



TALGA
RESOURCES



ASX: TLG

Removing the Volume and Cost Barriers to Graphene Commercialisation

**Graphene
& 2D Materials** 

Technology, Opportunities, Applications
28 - 29 April 2015 | Berlin, Germany

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Executive Summary



- ▶ Talga Resources Ltd ("Talga") ASX:TLG is an emerging advanced materials supply company with operations in Australia, Sweden and Germany.
- ▶ Talga aims to enable large commercial graphene applications which have to date been impeded by absence of bulk supply and prohibitive pricing, by focusing on high-margin large scale production of graphene with graphite by-product.
- ▶ In Sweden Talga owns five 100% owned high grade graphite mineral projects (including the world's highest grade graphite resource*) as well as non-core cobalt, gold deposits.
- ▶ Talga can produce quality graphene direct from natural unprocessed graphite ore which provides unique economic advantages compared to global graphene peers.
- ▶ Small but growing team in Australia and Europe as development status advances rapidly (scoping study complete, European trial mining and demonstration production in train).

High density water-based graphene dispersion from raw ore



*See www.techmetalsresearch.com for global graphite NI43-101/JORC resources.

Talga Europe Operations

Local Industry/Graphene End users

- ▶ Use research as interface
- ▶ Product testing/development

Research, Development and Analytics

- ▶ JV Uni of Dresden/Max Planck
- ▶ Friedrich-Schiller-University Jena



TALGA

German Operations

Talga Advanced Materials GmbH

- ▶ Demo graphene plant site/staff

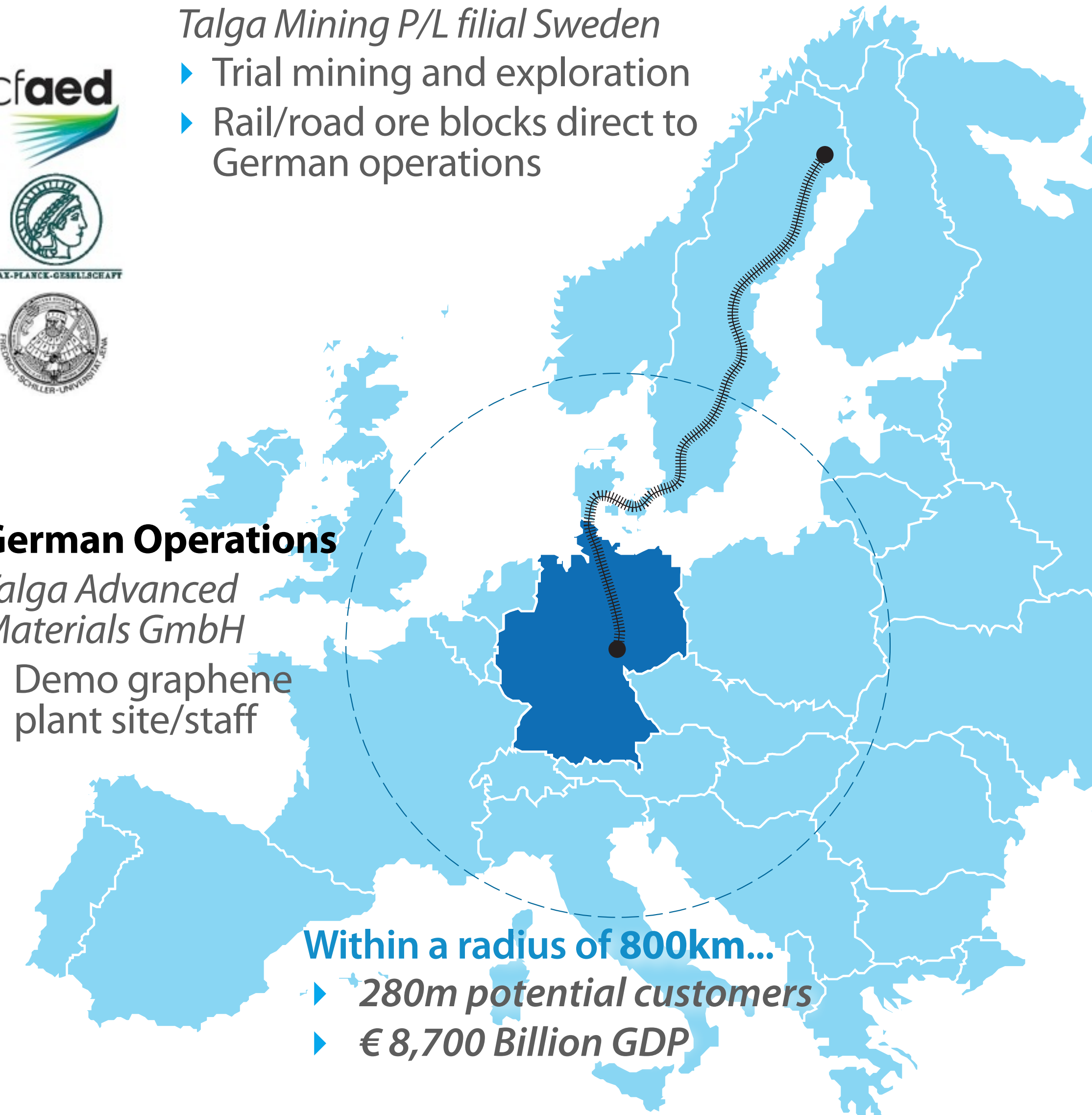
Consultants

- ▶ General Research GmbH
- ▶ Conduit to research, industry, local finance

Sweden Operations

Talga Mining P/L filial Sweden

- ▶ Trial mining and exploration
- ▶ Rail/road ore blocks direct to German operations



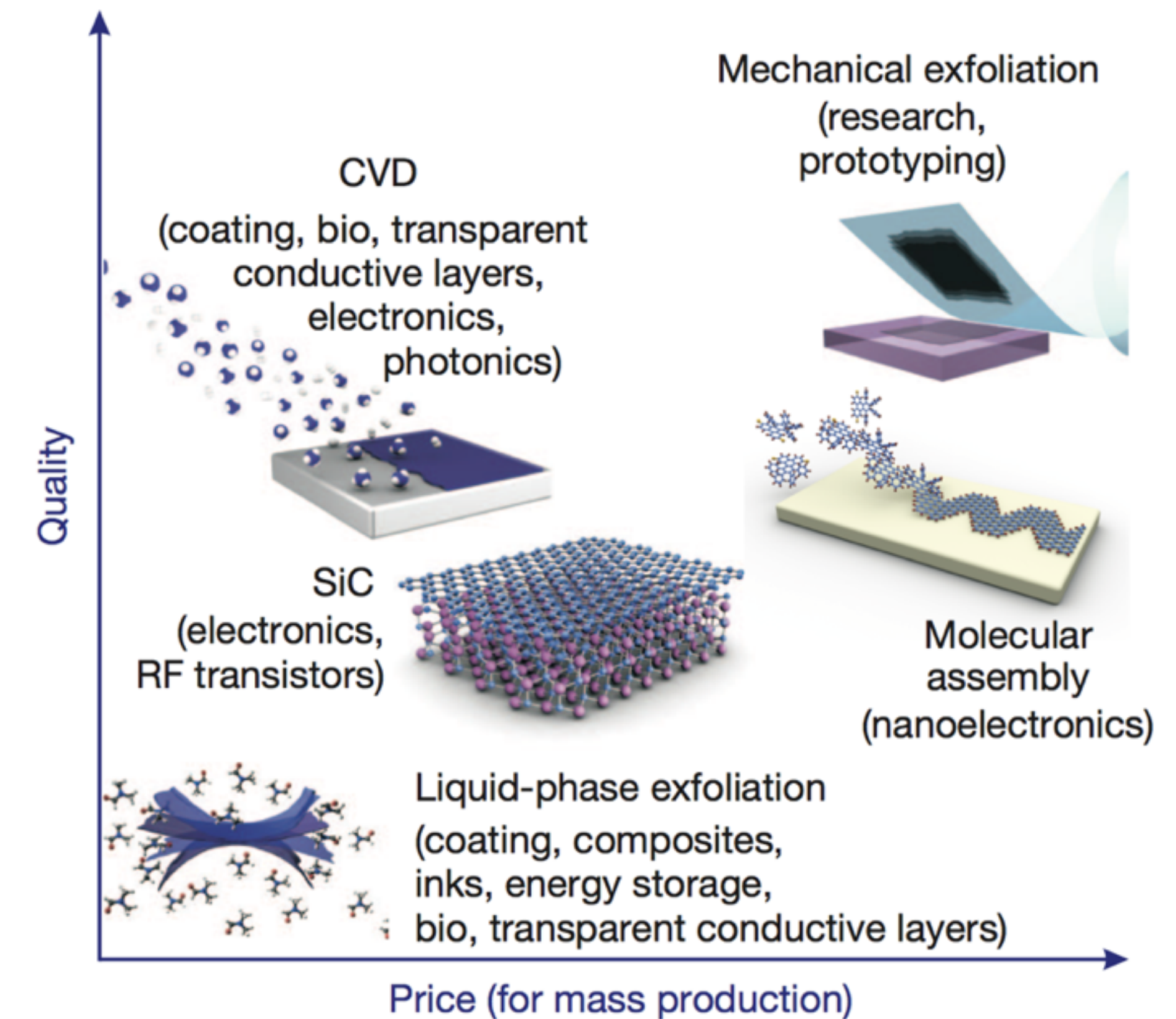
Within a radius of 800km...

- ▶ 280m potential customers
- ▶ € 8,700 Billion GDP

The Graphene Problem

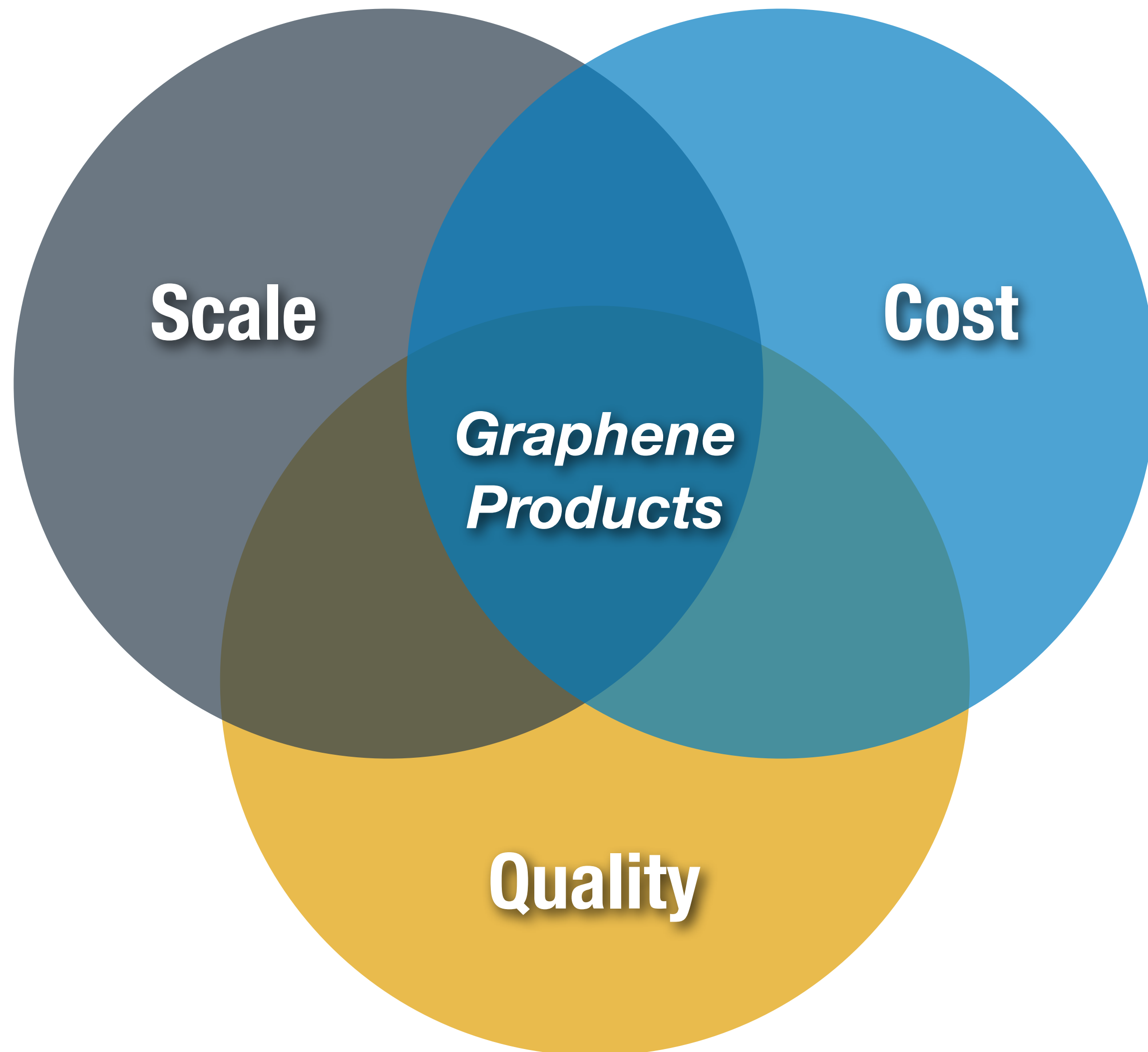
- ▶ Of the many methods of making graphene, most are either very expensive or not able to scale up to industrial requirements.
- ▶ Talga recognises there is an advantage using natural graphite as the precursor as nature has made the substantial energy/pressure/chemical inputs.
- ▶ Natural graphite therefore is already made of graphene (where the fewer the layers the better the properties depending on application).
- ▶ But methods separating natural graphite to a few atoms thick can also be expensive and hard to scale up.
- ▶ Many methods with scale tend to make smaller size particles or lower quality graphene than required by most applications.
- ▶ Oil is a good analogy to graphene - is present worldwide however fundamentals required for commercial success.

Different production methods for graphene; price vs quality (not to scale, or including scalability)



Commercialisation is held back by supply factors

Many applications have arisen from 10 years of graphene research but commercialisation is a question dominated by supply side factors



Main factors delaying uptake of graphene include:

- ▶ Lack of **scale**: most production methods are not scalable to the **large quantities** required to guarantee **long term** supply (>20 years)
- ▶ High **costs**: costs are falling but are still vastly **expensive** compared to most material inputs.
- ▶ Low quality: most bulk methods have inherent limitations on quality that **limit** applications/markets.
- ▶ **Scale and Cost are main constraints** as they have physical limitations while Quality can be manipulated to a degree by many methods.

Graphite to Graphene: do you know the cost?

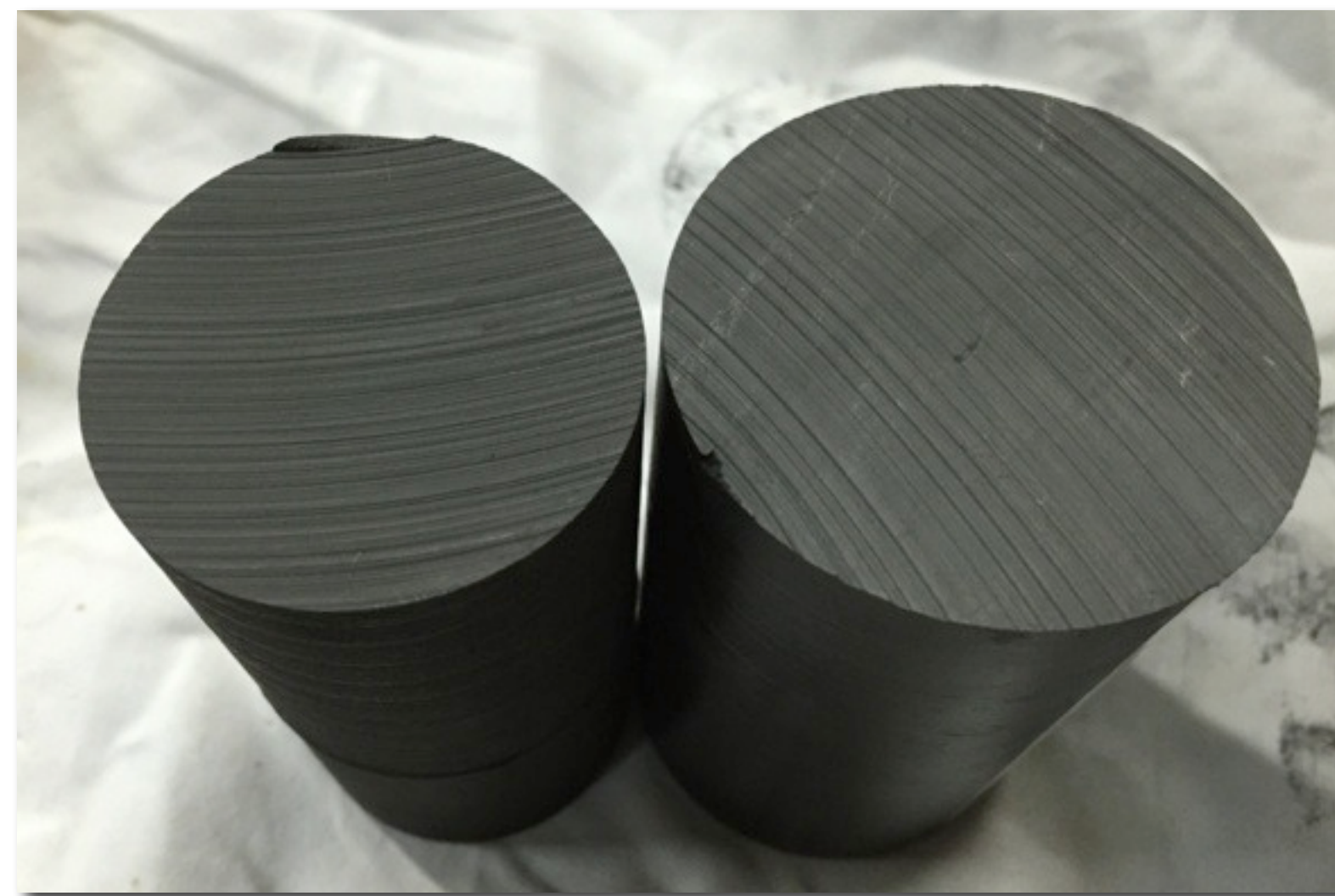


- ▶ Usually natural graphite requires mining, crushing, milling, flotation and other other steps to produce a pre-cursor to make graphene.
- ▶ This induces an environmental footprint from the chemicals, waste disposal, dust, and energy used at each stage.
- ▶ The graphite is blended from different sources and may contain impurities that differ depending on source.
- ▶ At the point of commencing a graphene liberation process, there has been considerable commercial and environmental cost that limit volume and quality and increase costs.
- ▶ Large companies want cleaner supply chains. Applications require consistency.

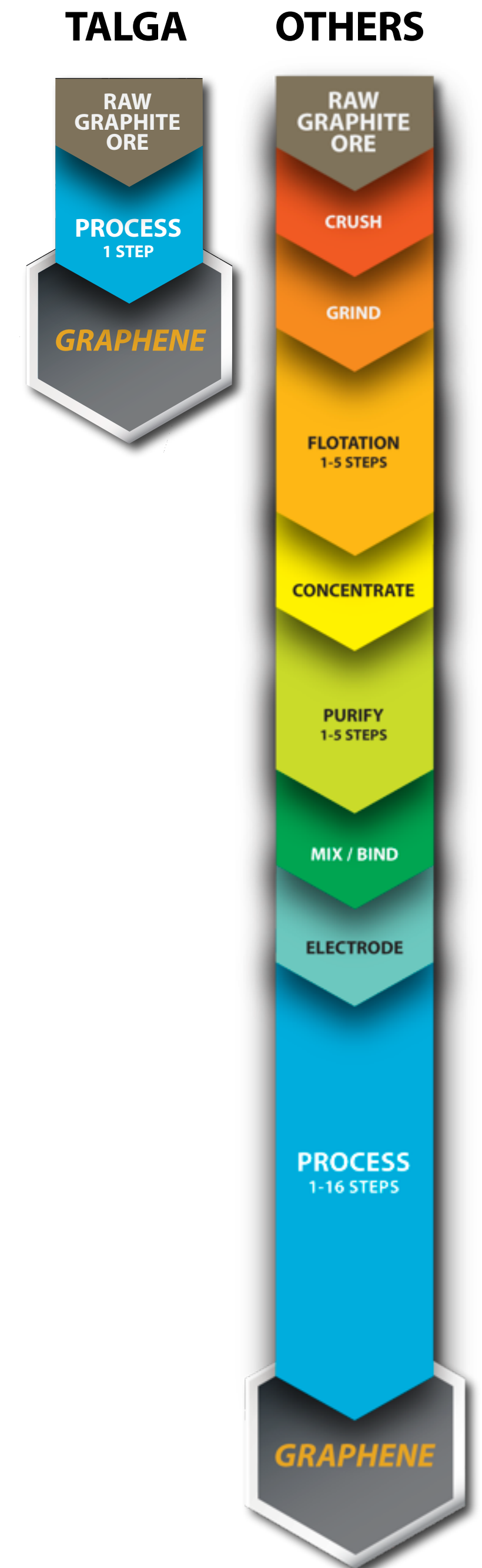
Solution-Talga is Different

- ▶ Talga extracts graphene directly from natural microcrystalline graphite ore using low impact physio-chemical techniques. The benefits include:
 - No requirement for crushing, grinding and usual purification stages that add cost.
 - Entirely scalable to large industrial volumes
 - Lower environmental footprint and emissions
 - Graphite is also recovered as a saleable by-product.
- ▶ Note the photo below - Talga's natural ore (uncrushed, right) has similar characteristics to high purity synthetic graphite HOPG (left), allowing it to have the lowest cost bulk processing pathway to graphene.

*Processed Synthetic
(HOPG) graphite
99.9% grade*

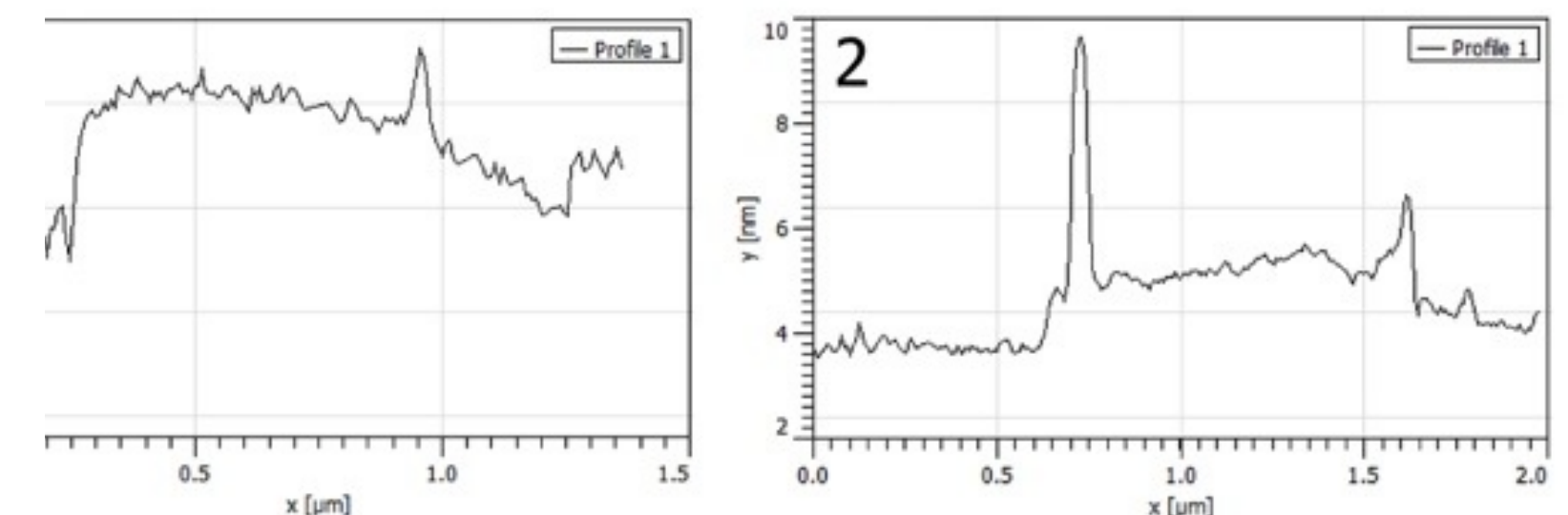
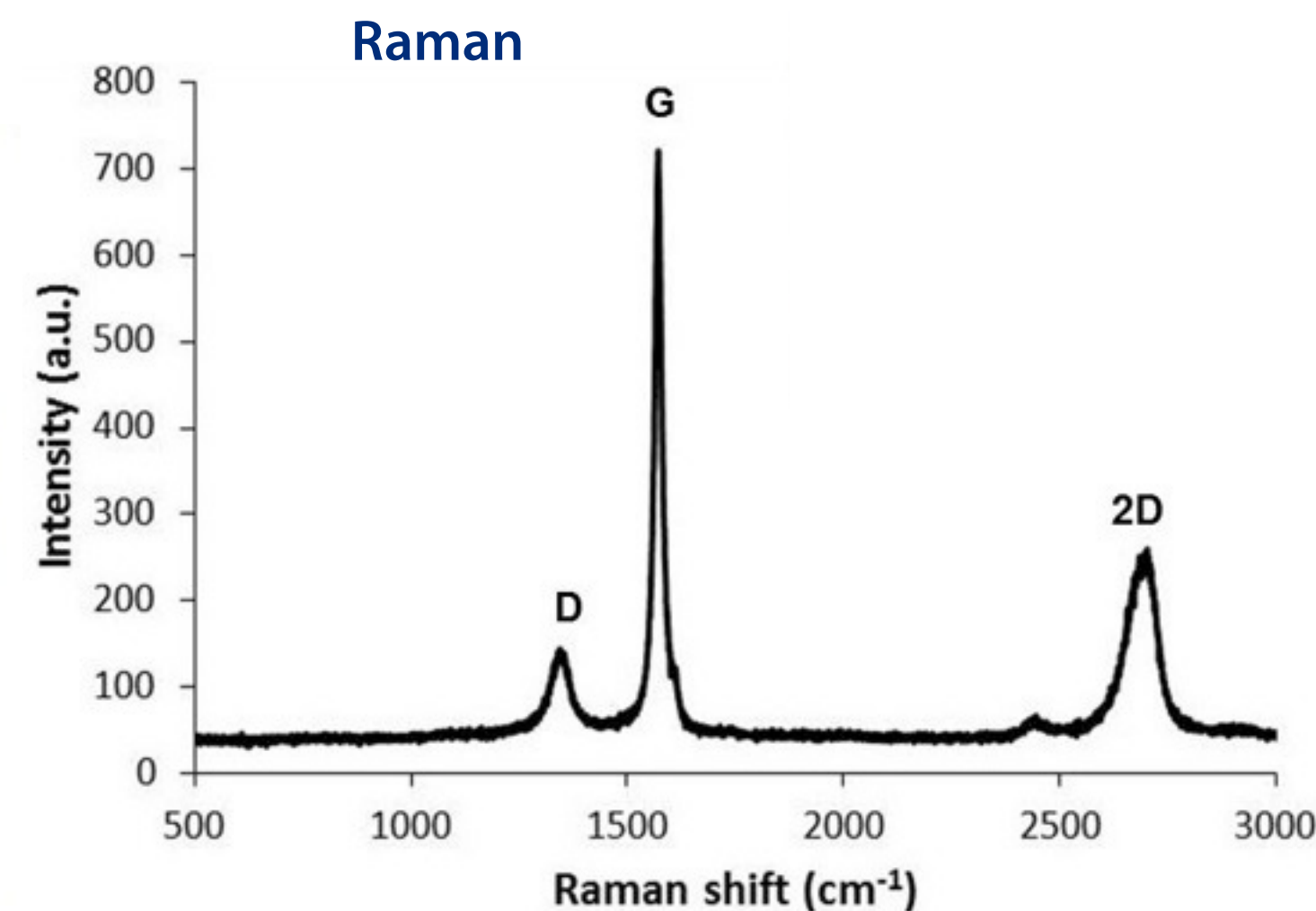
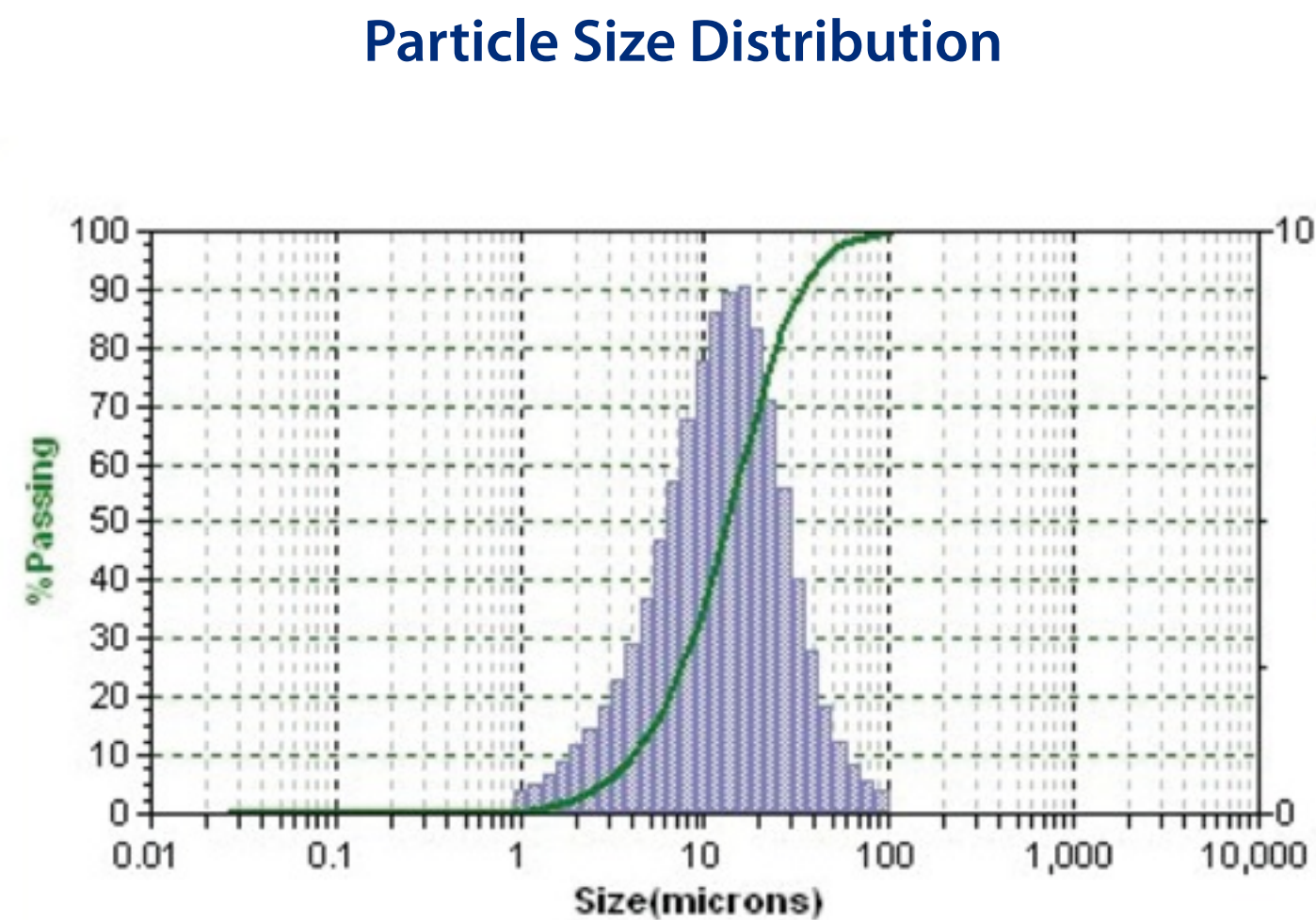
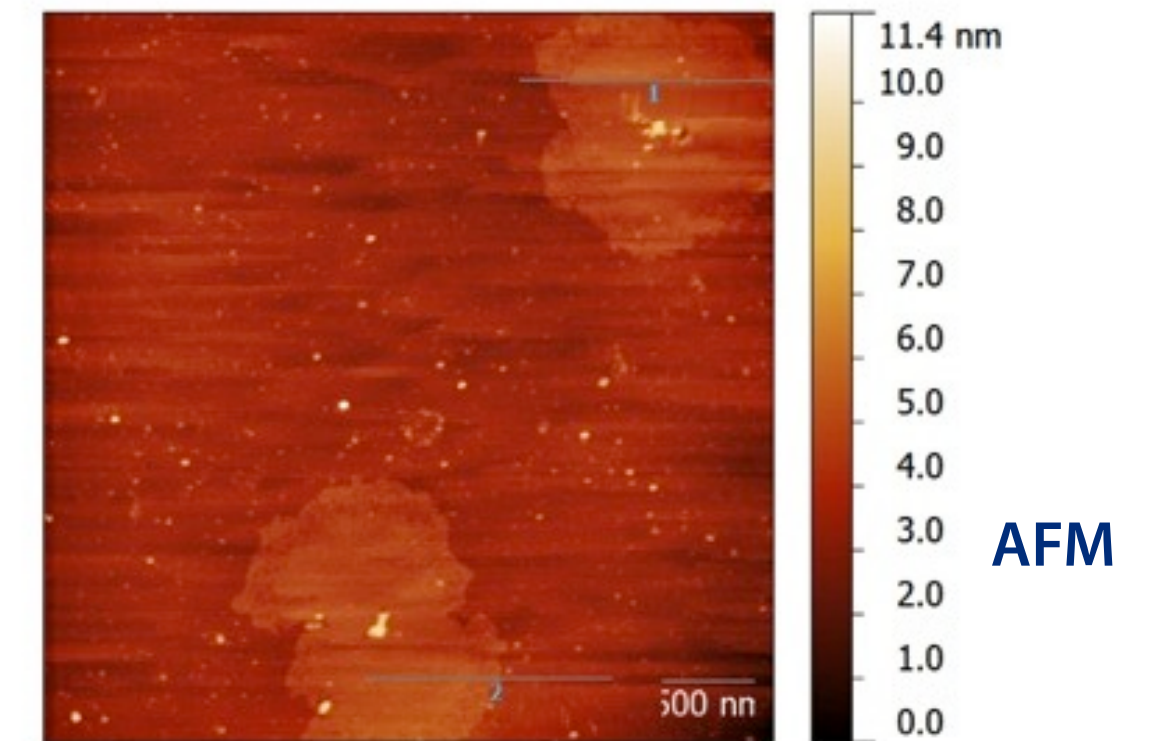
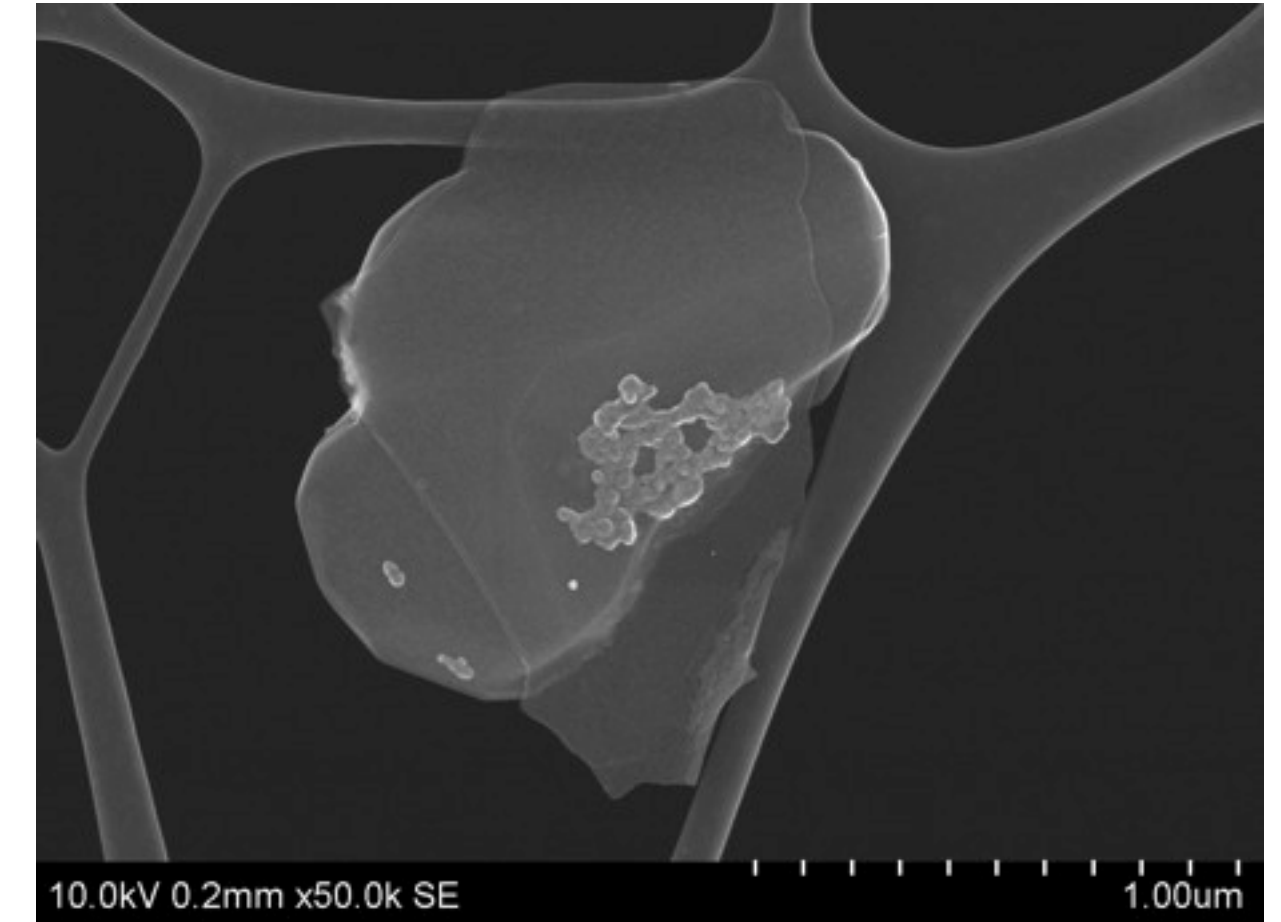


*Unprocessed
Talga graphite rock
24.4% grade*



Graphene direct from natural ore

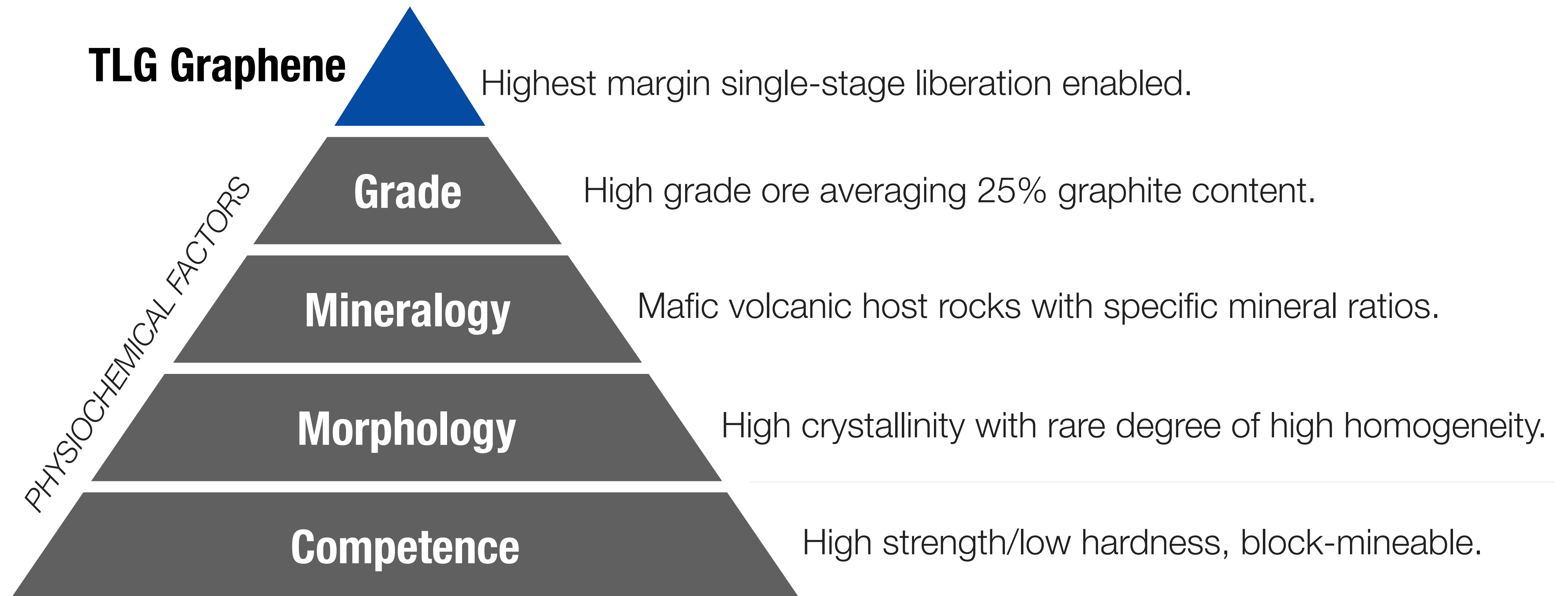
- ▶ Early stage characterisation by 3 universities across 2 countries confirms **high quality** 1-5 layer graphene (FLG) can be exfoliated directly from raw natural rock (unprocessed ore).
 - Low Cost
 - Low Environmental 'footprint'
 - Rapid Production
 - High Yield
- ▶ Is not processed using Hummers or Shear-based methods so retains low defects ($I_d/I_g \sim < 0.2$) and large natural particle size.
- ▶ Can be modified in layers/quality to suit full range of applications/cost.



Layer thickness varies. Profile 1 measures 1 and 2 layer graphene

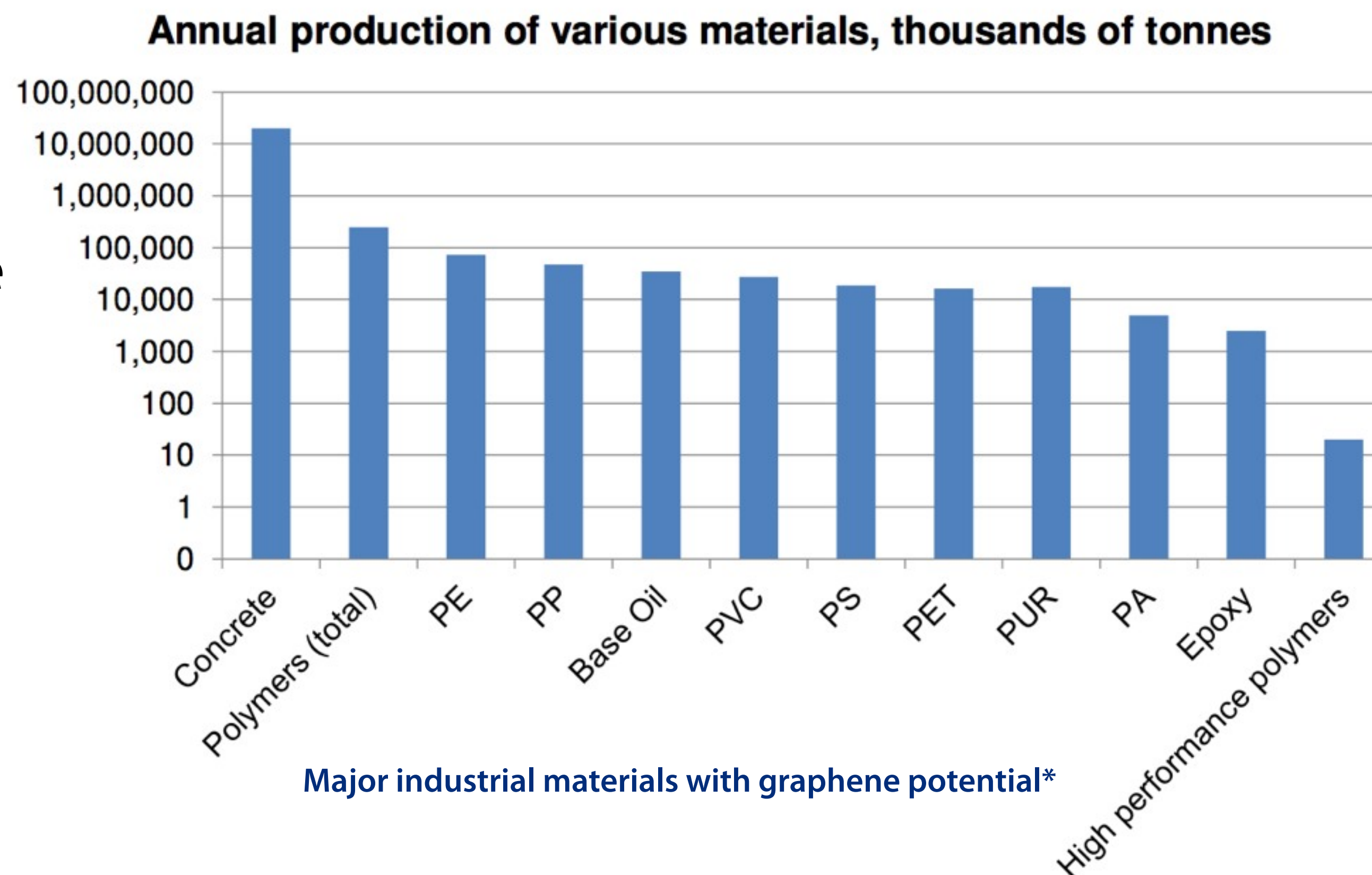
Why Is The Talga Approach Unique

- ▶ Graphite is made from layers of graphene so in theory anyone can produce graphene in a laboratory - but at what volume and cost? Talga ore is differentiator.
- ▶ Talga's production process unlikely to work on other deposits due to multiple physio-chemical factors required for raw ore to liberate graphene without physical comminution.



Markets

- ▶ While the media is excited by future 'hi-tech' applications, the main driver of near term graphene commoditisation is additives.
- ▶ Small amounts of graphene (0.05-2.0% vol) added to many materials can impart exponential increases in strength and/or conductivity enabling stronger, lighter (more energy efficient) products and new types of materials.
- ▶ Major volume markets for graphene include conductive inks, anti-corrosion coatings/galvanics, paints, plastics, carbon fibre composites, battery materials, 3-D printing inks, alloys and concrete/civil materials.



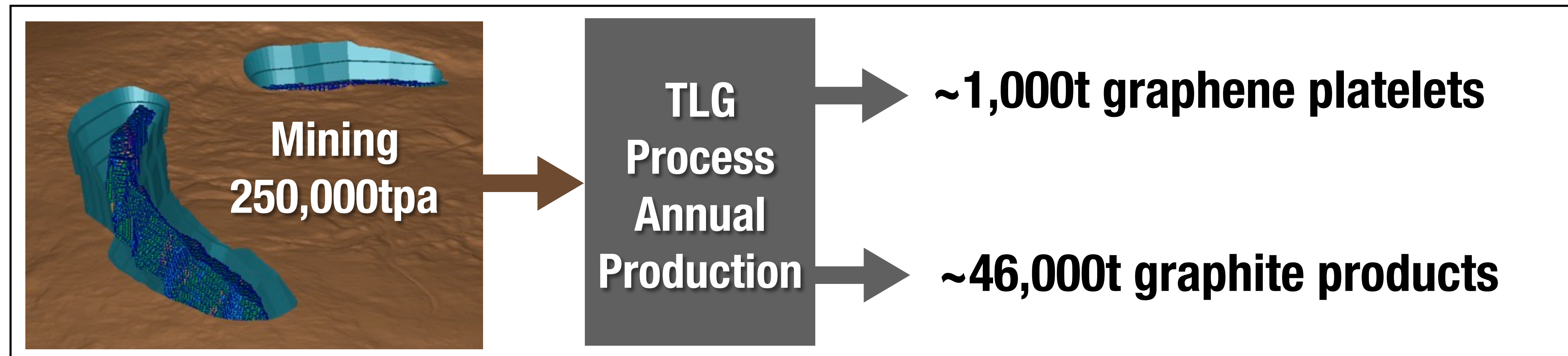
* Source: Fullerex Report for Talga 2014 (unpubl). Note: any data not specifically referenced is based on personal communications with industry participants where appropriate and/or unpublished technical research. See Appendix for further references.



Note: For sources see References in Appendix

Production Model

- ▶ Current aim to sell non-functionalised bulk graphene to large end users developing specific applications for nanoplatelets (polymers, coatings, additives, inks etc).
- ▶ Other future possibilities include licencing parts of the processing technique and equipment, and supplying semi-beneficiated ore for certain segments of the market.
- ▶ Economic study* shows Vittangi project:
 - Capital cost AUD\$29m
 - Minelife ~20yr
 - Pre-tax NPV¹² AUD\$490m using US\$55/kg graphene price on lowest production model



*See Scoping Study released to ASX 9 October 2014.

Full Scale Plant Design (Video)



Development Status

- ▶ Trial mining and demonstration plant provides opportunity for upscaling of technology and products.
- ▶ Lab and Benchtop scale trials complete.
- ▶ Now scaling up to demonstration plant in Germany.
- ▶ Received environmental permitting for trial mining to commence June 2015. First blocks of graphite will be delivered to the demonstration plant in July 2015.
- ▶ The demonstration plant will commission on ~1-2 kg/hr but in 2016 aim to produce ~50-60kg/hr graphene, for samples, product development and potential sales.
- ▶ Company focus is now on commercial relationships to place upcoming graphene and graphite production.
- ▶ Future full scale production planned to take place in Sweden.

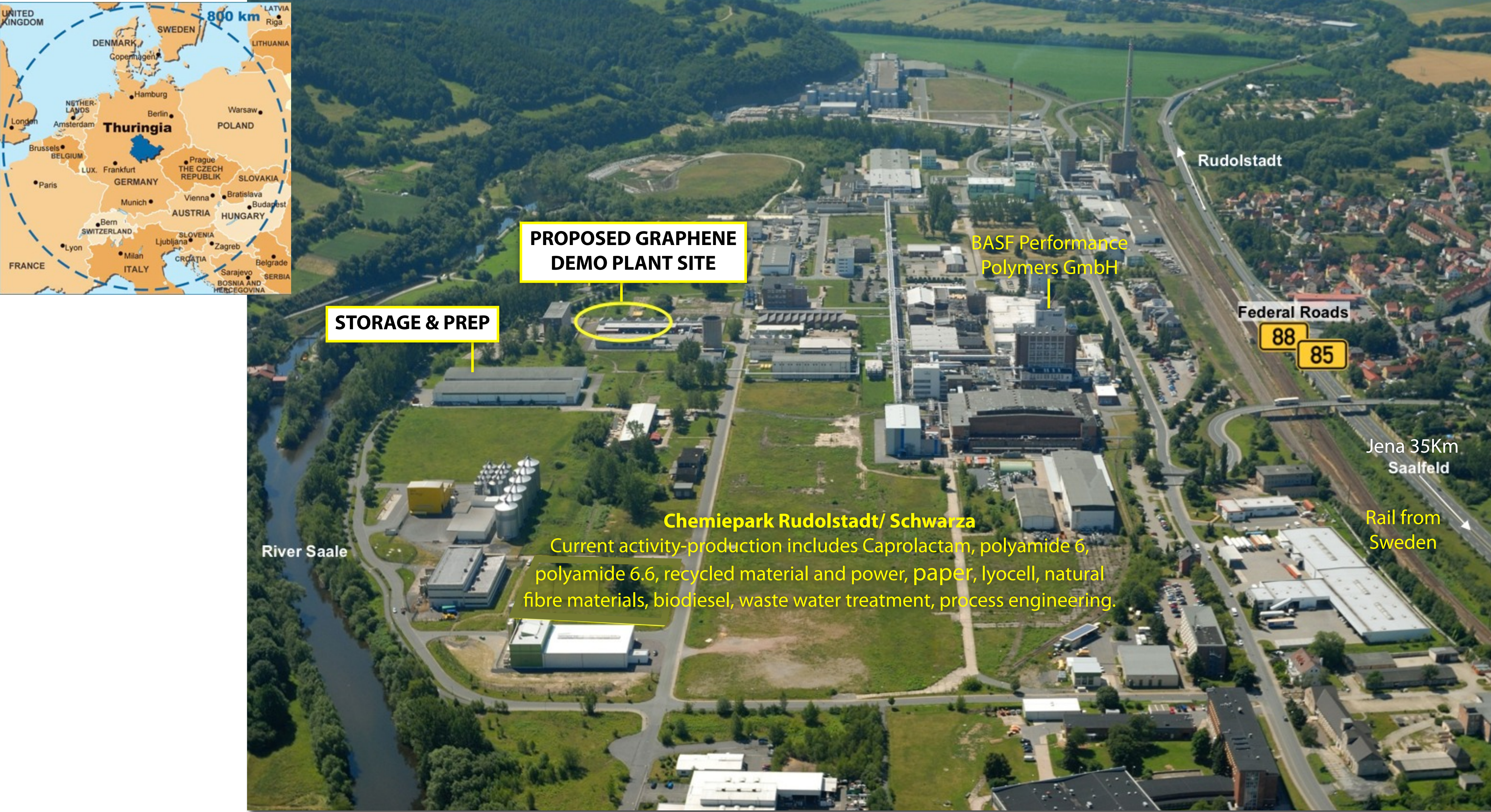
Example of sawn-block mining to be trialled at Vittangi 2015



~1 litre Vittangi graphene powder



Potential Demonstration Plant Site



Milestones on path to full-scale Production



Jan-Jun 2015

- ▶ Environmental permitting for trial mining - **complete**
- ▶ Gold asset divestment - **under option**
- ▶ Further exploration - test Jalkunen JORC Exploration Target for resource - **drilled**
- ▶ Select site for Demonstration Plant - **being finalised**
- ▶ Ongoing euro-based research and end-user collaboration results
- ▶ Ongoing metallurgical development

Jul-Dec 2015

- ▶ Demonstration plant construction in Germany
- ▶ Distribution of larger samples from demonstration plant
- ▶ Ongoing product development with end users
- ▶ IOCG/iron ore assets divestment
- ▶ Further exploration on flagship projects to grow resource base
- ▶ Ongoing permitting for full scale production in Sweden

Jan-Jun 2016

- ▶ Continue scale up of demonstration plant
- ▶ Investigate pre-feasibility study
- ▶ Permitting for second trial mine
- ▶ Begin permitting for aspects of full scale production targeting 2017
- ▶ Ongoing commercial developments with end users.
- ▶ Ongoing permitting for full scale production in Sweden

Financial and Corporate Summary



Capitalisation Summary

Shares on issue (TLG Ordinary)	138.4M
Options on issue (TLGO exp 30/11/15 35c)	7.7M
Unlisted Options ¹	11.9M
Market Capitalisation (<i>undiluted @ \$0.38</i>)	A\$52.6M

Cash: End of March 2015 ~\$6.9m

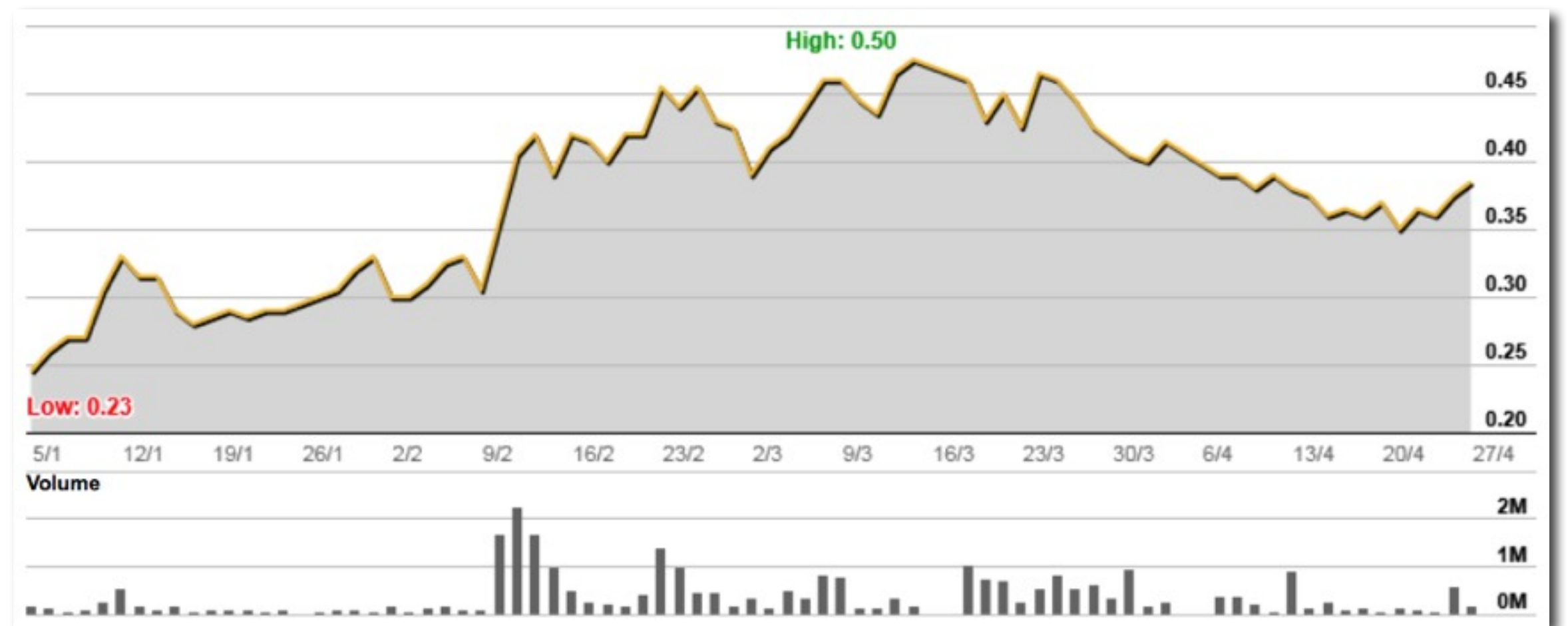
Debt: Nil

Top Shareholders (+3%)

Lateral Minerals Pty Ltd (<i>Mark Thompson</i>)	10.3%
Gregorach Pty Ltd and related co.	7.6%
HSBC Custody Nominees Australia Pty Ltd	5.2%
UBS Nominees Pty Ltd	3.3%

Share Price and Volume Year to Date

ASX:TLG



¹ Various expiry and strike prices with majority exp 2016 at 50-60c

Highlights



- ▶ Have ability to remove volume and price restrictions limiting widespread adoption of graphene.
- ▶ Growth profile of graphene producing resources is immense. Less than 2% of the graphite formation explored.
- ▶ World's highest grade graphite resource* - truly unique ore that facilitates high margin bulk production of graphene - we own assets 100%.
- ▶ Demonstration facility by years end with large samples available for industry.
- ▶ Risk to production reduced with best in class research partners, world class assets in a premier mining destination and small capex requirement.



Demonstration - Talga's graphite ore is naturally conductive enough for a small battery to power an LED globe through the unprocessed rock

Appendices

References

a) Lucintel - global polymer industry 2012_2017 trends forecast June 2012 b) Fullerex Graphene Report 2014 c) McKinsey Global Report 2013 “Disruptive technologies: Advances that will transform life, business, and the global economy” d) www.Directa-plus.com/applications/ e) www.paintsquare.com/news/images/Paint-Market-chart-500px-new.gif f) any data not specifically referenced is based on personal communications with industry participants where appropriate and/or unpublished technical research. *See www.techmetalsresearch.com for global graphite NI43-101/JORC resources.

¹ The Vittangi graphite project Mineral Resource (Nunasvaara deposit) estimate was first reported in February 2012 and has not been updated to comply with the 2012 JORC Code. The Company is not aware of any new information or data that materially affects the information included in the relevant market releases for this estimate. The Company confirms that all material assumptions and technical parameters underpinning the estimate in the relevant market releases continue to apply and have not materially changed. The Company confirms that the form and context in which the Competent Person’s findings are presented here have not been materially modified. In light of the positive results from the Study, Talga and its consultants have closely reviewed the parameters of the JORC 2004 estimate and are satisfied with its use in the context of this Study. A further revision of the estimate will be undertaken in order to move the resource to 2012 JORC compliant status in the near future as part of next stage feasibility studies.

Cautionary Statement

The scoping study referred to in this report is based on low level technical and economic assessments, and is insufficient to support estimation and economic assessments, and is insufficient to support estimation of Ore Reserves or to provide assurance of an economic development case at this stage, or to provide certainty that the conclusion of the scoping study will be realised. The Company confirms that all material assumptions and technical parameters underpinning the scoping study results and projections in this release continue to apply and have not materially changed. The use of the word "ore" in the context of this report does not support the definition of 'Ore Reserves' as defined by the 2012 Edition of the ‘Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves’. The word 'ore' is used in this report to give an indication of quality and quantity of mineralised material that would be fed to the processing plant and is not to be assumed that 'ore' will provide assurance of an economic development case at this stage, or to provide certainty that the conclusion of the scoping study will be realised.

Competent Person’s Statement

The information in this report that relates to Exploration Results is based on information compiled and reviewed by Mr Mark Thompson, who is a member of the Australian Institute of Geoscientists. Mr Thompson, an employee of the Company, has sufficient experience which is relevant to the activity which is being undertaken 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” (“JORC Code”). Mr Thompson consents to the inclusion in the report of the matters based on this information in the form and context in which it appears.

The information in this report that relates to Resource Estimation is based on information compiled and reviewed by Mr Simon Coxhell of CoxsRocks Pty Ltd. Mr Coxhell is a consultant to the Company and a member of the Australian Institute of Mining and Metallurgy. Mr Coxhell has sufficient experience relevant to the styles of mineralisation and types of deposits which are covered in this document 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” (“JORC Code”). Mr Coxhell consents to the inclusion in this report of the matters based on this information in the form and context in which it appears.