

# Alabama Graphite

**Metals & mining**
**3 March 2017**

## Perfectly located for US electric car market

Alabama Graphite's Coosa Graphite Project in Alabama positions the company to be the key producer of natural battery-ready, coated spherical purified graphite (CSPG) for the US. Logistically it is well situated to supply the US growth markets for lithium ion batteries for the fast-growing green energy market, including electric car batteries. Importantly, its focus on higher-value purified battery-ready product in the form of CSPG means it will not be selling the pre-cursor graphite concentrate, as is currently the emphasis of the junior graphite sector. This note is an introduction to Alabama Graphite ahead of our full initiation of coverage in Q217.

## Coosa CSPG proven to be suitable for LiB

Alabama has completed primary and secondary processing studies on Coosa's graphite; these are required steps to confirm the natural graphite can be used in LiB manufacture. Results have been highly positive, with the key reversible capacity factor close to the theoretical maximum (367.21mAh/g vs the maximum of 372mAh/g). Reversible capacity is the capacity of a material to hold charge consistently and reversibly achieved upon cycling.

## Focus on US could bode well for Coosa

Located in the US state of Alabama, Coosa should be relatively well insulated from any political risk associated with the sourcing of potentially strategic commodities such as graphite, from outside the US border. Its location plays perfectly to Elon Musk's (Tesla Motors CEO) stated desire to source all raw materials from within the US for Tesla's 35GWh output battery-making factory in Nevada. Further, the company announced on 2 March that it has held high-level government discussions, specifically with Alabama state senator, Richard C Shelby. These discussions covered a multitude of topics, including the security of supply of an environmentally friendly and America-sourced supply of battery-grade graphite, and the potential for Coosa to feed into Department of Defense applications.

## Valuation: PEA highlights high operating margins

With an estimated PEA (November 2015) level operating cost for Coosa production stated at US\$1,555/tonne, its operating margin on a production weighted basis is 79%. Compared to the operating margins of concentrate-only graphite companies, this would rank Coosa in the top quartile. The PEA NPV calculated using an 8% discount rate is US\$444m post-tax and US\$320m pre-tax. Coosa's internal rate of return is 45.7% post-tax and 52.2% pre-tax. Life-of-mine gross revenues are estimated at US\$2.4bn, and life-of-mine operating expenses total US\$533m. We will assess the valuation when we initiate full research coverage in Q217.

### Historical financial results

Year end	Revenue (C\$m)	PBT (C\$m)	EPS (c)	DPS (c)	P/E (x)	Yield (%)
08/15	N/A	(1.7)	(1.0)	0.0	N/A	N/A
08/16	N/A	(2.2)	(2.0)	0.0	N/A	N/A

Source: Alabama Graphite accounts

**Price** **C\$0.21**  
**Market cap** **C\$29m**

### Share price graph



### Share details

Code	CSPG
Listing	TSX-V
Shares in issue	136.4m

### Business description

Alabama Graphite is positioning itself as a major natural flake graphite producer in the US, and a principal supplier of battery-grade natural graphite to the green technology sector, in particular the manufacture of lithium-ion batteries (LiB). Its main project, Coosa, is strategically located in Alabama, US.

### Bull

- Contiguous US location.
- Secondary purification processes proven viable.
- Coosa geared to highest-growth LiB manufacturing sector only.

### Bear

- Natural graphite market still small.
- Electric vehicle market still small, though high growth.
- Project study financing risk.

### Analysts

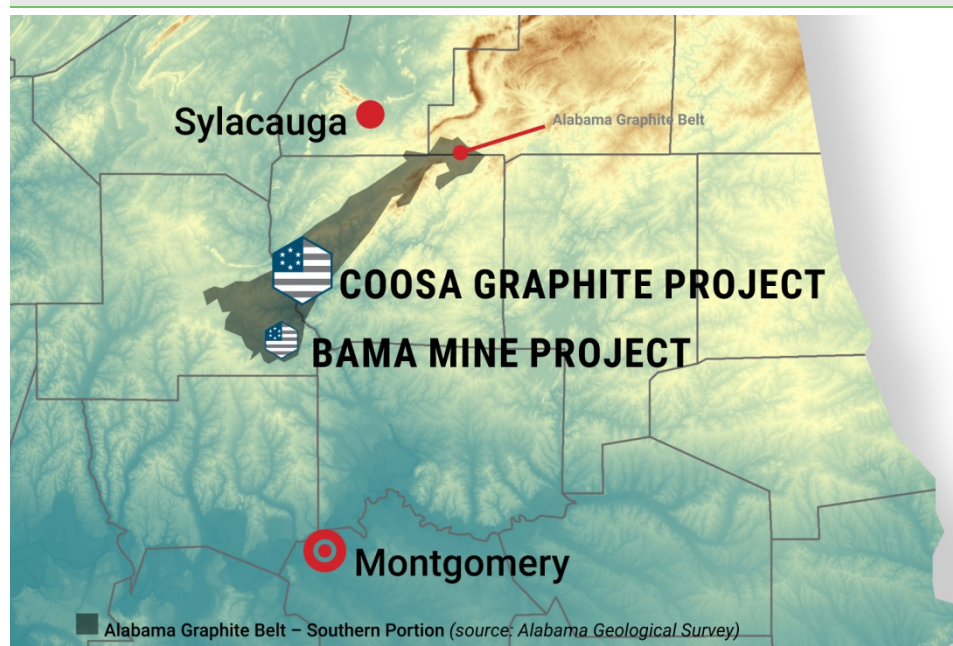
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## Coosa: Graphite for direct sale to battery makers

Alabama's Coosa graphite project stands apart from the majority of its graphite peers on the basis that it is focused on producing natural graphite for batteries rather than simply producing a graphite concentrate that would be sold to third-parties for secondary processing, including purification, micronization, spheronization and surface treatment, to produce a battery-grade graphite product. This is a key differentiator for Alabama which, in combination with being located in the US, means it is very well positioned to serve the country's nascent but high-growth electric car and battery makers, including US Department of Defense battery manufacturers and contractors. Further to these differentiating factors, Coosa's graphite has been proven to yield battery-grade material that exceeds current battery-making criteria.

**Exhibit 1: Coosa and Bama Mine project locations in Alabama, US**



Source: Alabama Graphite

### Initial lab works achieve positive purification results

In 2016 Alabama sent graphite samples to an undisclosed (which is not unusual for this type of commodity) North American laboratory for initial purification testing. To be clear, this test work is a step beyond the typical primary flotation testing performed by the majority of graphite peers. The laboratory performed a non-toxic conventional low-temperature thermal purification process, which we believe is crucial to expedite regulatory approval processes.

### Test results exceed nuclear grade requirements

On 17 February 2017 Alabama announced test results demonstrating that Coosa graphite, via the company's proprietary low-temperature thermal purification process, can achieve 99.99997% graphite purity. This exceeds the requirements for graphite used in nuclear applications, such as pebble bed reactors. Alabama's proprietary technology does not use hydrofluoric acids (such as can be used in the manufacture of Chinese graphite products) or sulphuric or nitric acids. Further, the process does not use alkali roasting or caustic soda roasting methods. Alabama states that its proprietary processing methods do not need vast amounts of clean water or energy-intensive, high-temperature thermal upgrading. Its proprietary process method should thus position it well for

Coosa's development in light of the sometimes onerous environmental regulatory approvals required by the US Environmental Protection Agency.

### 99.99% purity achieved across all flake sizes

A separate set of purification tests was also performed on Coosa's concentrate samples created by SGS Laboratories in Lakefield, Ontario. The flotation samples purified by the undisclosed laboratory are stated to be representative of the entire resource. The 99.99% CG purity was also achieved across all flake sizes, further demonstrating that purity, ahead of flake size, is the critical path factor in determining graphite resource suitability for LiB manufacturing purposes. The purification process used is a conventional low-temperature thermal process. Further, the purification process achieved the 99.99% purity level without any need to optimise the method used, demonstrating the ease at which Coosa's graphite purifies.

#### Exhibit 2: Backscattered electron micrograph showing 99.99997% purity Coosa graphite

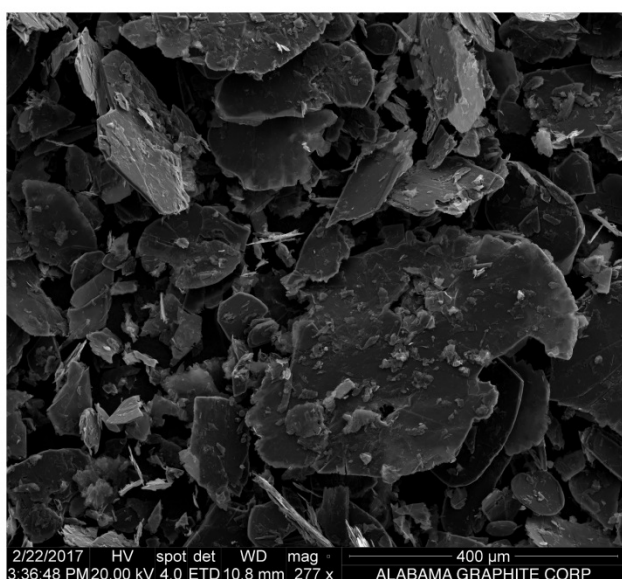


Image 1a

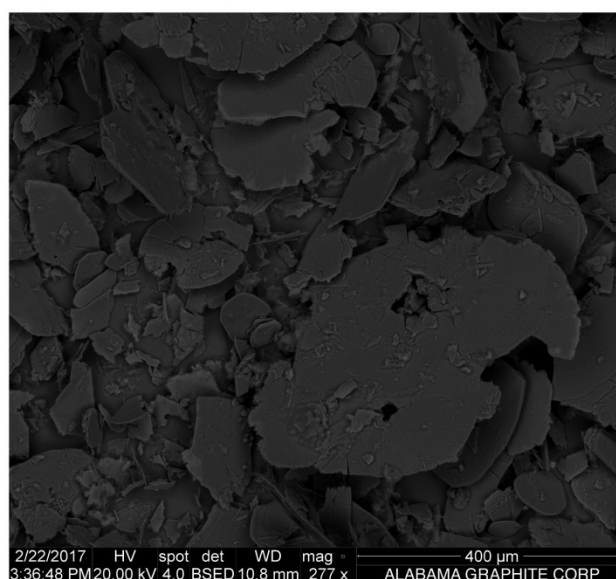


Image 1b

Source: Alabama Graphite

### Close to the theoretical maximum for reversible capacity

Reversible capacity is the capacity of a material to hold charge consistently and reversibly achieved upon cycling. This is a critical path factor in determining the suitability of natural graphite for use in LiB manufacturing. Alabama's positive results (Exhibit 3) were close to the theoretical maximum.

#### Exhibit 3: Alabama's reversible capacity data

CR2016 Li-ion battery anode	Reversible capacity	Irreversible capacity loss	BET surface area
ULTRACSPG Natural Graphite D50 = 18.3μm	367.21mAh/g	5.09% (94.61% efficient)	0.62m <sup>2</sup> /g
Commercial Lithium-ion Synthetic D50 = 15.8μm	347.2mAh/g	5.09% (93.94% efficient)	1.15m <sup>2</sup> /g

Source: Alabama Graphite

### Coosa resource: Large enough for purpose

Alabama's code-compliant resource estimate is presented in Exhibit 4 below. While this is a much lower grade in terms of raw graphitic carbon content, it should not be dismissed as marginal or un-economic at this stage (Alabama is yet to produce a feasibility study on Coosa). Indeed, the

company's Coosa project is located in a well-known historical graphite producing region, and while mining and processing techniques would have been primitive during the 19<sup>th</sup> and early 20<sup>th</sup> century, compared with today's mining standards this past production at least suggests potential economic viability for mining Coosa again. Indeed, the soft and shallow depths seen over Alabama's graphite resource bodes very well for free digging a significant portion of the resource, which should translate into lower mining costs and help offset the lower graphite grades present. Coosa's strip ratio is a very low 0.11:1 (waste to ore). Further, mining (as per the PEA, page 4) could potentially initially only take place over 10% of the resource within the highly weathered and soft oxide zone.

**Exhibit 4: Coosa mineral resource**

Resource category	Tonnage (tons)	Metric tonnes	Graphitic carbon (%)	In-situ/contained graphite (tons)	In-situ/contained graphite (tonnes)
Indicated	78,488,000	71,203,136	2.39	1,876,000	1,702,000
Inferred	79,433,000	72,060,426	2.56	2,034,000	1,845,000

Source: Alabama Graphite

## PEA highlights very low capex, and purified opex costs

Alabama published a preliminary economic assessment on Coosa in November 2015; however we expect revenue and cost assumptions to change in any upcoming feasibility study performed on Coosa, with special recognition that price assumptions used in the PEA may not adequately reflect the current expectation of battery manufacturing growth. The PEA study outlines the development of a conventional surface, open-pit operation using standard excavating and haulage equipment. The mining of Coosa graphite will take place over a planned 27 years. Material will be sent to the company's secondary processing plant, 19 miles south of the Coosa project to Rockford, Alabama initially to produce 5,000tpa of high-value secondary purified graphite products for sale into the LiB manufacturing sector and also potentially to the US Department of Defense for military applications. The company has not yet defined a code-compliant reserve estimate that would allow us to call the material ore. This initial phase of development is estimated to cost a very low US\$43.2m. We have not provided a capital intensity figure (US\$/t of product) as Coosa will not produce a concentrate, which is the current norm for its graphite peers.

Per the PEA, a secondary phase of expansion is planned in year five of the mine's operation, costing an additional US\$84.4m, and adding a further 11,000 tonnes of production capacity. Alabama Graphite intends to fund this expansion via the company's free cash flow.

The PEA NPV calculated using an 8% discount rate is US\$444m pre-tax, and US\$320m post-tax. Coosa's internal rate of return is 45.7% post-tax and 52.2% pre-tax. Life-of-mine gross revenues are estimated at US\$2.4bn and operating expenses total US\$533m.

We will include this data in our proprietary financial model and generate a fully diluted base-case valuation and full suite of sensitivities analyses when we initiate full coverage on Alabama Graphite in Q217.

The future Coosa operation outlines the production of two high-value, high purity graphite products. The first will constitute 75% of planned output and be a CSPG product, with the remaining 25% of output being purified micronized graphite (PMG) product. According to Alabama, the selling price for CSPG is US\$8,165/ton (US\$9,000/tonne) with PMG US\$1,814/ton (US\$2,000/tonne). The sale of CSPG at around US\$9,000/tonne compares with flotation concentrate selling prices that currently trade below US\$1,000/t.

## Coosa could rank in top quartile of concentrate producers

With an estimated PEA level operating cost for Coosa production stated at US\$1,555/tonne, its operating margin on a production- weighted basis is 79%. Compared to the operating margins of



concentrate only graphite companies, Coosa would rank in the top quartile. We will provide further detail of this analysis in our full initiation report.

## Management: Extensive graphite experience

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We highlight the extensive and crucial experience of Alabama's current CEO, Don Baxter. Mr Baxter, formerly president and COO at Focus Graphite, has over 25 years of specialist graphite industry experience, from mining, exploration and development through to sales, marketing and business development. This is highly advantageous to Alabama and the development of Coosa, particularly with graphite being very complex to understand and develop.

We also highlight the following Alabama management and note the in-depth graphite experience of the team.

- **Executive vice president Tyler Dinwoodie** has experience in both the graphite sector and also marketing in the mineral commodities space, spanning more than two decades. Most recently, he has served as a marketing and communications consultant for Alabama Graphite, having previously served as senior VP of marketing for Focus Graphite, as well as a marketing, communications and strategic consultant for other graphite development companies.
- **George C Hawley** has over 50 years of specialist graphite experience encompassing nuclear, chemical, rocket nozzles, anodes, friction materials, heat management, electrodes and carbon brushes. A member of the US Society of Plastics Engineers, American Chemical Society and the Society of Mining Engineers.
- **Randy A Moore** is the former president of the US Department of Defense lithium-ion battery manufacturer, EaglePicher Technologies. EaglePicher is the leading producer of high-reliability batteries and energetic devices for the defence, aerospace and commercial industries, and provides the most experience and broadest capability in battery electrochemistry of any battery supplier in the US. Mr Moore led EaglePicher for nearly eight years until the end of 2015.
- **Dr Gareth P Hatch (independent director)** holds a Bachelor of Engineering degree with honours in materials science and technology and a doctorate in metallurgy and materials, focused on rare earth permanent-magnet materials. He is a Fellow of the Institute of Materials, Minerals & Mining (IOM3), a Fellow of the Institution of Engineering & Technology (IET), a chartered engineer registered through the UK Engineering Council and a senior member of the Institute of Electronic and Electrical Engineers (IEEE). He is also a member of the Strategic Materials Advisory Council based in Washington, DC.
- **Jean Depatie (chairman of Alabama's board) and Daniel Goffaux (independent director):** Mr Depatie and Mr Goffaux discovered the orebody and subsequently built the world's largest graphite mine in Québec in the early 1990s – the Stratmin Lac-des-Îles Graphite Mine in Québec (now Imerys Graphite). After only two years of production, Stratmin Lac-des-Îles was selling graphite in more than 16 countries. It should be noted that there was only one other graphite mine in North America at the time and Don Baxter (then a mining engineer) was running it, mining, processing and overseeing the sale of thousands of tonnes of graphite.

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