

SUPPLY OF CRITICAL MINERALS AMID THE RUSSIA-UKRAINE WAR AND POSSIBLE SANCTIONS

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The US and EU governments are looking closely at further sanctions against Russia for its invasion of Ukraine that go beyond energy markets to directly target other sectors of the Russian natural resources and manufacturing complex. Even without direct sanctions, Russian production and exports across a wide range of commodities such as wheat, fertilizer, gold, uranium, lumber, pulp and paper, coal, aluminum, and palladium are at risk because of self-sanctioning divestment by non-Russian firms and sanctions affecting access to international banking and insurance markets, among other factors.¹

In particular, markets and policy makers are focused on the effect of the Russia-Ukraine conflict on major industrial base metals like aluminum and nickel, as well as strategic minerals like palladium, scandium, and titanium. All five are on the 2022 US Critical Minerals List.² Nickel and cobalt³ stand out because they are two of the four strategic minerals for lithium-ion battery production, along with lithium and graphite.

This commentary highlights Russia's market share in key metals and the mining sector, in particular critical minerals, to provide policy makers and industry leaders with a general sense of the concentration of such materials and the limited options for securing them elsewhere, should they consider broadening sanctions in that direction. The current Russia crisis brings to the fore chokepoints and risks in the fragile critical minerals supply chain, just as its importance as an enabler of both the clean energy transition and the digital economy are intensifying.

A critical mineral is defined in US law as a nonfuel mineral or mineral material essential to the economic or national security of the US and that has a supply chain vulnerable to disruption.⁴ Such minerals are a growing focus for policy makers because of their strategic role as a raw material for a range of key industries, from semiconductors to aerospace/defense to

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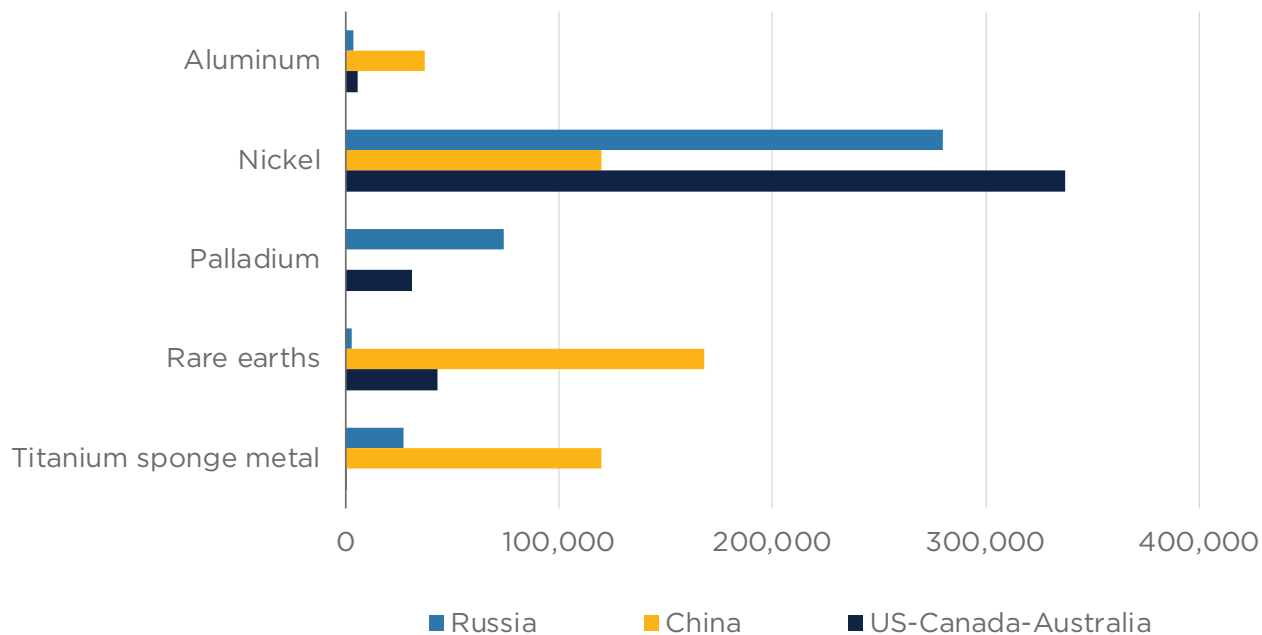
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renewable energy to batteries. Not only are the minerals strategic, they are expected to experience astonishing demand growth due in large part to their role in the energy transition.⁵ For example, the International Energy Agency (IEA) Sustainable Development scenario estimates nickel demand for use in batteries for electric vehicles and back-up energy storage for variable renewable electricity will grow from 196,000 tons in 2020 to 3,804,000 tons by 2040. In 2021, Russia was the world’s third largest producer of nickel, accounting for 10 percent of global supply.⁶

Russia-Ukraine is the first major interstate conflict since the decade-long US policy focus on critical minerals began with the 2010 Chinese embargo on rare exports to Japan, triggered by territorial disputes in the East China Sea.⁷ The US Geological Survey modeled the effects of a potential disruption to Russian metals exports in 2017, following a round of sanctions on the Russian economy imposed after the 2014 annexation of Crimea. The study noted that size is not the only factor shaping the consequences of a loss of Russian metals supply—much depends on market dynamics, such as the availability of alternative supplies and substitutes.⁸ See Figure 1.

Figure 1: Critical minerals in Russia, China, and combined US-Canada-Australia, 2021 annual production (1,000 tons)



Source: Natural Resources Canada and US Geological Survey.



Metals Markets

Nickel prices were rocked by the Russian invasion, jumping over 100 percent in the first two weeks after the conflict began.⁹ Russia's Nornickel is the world's largest nickel producer, with 236,000 kilotons of production in 2020.¹⁰ As noted, Russia in total accounts for 10 percent of global nickel production, behind Indonesia and the Philippines.¹¹ While Russia is an important supplier, the price spike in nickel driven by the threat of disruption to supply through sanctions or the war itself in fact ignited a market that already was in deep deficit thanks to surging demand for nickel in batteries. Moreover, due to an apparent lack of liquidity and a large role by a relatively small number of players, the nickel market is ill-equipped to handle volatility or a surge in buying and selling, as seen in the current crisis.

Aluminum is similar in many ways. Russia's RusAl is one of the world's largest producers and Russia itself supplies 6 percent of global production.¹² As with nickel, prices jumped after the invasion of Ukraine, both on fears of direct disruption and on concerns about soaring energy prices that could shut in production in Europe.¹³ RusAl had previously been sanctioned by the US but remains a critical supplier in a market with surging growth. Tesla was among several global manufacturers that received public blowback for reportedly being a large customer of the Russian metals giant for its European operations.¹⁴ So far there have been no further direct sanctions on RusAl in response to the Ukraine crisis, but Australia announced it would suspend its exports of bauxite and alumina to Russian buyers, potentially robbing RusAl of a critical raw material.¹⁵

Other metals of interest in the Russia crisis include titanium, scandium, and palladium. US aerospace giant Boeing announced on March 7 that it would suspend purchases of titanium from Russia, but as of this writing its EU rival Airbus continues to rely on Russian supply.¹⁶ Titanium is strategic for aerospace and defense applications and Russia is the world's third-largest producer of titanium sponge, the specific application that is critical for titanium metal.¹⁷

Scandium is another key rare earth metal for which Russia is one of the three largest global producers.¹⁸ Used extensively in aerospace and defense sectors, Russia had hoped to significantly increase its production of rare earth elements over the next decade, but such plans may be scuttled by the Ukraine war.¹⁹

Palladium is one of the most notable critical minerals affected by the Ukraine crisis because it is a critical input to the automotive and semiconductor industries and Russia supplies nearly 37 percent of global production.²⁰ Russian palladium illustrates one of the key geopolitical features of critical minerals: alternative supplies are often located in equally challenging markets. The second largest palladium producer is South Africa, where the mining sector has been wracked by strikes for the past decade.²¹

Government Reserves and Risk Management

The world's largest concentration of government-controlled metals reserves is in China.²² Beijing recently released some of its strategic metals reserves in response to supply chain disruptions due to COVID-19 and political tensions with key suppliers like Australia. With cracks developing in the supply chain of critical minerals from Russia, China will be a key



part of the global market and government responses through its production, processing, and strategic reserves. Shut out of Western markets, Russia may well look for new opportunities for cooperation with China in the area of critical minerals: both countries have immense reserves, processing and manufacturing capability, and strong geopolitical reasons to work together. This could be highly problematic for US efforts to reduce Chinese dominance of critical minerals production and processing.

In February 2021, the Biden administration launched a 100-day review of supply chains for four key products in the US economy. The review included both rare earth minerals as well as minerals and components for battery manufacturing, particularly lithium, cobalt, nickel, and graphite.²³ The Biden administration followed up in March 2022 with a commitment to use the Defense Production Act to bolster supply of critical minerals by providing government funding for feasibility studies for new mining projects alongside support for innovation around extracting minerals from waste tailings.²⁴ These efforts built on earlier work from the Trump administration to expand the list of designated critical minerals and intensify government efforts to understand and manage potential risks to US economic and national security associated with them. Parallel efforts have occurred in the EU and in Australia, Canada, and other countries.²⁵

Conclusions

It is too early to conclude that Russian-Chinese cooperation in critical minerals will accelerate because of the Ukraine war and resulting isolation of Russia from Western economies. What can be said is that a prolonged disruption of Russian critical minerals supply will stimulate extraction where possible elsewhere as the value of resources rise, further elevating the strategic profile of, for example, Indonesian nickel, South African palladium, and Chinese aluminum. But switching supplies is easier said than done due to long, multiyear project development and permitting cycles for new supplies and concentrations of many existing alternative supplies in regions challenged by political instability and/or weak environmental and labor standards.²⁶ A supply squeeze of critical minerals would be particularly ill-timed for the EU as it looks to accelerate the development of minerals-intensive renewable energy resources like wind, solar, and batteries as an alternative to Russian gas and coal.²⁷

Choices by Western governments with respect to sanctions on Russian critical minerals will come with risks, given limited supply options elsewhere and potential economic harm to vital industries and even the energy transition.²⁸ But given the key role of metals exports in the Russian economy,²⁹ sanctions may be explored closely by the US and other NATO governments. The imposition of US sanctions on Russia's largest diamond producer, state-owned Alrosa, may prove a harbinger of more to come.³⁰ Regardless of outcome, the Russia-Ukraine crisis is going to add further urgency to national-security-based assessments of critical minerals supply chains.



Notes

1. “Factbox: Commodity supplies at risk after Russia invades Ukraine,” Reuters, March 4, 2022, <https://www.reuters.com/business/commodity-supplies-risk-after-russia-invades-ukraine-2022-03-04/>.
2. US Geological Survey, “2022 Final List of Critical Minerals,” Federal Register, February 24, 2022, <https://www.federalregister.gov/documents/2022/02/24/2022-04027/2022-final-list-of-critical-minerals#:~:text=The%202022%20final%20list%20of%20critical%20minerals%2C%20which%20revises%20the,%2C%20gallium%2C%20germanium%2C%20graphite%2C>.
3. Russia is a large cobalt supplier, second only to the DRC, but with 95 percent less output. US Geological Survey, “Mineral Commodity Summaries 2022 – Cobalt,” Mineral Commodities Summaries, January 2022, <https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-cobalt.pdf>.
4. See Section 7002(c), “Energy Act of 2020,” US Senate Appropriations, December 21, 2020, <https://science.house.gov/imo/media/doc/Energy%20Act%20of%202020.pdf>.
5. “The Role of Critical Minerals in Clean Energy Transitions,” IEA World Energy Outlook Special Report, March 2022, <https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-44e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf>.
6. “Nickel facts,” Government of Canada, February 3, 2022, <https://www.nrcan.gc.ca/our-natural-resources/minerals-mining/minerals-metals-facts/nickel-facts/20519>.
7. “China cuts rare earth export quotas, U.S. concerned,” Reuters, December 28, 2010, <https://www.reuters.com/article/us-china-rareearth/china-cuts-rare-earth-export-quotas-u-s-concerned-idUSTRE6BROKX20101228>; While some conflicts—from the 1991 and 2003 US wars in Iraq to the Libyan civil war in 2011 and the first Russia-Ukraine conflict in Crimea in 2014—have focused attention on oil and gas implications, the ongoing violence in the Democratic Republic of Congo takes place in one of the world’s most important countries for producing cobalt and copper. See, Dionne Searcey, Michael Forsythe, and Eric Lipton, “A Power Struggle Over Cobalt Rattles the Clean Energy Revolution,” *New York Times*, November 20, 2021, <https://www.nytimes.com/2021/11/20/world/china-congo-cobalt.html>.
8. Elena Safirova et al., “Estimates of immediate effects on world markets of a hypothetical disruption to Russia’s supply of six mineral commodities,” US Geological Survey, May 18, 2017, <https://pubs.er.usgs.gov/publication/ofr20171023>.
9. Sam Meredith and Matt Clinch, “Nickel falls 8% to hit limit down in chaotic trade on London Metal Exchange,” CNBC, March 17, 2022, <https://www.cnbc.com/2022/03/17/nickel-falls-8percent-to-hit-limit-down-in-chaotic-trade-on-london-metal-exchange.html>.
10. Niccolo Conte, “The World’s Largest Nickel Mining Companies,” Visual Capitalist, December 23, 2021, <https://elements.visualcapitalist.com/the-worlds-largest-nickel-mining->



[companies/](#).

11. “Nickel facts,” Government of Canada, February 3, 2022, <https://www.nrcan.gc.ca/our-natural-resources/minerals-mining/minerals-metals-facts/nickel-facts/20519>.
12. “Aluminum facts,” Government of Canada, February 22, 2022, <https://www.nrcan.gc.ca/our-natural-resources/minerals-mining/minerals-metals-facts/aluminum-facts/20510>.
13. Eric Onstad, “Aluminium spikes to record after Russia sanctions stepped up,” Reuters, February 28, 2022, <https://www.reuters.com/markets/europe/lme-aluminium-nickel-gain-russian-supply-worries-intensify-2022-02-28/>.
14. Lora Kolodny, “Tesla has bought aluminum from Russian company Rusal since 2020, showing how war complicates supply chain,” CNBC, March 14, 2022, <https://www.cnbc.com/2022/03/14/tesla-has-bought-aluminum-from-russian-supplier-rusal-since-2020.html>.
15. Thomas Biesheuvel and James Thornhill, “Australian Export Ban Pushes Up Aluminum Prices, May Boost Inflation,” Bloomberg, March 21, 2022, <https://www.bloomberg.com/news/articles/2022-03-20/rio-in-spotlight-after-australia-bans-alumina-exports-to-russia>.
16. Aishwarya Nair and Tim Hephher, “Boeing suspends Russian titanium as Airbus keeps buying,” Reuters, March 7, 2022, <https://www.reuters.com/business/aerospace-defense/boeing-suspends-part-its-business-russia-wsj-2022-03-07/>.
17. The US has much more substantial production of titanium dioxide than titanium sponge.
18. “Mineral Commodity Summaries 2022 - Scandium,” US Geological Survey, January 2022, <https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-scandium.pdf>.
19. Anastasia Lyrchikova and Gleb Stolyarov, “Russia has \$1.5 billion plan to dent China’s rare earth dominance,” Reuters, August 12, 2020, <https://www.reuters.com/article/russia-rareearths/russia-has-1-5-billion-plan-to-dent-chinas-rare-earth-dominance-idUSL8N2F73F4>; Avery Chen, “Russian invasion of Ukraine may drive EU back to China as source for rare earths,” S&P Global Market Intelligence, March 15, 2022, <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/russian-invasion-of-ukraine-may-drive-eu-back-to-china-as-source-for-rare-earths-69217025>.
20. “Mineral Commodity Summaries 2022 - Platinum,” US Geological Survey, January 2022, <https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-platinum.pdf>.
21. Vladimir Basov, “Sibanye-Stillwater receives strike notice from two South African unions,” Kitco, March 8, 2022, <https://www.kitco.com/news/2022-03-08/PGM-producer-Sibanye-Stillwater-receives-strike-notice-from-two-South-African-unions.html>.
22. Tom Daly and Shivani Singh, “Explainer: What China keeps in its secretive commodity reserves,” Reuters, August 4, 2021, <https://www.reuters.com/world/china/what-china-keeps-its-secretive-commodity-reserves-2021-08-05/#:~:text=Based%20on%20past%20stockpiling%20activity,250%2C000%2D400%2C000%20tonnes%20of%20zinc>.



23. “Fact Sheet: Biden-Harris Administration 100-Day Battery Supply Chain Review,” US Department of Energy, June 8, 2021, <https://www.energy.gov/articles/fact-sheet-biden-harris-administration-100-day-battery-supply-chain-review>.
24. “Memorandum on Presidential Determination Pursuant to Section 303 of the Defense Production Act of 1950, as amended,” Presidential Determination No. 2022-11, US White House, March 31, 2022, <https://www.whitehouse.gov/briefing-room/presidential-actions/2022/03/31/memorandum-on-presidential-determination-pursuant-to-section-303-of-the-defense-production-act-of-1950-as-amended/> and <https://www.washingtonpost.com/climate-environment/2022/03/30/critical-minerals-defense-production-act/>.
25. “CRM list 2020,” European Commission Raw Materials Information System, April 12, 2022, <https://rmis.jrc.ec.europa.eu/?page=crm-list-2020-e294f6> and <https://www.nrcan.gc.ca/our-natural-resources/minerals-mining/critical-minerals/23414> and <https://www.industry.gov.au/data-and-publications/2022-critical-minerals-strategy>.
26. Jack Farchy, Mark Burton, and James Attwood, “Metals World Agonizes Over War But Keeps Buying From Russia,” April 4, 2022, <https://www.bloomberg.com/news/articles/2022-04-04/metals-world-agonizes-over-war-but-keeps-buying-from-russia>.
27. Matt McGrath, “Climate change: EU unveils plan to end reliance on Russian gas,” BBC News, March 8, 2022, <https://www.bbc.com/news/science-environment-60664799>.
28. Jael Holzman, “Could Russian sanctions hobble U.S. clean energy push?” E&E News, February 24, 2022, <https://www.eenews.net/articles/could-russian-sanctions-hobble-u-s-clean-energy-push/>.
29. “2017–2018 Minerals Yearbook: RUSSIA [ADVANCE RELEASE],” US Geological Survey, February 2022, <https://pubs.usgs.gov/myb/vol3/2017-18/myb3-2017-18-russia.pdf>.
30. “Shares in Russia’s Alrosa drop as US expands sanctions on company”, Reuters, April 4, 2022, <https://www.reuters.com/business/shares-russias-alrosa-drop-us-expands-sanctions-company-2022-04-08/#:~:text=Washington%20on%20Thursday%20placed%20Alrosa,in%20the%20global%20diamond%20market>.

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