes of contained tin. Inferred resources tally 740,000 tonnes averaging 1.91% tin for 14,100 tonnes of contained tin. With a base case assumption of US$10 per lb. tin and a 5% discount rate, a 2017 preliminary economic assessment estimated that pre-production capex would run to about US$118.7 million (payback in just under four years) and the project would have an internal rate of return of 23.4% and an after-tax net present value at a 5% discount rate of US$130.5 million (at a tin price of US$10 per lb.)

"Those economics are not terribly compelling, but they could be if tin goes on a tear," Bruggeman says, adding that Strongbow "appears to have solid management and backing from the Osisko group." **Osisko Gold Royalties** (TSX: OR) is Strongbow's largest shareholder, with 31% of the junior's issued and outstanding shares. Directors of the company include Grenville Thomas, chairman of the board; John Burzynski, the CEO of **Osisko Mining** (TSX: OSK); and Patrick Anderson, president and CEO of **Dalradian Resources** (TSX: DNA; LON: DALR) and co-founder and former CEO of Aurelian Resources.

Strongbow acquired South Crofty in July 2016. The project is fully permitted and has an underground mining licence valid until 2071. In addition, it has planning permission to build a new process plant and a permit from the Environment Agency

to dewater the mine. According to its website, the company “is now focused on the construction of a water treatment plant so the now-flooded mine can be dewatered.” The company “plans to bring the project to a production decision and complete a feasibility study in parallel with the mine dewatering process,” it says on its website. The underground permission area stretches across 1,490 hectares and includes 26 former producing mines, Strongbow says. Existing infrastructure includes four usable vertical shafts and a 300-metre decline.

The PEA outlined a mine life of eight years, average life-of-mine cash costs of $3.36 per lb. tin equivalent and average life-of-mine sustaining costs of $4.44 per lb. tin equivalent.

“Strongbow was kind enough to provide a summary of tin projects in its corporate presentation,” the blogger adds. “The comparison suggests that their resource is quite small, but their presentation suggests growth potential of 17 to 21 million tonnes. So, a cursory glance suggests that Strongbow is an interesting tin company in a good jurisdiction … not the DRC!”

Grade Comparison with Other Tin Projects

Company	Country	M&I Tonnes	Grade	
Alphamin Resources	DRC	4,600,000	4.52%	
Minsur	Peru	7,188,000	2.67%	In production
Strongbow	England	1,660,000	1.81%	
Metals X	Tasmania	12,874,000	1.46%	In production
Stellar Res. Ltd	Tasmania	1,290,000	1.32%	
Kasbah Res. Ltd	Morocco	14,900,000	0.85%	
Cons. Tin Mines	Australia	2,360,000	0.80%	
Elementos Limited	Tasmania	5,800,000	0.71%	
Euro Tin	Spain	9,160,000	0.56%	
Tin One	Kazakhstan	33,900,000	0.57%	
Anglo Saxony Mining	Germany	6,200,000	0.46%	
Tin International Ltd	Germany	11,600,000	0.37%	
Tin International Ltd	Germany	10,800,000	0.26%	
Venture Minerals	Tasmania	13,000,000	0.30%	
Aus Tin Mining	Australia	26,900,000	0.17%	

But Bruggeman is most excited about the prospects of Tinka Resources, one of his clients and major holdings, he says, which has “a significant” tin resource at its Ayawilca project.

The company owns 100% of Ayawilca, a 150-sq.-km project about 40 km northwest of Cerro de Pasco in the silver-lead-zinc belt of central Peru.
Ayawilca has two types of mineralization, tin-copper mineralization (the tin zone) and zinc-indium-silver-lead mineralization (the zinc zone).
Tin mineralization was discovered in the project’s central east and north areas following the re-assaying of 2012-2013 drill holes, the company states on its website.

The tin-copper mineralization lies within tabular mantos beneath and separately to the zinc sulphide mantos, and the tin occurs primarily as cassiterite within massive iron sulphide (pyrrhotite) mantos, together with minor chalcopyrite.

The Ayawilca tin zone has inferred resources of 10.5 million tonnes at 0.70% tin equivalent (0.63% tin, 0.23% copper, 12 grams per tonne silver), for 145 million lb. contained tin (66,000 tonnes), 53 million lb. copper, and 4 million oz. silver.

That puts it “in the middle of the pack in terms of size and grade,” Bruggeman says. Drill highlights include 50.5 metres grading 1.23% tin and 0.16% copper from a depth of 328 metres, including 2.5 metres of 8.81% tin and 0.18% copper from 330 metres; 16.2 metres of 1.03% tin and 0.67% copper from 328 metres downhole, including 2 metres of 4.8% tin and 2.1% copper from 330 metres; and 30.8 metres of 0.54% tin and 0.17% copper from 326 metres depth, including 2 metres of 2.5% tin and 0.2% copper from 326 metres downhole.

“Considering that the market is not giving Tinka minimal, if any, value for the tin resource, that adds a compelling angle to Tinka,” he argues, adding that the bullish outlook for tin in the MIT study “will cause Tinka to emphasize the tin resource some more.”

“Given the beating Tinka’s share price has taken this year,” Bruggeman says, “culminating in a financing at a disappointing price this month, some positive news to get retail investors excited again is very welcome.” (In addition to the tin, Ayawilca has an inferred zinc mineral resource of 42.7 million tonnes grading 6.0% zinc, 0.2% lead, 17 grams per tonne silver and 79 grams per tonne indium, for a zinc-equivalent grade of 7.3%.)

As for Eurotin, which owns the Oropesa tin deposit in southwestern Spain, Bruggeman says, “I’m sure that a tin rally might bring this back to life, but I don’t have the time to go digging to see if this is a diamond in the rough.”
In November 2016, the company started a 16-hole infill drill program to better delineate and upgrade the project’s known resources “to a standard sufficient to establish a commercial open pit mine,” and in January 2017 announced it was kicking off a feasibility study.

An October 2015 technical report outlined an indicated resource of 9.2 million tonnes grading 0.56% tin and an inferred resource of 3.3 million tonnes averaging 0.52% tin.