

What's so special about Ukraine's minerals? A geologist explains

Wednesday 12 March 2025, by [RAJI Munira](#) (Date first published: 10 March 2025).

Ukraine's minerals have become central to global geopolitics, with the US president, Donald Trump, [seeking a deal](#) with Ukraine's president Volodymyr Zelensky to access them. But what are these minerals exactly and why are they so sought after?

Contents

- [International race](#)
- [What about US's own minerals?](#)

Hard rock spodumene ore, a commercially important source of lithium. BJP7images/Shutterstock

Ukraine is often recognised for its vast agricultural lands and industrial heritage, but beneath its surface lies one of the world's most remarkable geological formations, the ["Ukrainian Shield"](#).

This massive, exposed crystalline rock formed over 2.5 billion years ago, stretches across much of Ukraine. It represents one of Earth's oldest and most stable continental blocks. The formation has undergone multiple episodes of mountain building, the formation and movement of magma and other change throughout time.

These geological processes [created favourable geological conditions](#) for forming several mineral deposits including lithium, graphite, manganese, titanium and rare earth elements. All these are now critical for modern industries and the [global green energy transition](#).

Ukraine has deposits containing 22 of 34 critical minerals identified by the European Union [as essential for energy security](#). This positions Ukraine among the world's most resource-rich nations.

International race

As the world races to decarbonise, demand for critical minerals is skyrocketing. Electric vehicles, wind turbines, solar panels and energy storage systems all require lithium, cobalt and rare Earth elements which Ukraine has in abundance.

The [price of lithium](#) has surged from US\$1,500 (£1,164) per ton in the 1990s to around \$20,000 per ton in recent years. Demand is expected to increase nearly 40-fold by 2040.

According to the International Energy Agency, the number of electric vehicles [is projected to exceed 125 million by 2030](#). Similar growth is expected for other battery metals. Each electric vehicle requires significantly more lithium than conventional electronics. For example, a [Tesla Model S battery](#) requires approximately 63kg of high-purity lithium.

Ukraine has three major lithium deposits. These include Shevchenkivske in the Donetsk region as well as Polokhivske and Stankuvatske in the centrally located Kirovograd region – all within the Ukrainian Shield. Despite the significant mineral potential, many of Ukraine’s mineral deposits have remained largely unexplored due to the war with Russia, which has disrupted mining operations and damaged infrastructure.

The Shevchenkivske lithium deposit contains high concentrations of spodumene — the primary lithium-bearing mineral used in battery production. Its reserve is estimated as [13.8 million tonnes of lithium ores](#). That said, extracting it requires an estimated [US\\$10-20 million in exploration investment](#) before mining can begin.

Meanwhile, the Polokhivske deposit at is approximately 270 thousand tons of lithium is considered one of the best lithium sites in Europe. That’s because of its favourable geological conditions, making extraction more economically viable.

But lithium represents just one element of Ukraine’s mineral resources. According to the US geological survey, Ukraine [ranks globally](#) as the third-largest producer of the mineral rutile - making up 15.7% of world’s total output. It is the sixth-largest producer of iron ore (3.2% of total output) and titanium (5.8%), as well as the seventh-largest producer of manganese ore (3.1%).

Ukraine is already a large producer of several minerals. Joaquin Corbalan P/Shutterstock

Ukraine also has Europe’s [largest uranium reserves](#), crucial for nuclear power and weapons. It boasts significant deposits of rare earth elements, including neodymium and dysprosium, which are needed for manufacturing everything from smartphones to wind turbines and electric motors.

In addition, Ukraine is home to the world’s largest proven reserves of manganese ores. There’s approximately 2.4 billion tonnes of it concentrated primarily in the Nikopol Basin on the southern slope of the Ukrainian Shield.

The strategic significance of Ukraine’s minerals has gained recognition in international diplomacy. Recent [bilateral negotiations](#) between Ukraine and the US highlight the geopolitical importance of these resources.

A proposed minerals deal would involve Ukraine [contributing 50% of future proceeds](#) from state-owned mineral resources, oil and gas and other extractable materials to a reconstruction investment fund for Ukraine’s post-war rebuilding. The fund would be jointly managed by Kyiv and Washington.

What about US’s own minerals?

The US’s interest in Ukrainian minerals reflects a broader [geopolitical concern](#) over [increasing demand](#), volatile price movements and [supply chain vulnerabilities](#).

While the US has many of the same [critical minerals](#) as Ukraine, it has historically outsourced mining and refining due to environmental regulations, high labour costs and more attractive foreign markets.

This has led to a reliance on imports, particularly from China, which dominates critical [mineral production and processing](#). Getting access to Ukraine’s minerals in exchange for military protection means the US can avoid having to buy these minerals from China.

The US federal strategy in fact states it will prioritise [diversification through mineral security](#)

[partnerships](#) aiming to establish a more stable and resilient supply chain.

The US's critical minerals are distributed across various [geological provinces](#) including the Appalachian Mountains, the Cordilleran Belt and the Precambrian Shield exposed in parts of the midwest.

While the US has developed substantial lithium resources, particularly in Nevada's Clayton Valley and North Carolina's Kings Mountain, much of its current lithium production comes from "[brine operations](#)". This is the extraction from salt solutions, such as seawater or saline lakes, which [can be more expensive](#) than hard-rock mining.

The global shift toward green energy and electric transportation is accelerating, and minerals are at the heart of this transition. Around 80% of the lithium produced globally is used for [battery production](#). Major automakers are investing billions in electric vehicle production, driving unprecedented demand for the minerals that power this technology.

Ukraine's mineral wealth positions it as a potential leader in the clean energy revolution. Once stability returns, Ukraine will have a golden opportunity to reshape the global supply chain for critical minerals. Even with a 50% allocation to the US, Ukraine would still be able to fund domestic infrastructure, industry growth, jobs and economic recovery.

[Munira Raji](#), Research Fellow of Geology, [University of Plymouth](#)

<https://theconversation.com/republishing-guidelines> —>

P.S.

- The Conversation. Published: March 10, 2025 6.05pm CET.

This article is republished from [The Conversation](#) under a Creative Commons license. Read the [original article](#).

- [Munira Raji](#), [University of Plymouth](#)

I am a Geoscientist and Science Diplomat researching the role of critical minerals in the global energy transition. As a Science Diplomat, I work at bridging the gap between scientific research, policy development, and international diplomacy to address the complex global challenges of our changing world. My current geoscience research focuses on key areas including geoscience for sustainable development goals (SDGs), geothermal and floating offshore wind energy, geological disposal of radioactive waste, geoscience diplomacy and the global governance of geological resources (georesources).

I hold a PhD in Geological Sciences from Durham University, an MSc in Applied Petroleum Geoscience from the University of Derby, and a BSc in Geology from the University of Portsmouth. I also have Certificates in Science Diplomacy from both the United Nations Institute for Training and Research (UNITAR)/GESDA and the Institut Barcelona d'Estudis Internacionals. Currently, I am further expanding my global policy knowledge by pursuing a Master's degree in Global Energy and Climate Policy at the School of Oriental and African Studies (SOAS), University of London (October 2023-October 2025).

- The Conversation is a nonprofit news organization dedicated to helping academic experts share ideas with the public. We can give away our articles thanks to the help of foundations, universities and readers like you. [Donate Now to support research-based journalims](#)