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FAR EAST CAPITAL
The Mining Investment Experts

Weekly Commentary

19 February 2022 | *On Friday's Close* | Analyst : Warwick Grigor

Continuing the deep dive into anodes and spheronisation

A new term has been coined that describes the Ukraine-Russia scenario; WOWO - "War On War Off". Just as our newspapers were publishing doom and gloom on Wednesday morning, radio news was reporting 35,000 Russian troops were returning to base following completion of military exercises. But wait, that seems to have been a ruse. It looks like they were just being shuffled around.

The most likely scenario seems to be that Putin has been having fun throwing the cat amongst the pigeons. He knows his demands would never be accepted as they were even worse than ambit claims. He has been having fun watching how the West has been working itself into a lather in recent weeks while he has been behaving like a playground bully.

I have no military experience, but I am smart enough to know that telecasting moves so far in advance is not the way to win by surprise. That is just common sense. If Putin was really committed to the objective of invading Ukraine further, he wouldn't have given NATO the opportunity to better arm the Ukrainian forces. But, who really knows?

On the economic front, Russia needs to keep selling gas to the West. If Biden kills the pipelines then Russia's greatest source of export earnings dries up. It is too risky. There will continue to be volatility in our markets based on daily expectations regarding WOWO, but that is good for traders, so there is no interest from that end of the market for an early resolution.

With the nervousness in the markets there is one thing for sure - gold is back in favour - and oil is at a seven year high. There have many times in history where oil and gold have worked in tandem. That duo is back in partnership again.

Digging deeper on graphite anodes

Last week's piece on anode companies should be seen as an introduction as to where some of the players are sitting, and an attempt to point to where there is or isn't transparency, but the whole battery anode scene requires a much deeper understanding.

Why do you need to coat graphite anodes anyway?

Anodes that are coated give a larger surface area and depending upon the coating used, they may enable a longer battery life. Every time you lithiate the anode it expands and contracts. Over an extended period of time this can cause the formation of dendrites which reduce the capacity and in extreme cases, can introduce the risk of overheating that can lead to battery fires. Coating can address these concerns. As we saw last week, HPA is proving itself to be a good coating material, and graphene is starting to show its credentials in this regard.

Graphite needs to purified to be suitable for anodes

Graphite mining companies employ process flow sheets that take the purity of their concentrates to 96% or better, but purity levels of 99.95% are needed for their product to be acceptable for use in anodes.

Hydrofluoric acid is the only commercial process available today and is done almost exclusively in China. However, it is time-consuming, causes severe pollution, and is incredibly difficult to permit in developed economies.

One alternative method is pyrometallurgical purification which involves chlorination roasting. While it is chemically efficient, it is also expensive and the expelled gases are difficult to deal with.

Another alternative is the high-temperature method, whereby graphite is heated to more than 4892°C. The impurities with a lower boiling point become vaporised and they are removed. Thus, the purity of graphite becomes more than 99.95%. However, the drawback of this method is that a large-scale infrastructure investment is required, along with high electricity consumption.

Currently, of the natural graphite range, only lump and flake graphite can be used as the raw material for anodes in LIBs due to the two reasons of (a) their high degree of graphitization and (b) crystal characteristics with large flake size. However, the flake graphite needs to go through a spheronisation process to improve its energy storage capacity. The products of upgraded flake graphite are roughly spherical type particles with more than 99.95% carbon purity, but the yield to spherical is low at 30-50%.

Innovation is chasing improvements in anodes

Improvements in the performance of anodes are being researched by companies adding graphene, carbon nanotube, carbon nanofibre, and fullerene materials. This is all work in progress, as is the adding of silicon to increase the energy storage capacity.

It seems that there are opportunities for junior Australian companies to improve the methodology of preparing the graphite in the first instance, to provide more environmentally friendly methods of purifying the graphite to 99.9% levels. Implementation of better methods of purifing graphite will have fewer impediments to adoption than changes to the composition of the anodes themselves, and they can make the resultant product more acceptable to stringent EU environmental guidelines. EcoGraf, Mineral Commodities, Renascor, Talga and Volt Resources all make claims to the development of better techniques. Remember that ESG considerations are likely to dominate pure economic cost consideration in this new green world.

Spheronised graphite is the standard for LIBs

Spheronised graphite for lithium ion battery (LIB) anodes can be made from synthetic graphite or flake graphite. Synthetic graphite has fewer impurities. It is harder than flake graphite so it lasts longer, but it can't hold quite as much change. So, a compromise often involves a blend of the two types of graphite to optimise the outcome.

Demand in Europe will exceed EU supply

Speaking with industry participants and focusing on Europe in particular, it is clear that there will be huge demand for spheronised graphite anode capacity over the next 10 years. Given the regulatory obstacles involved with stringent ESG parameters, it is actually difficult to see that European industry will be able to meet the challenge. These are macro-scale issues that go well beyond the aspirations of individual companies such as those listed on the ASX.

At the moment the world is heavily dependent upon spheronised graphite out of China, a country that has traditionally used the highly toxic hydrofluoric acid purification methodology that would most likely be environmentally unacceptable in Europe. That observation serves as an impetus for new, cleaner technology, but a rapid introduction of such innovation is unlikely due to the extended qualifying period required by end users.

Regulations are puting up obstacles.

The EU has proscribed a torturous ESG qualification process that will slow down any European-based developments, extending from the permitting of graphite mines through to the purification process and the manufacturing of the anodes themselves. The whole value chain needs to be audited according to stringent standards before being given the sign-off. Getting a mining permit is just the start of it.

There is an overriding geopolitical aspect to the business as well. The potential for China to weaponise supply chains is more real than ever today, providing very strong incentive for Europe (and the rest of the world) to wean itself off its reliance on Chinese spheronised graphite. Any European-based production is certain to be more expensive than product supplied from China, but we can expect that there will be legislation that will effectively build tariffs to support homegrown industry, or maybe just environmental standards that have the same effect.

Interestingly, Mineral Commodities is a small Australian mining company that already owns 90% of an operating graphite mine in Norway. This could be a very strategic asset because it is one of the very few known, permitted and operating graphite mines in Europe that could qualify for the supply of graphite for spheronisation. (See separate pieces on **Mineral Commodities** and **Volt Resources**, below). Every other potential producer, including Talga, will need to co-ordinate mine permitting and manufacturing permitting in what is likely to be a lengthy and difficult exercise. Add this to the elongated qualification process during which an anode input company needs to progressively provide larger samples for the manufacturing of test batteries and you start to talk a time frame of quite a few years.

One estimate of demand for spheronised graphite from Euopean battery manufacturers is 440,000 tpa by 2030. Compare this with the plans of EcoGraf and Talga to start off with capacity of 20,000 tpa each, and you can put the expected demand into perspective. It is highly unlikely that Europe will be able to ramp up its production fast enough to meet this date, so whether it likes it or not, China will still be needed as a major supplier.

Note that the expected yield in the spheronisation process is about 50%, meaning the graphite concentrates demand will be in the order of 900,000 tpa. That will require many new mines. In reality it will be impossible for Europe to get by without importing concentrates from places like Africa. Auditing that supply chain will add another layer of regulatory complication. Maybe it will require a European company to front this part of the supply chain.

Reliability is more important that innovation

As good as the promoters make the new, innovative anode sound, achieving a commercial result for the new technology might involve too much technical risk for battery manufactures in the first instance. All of the IP involved in battery manufacturing is controlled by Chinese, Korean and Japanese companies. They will tell prospective suppliers of anode materials what specification they want, and if the suppliers can deliver, they will have an entrè into the battery market. The first step will be to prove that they will be reliable suppliers. Introduction of the next generation, innovative technology will be much easier once these companies have a seat at the table, but it is very difficult to force change on customers. Coating innovation will be seen as an add-on technology rather than a ground breaking development.

Mineral Commodities is also into anodes

Another ASX-listed company working on anodes is Minerals Commodities (MRC), with a market capitalisation of $72m and a modest cash balance of US$4.3m, as at 31 December 2021. An ultra-high net worth investor from the UK is the largest shareholder with about 30% of the issued capital.

The Skaland Underground Graphite Mine (90% MRC)

Like Talga, MRC is operating in Scandinavia, but in Norway rather than Sweden. It has a small, high grade JORC resource based on the Trælen graphite deposit, being 1.84 Mt at 23.6% TGC with M/I/I resources comprising 434,000 t and a Proved and Probable Ore Reserve of 640,000 t at 24.8% TGC. While this is significantly smaller than Talga's, there is one very important distinguishing feature. MRC has a mining licence and an operating mine at Skaland, mining at a rate of 40,0000 tpa for 10,000 tpa of graphite product. Talga hasn't been able to secure a mining licence yet.

Being an underground mine, for which resources and reserves required underground development in order to be reportable, the mine life will be a function of that development. What the ultimate resource will be is open to speculation, but an appreciation of the geology leaves us in no doubt that there can be a long life mine at Skaland.

MRC will need to expand the mining rate if it is going to rise to the challenge of increased demand. A continual capital expenditure program has seen the excavation of a decline last year for better access to the orebody, but more is required. The permits allow for expanded operations of up to 16,000 tpa of concentrates, but this is still small. Improvements to the flow sheet could enable concentrate grades to lift from the current levels of 91-92%, perhaps up to 97-98%.

MRC's Skaland Anode Material Project

The Skaland Anode Material initiative involves working with the CSIRO as it develops a "new environmentally sustainable" process (of course) that uses standard industrial agents and avoids the use of toxic hydrofluoric acid.

MRC has reported First Charge Efficiency levels of 90.6%, which is commercially acceptable. The Steady-State Capacity has been measured at 369 mA/g, which is close to the theoretical maximum of 372 mA/g for graphite. The Company is undertaking planning for larger scale piloting to support product qualification, process scale-up and the development of value-added anode materials production in Australia and Norway.

South African mineral sands mine

MRC also owns 50% of Mineral Sands Resources (Pty) Ltd, an operating minerals sands miner in South Africa, with a resource of 212 Mt at 9% Total Heavy Mineral (THM). The Tormin mine produced 2.36 Mt of ore in 2021, recovering garnet, ilmenite, iron and rutile. December Quarter revenue almost doubled to US$13.6m, from US$6.6m in the previous corresponding quarter. Nevetheless, the mine continues to struggle while it is sorting out permitting issues. Larger scale production is needed to ensure profitability.

Volt Resources also has a foothold in Europe

Volt (VRC) is another one of the companies with Tanzanian graphite assets that has had to think outside the square in order to maintain momentum beyond the licensing obstacles. Back in May 2021, Volt successfully completed its due diligence on the ZG Group, a Ukrainian-based graphite company, clearing the way to paying US$7.5m for a 70% interest in the Zavalievsky graphite business.

ZG Group is located roughly halfway between Kiev and the port of Odessa, to the south. The mine has produced a total of 22.9 Mt at 6.8% carbon over a mine life of about 90 years, recently supplying a concentrate grade of 99.5% TGC. Mineralisation comes from seven steeply dipping veins over a 2.1 km strike length with widths of 630m, to a depth of 215m. December quarter production was 43,582 t at 6.07% C for concentrate production of 1,369 t, on only 27 days of operation. Productivity at the plant suffers from freezing over the winter months.

ZG has a plan to produce spheronised purified graphite to supply the European battery market. In August 2021, it announced an innovative flow sheet from Volt's Bunyu graphite project in Tanzania, following test work undertaken by American Energy Technologies Co., which is based in Illinois, USA. Rather than use the hydrofluoric acid method, Volt plans to use a high temperature purification process. This is not so much a new technology, but a variation of a known, more expensive but less environmentally damaging method of purification. Test work has showed positive First Charge Efficiency levels up to 92% capacity and charging at 354.7 mAh/g. Thus it is in the ball park but has not yet extended the life out to 800 cycles. On 31 January 2022, the Quarterly report stated that it had passed 170 cycles.

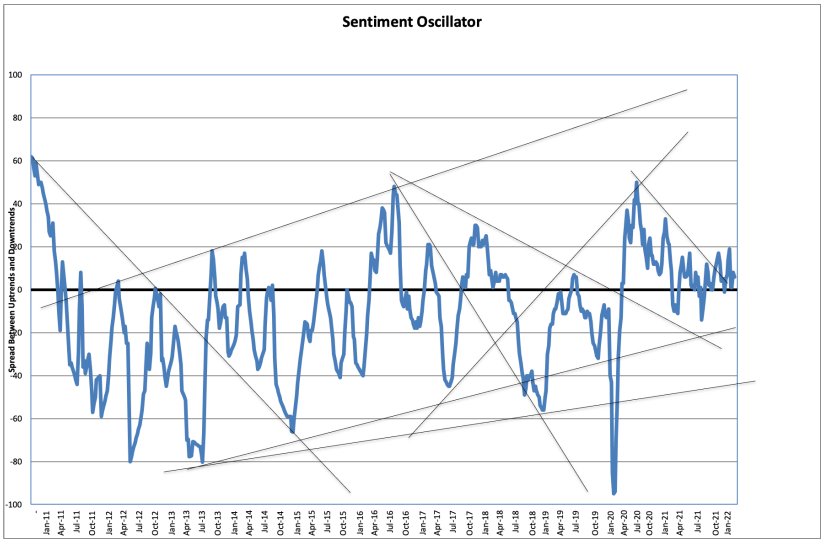
Volt has also acquired a lithium project at Jadar North in Serbia, but I hear Australians are not very popular in Serbia at present, especially amongst tennis fans. RIO is not making much headway with its giant lithium project due to social approval problems.

The future of Volt's Ukrainian operation is uncertain at present due to Putin's posturing. We just don't know what the future holds. There is also uncertainty as to how comfortably it fits in with the EU's strategy.

Lithoquest placement closing next week

Please be advised that the Lithoquest placement will close next week. The issue price is 11.5¢ with a 1 for 2, two year warrant exerciseable at 17¢. The share price closed on Friday at 16¢ (C$).

Disclosure: Interests associated with the author own shares in Lithoquest Resources



Sentiment Oscillator: Sentiment eased slightly. There were 36% (38%) of the charts in uptrend and 30% (30%) in downtrend on Friday's close.

Detailed Chart Comments

NB. Only the bold comments have been updated. Comments in grey type are from previous weeks and will be less relevant. Please note that this list is a cross section of the market. It IS NOT a list of recommendations.

Indices	**Code**		**Trend Comment**	
All Ordinaries	XAO		consolidating after strong rebound	
Metals and Mining	XMM		great rebound	
Energy	XEJ		rising again	
Information Technology	XIJ		rallying	
Stocks	**Code**		**Trend Comment (updated comments in bold)**	**Main Interest**
Alpha HPA	A4N		pullback	HPA
Adriatic Resources	ADT		continuing down	zinc, polymetalic
Alkane Resources	ALK		stronger	gold
Alicanto Minerals	AQI		downtrend	base metals, silver, gold
Altech Chemical	ATC		down	HPA, anodes
Alto Metals	AME		sideways	gold exploration
American Borates	ABR		recapturing uptrend	borate
American Rare Earths (was BPL)	ARR		off its highs	rare earths
Antilles Gold	AAU		testing downtrend	gold
Arafura Resources	ARU		rising	rare earths
Ardea Resources	ARL		new high	nickel
Aurelia Metals	AMI		new uptrend	gold + base metals
Australian Potash	APC		heavy fall	potash
Australian Rare Earths	AR3		breached uptrend	rare earths
Auteco Minerals	AUT		rallying	gold exploration
Azure Minerals	AZS		rising	nickel exploration
BHP	BHP		pullback	diversified, iron ore
Beach Energy	BPT		new uptrend confirmed	oil and gas
Bellevue Gold	BGL		down	gold exploration
Benz Mining	BNZ		new low	gold
Blue Star Helium	BNL		down	gas, helium
BMG Resources	BMG		new low	gold exploration
Boab Metals	BML		in a secondary downtrend	silver/lead
Breaker Resources	BRB		heavy fall from highs	gold exploration
Buru Energy	BRU		testing uptrend	oil
Calidus Resources	CAI		on support line	gold
Capricorn Metals	CMM		surge to new high	gold
Caravel Minerals	CVV		slump	copper
Celsius Resources	CLA		testing short-term uptrend	copper
Chalice Mining	CHN		down	nicklel, copper, PGMs, gold exploration
Chesser Resources	CHZ		rallied off lows	gold exploration
Cobalt Blue	COB		surge to new high	cobalt
Cyprium Metals	CYM		rallied to meet resistance line	copper
Danakali	DNK		downtrend accelerating	potash

De Grey	DEG		on support line	gold
E2 Metals	E2M		surge higher, then heavy fall	gold exploration
Ecograf	EGR		down	graphite
Element 25	E25		breaching uptrend	manganese
Emerald Resources	EMR		rising again	gold
Empire Energy	EEG		holding uptrend	gas
Euro Manganese	EMN		testing downtrend	manganese
Evolution Mining	EVN		breached uptrend	gold
Firefinch	FFX		breached uptrend	gold
First Graphene	FGR		testing uptrend	graphene
Fortescue Metals	FMG		testing uptrend	iron ore
FYI Resources	FYI		new uptrend being tested	HPA
Galena Mining	G1A		still down	lead
Galilee Energy	GLL		sideways	oil and gas, CBM
Genesis Minerals	GMD		surged higher after consolidation	gold
Genmin	GEN		new uptrend	iron ore
Global Energy Ventures	GEV		testing downtrend	hydrogen
Gold Road	GOR		testing downtrend	gold
Great Boulder Resources	GBR		rising	gold exploration
Hastings Technology Metals	HAS		testing uptrend	rare earths
Hazer Group	HZR		bounce back to resistance line	hydrogen
Highfield Resources	HFR		back to resistance line	potash
Hillgrove Resources	HGO		long term uptrend	copper
Iluka Resources	ILU		breached downtrend, back to highs	mineral sands
Image Resources	IMA		new uptrend	mineral sands
Independence Group	IGO		new high	gold
ioneer (was Global Geoscience)	INR		slump	lithium
Ionic Rare Earths (Oro Verde)	IXR		recovering long term uptrend	rare earths
Jervois Mining	JVR		shallower uptrend	nickel/cobalt
Jindalee Resources	JRL		strong rally	lithium
Kairos Minerals	KAI		breached ST downtrend	gold exploration, lithium
Kingston Resources	KSN		rallying	gold
Kingwest Resources	KWR		testing uptrend	gold
Legend Mining	LEG		surge higher	nickel exploration
Lepidico	LPD		testing steepest uptrend	lithium
Lindian Resources	LIN		surge higher	bauxite
Lion One Metals	LLO		spike higher	gold
Lithium Australia	LIT		sideways	lithium
Los Cerros	LCL		rallied to hit resistance line	gold exploration
Lotus Resources	LOT		short term down	uranium
Lucapa Diamond	LOM		new uptrend being tested	diamonds
Lynas Corp.	LYC		sharp pullback	rare earths
Magnetic Resources	MAU		sideways	gold exploration
Mako Gold	MKG		breaching support	gold exploration

Marmota	MEU		sideways	gold exploration
Marvel Gold	MVL		breached uptrend	gold exploration
Matador Mining	MZZ		rallied to hit resistance line	gold exploration
Mayur Resources	MRL		base forming	renewables, cement
Meeka Gold	MEK		strong rise but still LT downtrend	gold
Megado Gold	MEG		new low	gold exploration
MetalTech	MTC		off the end of a ramp	gold
Meteoric Resources	MEI		sideways out of downtrend	gold exploration
MetalsX	MLX		new high	tin, nickel
Metro Mining	MMI		new uptrend confirmed	bauxite
Mincor Resources	MCR		new high	gold/nickel
Mithril Resources	MTH		down	gold/silver
Musgrave Minerals	MGV		testing downtrend	gold exploration
Neometals	NMT		new high then heavy slump	lithium
Northern Minerals	NTU		rising	REE
Northern Star Res.	NST		slump back into downtrend	gold
Nova Minerals	NVA		heavy slump	gold exploration
Oceana Gold	OGC		down	gold
Oklo Resources	OKU		down	gold expl.
Orecorp	ORR		down	gold development
Oz Minerals	OZL		standard retracmente	copper
Pacific American	PAK		back to lows	coking coal
Pantoro	PNR		surge higher	gold
Panoramic Res	PAN		surge higher	nickel
Peak Minerals	PUA		new low	copper exploration
Peak Resources	PEK		broken down through support line, but rebound	rare earths
Peel Mining	PEX		down	copper
Peninsula Energy	PEN		on support line	uranium
Poseidon Nickel	POS		sideways	nickel
Perseus Mining	PRU		slump	gold
PVW Resources	PVW		steep rise	rare earths
Queensland Pacific Metals	QPM		sideways through downtrend line	nickel/cobalt/HPA
Red River Resources	RVR		still down	zinc
Regis Resources	RRL		new low on large financing	gold
Renergen	RLT		rallying	gas, helium
RIO	RIO		new uptrend	diversified, iron ore
Rumble Resources	RTR		breached downtrend	gold exploration
S2 Resources	S2R		consolidating after steep rise	gold exploration
St Barbara	SBM		downtrend	gold
Sandfire Resources	SFR		attempting new uptrend	copper
Santos	STO		breached downtrend	oil/gas
Saturn Metals	STN		breached ST downtrend, but still in LT one	gold exploration
Silex Systems	SLX		sideways through downtrend	uranium enrichment technology
Silver Mines	SVL		sideways	silver

South Harz Potash	SHP		back to highs	potash
Stanmore Coal	SMR		hitting resistance line	coal
Strandline Resources	STA		new high	mineral sands
Sunstone Metals	STM		off its highs	exploration
Talga Resources	TLG		still down	graphite
Technology Metals	TMT		down	vanadium
Tesoro Resources	TSO		new low	gold exploration
Theta Gold Mines	TGM		down	gold
Thor Mining	THR		downtrend breached	gold exploration
Tietto Minerals	TIE		strong rise	gold
Titan Minerals	TTM		breached downtrend	gold
Turaco Gold	TCG		sideways	gold exploration
Vanadium Resources	VR8		back to highs	vanadium
Vimy Resources	VMY		testing downtrend	uranium
West African Resources	WAF		new high	gold
Westgold Resources	WGX		new uptrend being tested	gold
West Wits Mining	WWI		risen to meet resistance line	gold
Whitehaven Coal	WHC		secondary uptrend	coal
Wiluna Mining	WMC		gently higher	gold
Yandal Resources	YRL		breached uptrend	gold exploration
Zenith Minerals	ZNC		surge to new high	gold exploration
Zinc Mines of Ireland	ZMI		sideways	zinc
Totals	36%	52	Uptrend	
	30%	43	Downtrend	
		144	Total	

Guides to Chart Interpretations

- Charts usually go pass from one trend (up or down) into the other via a period of indecision and uncertainty during which the trend can either recover or change. This period is signified by the orange colour. The orange represent both the greatest risk and greatest reward possibilities.
- Once a chart is in confirmed up or downtrends it is not uncommon for 10-20% of that trend to have already transpired.
- There are trends within trends. The focus of this chart review is the immediate trend that affects the sentiment i.e. it can be a downtrend within a long-term uptrend.
- Not every chart warrants a new comment every week. The new comments are in bold type. Grey type comments may be dated.
- Individual charts provide a single view. It is valuable to look at charts of other companies in similar commodities, and the overall sentiment is also very valuable. Not many stocks can swim against the tide.
- We periodically add or delete charts, some times for obscure reasons. If a chart consistent gives poor signals or is very erratic, we may delete it. Sometimes we add a chart because we want to see what all the fuss is about. We do have a preference for charting stocks that we cover in our research as well.
- Errors and omissions may occur from time to time, especially in fast moving markets.

Amber Lights in Tables: Just a reminder if when the amber light is used in the table – it is when the charts are ambiguous or when there is a change of trend taking place. If a chart is breaching a downtrend it can either be a positive sign or a trap. Only once it has done more work can it be confirmed as a new uptrend. Maybe it is a new uptrend (or conversely a new downtrend); the risk takers can decide to jump on board early (or sell). They will maximise their profits (or minimise their losses if indeed it is the start of the new uptrend (downtrend). More risk-averse investors should wait a little longer, being prepared to give up some of the gains in return for greater certainty.

Weightings of Sectors Represented in the Company Charts			
Sector	**No. of Companies**	**Weighting**	
Gold	**31**	**21.5%**	
Gold Exploration	**26**	**18.1%**	
Nickel	**11**	**7.6%**	
Copper	**10**	**6.9%**	
Rare Earths	**9**	**6.3%**	
Oil/Gas	**7**	**4.9%**	
Iron Ore/Manganese	**6**	**4.2%**	
Lithium	**5**	**3.5%**	
Potash/Phosphate	**5**	**3.5%**	
Graphite/graphene	**4**	**2.8%**	
Uranium	**4**	**2.8%**	
Zinc/Lead	**4**	**2.8%**	
Mineral Sands	**3**	**2.1%**	
Silver	**3**	**2.1%**	
Coal	**3**	**2.1%**	
Bauxite	**2**	**1.4%**	
Cobalt	**1**	**0.7%**	
Tin	**1**	**0.7%**	
Diamonds	**1**	**0.7%**	
Other	**8**		
Total	**144**		

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