BKT Battery Anode Pre-Cursor Production Trial Delivers Industry Leading Results

HIGHLIGHTS

- **Spheronising yields of up to 53% achieved, significantly exceed industry standard for battery anode materials**
- **99.98% TGC* purity delivered with simple acid leaching, exceeding industry standard for battery anode materials**
- **Large scale Spherical Purified Graphite (SPG) production trial of 400kg is 100 times larger than Black Rock's previous laboratory experiments**
- **Proposed Mahenge concentrator flowsheet demonstrated no damage to flake**
- **Chinese industrial trial replicated strong results previously achieved in Western laboratories**

Tanzanian graphite developer Black Rock Mining Limited (BKT: ASX) ("Black Rock" or the "Company") is pleased to announce it has completed a large-scale spheronising and purification trial using 400kg of sub 80 mesh concentrate generated during the March 2019 Pilot Plant run (refer ASX release 3 April 2019). The trial has demonstrated a yield to final product of 48% and 53%, and final purity of 99.98% TGC* using commercial scale equipment in commercial processing and in dedicated research facilities. These outcomes significantly exceed Chinese Industry Benchmark yields of 35-45% and purity of 99.95% while using standard equipment and techniques. Spherical Purified Graphite (SPG) produced from the trials has been sent to interested parties for further testing.

Table 1 | Summary Trial Data

		Yantai Pilot Plant Enhanced Definitive Feasibility Study (eDFS) (2019)		
		Chinese Industry Benchmark	**Inner Mongolia Ruisheng Graphite New Material Co - Acid Purified + Thermal & Reshaped**	**Wuhan University of Technology**
Purification Process		Acid	Acid/Thermal	Thermal
Process yield to SPG	%	35% - 45%	53%^	48%
Final purity	%	**99.95%**	**99.98%**	**99.98%**

^ 53% achieved after Acid Bath, but before Thermal
* Total Graphitic Carbon as reported by Loss on Ignition

Commenting on the spheronising results, Black Rock's CEO, John de Vries, said

"The best way to think of the bulk spheronising trial is that it is the equivalent of our pilot plant strategy, but in this case, done downstream. The fundamental objectives of the pilot plant approach remain the same and that is to improve our attractiveness to financiers and investors by demonstrating and de-risking Mahenge's superior performance in our potential customers' business.

In completing this round of work, we had two key objectives. Firstly, to ensure that the flow sheet developed for the Mahenge concentrator preserves the integrity of the flake and does not impair spheronising performance. Secondly, to demonstrate that offtake partners can achieve industry leading performance using our flake in their existing facilities. This underpins our price point and volumes in our pricing framework agreements (refer to ASX release 8 May 2019).

Conducting a large-scale spheronising trial using industry standard equipment allows us to assess how initial laboratory results obtained during the Pre-Feasibility Study in 2017 (refer to ASX release 7 June 2017) scale up in the industrial context that our customers operate in. For our customers to be able to replicate the best-in-class spheronising results, that are up to a 50% improvement on current yields, while able to replicate results obtained in highly controlled laboratory conditions by skilled researchers, with no modifications to their processes, is simply stunning.

Concentrate used for these trials was produced at the Chinese pilot plant (refer to ASX release 23 April 2019) where the design flowsheet intended for the Mahenge Graphite Project was demonstrated. The exceptional spheronising yields obtained in the trial show that the planned flowsheet does not damage our flake. This talks to the unique geological advantage of Mahenge graphite, and the diligence applied to design and trials to optimise and de-risk our flowsheet before construction.

With the completion of this technical work, we can confidently focus on completing our financing discussions and documenting the shareholder agreement with the Tanzanian Government."

Trial Context

As part of the Chinese pilot plant operations run in March 2019, 400kg of sub 80 mesh concentrate was processed through to Spherical Purified Graphite. The trial was originally contemplated to support the marketing objectives of the pilot plant process relative to the energy storage market as well as demonstrate performance at scale for potential offtake customers and potential funders.

The objectives of this trial were to:

- Validate Black Rock's Mahenge graphite product in the Chinese market
- Replicate industry leading spheronising yields achieved previously in Western laboratory trials (refer to ASX release 7 June 2017) conducted as part of the Pre-Feasibility Study
- Ensure that industry leading results obtained in the laboratory were achievable at scale in standard industrial processes
- Demonstrate that the proposed mill flowsheet tested in the Chinese Pilot Plant (refer to ASX release 3 April 2019) does not damage the flake

Trial details

The 400kg of concentrate was split into two 200kg batches. Each batch was processed through two alternative processes commonly used in the Chinese battery pre-cursor industry. The trials were conducted at the following locations:

- Inner Mongolia Ruisheng New Material Co Ltd (a commercial producer)
- Wuhan University of Technology (a Chinese research facility)

The objective of using both a commercial producer and a Chinese research facility was to ensure comparability between Western and Chinese laboratory results, and to understand how the product would perform when scaled up in a commercial facility typical of Black Rock's potential customer base.

Two target sizes were produced. The first was a 18*um* sizing, which is typical for consumer devices. A second sizing of 12*um* is typical for lower performance EV batteries.

Two routes were trialled for purification, acid bath and thermal. Both routes demonstrated capacity to deliver well above the minimum purity threshold for batteries of 99.95% TGC. Thermal purification achieved 99.98% TGC purity in one hour at 3,000 degrees in a halogen inert furnace.

Trial Site 1 - Inner Mongolia Ruisheng New Material Co Ltd

Inner Mongolia Ruisheng New Material Co Ltd (IMRG) is a large commercial producer of spherical anode materials in the Chinese market. In FY 2018, total production exceeded 20,000 tonnes of finished product. IMRG process involves spheronisation, followed by acid leaching to produce a target purity of 99.95% TGC.

The experimental process involved micronizing the flakes to 150*um*, followed by spheronisation. The spheronising process involved blanking off a single air turbine mill and recirculating the micronized graphite in a closed loop to simulate a typical cascade mill arrangement. Productivity was high and achieved over 200kg/hr to final sizing of 18.8*um* with a yield of 53% to SPG. Following spheronisation, the feedstock was leached in a single acid bath using a standard leach process and formulation. The acid bath was not optimised for Mahenge's signature.

After sampling, final SPG was then sent to Wuhan University of Technology for reprocessing using thermal purification. The objective of this step was to allow further comparison between the increasingly regulated acid bath purification route and the more costly but environmentally benign thermal process route.


Figures 1 & 2 | Airflow turbine crushing and shaping system

Trial Site 2 - Wuhan University of Technology

Wuhan University of Technology is a leading Chinese research facility with a significant skills base in battery development and graphite processing. The processing of the 200kg dedicated thermal batch, and subsequent thermal upgrading of the IMRG material, was done under the supervision of Professor Yangshuai Qiu.



Figures 3,4 & 5 | QWJ airflow turbine pulverizing system

Wuhan University material was processed in a dedicated machine specifically designed for research. Micronized graphite was processed 17 times before target sizing was achieved. This compares well to industry standards of 25 to 30 stages to produce final sizing. Size reduction is illustrated in Chart 1 below.

Yields of 48% exceeded the Chinese Industry Benchmark of 35-45%, but were not as high as the 53% achieved at IMRG. This difference is attributed to some loss of material due to thermal upgrading.

Trial results

A summary of the 400kg trial results data is presented below in Tables 2 and 3, as well as Charts 1 and 2.

Table 2 | Trial data compared to PFS samples

		BKT Battery Development Program - Pre Feasibility* (2017)		Yantai Pilot Plant Enhanced Definitive Feasibility Study (eDFS) (2019)			
		Dorfner Anzaplan*	Chinese Control Sample	Chinese Industry Benchmark	Inner Mongolia Ruisheng New Material Co - Acid Purified	Inner Mongolia Ruisheng Graphite New Material Co - Acid Purified + Thermal & Reshaped	Wuhan University of Technology
Purification Process		Two Stage Acid Leach	Two Stage Acid Leach	Acid	One Stage Acid Leach	Acid/Thermal	Thermal
Spheronising Process		Lab Air Turbine	Lab Air Turbine	Cascade Mill	Cascade Mill	Cascade Mill	Cascade Mill
Process yield to SPG	**%**	60%	35%	35% - 45%	53%	48%	48%
TAP Density final product	**g/cm^3**	0.93	0.88	0.88	0.92	0.95	0.83
Specific Surface Area (BET)	**m^2/g**	5.9	3.8	7.0	4.8	5.9	5.1
D_{90}		22.5	39.0		29.1	30.3	21.2
D_{50}		16.3	23.4		18.8	17.2	12.2
D_{90}/D_{50}		1.4	1.7		1.5	1.8	1.7
Final purity		**99.98%**	**99.60%**	**99.95%**	**99.96%**	**99.98%**	**99.98%**

** refer to ASX release 7 June 2017*

Table 3 | Mahenge Bulk Spheronising Trail - Purified Residual Chemistry

Test Site	Route	Ash %	Al PPM	Fe PPM	Si PPM	S PPM	Ca PPM	Cl PPM	Br PPM	Zr PPM	B PPM
Inner Mongolia Ruisheng New Material Co	Acid	0.033	9.6	18.1	5.7	27.1	18.7	208.4	14.0	2.5	8.5
Inner Mongolia Ruisheng New Material Co	Acid + Thermal	0.020	8.3	16.4	15.5	0.0	9.7	11.7	8.7	0.0	6.5
Wuhan University of Technology	Thermal	0.020	9.6	12.4	8.4	0.0	12.4	10.1	5.5	1.7	7.8

Chart 1 | Spheronisation Property Development

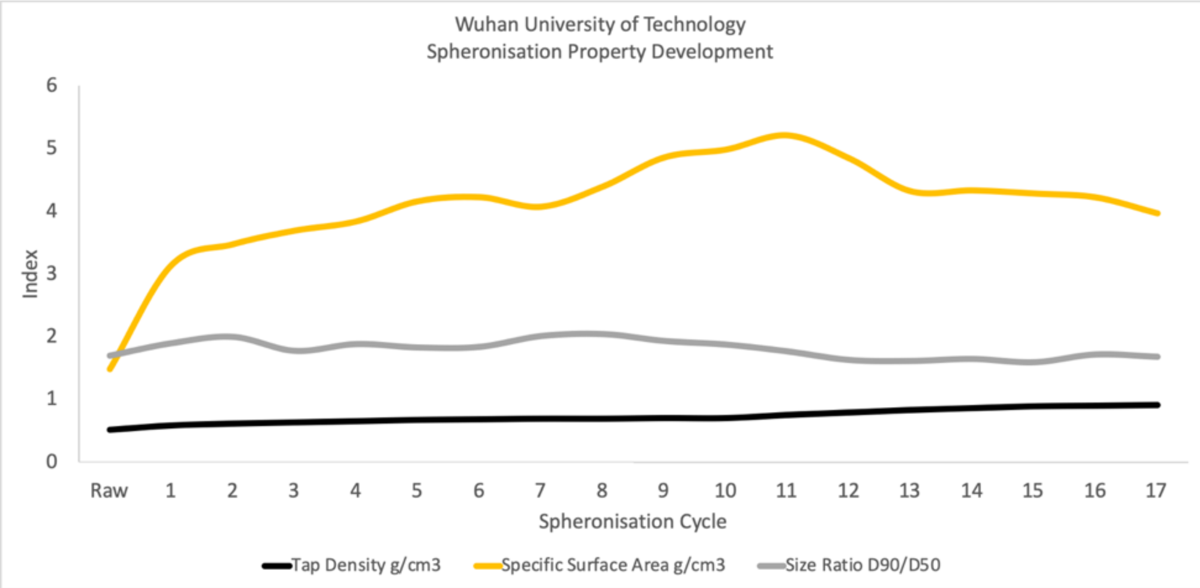
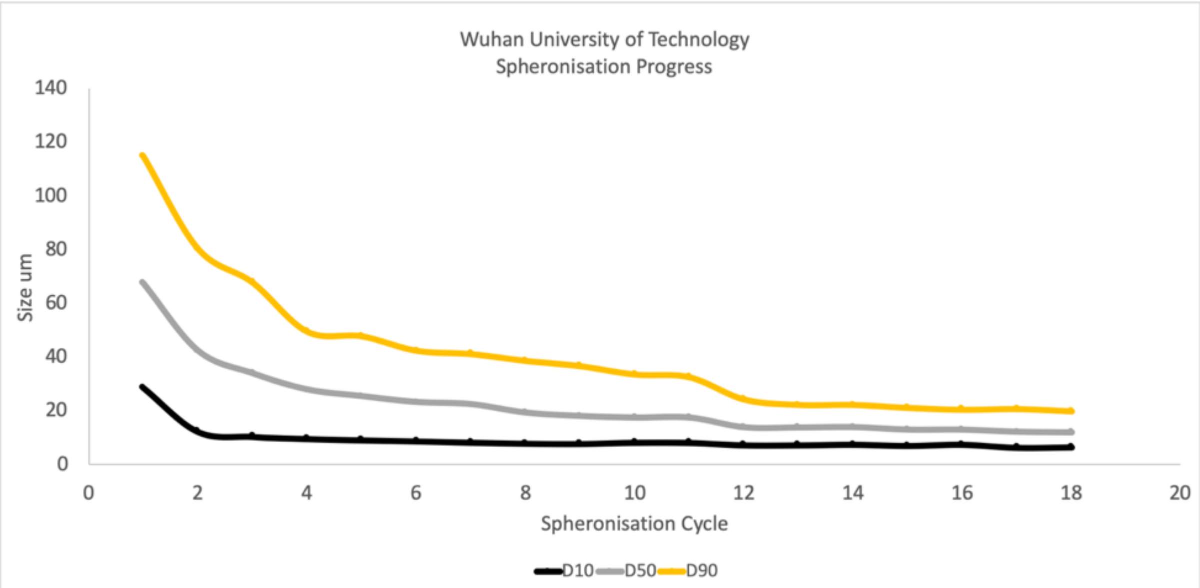


Chart 2 | Spheronisation Progress Against Fraction Sizing*



*D_{10}, D_{50} and D_{90} nomenclature represent to percentage size fraction passing

Ends

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About Black Rock Mining

Black Rock Mining Limited is an Australian based company listed on the Australian Securities Exchange (ASX:BKT). The Company has a 100% interest in the Mahenge Graphite Project (the "Project") located in Tanzania. The Project has a JORC compliant Mineral Resource Estimate of 212m tonnes at 7.8% TGC. It also has Ore Reserves of 70m tonnes at 8.5% TGC. The Ore Reserves support a mine life of up to 350k tonnes of graphite per annum for a reserve life of 16 years. Since the release of the Mineral Resource Estimate, the Company confirms that it is not aware of any new information or data that materially affects the mineral resources estimate.

In October 2018, the Company released a Definitive Feasibility Study (DFS) for the Project, which was based on strong customer demand. This was enhanced in July 2019 (refer to ASX release 25 July 2019), and demonstrates exceptional financial metrics including:

- *Low Capex*: Lowest peak capital expenditure of US$116M for phase one*;
- *High Margin*: AISC margin of 63.1%;
- *Low Technical Risk*: Substantial pilot plant operations run of 110 tonnes; and
- *Superior Economics*: IRR of 44.8% with NPV_{10} of US$1.16bn (A$1.65bn**)

In February 2019, the Company announced receipt of its mining licence for the DFS project.

In May 2019, the Company announced it had substantially allocated planned production with up to 255k tonnes per annum of graphite committed to sale by year three of production, through Pricing Framework Agreements (refer to ASX release 8 May 2019). The Company is progressing these agreements into binding offtake commitments.

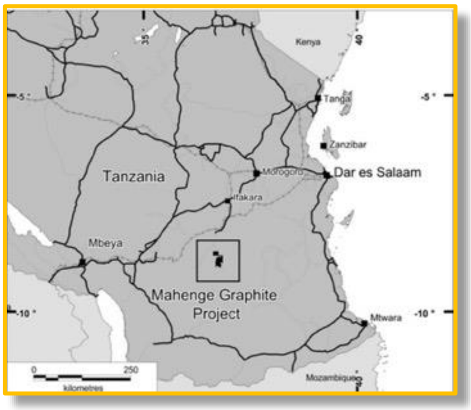
Following release of the enhanced DFS (eDFS) in July 2019, the Company confirms that it is not aware of any new data or information that materially affects the results of the eDFS and that all material assumptions and, in the case of estimates of Mineral Resources or Ore Reserves, technical parameters underpinning the estimates in the relevant market announcements continue to apply and have not materially changed.

The estimated Ore Reserves and Mineral Resources underpinning the production target has been prepared by competent persons in accordance with the requirements in Appendix 5A (JORC Code).

The Company is currently progressing financing discussions and detailed engineering with a view to commencing construction of the mine.

JORC Compliant Mineral Resource Estimate and Ore Reserve***

Ore Reserves	Tonnes (Mt)	Grade (% TGC)	Contained Graphite (Mt)
- Proven	0	0.0	0.0
- Probable	69.6	8.5	6.0
Total Ore Reserves	**69.6**	**8.5**	**6.0**
Mineral Resources			
- Measured	25.5	8.6	2.2
- Indicated	88.1	7.9	6.9
Total M&I	**113.6**	**8.1**	**9.1**
- Inferred	98.3	7.6	7.4
Total M, I&I	**211.9**	**7.8**	**16.6**



For further information on Black Rock Mining Ltd, please visit **www.blackrockmining.com.au**

* Forecast Capex has been classified as a Class 3 estimate with accuracy of ±10% as defined by AACE
** $AUD/USD 0.70
*** Resource and Ore Reserve Estimates as released to ASX on 8 August 2017 Optimised PFS

Competent Person Statement

The information in this report that relates to Ore Reserves is based on information compiled by Mr John de Vries, who is a Member of the Australian Institute of Mining and Metallurgy. Mr de Vries is a full time employee and Executive Director of Black Rock Mining at the time this report was compiled and has sufficient experience relevant to the style of mineralisation and type of deposit under and to the activity which he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves"

The program reported on relates to the performance of metallurgical concentrates in potential downstream manufacturing processes and was conducted to support marketing to battery supply chain participants. The results are independent of modifying factors considered in the Ore Reserve Estimate and should be considered as having no material impact on reported Reserves or Resources.

The reported concentrate processed to manufactured products was obtained from pilot plant operations milling a bulk sample obtained from the proposed Ulanzi pit, and was reported to the ASX 3 April 2019. The bulk sample was obtained from the collar position of drill hole RC47 in the Ulanzi project area. Sample site is illustrated in Figure 6.

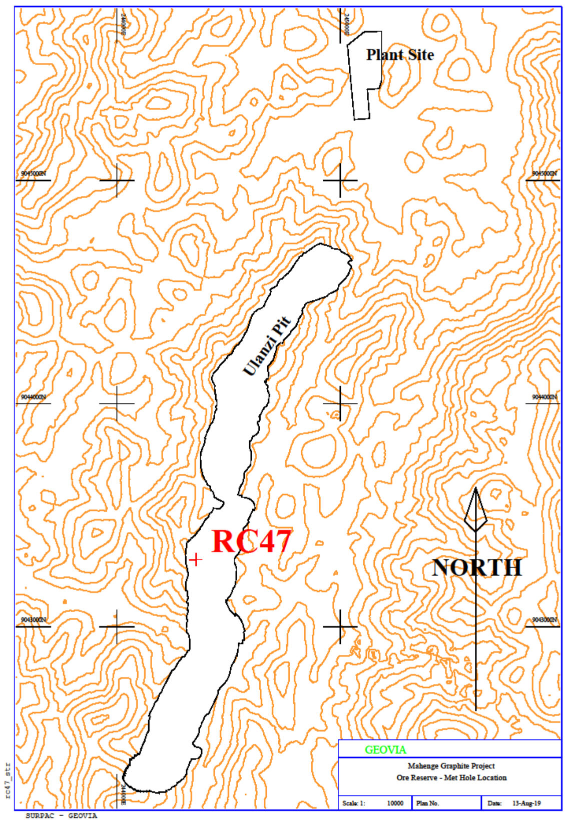


Figure 6 | Location of Drill H47 Hole RC relative to planned Ulanzi Pit

Section 1 Sampling Techniques and Data

(Criteria in this section apply to all succeeding sections.)

Criteria	JORC Code explanation	
Sampling techniques	• *Nature and quality of sampling (eg cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling.* • *Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used.* • *Aspects of the determination of mineralisation that are Material to the Public Report.* • *In cases where 'industry standard' work has been done this would be relatively simple (e.g. 'reverse circulation drilling was used to obtain 1 m samples from which 3 kg was pulverised to produce a 30g charge for fire assay'). In other cases more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual commodities or mineralisation types (e.g. submarine nodules) may warrant disclosure of detailed information.*	• *The Company has taken all care to ensure no material containing additional carbon or other deleterious elements has contaminated the samples.* • *The sample consists of a single 7.5m³ hand dug sample taken from in situ oxide mineralisation at the collar of the nominated drill hole. The sample represents an "insitu" sample of the Ulanzi orebody and is considered suitable for pilot plant purposes* • *Grades and flake distribution were compared against exploration results* • *Samples were placed on ground sheets prior to bagging to ensure no contamination from surrounding surface occurred* • *The sample was bagged into 1 tonne "bulka" bags and stored in a secure location prior to transport to the pilot plant* • *Samples were containerised in sealed shipping containers prior to transport to the pilot plant location* • *The company maintains a secure storage area for all samples and core held on site.*
Drilling techniques	• *Drill type (e.g. core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (e.g. core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).*	• *No drilling was involved. Samples were obtained from hand dug pit of 7.5m³ volume obtained from the collar of the nominated drill hole*

Criteria	JORC Code explanation	
Drill sample recovery	• *Method of recording and assessing core and chip sample recoveries and results assessed.* • *Measures taken to maximise sample recovery and ensure representative nature of the samples.* • *Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.*	• *The sample was obtained from hand dug pits located at the collar of the drill hole* • *The excavated sample location was surveyed using differential GPS methods and position verified by drill hole location* • *Sample pit recovery was estimated using surveyed volumes* • *Reconciliation of sample to drill hole results indicates no bias has occurred with respect to Graphitic carbon. The use of Reverse Circulation precludes flake size comparison*
Logging	• *Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies.* • *Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography.* • *The total length and percentage of the relevant intersections logged.*	• *Sample lithology was reconciled to drill hole lithology for the first 2.5m of excavation* • *Samples were logged for location and bag number, with metallurgical characterisation occurring as part of the pilot plant process* • *Sample pits were photographed prior to being filled in*
Sub-sampling techniques and sample preparation	• *If core, whether cut or sawn and whether quarter, half or all core taken.* • *If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry.* • *For all sample types, the nature, quality and appropriateness of the sample preparation technique.* • *Quality control procedures adopted for all sub-sampling stages to maximise representivity of samples.* • *Measures taken to ensure that the sampling is representative of the in-situ material collected, including for instance results for field duplicate/second-half sampling.* • *Whether sample sizes are appropriate to the grain size of the material being sampled.*	• *The bulk samples were not sub sampled* • *The bulk sample was transported to a metallurgical research facility where the ore was characterised as oxide, transition or primary prior to being milled in the pilot plant* • *Entire sample was milled in the pilot plant process with no duplicates retained* • *Sample size of 18 tonnes was appropriate for this style of graphite mineralisation and the process used.* • *"Bulka" bags were emptied into a dedicated area and mixed to form a single homogenous stockpile prior to milling*

Criteria	JORC Code explanation	
Quality of assay data and laboratory tests	• *The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total.* • *For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc.* • *Nature of quality control procedures adopted (e.g. standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (i.e. lack of bias) and precision have been established.*	• *The samples were sent to Yantai Jinyuan Mining Machinery for processing through a flotation plant to graphite concentrate.* • *Graphitic C is determined by "Loss on Ignition" LOI methodology. The sample is dried at 550 degrees to remove organic carbon. Once dried the sample is weighted prior to being combusted in a furnace at 950 degrees to combust inorganic carbon (graphite). Ash residue is weighted with the mass loss being reported as LOI. Method Precision: ± 0.1% Carbon Limit:0.02 – 100 % Carbon.* • *Ore sample was analysed for Multi-elements using ME-ICP81 sodium peroxide fusion and dissolution with elements determined by ICP prior to milling in the pilot plant.* • *All analysis has been carried out by Chinese certified laboratory – Yantai Jinyuan Metallurgical Research Laboratories.* • *Flake sizing was by a Star Trace Industrial Vibro Sifter type screen to standard ASTM sizing. Sizing used standard ASTM screen sizes of +32 mesh, +50 mesh, + 80 mesh, +100 mesh and – 100 mesh* • *Purpose of the test program was to determine the optimal flow sheet for mill design* • *Due to the nature of a single 18.5 tonne sample, the use of blanks was considered inappropriate for pilot plant operation*
Verification of sampling and assaying	• *The verification of significant intersections by either independent or alternative company personnel.* • *The use of twinned holes.* • *Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols.* • *Discuss any adjustment to assay data.*	• *The data has been manually updated into a master spreadsheet and a GIS database, considered to be appropriate for this metallurgical development program.* • *Samples were obtained from drill collars where those drill locations occur within the outcropping portion of the orebody. Drill collar locations have been checked by a consultant geologist as part of the data validation process and errors corrected prior to resource estimation.* • *Bulk sampling was used to compare results from drilling. Correlation of results was excellent.* • *There has been no adjustment of assay data.*

Criteria	JORC Code explanation	
Location of data points	• *Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation.* • *Specification of the grid system used.* • *Quality and adequacy of topographic control.*	• *Bulk samples were obtained from the collar coordinates of drill holes used in exploration and infill drilling* • *Drill collars have been surveyed with a DGPS for sub-metre accuracy for the X, Y and Z components and the Ulanzi, Cascade and Epanko North prospects have been surveyed with a high resolution aerial drone to generate an accurate contour map and high resolution photo image. The Z component has also been checked by draping the collar position over a high quality digital terrain model and comparing to the DGPS Z reading.* • *BKT is satisfied the location of trenches, pits and drill holes have been located with a high degree of accuracy.*
Data spacing and distribution	• *Data spacing for reporting of Exploration Results.* • *Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied.* • *Whether sample compositing has been applied.*	• *Data spacing and distribution is considered to be appropriate for the estimation of a Mineral Resource.* • *The company has used 100 x 100m or 100 x 50m or 50 x 50m grid spacing which has been sufficient to show geological and grade continuity.* • *The drill spacing is appropriate for Resource Estimation.* • *No further sample compositing has been applied post the sub-sampling stage.*
Orientation of data in relation to geological structure	• *Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type.* • *If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.*	• *Bulk samples are large by nature and volume exceeds small scale local bias* • *The orientation of the bulk sample is along the Z axis of the nominal drill hole.*

Criteria	JORC Code explanation	
Sample security	• *The measures taken to ensure sample security.*	• *The samples were taken under the supervision of an experienced geologist employed as a consultant to BKT.* • *The samples were transferred under BKT supervision from site to the local town of Mahenge where the samples were then transported from Mahenge to Ifakara. Samples were containerised at Ifakara and railed to the Port of Dar es Salaam prior to export* • *Chain of custody protocols were observed to ensure the samples were not tampered with post-sampling and until delivery to the laboratory for preparation and analysis.* • *Tamper proof plastic security tags were fastened to the sample bags. No evidence of sample tampering was reported by the receiving laboratory.*
Audits or reviews	• *The results of any audits or reviews of sampling techniques and data.*	• *Bulk Sampling, trenching and drilling information collected by BKT has been evaluated for sampling techniques, appropriateness of methods and data accuracy by an external geological consultant.*