

Queensland
Government

mining journal



2016 Vol. 113 No.1

Graphite: An old product with new uses opens up opportunities for Queensland

Carbon is the fifteenth most abundant element in the Earth's crust and is the basis for all life forms on Earth. It is one of the lighter elements on the periodic table coming in at number six. Various forms of carbon (mainly graphite) have an increasing usage in modern technologies – a trend which is accelerating as product research progresses. Appropriate forms of graphite for use in industrial applications are increasingly being sought.

Recent exploration in Queensland has identified a promising graphite occurrence north of Cloncurry, and this deposit may be developed as a resource for future production. Another possible graphite resource is also being explored south of Croydon.

What is Graphite?

Graphite is an allotrope of carbon which comprises simple hexagonal arrangements of carbon atoms in a platy fabric. Other allotropes of carbon include amorphous carbon and diamond. It is one of the softest known substances.

Graphite's earliest use was in 'lead' pencils for writing on paper.

At atmospheric pressure it has no melting point (it sublimates at temperatures ~53000C) and remains solid at higher temperatures than metals such as tungsten or rhenium.

Graphite is a conductor of electricity. Some forms are used for thermal insulation but other forms are good thermal conductors.

Graphite occurs in three forms in nature:

- Amorphous graphite (lowest value and most of the world's deposits)
- Flake graphite (less common and higher value than amorphous graphite)
- Vein or lump graphite (plumbago; highest quality/price)

How do we use Graphite?

Graphite has a number of traditional uses, including refractory applications (foundry facings, crucibles, retort linings), brushes in electric motors, dry cells 'lead' pencils, and as an additive in paints, lubricants and stove polishes.

The automotive industry has also adopted graphite for use in brake linings, gaskets, clutch materials and dry lubricants, while elsewhere it has been adopted for use in fire retardants and reinforcements in plastics. Graphite is now also used in nuclear reactors to control the speed of the nuclear fission reaction.

More recently, the market for graphite has begun to expand incrementally reflecting its use in a number of green technologies including lithium ion batteries, fuel cells, flow batteries and the expansion of nuclear power sector. Many of these applications have the potential to consume more graphite than all present uses combined. The proliferation of batteries used in the development of electric cars will further drive increased graphite demand in the future. Battery grade graphite involves production of a new form of graphite – spherical graphite. The manufacture of spherical graphite requires chemical modification of flake graphite and at present is mainly performed in China. However other parts of the world are seeking to manufacture the product.

A new carbon-based compound, graphene, has also been developed from flake graphite. Graphene is a two-dimensional hexagonal lattice of pure graphite one atom thick which is very strong and efficiently conducts heat. It is 100 times as strong as steel and has exciting uses in areas such as battery technology and conductive coatings.

Some of the research for future uses of graphene include:

- Flexible solar cells
- Smart wallpaper which collects heat and generates electricity
- 'Intelligent' windows with virtual curtains
- Clothing impregnated with graphene which can charge our mobile phones as we walk
- 'Smart' paint on our cars
- Graphene cables to transmit heat from deep geothermal resources.

Where and how is Graphite found in Queensland?

Historically, graphite was produced from two deposits in Queensland – at Mount Bopple (Bauple) near Maryborough, and at Jacks Creek near Collinsville.

The earliest major production of graphite occurred at Jacks Creek, which was discovered in 1932 and was continuously worked until 1957. This deposit contains high-grade amorphous graphite distributed through two bands of steeply dipping sediments, separated by a low-grade band in shale and sandstone of the Upper Bowen Coal Measures. The graphite was formed by metamorphism of coal seams by nearby igneous intrusions. The footwall of the deposit is a hornblende porphyry sill.

More recently, Graphitecorp Limited has been exploring the Mount Dromedary flake graphite deposit located 125 km north of Cloncurry. The deposit is hosted in schist and slate and outcrops over a 3 km strike length. A preliminary drilling program over a small portion of the deposit has outlined an inferred resource. Flake sizes are in the range of 27% jumbo, 18% coarse, 6% medium, 23% fine and 26% very fine. The flake size and grade increases with depth.

Further east at a location 70 km south of Croydon, Metallica Minerals Limited has encountered significant graphite mineralisation at their Esmeralda Project near Prospect Station. Their 2015 drilling program in the area targeted graphite associated with the Esmeralda Granite, based on their previous exploration for massive sulphide mineralisation in the area.

The granite-hosted graphite may be formed from assimilation of highly carbonaceous metasedimentary rocks or may be formed from hydrothermal sources. The latter deposit types are typically of very high purity graphite in either flake or crystalline form forming the basis for high grade, high value resources.



Plate 1: Photo of core from the Esmeralda Granite showing clots of graphite (dark clots). Photo from Metallica Minerals Ltd.

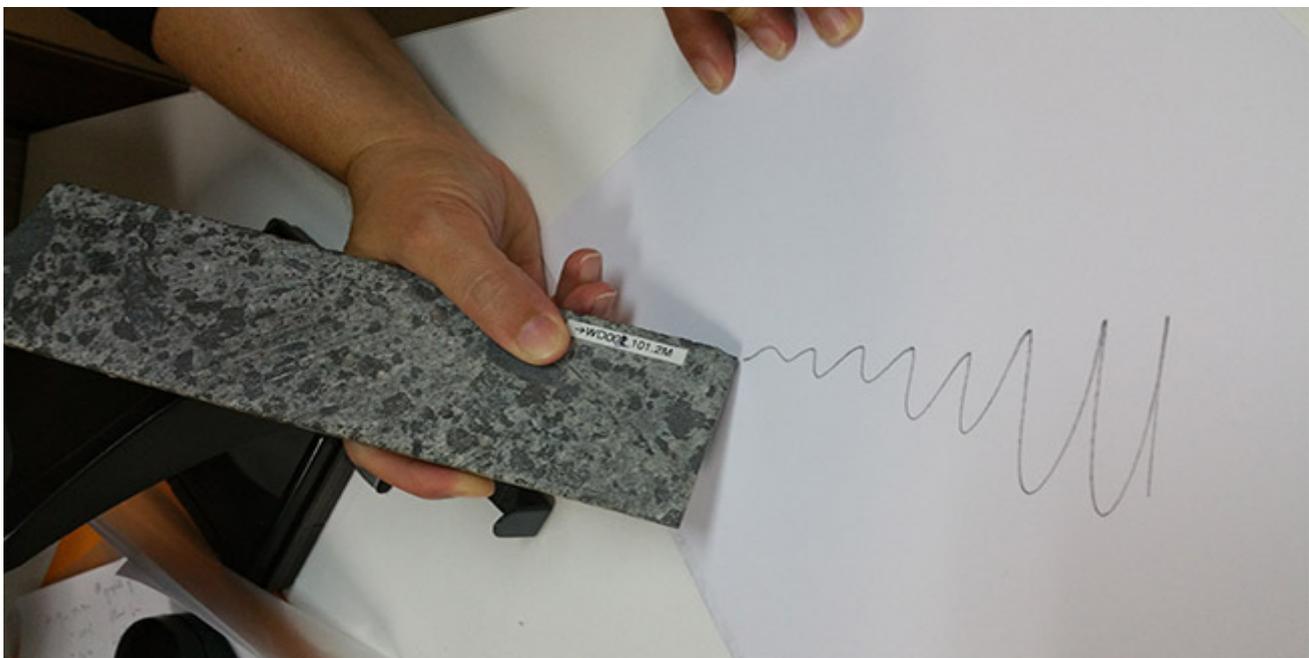


Plate 2: Photo showing graphite in core of the Esmeralda Granite drawing on paper. Photo

from Metallica Minerals Ltd.

[References](#)

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[Back to contents page](#)

