

SP Angel – Morning View – Tuesday 11 09 18
China Blue Sky protection driving strong graphite demand

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Arc Minerals (ARCM LN) – STRONG BUY – Drill results indicate significant scale copper project at Kalaba, Zambia

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Anglo American (AAL LN) 1455 pence, Mkt Cap £18.8bn – De Beers diamond sales

Bushveld Minerals (BMN LN) – Bushveld proposes return to work on basis of continuous engagement

Mkango Resources Ltd (MKA LN) – Completed major drill programme intersects further extensive zones of rare earth mineralisation

Talga Resources Ltd (TLG AU) - Talga expands industry potential for graphene products with multiple agreements

China clean-air drive

- China's drive for clean air is causing an obscure steelmaking ingredient to fuel grains of as much as 2,600% since the start of 2017 for the few companies supplying graphite.
- The 3-year "blue sky protection plan" unveiled in July is widening anti-pollution controls that are shuttering plants that make the graphite electrodes and traditional blast-furnace steel mills. Companies that recycle China's increasing mountains of scrap metal are being forced to switch to electric-arc furnaces that burn through about 2.5kg of graphite electrodes for each ton of steel produced.
- China's pollution curbs could double the share of electric arc mills to 20% of total production by 2020, from less than 10% now, pushing global demand for electrodes up 60%, according to Mitsubishi UFJ Morgan Stanley Securities Co.
- The drive in demand, also boosted by electric-vehicle battery manufacture, has propelled shares of Graphite India Ltd. up more than 1,200% since January 2017, boosting the wealth of founder K.K. Bangur to about \$1.75bn, according to Bloomberg calculations. He notes "*this uplift should be viewed as structural and not just an up cycle*".
- The graphite crunch has had repercussions around the world. In Japan, industry leader Showa Denko KK's value has tripled to \$6.7bn, giving it ammunition to consider buying assets in Europe. Rival Tokai Carbon Co., which has seen its market value jump to \$3.8bn, from \$691m two years ago, forecasts that the market won't peak for at least another four to five years. U.S.-based producer GrafTech International Ltd. has risen 15% since an initial public offering in April.
- The graphite electrode market is expected to remain extremely tight, with HEG Ltd (alongside Graphite India producing ~25% global supply) raising capacity by a quarter to 100,000t. Chairman Jhunjunwala noted "*even then, it is going to take us a minimum of 2.5 years. Due to challenging entry barriers and being a highly capital intensive business, supply constraints are expected to continue for the foreseeable future*".
- Graphite electrodes are manufactured using needle coke, a material made from coal tar or the carbon residue from refining crude oil, while natural graphite is mostly used to raise the carbon content of steel in a blast furnace. An unexpected factor boosting synthetic graphite is the diversion of some needle coke to making lithium batteries, according to consultant Roskill.

Chinese provinces may set own winter output curbs for heavy industry

- China is considering allowing its northern provinces to decide individual output cuts by heavy industry to rein in emissions during the winter heating period, ditching previous plans for further blanket cuts. Talk of the move drove down prices of steel and steel-making raw materials and comes as Beijing looks to end its "one-size-fits-all" fight on pollution, devising more nuanced policies reflecting local conditions to limit economic disruption.

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- While the announcement has not been made public by the Ministry of ecology and environment, sources note “production cuts on heavy industry will remain this winter, but detailed cutting rates will be set by local authorities based on their own situation”.
- The move represents another signal Beijing is finetuning policy for its fight against smog. Plans would ease sweeping proposals in the ministry's draft plan, reported by Reuters last month, for cuts of 50 percent in steel production and 30 percent in primary aluminium in some areas.
- The potential for more flexible output curbs applied downward pressure on prices of steel and raw materials, as steel rebar lost 2.2%, heading for their worst daily performance since June.
- Last winter, a plan to switch millions of households and thousands of businesses in north China to natural gas from coal backfired as severe gas shortages crippled the region.

New battery manufacturing facility to be based in Coventry

- Williams Advanced Engineering, an arm of the once-successful Williams Formula One team has announced that they are partnering with Unipart and Warwick University's Advanced Propulsion Centre to develop a manufacturing facility for electric car batteries. The JV will be called Hyperbat and aims to build 10,000 battery and power systems a year. Williams AE have been at the forefront of developing electric cars in the UK working closely with companies like Jaguar Land-Rover, Aston Martin and Nissan. Since 2014, they have been the sole supplier of battery systems for the entire Formula E grid and operate the Jaguar Formula E team. Last year they showed their own in-house electric car platform, the FW-EVX.
- The batteries will be initially used by Aston Martin for a fully electric car called the RapidE which was developed by Williams. According to The Times, the batteries are said to be twice as powerful as those found in Tesla's. Beyond this, they expect to supply other manufacturers in the UK most likely Jaguar Land-Rover who currently sub-contract the manufacture of their i-Pace model in Austria, but are developing further electric models. The next Jaguar XJ is likely to be a fully electric car and built in Britain.

Dow Jones Industrials	-0.31%	at	25,917
Nikkei 225	+0.30%	at	22,373
HK Hang Seng	-1.40%	at	26,595
Shanghai Composite	-1.22%	at	2,669
FTSE 350 Mining	-1.87%	at	15,864
AIM Basic Resources	-0.90%	at	2,162

Economics

US – The US\$ weakened as the pound and euro climbed on the outlook that Britain may achieve an amicable split from the EU.

- Most emerging currencies are stronger today with a series of central bank meeting scheduled for this month.

UK – The pound climbed to the highest level in more than a month on the back of optimistic Michel Barnier comments that a Brexit deal could be reached within six to eight weeks.

- Furthermore, labour earnings came in stronger than forecast with the growth pace seen accelerating in the three months to July.
- This is a positive development in the wake of latest sluggish performance in real wages.
- Average weekly earnings excluding bonuses climbed 2.9%yoy, the fastest rate since March and up on 2.7%yoy recorded in three months to July; estimates were for a 2.8%yoy increase.
- The unemployment rate held steady at 4.0%, the joint lowest level since 1975.
- “The labour market remains robust, with the number of people working still at historically high levels,” the ONS said.

New car registrations climbed 23.1%yoy in August in the UK with the YTD fall reduced to -4.2%; alternative fuel vehicle (AFV) segment reaches record market share.

- 94,094 new cars were registered in the month as the market responded to regulatory changes, with cost-savvy buyers taking advantage of some compelling deals in what is typically the most quiet month of the year.

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- Growth was driven by petrol and AFV (alternative fuel vehicles) segments that recorded 39.1%yoy and 88.7%yoy, respectively.
- Diesel segment remained weak with growth in August coming in -7.7%yoy and -28.7%YTD.
- Buyers are increasingly switching to AFV engines with the sector now accounting for 8.0% of the market, the highest ever level, as billion of pounds of manufacturer investment help deliver more ultra-low and zero emission models to the market.

India – The rupee is hovering around record low with latest reports showing strong capital outflows from Indian debt markets.

- Global funds sold \$684m of rupee-denominated debt last week marking the highest amount in four months and more than combined \$460m of inflows in July and August.
- Investors has been shunning away from emerging market assets lately with rising oil prices weighing on the nation's twin deficits.
- The currency has been testing new lows almost every day and dropped as much as 1.3% yesterday.

Italy – 10y sovereign bond yields continued to pullback trading at 2.89%, down 35bp this month, on investor confidence over budget.

- The government is set to auction €7.75bn of debt on Thursday of maturities ranging from three to 30 years which would be help to capture the investor sentiment.

Australia – The A\$ is trading around the weakest point since Feb/16 amid risks of increase US-China trade fallout.

Argentina – The peso is weakened yesterday as the central bank is set to announce no change in key rate of 60% today.

Currencies

US\$1.1543/eur vs 1.1639/eur yesterday Yen 111.01/\$ vs 110.70/\$ SAR 15.267/\$ vs 15.242/\$ \$1.291/gbp vs \$1.294/gbp 0.710/aud vs 0.715/aud CNY 6.861/\$ vs 6.839/\$

Commodity News

Precious metals:

Gold US\$1,196/oz vs US\$1,193/oz yesterday

Gold ETFs 67.8moz vs US\$67.8moz yesterday

Platinum US\$792/oz vs US\$780/oz yesterday

Palladium US\$985/oz vs US\$978/oz yesterday

Silver US\$14.21/oz vs US\$14.13/oz yesterday

Base metals:

Copper US\$ 5,926/t vs US\$5,855/t yesterday

Aluminium US\$ 2,095/t vs US\$2,047/t yesterday

- The aluminium begins to respond to concerns over Russia supply, posting a second straight gain and erasing earlier losses. United Co. Rusal, the world's top supplier outside of China, is preparing for output cuts as US sanctions leave the Russian giant sidelined from annual contract talks.
- In April aluminium surged to the highest since 2011 after the US announced sanctions against Rusal, with the news of output preparations causing metal prices to trend higher; aluminium for delivery in three months rose 1.2% to settle at \$2,095/t on the London Metal Exchange. Metals broker Zaner Group note "if they are going to be held back, there's going to be a lot less product coming into the market".

Nickel US\$ 12,390/t vs US\$12,315/t yesterday - Nickel futures rise 0.27% on firm spot cues

- Nickel future rose 0.27% to Rs 896/kg in futures trade yesterday
- Nickel for delivery in October moved up by Rs 2.40/kg in a business turnover of six lots

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Zinc US\$ 2,369/t vs US\$2,403/t yesterday

Lead US\$ 2,010/t vs US\$2,069/t yesterday

Tin US\$ 19,090/t vs US\$19,050/t yesterday

Energy:

Oil US\$77.8/bbl vs US\$77.5/bbl yesterday

Natural Gas US\$2.813/mmbtu vs US\$2.770/mmbtu yesterday

Uranium US\$26.95/lb vs US\$26.90/lb yesterday

Swiss Company Introduces New Renewable Energy Storage Technology

- A new system using a crane and concrete blocks to address the difficulty faced in attempting to store renewable energy for later use
- Energy Vault is proposing the following system: a crane use excess electricity from the grid to lift and stack large blocks of concrete, before dropping the blocks again in a controlled way to retrieve the same amount of energy through a generator
- A demo version has been built, costing \$2 million and is purported to recover 85% of the energy used to lift the blocks.

Bulk:

Iron ore 62% Fe spot (cfr Tianjin) US\$67.7/t vs US\$67.9/t

Chinese steel rebar 25mm US\$698.4/t vs US\$698.6/t

Thermal coal (1st year forward cif ARA) US\$95.2/t vs US\$93.5/t

Premium hard coking coal Aus fob US\$182.2/t vs US\$182.2/t

Other:

Cobalt LME 3m US\$62,000/t vs US\$62,000/t

Tungsten APT European US\$275-290/mtu vs US\$275-290/mtu

Lithium - Cathode fabrication for oxide solid-state batteries at room temperature

- Researchers at the Toyohashi University of Technology have successfully fabricated a lithium trivanadate cathode thick film on a garnet-type oxide solid electrolyte use the aerosol deposition method.
- It showed a large reversible charge and discharge capacity as high as 300 mAh/g and a good cycling stability at 100 °C
- This may contribute to the realisation of highly safe and chemically stable oxide-based all-solid-state lithium batteries.

Company News

Arc Minerals (ARCM LN) 4.9p, Mkt Cap £29m – Drill results indicate significant scale copper project at Kalaba, Zambia

(ARC Minerals currently owns 55% of Zamsort which holds 100% of the Kalaba copper/cobalt mine and associated mineral licenses)

STRONG BUY

- Arc Minerals report results from the first four Reverse Circulation 'RC' drill holes drilled at Kalaba in Zambia.
- The results show the project is significantly greater in scale than previously anticipated and with better copper equivalent grades than expected.
- They also show significantly higher cobalt grades over longer widths than was also anticipated with high copper and high cobalt grades combining to produce shorter but still impressive lengths of >2% and
- The assays add to the three Diamond drill holes already reported at site out of 19 holes so far drilled.
- The first four RC holes assayed show significant scale potential for the Kalaba project with mineralisation open to the north, east and west from surface including:

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- 20m at 1.31% CuEq.
- 25m at 1.24% CuEq.
- 26m at 1.10% CuEq.
- The intersections are from surface and near-surface for open cast mining with assays expected shortly from the other 12 of the 19 holes so far drilled
- Drill holes are sited along a single line 200m east of the Kalaba open pit indicating a good strike length
- Looking at the drill sections in more detail indicates potential for selective mining of very high grade mineralisation with the option of leaving the lower grade sections for processing at a later date.
- Alternatively it may prove more profitable to mine and process the 50-90m mineralised section as a whole.
- The higher than expected cobalt grades are interesting and skew the Copper Equivalent grades higher partly due to the high cobalt content and also due to the relatively high price of cobalt.
- **Copper equivalent grades** are calculated at current metal prices and while we feel the current copper price is relatively conservative while we note that cobalt prices remain relatively high at \$62,000/t.
- We note: cobalt prices have fallen from a peak of \$95,250/t but are still higher than the year-low of \$55,750/t though they remain significantly higher than the five-year average of \$40,770/t eg from before the start of the battery-metals revolution.
- **Scale:** it is too difficult to hazard a proper estimate at the tonnage of the project without access to maps or cross-sections but if we assume the mineralised strike runs for 1200m long and guess that the mineralisation runs across a 200m width and is from surface to a depth of 30m then we could guess at a tonnage of around 15mt assuming a density of 2.5t/cubic meter. The drilling is 200m to the east of the Kalaba open pit, hence our 200m width assumption.
- It is possible that the ore zone may vary from around 50m deep to 80-90m of mineralisation
- **Grades:** the average grade also looks to be >0.9% copper equivalent to give around 135,000t of contained copper equivalent with the emphasis on the cobalt more than the copper.
- Mineralisation is open in all directions according to the statement indicating that there should be more mineralisation to come.
- **Metallurgical test work** on the nature of the mineralisation still needs to be done to determine recovery rates and the eventual potential value of the project. The mineralisation is hosted by a dolomitic unit as seen in some other Copperbelt mines. While the dolomite consumes acid raising costs its effect can be reduced before processing to improve recoveries and lower costs.
- **Process plant:** Zamsort appeared to be more than half way through the construction of their process plant in August. We look forward to further news on its construction and potential commissioning later this year.

Conclusion: These are very encouraging results indicating a significantly larger cobalt / copper mine at Kalaba than previously envisaged. We look forward to being able to estimate a significantly larger tonnage of mineralised material from the next set of assay results in the short term.

**An SP Angel analyst has recently visited the Kalaba open pit mine, stockpiles, process plant and drilling operations. Our intrepid analyst and co-driver drove to site from Lusaka and back again.*

**SP Angel acts as nomad and broker to Arc Minerals.*

Anglo American (AAL LN) 1455 pence, Mkt Cap £18.8bn – De Beers diamond sales

- Anglo American reports that De Beers achieved sales of US\$505m for its 7th diamond sale of 2018. The sales are around 5% lower than the revised US\$533m of the previous sale and in line with the US\$507m achieved in the equivalent sales in 2017. At this stage, the figures are provisionally correct as of 10th September 2018.
- On a year to date basis, we estimate that sales amount to approximately US\$3.9bn or around 2% below the comparable level in 2017.
- Commenting on the sale and market outlook, De Beers CEO, Bruce Cleaver said that “*Demand remains stable ahead of the September Hong Kong Jewellery & Gem Fair.*”

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Bushveld Minerals (BMN LN) 19.8p, £219m – Bushveld proposes return to work on basis of continuous engagement

Recommendation SUSPENDED - Target adjusted to 31.8p (from 33.6p)

(Bushveld Minerals hold 59.1% of Vametco)

- Bushveld Minerals have proposed in a statement on Friday that all labour should resume work with immediate effect, on the basis of continuous engagement between both parties, with a final resolution being achieved in this coming week.
- Discussions with representatives relate to historic compensation structures but these discussions may be disregarded by workers who are staging unofficial 'unprotected' action.
- **Vanadium prices:** continued higher again last week further to US\$84.5-85.2/kgV in Western Europe and to \$80-82/kgV in China according to the Metal Bulletin.
- The Ferro vanadium price was US\$46.3-49/kgV a year ago.
- Ferro-vanadium prices are reported to be being driven by a return of consumer interest in the spot market .
- China's new standard for higher-content steel rebar is being implemented in 'November' which may be helping to drive prices higher for last minute buyers of the metal for inclusion into rebar steel.
- Production of Ferro-vanadium is currently lower in China due to environmental regulations reducing the amount of vanadium from low-quality stone coal and furnace slag.

Conclusion: The stoppage is not expected to affect the company's recently revised year-end production guidance. We expect Fortune Mojapelo, Bill Chipane and the team to work to resolve this action relatively quickly.

Note: *Bushveld Minerals controls and holds an effective 59.1% of Vametco*

**An SP Angel mining analyst and nomad have visited the Vametco vanadium mine and processing facilities in South Africa.*

**SP Angel act as Nomad and broker to Bushveld Minerals*

Mkango Resources Ltd (MKA LN) 8.8p, Mkt Cap £9.5m – Completed major drill programme intersects further extensive zones of rare earth mineralisation

- Mkango Resources has now completed the latest major drill programme at the Songwe Hill Rare Earths Project in Malawi, totaling 10,891m and comprising 91 drill holes to a maximum depth of 220m.
- The company announce assay results for a further eight holes, which principally focus on infill drilling to confirm and upgrade the existing Indicated and Inferred Mineral Resource Estimates, testing extensions to the mineralisation, and geotechnical drilling. Infill drill holes all intersected broad zones of mineralisation, with highlighted average results grading 1.7% TREO, which is above the existing PFS resource average of 1.6% TREO.
- Drill hole PX082 was focused on testing the North-West extension of mineralisation, outside the previously delineated Indicated and Inferred Mineral Resource Estimate. Total REO's grade 1.6% over 38.0m, which confirms intersected mineralisation for the first time coincident with the targeted radiometric anomaly.

Conclusion: Completion of the major drill programme is significant news with the work contributing an integral part of the ongoing Feasibility Study. Intersected mineralisation gives preliminary assay results for rare earth content within the targeted radiometric anomaly extending outside and to the North-West the PFS resource statement, which could provide upside to the previous resource statement.

Talga Resources Ltd (TLG AU) A\$0.5, Mkt Cap A\$112m - Talga expands industry potential for graphene products with multiple agreements

- Advanced materials technology company, Talga Resources, recently announced innovative use cases for graphene products confirmed with agreements in packaging application and thermoplastics.
- The company has signed a Letter of Intent with Swedish-based multinational packaging company, BillerudKorsnäs. The partnership aims to jointly explore potential benefits of incorporating a Talphene® product into BillerudKorsnäs packaging applications. While in early stage of development, the addition of graphene is set to enhance the strength, barrier effect and conductivity of packaging.

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- BillerudKorsnäs are currently investigating The Paper Bottle innovation project, which under a collaborative effort with leading players in barriers, design and technology are developing the world's first 100% recyclable and biodegradable paper bottle.
- Graphene additives can support the development of the Paper Bottle project and subsequent packaging compounds to improve performance and recycling efficiency:
 - Stronger, more flexible containers that are protected from UVA rays courtesy of graphene composites in the form of Masterbatches (PE, PP, ABS, POM).
 - Completely waterproof and antibacterial containers, with graphene-infused packaging forming an impermeable layer to any gas, substance or bacteria. Graphene packaging has been identified in *ACS Nano* to be a million times better at restricting water vapour across the packaging membrane. Further graphene-based nanomaterials have been identified as “*excellent antibacterial activity and minimal cytotoxicity of graphene oxide sheets*”, according to researchers from Shanghai University. The research noted the macroscopic antibacterial graphene-based paper can be “*conveniently fabricated with superior inhibition ability to bacteria growth*”.
 - Intelligent containers that are sensitive to infra-red rays manufactured with inks, resins and conductive dispersions of graphene.
- Talga has signed a Joint Development Agreement with Biomer Technology Ltd, a UK-based polymer manufacturing and technology company, to co-develop graphene-enhanced thermoplastics for potential commercialisation in the healthcare and coatings markets.
- Falling under the composites sector of Talga's graphene commercialisation strategy, the agreement focuses on potential five years exclusive supply in the event of commercialisation of a new multifunctional thermoplastic polyurethanes (“TPU”) incorporating Talphene® in Biomer polymers.
- Incorporation of graphene TPU is expected to improve chemical resistance, wear & abrasion resistance, surface finish, mechanical strength, biocompatibility/biofouling and electrical conductivity.
- The market potential is significant with the existing thermoplastic polyurethane market size exceeding 21.7 million tonnes products and total market value c.US\$57.8 billion including, automotive, aerospace, coatings, healthcare products, and many other applications.
- Managing Director Mark Thompson notes “*we look forward to working with Biomer through the JDA to incorporate Talphene® into Biomer products with a view to enhancing people's lives through advanced biomedical healthcare products, reducing eco-impacts of ship coatings in the marine environment and improvements to many other polyurethane based products*”.

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