

GRAPHITE

Investing News

Graphite Mining
in the US

Best Graphite
Stocks to Buy

A collection of articles from Graphite Investing News
looking at the companies shaping the investment
opportunity

By Charlotte McLeod



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Introduction

Graphite Mining in the US: Best Graphite Stocks to Buy is designed for investors looking to learn about the opportunities surrounding US-focused graphite companies. However, before dipping a toe into those waters it's important to be aware of the state of the graphite market as a whole.

That's why **Graphite Mining in the US: Best Graphite Stocks to Buy** includes overarching information on the graphite space, including supply, demand and price information, as well as an overview of the different types of graphite and where the most graphite is being produced. Read on to learn more about those topics, and ultimately to discover why US graphite stocks may be a profitable investment.

Charlotte McLeod
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Graphite Investing: An Overview of the Market Today

Graphite is one of the hottest sectors in the resource space today, and has sparked investor interest and an exploration boom. Some of the most critical factors that have pushed the metal to the fore include the ongoing shift toward alternative [energy](#) and the issue of Chinese supply.

But what exactly is graphite? And in today's tough markets, can investors really make a profit from graphite investing? Here are some brief answers to those questions and more.

What is graphite?

Graphite has a layered, planar structure, with carbon atoms arranged in a honeycomb lattice. It's thermally stable and can conduct electricity, but is also valued for its self- and dry-lubricating properties. Interestingly, there is more than one type of graphite, with the three main kinds being [flake, amorphous and vein](#). While all are important for different industries, currently flake graphite is getting the most buzz.

Flake graphite has become especially important since early 2014, when Tesla Motors (NASDAQ:[TSLA](#)) CEO Elon Musk announced that his company would be building a [lithium](#)-ion battery gigafactory. Graphite is used in lithium-ion battery anodes, and the announcement immediately sparked predictions of how much of the metal the gigafactory might require. That speculation has only continued as Tesla has taken further steps — most recently, it signed its [first](#) and [second](#) lithium supply deals.

Aside from lithium-ion batteries, flake graphite can be used in pebble-bed nuclear reactors, as well as in the refractory and steel industries. It's also used in fuel cells and [vanadium](#)-redox batteries. Amorphous graphite is used in the refractory industry as well, and also in mechanisms like brake linings, gaskets and clutch materials. Vein graphite finds a home in advanced, thermal and high-friction applications.

The graphite market today

As mentioned, Tesla and flake graphite are currently gaining a lot of attention in the graphite market as market participants try to guess how much the gigafactory will impact graphite demand (the fact that [other megafactories are in the works](#) hasn't hurt either).



However, other factors are impacting the graphite space as well, with a key one being China. Back in 2013, the Asian nation ordered 55 graphite miners and processors in the city of Pingdu to cease production on environmental grounds. Originally the expectation was that those companies would start producing again midway through 2014, and indeed, they did begin to do so; however, at the start of 2015, sanctions were increased — to date, output from the area remains restricted.

Those shutdowns, coupled with impending megafactory demand, were expected to boost graphite prices, but ultimately that did not happen. Now, the consensus is that prices for the metal may start to rise as buyers become more concerned about impending megafactory demand.

Graphite investing

To get an idea of why restricted Chinese output was expected to have such an impact on the graphite space, one need only look at how much graphite the country produces. Even in 2014, when production of the metal was restricted, the Asian nation was the world's [top producer of graphite](#), putting out 780,000 MT of the material — that's miles ahead of India, the second-biggest producer at 170,000 MT.

Unfortunately for investors, it's tough — and not necessarily desirable — to invest in Chinese graphite companies. For one thing, they're generally state owned, and for another, as mentioned above, environmental problems are an issue. So where's an investor to look for graphite stocks if not in the top-producing country?

Many investors are interested in graphite juniors, particularly those they believe have a chance at signing supply contracts with Tesla, which has expressed an interest in companies operating in North America. Juniors focused on that region include: [Alabama Graphite](#) (TSXV:[ALP](#)), [Canada Carbon](#) (TSXV:[CCB](#)), Canada Strategic Metals (TSXV:[CJC](#)), Caribou King Resources (TSXV:[CKR](#)), [Focus Graphite](#) (TSXV:[FMS](#)), [Graphite One Resources](#) (TSXV:[GPH](#)), Great Lakes Graphite (TSXV:[GLK](#)), [Lomiko Metals](#) (TSXV:[LMR](#)), Northern Graphite (TSXV:[NGC](#)) and Zenyatta Ventures (TSXV:[ZEN](#)).

That said, there are plenty of graphite juniors focused on other areas. Indeed, Australia and Africa are popular locales, with plenty of companies pursuing projects there. A few examples include [Energizer Resources](#) (TSX:[EGZ](#)), IMX Resources (ASX:[IXR](#)), Kibaran Resources (ASX:[KNL](#)), [Magnis Resources](#) (ASX:[MNS](#)), [Next Graphite](#) (OTCMKTS:[GPNE](#)) and Triton Minerals (ASX:[TON](#)).

There are also options for investors interested in small-scale graphite producers. [Eagle Graphite](#) (TSXV:[EGA](#)) bills itself as Western North America's only flake graphite producer, and [Flinders Resources](#) (TSXV:[FDR](#)) holds the producing Sweden-based Woxna graphite mine. StratMin Global Resources (LSE:[STGR](#)) is also an option.

Graphite prices

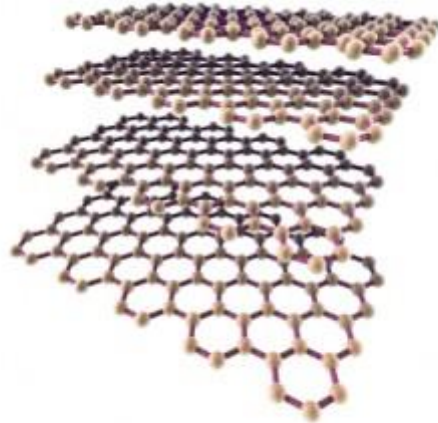
The [overall downturn](#) in the graphite market is no secret, but it can be tough to get an idea of exactly how much graphite costs. That's because unlike [gold](#), [silver](#) and other more common metals, graphite is not traded on an exchange. Instead, graphite miners will typically set up offtake agreements under which end users agree to buy a specific amount of graphite over a particular period of time.

That set up comes with a [variety of issues](#) for graphite companies and market participants alike, but for many investors the key concern is that they can feel like they're operating blind. After all, it's tough to get an idea of whether a company is putting out good results without having an idea of how much it will be able to sell its product for.

Luckily, some industry experts are looking to increase transparency in the graphite sector. In particular, Simon Moores-led firm Benchmark Mineral Intelligence is working to provide investors with accurate and up-to-date information on [graphite pricing](#).

Types of Graphite: Flake, Amorphous and Vein

As mentioned, graphite has a layered, planar structure, with carbon atoms arranged in a honeycomb lattice. It's because of this unique structure that graphite has such a [stellar combination of properties](#) — for example, it's flexible, highly refractory, chemically inert and has high thermal and electrical conductivity.



Those characteristics allow graphite to be used in a variety of places, including brake linings, foundry operations, lubricants, refractory applications and steelmaking. However, not all graphite is suitable for all applications. Indeed, there are three main types of graphite, and in many cases specific applications require one type in particular.

Here's a brief look at those three types of graphite and how they're used in the world today.

Flake graphite

Flake graphite occurs as isolated, flat, plate-like particles with either hexagonal or angular edges. It is found in metamorphic rocks — such as limestone, gneiss and schist — either uniformly distributed through the body of the ore or in concentrated, lens-shaped pockets.

Today, flake graphite is the type of graphite that those in the industry are most interested in. That's because it's the type of graphite that Tesla Motors (NASDAQ:[TSLA](#)) will require for its [lithium-ion battery gigafactory](#); other companies with [megafactories in the works](#) will also need it.

Flake graphite comes in four basic sizes: jumbo, large, medium and fine. And while it can be tough to understand how they differ and how they relate to purity, it's important for graphite-focused investors to get a handle on those topics.

[According to Stephen Riddle](#), CEO of privately owned Asbury Carbons, a supplier of carbon and graphite products for various industrial applications, industry standards for flake size are as follows:

- *Jumbo flake*: +35 mesh or +500 microns
- *Large flake*: -35 mesh by 50 mesh or -300 microns by 500 microns
- *Medium flake*: -50 mesh by 80 mesh or -150 microns by 300 microns
- *Fine flake*: -80 mesh and finer

Riddle said that when those in the graphite space refer to “good” flake size, they’re usually referring to “a graphite deposit or graphite mine [that] is projected to have a high percentage of its total graphite concentrate with flakes greater than 80 mesh — and preferably including some +50 mesh and even possibly some +35 mesh.”

He added that it’s important to consider whether a company has reached those numbers after flotation “because a lot of times during flotation graphite mines break down the flakes in order to get the purity level required by the market.”

In terms of how purity fits into the mix, Riddle said that in general, “the higher the purity of the graphite concentrate, the higher the average realistic FOB mine selling price tends to be.” Essentially, a purer product will likely require less processing, and thus will cost the producer less money to make.

Overall, then, it would appear that large-flake, high-purity graphite is the most desirable product for a company to have. However, [Andrew Miller of Benchmark Mineral Intelligence](#) has explained that the equation is not always that simple. “Quite often because of the niche requirements of each industry ... they have very specific criteria. For some industries purity is more important, and for other industries flake size is more important,” he said.

For instance, for the [spherical graphite](#) industry “purity and the shape of the particle are both key factors.” Meanwhile, for the refractories industry flake size is the overriding price influencer. “It’s not ... clear cut,” Miller noted. “There’s no exact perfect grade out there — but there’s a need to tailor what you produce for the market.”

Uses

As Tesla and other companies build lithium-ion battery megafactories, demand for flake graphite is expected to increase substantially. That’s because flake graphite is an important component of lithium-ion battery anodes.

Currently there’s no telling exactly how much graphite these companies may require. Though Tesla has now signed [two lithium supply deals](#), it has yet to secure graphite supply; data on the other megafactories is also scarce.

That said, predictions have definitely been made about how much graphite Tesla’s gigafactory will require. For instance, Benchmark Mineral Intelligence [has said](#) that if it reaches its target capacity of 35 GWh by 2020, it may need 25,000 tonnes per year of lithium, 112,500 tonnes per year of flake graphite, 45,000 tonnes per year of spherical graphite and 7,000 tonnes per year of [cobalt](#).

However, it’s important for investors to remember that flake graphite has applications other than lithium-ion batteries. For instance, fuel cells use even more graphite than lithium-ion batteries, and are expected to replace combustion engines as a more efficient means of converting fuel to [energy](#). Fuel cells of all sizes are also making their way into the personal electronics sector and even into the utilities sector, where they can be used to provide emergency power to hospitals or turn methane [gas](#) into electricity at wastewater plants.

Flake graphite is also an essential part of [vanadium](#)-redox battery technology, with nearly 300 tonnes of flake graphite [required](#) per 1,000 megawatts of storage. The unique properties of vanadium and graphite combined allow for the long-term storage of excess energy to be used during interrupted energy production.

Pebble-bed nuclear reactors, which use [uranium](#) embedded in fist-sized graphite balls, are another example of how important graphite is becoming to the energy sector. Just one 100-GW pebble-bed nuclear reactor [requires](#) 300 tonnes of graphite to start initial production, followed by an additional 60 to 100 tonnes per year for continual operation.

Amorphous graphite

Amorphous graphite is [found](#) as extremely small, crystal-like particles in beds of mesomorphic rocks like [coal](#), slate and shale, and its carbon content depends on that of its parent material. When found in coal it is the result of the thermal metamorphism of coal, and is referred to as meta-anthracite. However, unlike coal, amorphous graphite is not used as fuel as it is difficult to ignite.

According to Riddle, amorphous graphite that is marketable today typically ranges in purity from 70 to 90 percent. “You can’t afford to upgrade it if you are to be cost effective,” he said.

Uses

Amorphous graphite is used in the refractories industry to manufacture crucibles, ladles, molds, nozzles and troughs that can withstand very high temperatures, particularly the casting of steel. Indeed, the electrodes used in many electrical metallurgical furnaces, including the electric arc furnaces used in steel processing, are manufactured from graphite. Furthermore, in the production of steel itself, graphite is used as a carbon raiser to strengthen steel. It’s also used in blast furnace linings for the production of [iron](#) because of its high thermal conductivity.

Aside from the refractories industry, amorphous graphite is also used in brake linings, gaskets and clutch materials. Amorphous graphite is also used in foundry facing mold wash, where it helps ease the separation of casted objects from molds. Finally, low-quality amorphous graphite, mostly from China, is used to make pencil [lead](#).

Vein graphite

Vein graphite, also referred to as lump graphite, is believed to have hydrothermal origins and occurs in fissures or fractures, appearing as massive platy intergrowths of fibrous or needle-like crystalline aggregates. Vein graphite is believed to originate from crude [oil](#) deposits that through time, temperature and pressure were converted to graphite. Riddle said that the veins “are extremely small and range between 5 and 10 centimeters wide;” generally they have a purity level of 70 to 99+.

Graphite in this form is found all over the world, but is only currently mined in Sri Lanka.

Uses

Vein graphite is used in advanced, thermal and high-friction applications such as car brakes and clutches. It can also be used in much the same way as flake graphite as its shows great performance in applications that require high thermal and electrical conductivity.

Graphite Mining in the US: Will it Happen?

Given the seeming inevitability of a graphite supply crunch, it's no surprise that investor interest in the metal is rising. However, as mentioned, China is the [top producer of graphite](#) by a long shot, and it's not particularly easy — or indeed desirable — to invest in companies mining graphite there.



Instead, many investors are looking to North America for graphite investing opportunities, particularly since Tesla Motors' (NASDAQ:[TSLA](#)) announcement that it plans to source the [lithium](#), graphite and [cobalt](#) it needs for its gigafactory from companies working on the continent. The fact that Tesla recently backed up that statement by signing [two lithium supply deals](#) with companies whose projects are in North America has only strengthened interest in the area.

But while investors are keen to take stakes in North America-focused graphite companies, the fact remains that very few companies are producing graphite there. In fact, in 2014 only two North American countries produced any graphite at all — Canada put out 30,000 MT of the metal while Mexico produced just 8,000 MT. Meanwhile, the US produced none at all.

Market watchers are thus understandably wondering whether North American graphite production is set to rise, and in particular whether graphite mining in the US will ever happen. On that note, here's a look at the history of US graphite production and what the country may do in the future.

Stats on graphite mining in the US

Graphite is deemed a critical material by the US and other countries, and about a century ago it was mined abundantly there, mostly in Alabama. A [New York Times article](#) states that in 1916 the country produced 10.9 million pounds of crystalline graphite, while in 1917, it put out 2,622 tons of amorphous graphite.

However, according to a [report from the US Geological Survey](#), graphite mining in the US has long since stagnated. In fact, the metal has not been mined in the country since 1990, when United Minerals suspended operations at its graphite mine in Montana.

As a result, the US now imports all of the graphite it requires. In terms of exactly how much the country needs, another [US Geological Survey report](#) states that in 2014, 90 US firms consumed 53,200 MT of natural graphite valued at \$57.5 million.

Total imports stood at 62,400 MT of natural graphite — of that amount, 65 percent was flake and high-purity graphite and 35 percent was amorphous graphite. The US' main sources of graphite for the year were China (45 percent), Mexico (28 percent), Canada (17 percent) and Brazil (6 percent). The other 4 percent brought in was derived from various other sources.

The US mainly used that graphite in brake linings, foundry operations, lubricants, refractory applications and steelmaking.

A growing need for graphite

The above statistics indicate that the US seems to be meeting its graphite needs despite the fact that it does not produce the metal. However, the country has made clear that it's not satisfied with the status quo, and — as mentioned — considers graphite a critical material.

Case in point: in its [Strategic and Critical Materials 2015 Report on Stockpile Requirements](#), the US Department of Defense includes graphite on its list of shortfall materials, identifying a gross shortfall of 82,612 MT. Of the metal, the report states, “[o]ne key sub-segment of the market for graphite is in high demand whilst supply adequacy is uncertain.” Specifically, it identifies lithium-ion batteries and expandable graphite as applications that require “top quality flake graphite.”

What's more, the report appears to recognize that the US may not always be able to get its graphite from the sources it currently uses. “Demand for top quality natural flake graphite has led to recent exploration activity mainly in Canada but exploration often fails to result in production,” it states.

And while the report does note that [synthetic graphite](#) and organic composites could be used as substitutes for natural graphite, it cites “[i]ncreased costs” and the lengthy production process for synthetic graphite as issues with both of those plans.

What's next?

It's clear that while graphite mining in the US is currently not happening, the country recognizes that it's something that needs to occur. Read on for an overview of which companies are currently exploring for graphite in the US and where they're at with their projects right now.

US Graphite Stocks: Alabama Graphite and Graphite One Resources

Graphite mining in the US is clearly a hot topic for both investors and the US government. However, despite that interest, very little graphite exploration is taking place in the US, and as a result, there are very few US graphite stocks available to invest in.



In fact, at the moment just two companies are making progress at graphite exploration in the US. They are [Alabama Graphite](#) (TSXV:[ALP](#)) and [Graphite One Resources](#) (TSXV:[GPH](#)). Here's a look at what those companies are up to now and why they're interested in the US.

US graphite stocks: Alabama Graphite

Alabama Graphite holds two flake graphite projects in Alabama: Coosa and Bama. Respectively, they are in Coosa County and Chilton County, and according to the company both are “within the heart of a previously producing region.”

The company's work this year has largely centered around Coosa. It's been conducting drilling there, and this past summer announced that it's [begun a preliminary economic assessment](#) (PEA) for the project. Release of the PEA is [scheduled for November 27, 2015](#). Alabama Graphite also announced the [initiation of a pilot plant](#) for Coosa, noting that by Q4 2015 it expects to have “multiple tons of ... finished graphite” available to send to potential offtake partners for evaluation.

Perhaps most importantly, an [updated mineral resource estimate](#) for Coosa was published on October 13. It shows that the project holds an indicated resource of 78,488,000 tons at 2.39 percent graphitic carbon, and an inferred resource of 79,443,000 tons at 2.56 percent graphitic carbon, both using a 1-percent cut-off grade. According to the company, that's the largest indicated graphite resource in the US.

Investors who've been watching Alabama Graphite may also remember that it's been in the news for another reason this year. Back in March it [announced the discovery](#) of “naturally occurring flake [graphene](#)” at Coosa, drawing attention because no other company has ever claimed to have found natural graphene.

As yet, not much more information about the discovery has been released, though Alabama Graphite [did say a couple of months later](#) that it had found “additional types of naturally occurring graphene-based derivatives called few-layer graphene (2-5 layers), multi-layer graphene (2-10 layers), and graphite nanoplates (less than 100 nm thick)” at Coosa.

Even so, the story continues to pique interest, and many market watchers remain eager to learn more about what the company has found. Co-CEO Ron Roda said at the time of the second announcement, “[w]ork is ongoing on commercial scalability of our naturally occurring graphene and graphene-based derivatives. We are encouraged by the potential of developing natural alternatives to synthetic quality graphene derivatives at a lower cost.”

Also noteworthy is the company’s [appointment of Don Baxter](#) as co-CEO and director in June. Baxter, formerly of [Focus Graphite](#) (TSXV:FMS), will help move the PEA for Coosa forward and help develop offtake agreements, among other duties.

US graphite stocks: Graphite One Resources

Graphite One Resources is focused on the Graphite Creek deposit, which it bills as North America’s largest-known flake graphite deposit. Graphite Creek is located in Alaska, and consists of 129 mineral claims covering 6,799 hectares. According to Graphite One, it “controls all prospective lands with known graphite mineralization in the region.”

An [updated mineral resource estimate](#) for Graphite Creek published in March 2015 shows that it has an indicated resource of 17.95 million tonnes grading 6.3 percent graphitic carbon at a cut-off grade of 3 percent. Its inferred resource stands at 154.36 million tonnes grading 5.7 percent graphitic carbon, also at a cut off of 3 percent.

Significantly, TRU Group’s [Stage B Report](#) on Graphite Creek, completed this past April, shows that mineralization at the project has “distinguishing features can be described as Spheroidal, Thin, Aggregate and EXpanded, or STAX.” The company said at the time that it was applying to trademark STAX in association with Graphite Creek graphite, and believes that STAX could positively impact the PEA for the project.

Originally, that PEA was expected to be released in Q2 2015. However, the company announced a brief suspension to work on the PEA following the STAX announcement, and most recently completed a [non-brokered private placement](#) for gross proceeds of \$1,359,234.94.

Money raised will be put toward exploration and development at Graphite Creek. Graphite One is also said it plans to close a further financing for gross proceeds of \$600,000.

Investor takeaway

While graphite mining in the US isn’t currently taking place, there are certainly US graphite stocks that investors can turn to. And with both Alabama Graphite and Graphite One both on the move, there are plenty of catalysts to watch.

10 Top Graphite-producing Countries

As investors wait for US companies to begin producing graphite, it's worth taking a look at which countries currently produce the most of the metal. China, as noted, is the top producer by hundreds of thousands of metric tons, but that doesn't mean no other countries are producing the metal.

Without further ado, here's a brief overview of the 10 top graphite-producing countries of 2014, as per [data from the US Geological Survey](#).

1. China

Mine Production: 780,000 MT

China is the largest producer of graphite in the world, and in 2014 it put out 780,000 MT of the metal, more than 2013's 750,000 MT.

While that's a significant jump, industry experts do not expect similar rises in the future. That's largely because in 2014, the Asian nation suspended production at many of its flake graphite mines due to pollution concerns. While those mines did start coming back online last year, a return to former production levels is unlikely. [According to Andrew Miller](#) of Benchmark Mineral Intelligence, sanctions were increased on those miners at the start of 2015. "That's restricted quite a lot of output," he said.

2. India

Mine production: 170,000 MT

Significantly behind China, but still in the number-two spot, is India. Last year, the country produced about the same amount of graphite as it did in 2013.

Graphite India (NSE:[GRAPHITE](#)), which began operating in the 1960s, is a key player in the nation's graphite sector, though it's focused on producing graphite electrodes, not mining the metal. That said, other companies are trying to make their way into the mix. KS Mines, for example, is looking to restart a flake graphite mine in the country.

3. Brazil

Mine production: 80,000 MT



Brazil produced 80,000 MT of graphite in 2014, less than the 95,000 MT it put out in 2013. However, Brazil is South America's only producer of graphite, and that has made the country popular for investors and companies in recent years.

One graphite-focused company currently operating in Brazil is Lara Exploration (TSXV:[LRA](#)). It's focused on the Caninde project, and [in May of this year intersected](#) 13.69 meters grading 18.38 percent graphitic carbon at the Pedra Preta target. Since then, however, it has focused its exploration efforts on other projects.

4. Canada

Mine production: 30,000 MT

Canada's graphite production increased by 10,000 MT from 2013 to 2014. That might sound surprising, but Business News Network [reported](#) earlier this year that the country has lately been putting an increasing amount of effort into graphite production and exploration. Indeed, the news outlet states that Canada has played host to events that are like "speed dating for prospective producers and potential investors."

Though listed as number four on this list, the country is actually tied in production with both North Korea and Turkey.

5. North Korea

Mine production: 30,000 MT

Graphite production in North Korea kept relatively even from 2013 to 2014. As noted, it's tied for fourth-largest producer with Canada and Turkey. That said, while North Korea's graphite production is fairly significant, there is little data on the country's mining activities, [as per The Wall Street Journal](#).

6. Turkey

Mine production: 30,000 MT

Turkey saw an impressive 25,000-MT jump in graphite production from 2013 to 2014, allowing it to tie with Canada and North Korea. Turkey's graphite production has been irregular over the years, and little further information is available regarding its production.

7. Russia

Mine production: 14,000 MT

Russia's graphite production has only been tracked by the USGS for the last three years, and each time it has produced the same amount of graphite. The first year it was listed was 2012, the same year it decided to [increase its graphite production](#).

Prior to that time, the country had faced a shortage of graphite. The government then created incentives for private investors to explore and develop new deposits.

8. Mexico

Mine production: 8,000 MT

Mexico's graphite production increased last year, rising to 8,000 MT from 7,000 MT in 2013. While previously there had been speculation that its output would rise in the coming years, that is now less certain — Big North Graphite (TSXV:[NRT](#)), which had planned to reopen the El Tejon flake graphite mine and mill, recently [decided not to proceed](#) with its option on the project.

9. Ukraine

Mine production: 6,000 MT

Ukraine kept even with its 2013 production rate at 6,000 MT, tying with Zimbabwe in terms of output. The Zavalye mine is [the country's largest graphite producer](#); little other data exists on its production.

10. Zimbabwe

Mine production: 6,000 MT

As mentioned, Zimbabwe tied with Ukraine to produce 6,000 MT of graphite in 2014. That's an increase for Zimbabwe, which produced 4,000 MT in 2013. According to The People's Voice, Zimbabwe is only one of two countries in Africa to host [developed natural graphite mines](#). The Chamber of Mines of Zimbabwe states that Lynx mine is the only mine producing graphite in the country.