

The future of graphite

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## Syrah Resources – The Future of Graphite

- The only major, fully funded, natural graphite development project in construction globally
- Will be the largest natural graphite producer globally, oriented to battery market growth
- A world class, tier-1 asset by any measure
- Significant grade advantage
- Lowest quartile of the cost curve
- Ramp-up plan and volume in place
- Deeply commercially engaged with major consumers
- Battery Anode Material strategy development progressing production, partnership, development



## **Summary of Balama Project features**

Reserves and Resources <sup>(1)</sup>	<ul> <li>Reserves: 114.5Mt at 16.6% TGC (18.6Mt contained graphite)</li> <li>Resources: 1,191Mt at 11.0% TGC (128.5Mt of contained graphite)</li> </ul>
Mining Method	Simple open pit operation with low strip ratio; operations will commence as free-dig mining using conventional truck and shovel mining
Processing method	Conventional process including crushing, grinding, flotation, filtration, drying, screening and bagging
Processing rate	2 Mtpa
Product	95% to >98% TGC concentrate to be produced across a range of flake sizes
Production	Nameplate capacity of 380,000 tonnes of graphite concentrate per annum
Total cash operating costs	<ul> <li>Initially achieve a C1 production cash cost of <us\$400 first<br="" in="" per="" the="" tonne="">12 months (with later progression to less than US\$300 per tonne)</us\$400></li> </ul>
Life of mine	Almost 60 years



# Syrah's integrated supply chain will service traditional industrial and growth battery markets from start up



Balama ore (Mozambique)



#### Processing

- Grinding
- Flotation
- Screening
- Bagging

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Export





#### **Traditional markets**

- Refractory
- Lubricants
- Recarburisers



#### Lithium ion battery

- Electric vehicles
- Grid storage



Direct sales to spherical graphite producers



Battery Anode Material (BAM) Commercial Facility (Louisiana)

- SpheroidisationPurification
- SYRAH RESOURCES
- Coating

## Syrah's Balama project has the largest defined reserve and significant grade advantage



Cut-off grade for Northern Graphite (Ontario, Canada) is 1% TGC Cut-off grade for Energizer Resources (Madagascar) is 4.5% TGC Cut-off grade for Kibaran Resources (Tanzania) is 5% TGC Cut-off grade for Battery Minerals (Mozambique) is 4.4% TGC (Cut-off grade for Focus Graphite (Quebec, Canada) is 3.1% TGC Cut-off grade for Mason Graphite (Quebec, Canada) is 3.1% TGC Cut-off grade for Volt Resources (Tanzania) is 1.3% to 1.8% TGC Bass Metals is a resource definition, not a JORC compliant reserve TGC = Total graphitic carbon







### Balama commissioning activities have commenced with first production scheduled for August 2017

- Balama Project is approaching 80% complete; commissioning activity has commenced
- Capital budget remains at US\$193 million plus a project contingency of US\$7 million
- Production ramp up volumes of flake graphite concentrate:
  - □ Year 1: 140kt to 160kt
  - Year 2: 250kt to 300kt of production
- Water Pipeline Construction Agreement granted and construction commenced
- Mining Agreement continues to progress through government approval channels
- Multiple sales initiatives progressed :
  - MOU with BTR New Energy Materials, the world's largest battery anode manufacturer  $\succ$
  - Statement of Sales Intent (SSI) with a European trader consortium
- Progress well advanced for US\$50 million in working capital debt funding



## Major project metrics highlight the attractiveness the Balama investment



Competitor location based on location of proposed mine, not company headquarters.

### Syrah Resources will be a first quartile producer both during ramp up and at full capacity

Flake Graphite C1 Cost Curve

(Not concentrate TGC adjusted, first 12 months of production for Syrah Resources, 2017/18)



#### Source: Syrah Resources

Notes: Cost curves include current operating graphite mines that accounted for ~95% of global production in 2016.

## **Global graphite market definition and flow**



- The total graphite market refers to the sum of natural and synthetic graphite production.
- Synthetic graphite predominately derived from petroleum coke, with a small amount from coal tar pitch
- Majority of world's amorphous and flake supply is from China
- All vein supply is from Sri Lanka.
- Currently, the steel market is the main end use market
- Battery market is the fastest growing sector of the natural flake market moving from 15% to 35% share by 2021



## By 2020 Syrah will be the largest individual natural flake graphite producer in the world with ~40% market share



### Syrah's Balama production ramp up will be driven by the strong global demand growth profile



Source: Syrah Resources

Notes: Steel sector includes refractory bricks, foundries and recarburising products. Other includes lubricants, brakes, friction products and pencils.

# Syrah's product quality and grade will command a premium price

Flake prices are determined based on a range of value in use variables such as graphite content, flake size and impurity levels.



The market already appreciates this value. An additional +1% of TGC equates to a +4 - +7% value uplift, depending on the flake size.

#### % price change per % change in TGC



## Syrah's graphite is in demand, and characteristics provide production and cost advantages

#### Syrah Resources Spherical Graphite



Syrah Resources Flake Graphite Concentrate

#### **Characteristics of Syrah Resources' graphite**

#### 1 Optimal flake size

-100 mesh maximises production yield for battery market. +100 mesh material primarily for industrial markets.

#### 2 Crystallisation

Balama graphite has a fully ordered crystalline structure.

#### 3 High production yields

Spherical graphite production yield of 45% - 55%, compared to typical yields of 30% - 40%.

#### 4 Degree of spheroidisation

Well rounded spherules, increased tap density and anode efficiency.

#### 5 Purity level

High ore graphite content eases purification to 99.95%+ that increases anode life and conductivity.



### A higher proportion of natural graphite drives down battery cost, and improves capacity

#### Natural graphite



Synthetic graphite



Natural graphite anode active material has an average capacity +6% greater than synthetic graphite.

Substituting a higher proportion of natural graphite into the anode reduces battery costs.

This facilitates overall battery prices to decline without placing price pressure on the natural flake and anode producers.

Current industry research is focused on improving the cycle lifetime of natural flake anodes.

Our MOU with Cadenza will allow us to further test and develop battery anode material options.



## Price historically driven by steel and industrial applications; now and in future by battery demand





Source: USGS, Syrah Resources Notes: for low grade fines

## Syrah's marketing strategy is to be diversified across end user markets and geographies



# Syrah's current flake concentrate and downstream commercial arrangements

Customer	Туре	Region	Product	Tonnes p.a.	Duration	Status					
Flake concentrate											
Chalieco	Offtake	China	Flake graphite	80,000	3 years	Being operationalised (timing, customer volumes, pricing)					
Marubeni	Offtake	Japan & Korea	Flake graphite	20,000	3 years	Being operationalised (timing, customer volumes, pricing)					
Hiller Carbon	SSI	North America and Mexico	Recarburiser	25,000 to 35,000	5 years	Extending focus of agreement to include traditional markets					
European refractory producer	SSI	Europe	Flake graphite	Up to 15,000	10 years	Awaiting commercial production to operationalise contract					
European trader consortium (NEW)	SSI	Europe	Flake graphite	15,000 to 25,000	5 years	Agency and direct sales for traditional markets only; excluding battery and recarburiser markets					
BTR New Energy Materials (NEW)	MOU	China	Flake graphite and supply chain co- operation	Confidential							
Battery anode mater	rial										
Marubeni	Offtake	Japan & Korea	Uncoated spherical graphite	50,000	5 years	Ongoing sample testing and customer engagement. Awaiting production from US plant					
Morgan Hairong	Offtake	China	Uncoated spherical graphite	2,000 3 years		Awaiting production from US plant					
Morgan Hairong	Marketing	China	Coated and uncoated spherical graphite	7,000 3 years		Awaiting production from US plant					

### **Battery Anode Material – vertical integration** through production, partnership and development



Producing to Customer Specifications



### **Timetable**

	2017				2018												
		Q2		Q3		Q4	Q	1		Q2			Q3			<b>Q4</b>	
Balama Graphite Project, Mozambique																	
Balama Plant Construction																	
Commissioning																	
First Ore & Production Ramp Up																	
Full Production Capacity																	
BAM - Qualification Plant, Louisiana USA																	
Development																	
Customer Product Qualification																	
BAM - Commercial Plant, Louisiana USA		BFS	•														
Development																	
Production			•		>												
				\$													
BAM - China / Perth																	
China Pilot Plant																	
Perth Technology Centre																	

Overlap between tail end of construction, start of commissioning and first production



### Conclusion

- Syrah is the only major natural graphite development project in construction globally, and is fully funded for production of graphite concentrate from Balama in only a few months' time
- We have an extraordinary deposit with almost 60 years mine life as the largest natural graphite producer globally
- We have a world class tier 1 asset by any measure size, quality, life, expandability
- Our grade advantage is significant. It requires less work and lower cost to produce high carbon content concentrate, which will over time attract a premium price
- □ We are positioned and will remain in the lowest quartile of the cost curve
- And we are advancing our downstream Battery Anode Material project to capitalise on the available margins and exponential growth in the global battery market
- In doing so we are deeply commercially engaged with the major consumers in the traditional and downstream markets building baseload contractual relationships – including that with BTR, the world's largest battery anode manufacturer
- Optionality for rapid, significant expansion at low capex



# Appendices

Summing

Corporate / Finance









### **Our vision and values**

Syrah's vision is to be the **leading supplier** of **superior quality graphite products**, working closely with our customers and supply chain to innovate and bring **enhanced value** to **industrial** and **emerging technology markets** globally.

#### Syrah is committed to:

- WORKING SAFELY at all times
- PARTNERING WITH STAKEHOLDERS for community and environmental sustainability
- INTEGRITY and FAIRNESS in all our business dealings
- Being **ACCOUNTABLE** for all our decisions and actions
- **SETTING GOALS** and supporting people to achieve them

We will work as a team and act as owners.





### **Capital structure**

#### **Key details**

Shares on issue (as at 17 May 2017)	263.8m
Options on issue (as at 17 May 2017)	9.3m
Unlisted performance rights (as at 17 May 2017)	0.8m
Cash as at 31 March 2017	US\$134.9m
Debt as at 31 March 2017	Nil

#### Geographic analysis of investors<sup>(1)</sup>



Source: Company filings, IRESS





### Short sell volume over the last 12 months





### **Board of directors and executive management team**



Jim Askew Non-Executive Chairman Over 40 years of experience as a Director / CEO of Australian and international publicly mining companies



Sam Riggall
Non-Executive Director

Over 20 years of experience in mining project generation and evaluation, business development and capital market transactions



Dr. Christina Lampe-Onnerud Non-Executive Director Founder of Boston Power and over 20 years of experience in the lithium ion battery sector



Rhett Brans Non-Executive Director Over 40 years experience in the design and construction of mineral processing facilities and extensive African experience



José Caldeira Non-Executive Director Pre-eminent legal and regulatory professional in Mozambique with over 25 years experience



Shaun Verner Managing Director & CEO

Previously a senior sales and marketing executive at BHP Billiton



Darrin Strange Chief Operating Officer

25 years of experience in mining, manufacturing and engineering firms in Australia and internationally



Rob Schaefer Chief Commercial Officer

Extensive sales, marketing and finance experience in the resources industry with senior roles at WMC Limited, BHP Billiton and most recently MMG Ltd



David Corr Chief Financial Officer

Over 15 years of experience in the resources industry in Australia and internationally

## Solid balance sheet with no debt (as at 31 Mar 2017)

□ Fully funded to deliver the development of the Balama Project

US\$50 million to fund working capital requirements for the Balama Project through to positive cash flows across a range of reasonable assumptions





Balama Project



## Across the graphite value chain, a consistent, high quality supplier can capture attractive margins

	Flake Graphite	Uncoated Spherical	Coated Spherical				
Products							
Cost	US\$300/t <sup>(1)</sup>	US\$2,300/t <sup>(2)</sup>	US\$3,200/t <sup>(3)</sup>				
Current Price	US\$575/t - US\$1,100/t <sup>(4)</sup>	US\$2,800/t - US\$4,000/t <sup>(5)</sup>	US\$7,000/t - US\$10,000/t <sup>(2)</sup>				
	Mozambique	Louisiana					

Syrah's strategy is to **capture enhanced value** by positioning itself as the **leading**, **high quality** and **consistent** supplier to the **high growth technology markets**.

- (2) Based on Syrah's market inquiries
- (3) Syrah internal economic assessment refer to ASX announcement dated 18<sup>th</sup> June 2015 for coated figures
- (4) Based on Benchmark Minerals 2017 price data
- (5) Based on Benchmark Minerals 2017 price data for 15µm (D50) spherical graphite product



<sup>(1)</sup> Initially achieve a C1 production cash cost of <US\$400 per tonne in the first 12 months (with later progression to less than US\$300 per tonne)

## Majority of incremental demand growth is for smaller sized flake used in the battery sector



Source: Syrah Resources, Benchmark Minerals, Industrial Minerals

Notes: 1. April 2017 prices. Market value based on today's prices. Prices based on a 90% to 95% concentrate product, FOB China and CIF EU. Syrah Resources will be producing a 98% product. 2. Steel products include crucibles, foundries, recarburizer and refractories 3. Based on full production capacity

## Low risk and low cost mining drives a significant competitive advantage

- Conventional truck and shovel mining methods
- □ Mining 2 Mtpa at a very low average strip ratio of 0.04:1 projected over the life of mine
  - Strip ratio is inclusive of economic low grade ore (> 2% to < 9% TGC) which will be stockpiled for processing in the future</p>
  - Approximately 2 million tonnes of low grade (> 2% to < 9% TGC) material will be stockpiled per annum over the first 10 years of operations
- Following completion of open pit mining at Balama West, operations will shift to the pits in Balama East followed by Mualia
- Sufficient Ore Reserves to support operations for almost 60 years of production and provides opportunity for both mine life extensions and production increases
- Syrah's Mining Concession (issued on 6 December 2013) covers a 25 year period and is renewable for a further term of 25 years



## Balama commissioning will be staged sequentially to commence as section construction completes

- Wet commissioning of the processing plant remains on schedule for Q2 2017, followed shortly afterwards by ore commissioning
- Commissioning will be staged to be completed in parallel with construction completion
- □ The stages used in the Commissioning are C1 to C4:
  - Construction Verification (C0)
  - Dry Commissioning (C1) No-load energisation
  - Wet Commissioning (C2) Running with water and air
  - Ore Commissioning (C3) Initial introduction of ore
  - Optimisation (C4) Tuning to enable capacity and product specifications to be achieved.



Balama ore commissioning sequence overview



## Traditional and developing markets for graphite offer a multi-channel marketing opportunity

#### **Traditional markets**

- Refractories act as protective insulating materials in industrial processes which involve extremely high temperatures, corrosive and abrasive environments
- Lubricants used to reduce friction between moving surfaces e.g. additive in petroleum oil or aerosol
- □ Industrial products devices, shapes and products e.g. brake pads, pencils and graphite foils
- Recarburisers carbon additive used to increase the carbon content of steel up to the required specification for different applications
- Lead acid batteries used in the electrodes as an electrically conductive additive to help extend the battery's life-cycle and improve the charging process

#### **Developing markets**

- Battery anode materials coated spherical graphite is used in the manufacture of anodes in lithium ion batteries for electric vehicle and energy storage applications
- **Expandable graphite** used as a fire retardant and to prevent oxidation and heat loss in metallurgical application



## Non-metallic and metallic properties of flake graphite ensure the largest variety of applications



**Technical:** Electrodes for steel and aluminium production, expandable, brakes, flame retardants, nuclear reactors. **Other:** Pencils, lubricants, paints.

#### Chinese exports have been on a downward trend since 2011 due to the reduced availability of export quality material



#### **China Flake Graphite Exports**

Source: Syrah Resources, Ministry of Land and Resources

### How much does an additional GWh of battery production impact flake graphite demand? It depends...



Source: Syrah Resources Notes: 1. Nominal 60kWh advertised to consumers contains ~75kWh absolute capacity to compensate for lifetime capacity fading.



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**BAM Project** 



### Blending natural and synthetic graphite in anodes enables a balance of performance and cost



#### Anode capacity and graphite type penetration

Volume



## Why does product qualification take time?

- Demonstrating consistency in product across the qualification period places Syrah in a strong position
- Observed demand pressure on raw material supply is assisting in building relationships and facilitating collaboration with key customers





## **Establishing a Louisiana Product Qualification Plant** will accelerate commerciality



- Detailed design completed and in discussions with US authorities on location and permitting
- □ The plant will consist of a full scale production line
- □ Necessity for a Qualification Plant:
  - Satisfies customers' timing requirement for commercial scale product qualification (minimum 6 month period) prior to issuing Product Purchase Orders
  - Accelerates sales and cash flows from the Commercial Plant by allowing product qualification and sales to occur prior to the commencement of full production
  - > Pathway to early cash flows through sales to Morgan Hairong for coating Louisiana product in China

USA based **Product Qualification** will **accelerate sales** and **cash flows** from the Commercial Plant by **fast tracking product qualification** by customers



### A Perth based Technology Centre will provide sales and marketing data and optimise process development



Currently specifying design, coordinating spheroidisation of material and purification tests

- Syrah's spherical graphite milling machines in China will be relocated to Perth in mid-2017:
  - > Process training early training and manual preparation for knowledge transfer to the Commercial Plant
  - Optimisation development ongoing test work to optimise product yields, quality and consistency
- Building out our proprietary data-bank which aids our marketing and product development efforts

Perth based Technology Centre focused on process training and optimisation development.

