Critical Minerals as the Organizing Logic of Contemporary Globalization: China, the Geopolitics of Resource Control, and Technology

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Introduction

The foundation of the modern world, from the microprocessors powering artificial intelligence to the batteries storing energy for the global climate transition, rests on materials that are rarely seen and often poorly understood: critical minerals. These nonfuel mineral materials, such as lithium, cobalt, graphite, and rare earth elements (REEs), are essential to national and economic security, serving as the inputs for defense systems, advanced technologies, and the clean energy infrastructure of the future.[1] However, this material dependence has ignited a geopolitical competition so intense that it now threatens to systemically reorder contemporary globalization, defining a new resource scramble akin to historical dependencies on hydrocarbons.[2]

This paper's central argument is that critical minerals, examined through their historical evolution, are not merely a background input to globalization but constitute its organizing logic. Their production and control have fueled technological innovation and shaped contemporary great power competition of the 21st century - dynamics that remain underexamined in dominant globalization narratives that no longer fully capture the present world order. As historical material dependencies shaped imperial and industrial power, the 21st century sees similar dynamics play out through China's strategic command over critical minerals, affecting both global supply chains and technological leadership.

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[1] Baskaran, Gracelin, and Duncan Wood. *Critical Minerals and the Future of the U.S. Economy*. Center for Strategic and International Studies, 2025. https://www.csis.org/analysis/critical-minerals-and-future-us-economy.
[2] Sanderson, Henry. *Volt Rush: The Winners and Losers in the Race to Go Green*. Oneworld Publications, 2022. p. 6.

Historical Material Dependence and Industrialization

The history of globalization is inseparable from the quest for vital raw materials,[3] fundamentally structuring world systems, international trade, and geopolitical power for centuries. A material functions as an organizing logic of globalization when its specific physical and economic imperatives become the central axis around which the world economy is structurally reordered,[4] necessitating the development and adoption of specific technological choices - such as the innovations required for mass production or specialized refinement as seen with cotton leading up to the industrial revolution.[5]

By conferring decisive leverage over manufacturing and military capabilities, mastery over the control and transformation of said material provides the physical basis for establishing and maintaining geopolitical power hierarchies; as seen in the past, the present, and likely the future. Thus, the material's systemic demands define a distinct historical phase of globalization, differentiating producing nations that command the input from consuming nations that lack mastery over it. Regions like India, Africa, and South America historically provided critical raw materials, positioning them as essential yet structurally constrained actors within global trade networks.

In earlier eras of industrial expansion and imperial rivalry, countries relied heavily on distant sites for critical inputs such as copper, tungsten, jute, and guano, sometimes leading to the adjustment of national borders to secure supply lines.[6] This material necessity inextricably linked industrialization with imperialism. For the United States (U.S.), resource strategy was long

[3] Baskaran and Wood, *Critical Minerals and the Future of the U.S. Economy*.
[4] Beckert, Sven. *Empire of Cotton: A Global History*. Alfred A. Knopf, 2015. p. 4.
[5] Ibid., ch. 3, pp. 86-87.
[6] Ibid.; Immerwahr, Daniel. *How to Hide an Empire: A History of the Greater United States*. Farrar, Straus and Giroux, 2019, ch. 4. p. 65.

framed by military necessity, exemplified by the Strategic and Critical Materials Stockpiling Act of 1939,[7] which was adopted to acquire and retain reserves of materials essential for national defense at a time when commercial stocks were low and possession of such reserves was considered of vital importance in an era of unlimited warfare.[8]

While dominant accounts of globalization emphasize institutional design, liberal norms, or technological diffusion, this analysis foregrounds material constraints as the primary structuring force of global integration. Critical minerals, as seen through examples further on, impose physical, geographical, and technological limits that markets alone cannot resolve, making them uniquely capable of reordering production, power, and dependency. Therefore, they cannot be treated as just a background variable to globalization - which could be viewed as a materially contingent process rather than a purely institutional or ideational one.

Post-WWII Western Industrial Strategy

Following World War II, the West's sense of urgency over raw materials waned, leading governments to rely on international trade instead of sustained colonial extraction[9] - reflecting the view that "Western governments started to feel that natural resource security, especially critical material supply, was yesterday's issue."[10] As Western industrial strategy prioritized liberalized markets, it gradually outsourced "dirty industry" and mineral processing overseas, racializing pollution in the process and associating it with China.[11] This strategic choice of

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[7] Strategic and Critical Minerals Stockpiling Act, H.R.2670, 118th Congress (1939). https://www.govinfo.gov/content/pkg/COMPS-674/pdf/COMPS-674.pdf.
[8] Baskaran and Wood, *Critical Minerals and the Future of the U.S. Economy*.
[9] Immerwahr, *How to Hide an Empire.* ch. 16. p. 281.
[10] Abraham, David. *The Elements of Power: Gadgets, Guns, and the Struggle for a Sustainable Future*. Yale University Press, 2015, ch. 2, p. 31.
[11] Klinger, Julie Michelle. *Rare Earth Frontiers: From Terrestrial Subsoils to Lunar Landscapes*. Cornell University Press, 2017, ch. 1, p. 56 and ch. 3, p. 117.

prioritizing markets over industrial self-sufficiency left the U.S. defense sector vulnerable to the supply disruptions of bauxite, uranium, and cobalt, foreshadowing the complex dependencies that would define 21st-century geopolitics.[12]

Consequently, by the 1990s, the U.S. relied heavily on imports and foreign refining capacity for critical minerals, creating structural dependencies that would later heighten vulnerabilities to China's industrial rise. An additional contemporary and technological contextual point in the realm of globalization is that this shift in Western industrial strategy revealed resource availability (as in Africa or Latin America) or innovation alone (as in the U.S. or Europe), in isolation, are insufficient; rather, technological progress depends on their alignment, as scaling is never guaranteed solely by one or the other. Instead, it relies heavily on the co-location of design and manufacturing expertise with secure access to processed materials.[13] The West's retreat from material control created the structural conditions that China would later exploit.

The People's Republic of China (PRC)'s Strategic Ascent

The People's Republic of China (PRC)'s ascent to dominance in critical minerals began following the turbulent Maoist era, utilizing the global pivot toward liberalized trade that the West had inadvertently made possible. The West's strategic negligence created an opportunity for China to implement a decades-long industrial plan focused on achieving global mineral market domination.[14] Prior to the late 1970s, the priority of the Chinese government was focused

[12] Immerwahr, *How to Hide an Empire.* ch. 16, p. 289.
[13] Miller, Chris. *Chip War: The Fight for the World's Most Critical Technology*. Scribner (an imprint of Simon & Schuster), 2022. pp. 12, 46.
[14] Baskaran and Wood, *Critical Minerals and the Future of the U.S. Economy*.

on building heavy industry like iron and steel.[15] However, the economic liberalization initiated by Deng Xiaoping in 1978 laid the foundational shift by moving China from central planning and autarky toward a market-oriented economy,[16] which prioritized economic and technological development and integrated China into the global trading system.[17] This 'reform and opening'[18] provided vast pools of inexpensive labor and eased environmental regulations, which attracted significant foreign direct investment (FDI) and enabled the transfer of industrial capacity from the West.[19]

Throughout the 1980s and 1990s, China gradually consolidated control over domestic mining, established early joint ventures abroad, and developed refining capabilities that allowed it to dominate critical midstream processing.[20] These incremental steps laid the foundation for China's later appetite for and ability to leverage minerals for technological and geopolitical advantage at an unprecedented scale. Its success was not inevitable, nor solely a function of geological endowment.[21] Rather, it reflected a political economy willing to absorb environmental degradation, suppress short-term profit expectations, and coordinate state, industry, and foreign policy over decades[22] - capacities largely absent in liberal market economies. While Western states prioritized efficiency and shareholder value, China quietly prioritized system-wide control,

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[15] Miller, *Chip War.* ch. 30, p. 234.
[16] Dorn, "China's Post-1978 Economic Development."
[17] Ibid.
[18] Naughton, Barry. *The Rise of China's Industrial Policy: 1978 to 2020*. Lynne Rienner Publishers, 2021. ch. 1, p. 12.
[19] Klinger, *Rare Earth Frontiers.* p. 5; Abraham, *The Elements of Power,* ch. 2, p. 32.
[20] Dorn, James A. "China's Post-1978 Economic Development and Entry into the Global Trading System." *CATO Institute*, October 10, 2023. https://www.cato.org/publications/chinas-post-1978-economic-development-entry-global-trading-system.
[21] Klinger, *Rare Earth Frontiers.*
[22] Baskaran and Wood, *Critical Minerals and the Future of the U.S. Economy*.

enabling it to dominate the most capital-intensive and pollution-heavy stages of mineral processing that others abandoned.[23]

The Chinese Industrial Regime & Mineral Supply Strategy

Crucially, Beijing quickly moved beyond passive liberalization to adopt an aggressive and interventionist industrial policy after 2006, aiming to seize the 'commanding heights'[24] of new technology sectors.[25] Recognizing the strategic value of minerals, a focus cemented by Deng Xiaoping's declaration that "there is oil in the Middle East; there is rare earth in China,"[26] the state directed massive resources to master the complex and energy-intensive midstream stages - processing raw ores into high-purity metals and components - of mineral processing and refining.[27]

This strategy included providing state-backed financing, subsidies, and tax incentives to further encourage domestic firms and joint ventures, allowing Chinese producers to undersell foreign competition and eliminate Western processing capacity, leading directly to the current state of acute reliance on Chinese refining capabilities.[28] Today, China refines a dominant share - between 40 percent and 90 percent - of the world's supply of critical minerals, including REEs, cobalt, lithium, and graphite, establishing a powerful chokehold.[29] Even materials mined

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[23] Abraham, *The Elements of Power.*
[24] Naughton, *The Rise of China's Industrial Policy.* ch. 3, p. 61 (Wan 2009).
[25] Ibid., ch. 1, p. 12.
[26] Abraham, *The Elements of Power,* ch. 2, p. 32.
[27] Foroohar, "How the US Let China Dominate Rare Earths."
[28] Klinger, *Rare Earth Frontiers.* ch. 3, p. 113.
[29] *Global Critical Minerals Outlook*. International Energy Agency

domestically in the U.S., such as REEs from the Mountain Pass mine, were historically shipped to China for processing.[30]

Moreover, to sustain this processing advantage, China implemented strategies to secure upstream raw material access globally, often through extensive state-backed diplomacy. This was prominently executed through foreign policy tools like the Belt and Road Initiative (BRI), which funded 'infrastructure-for-minerals'[31] deals across resource-rich nations in Africa and Latin America.[32] These deals guaranteed long-term feedstock supplies, which were processed within China's domestic industrial ecosystem, further solidifying its monopoly position and reinforcing vulnerabilities for consuming nations.[33] Ultimately, this arrangement mirrors historic patterns where resource wealth failed to yield long-term benefits or industrial stability for the producing nations, situating Africa and Latin America in a precarious role within the current global economic hierarchy.[34]

These regions occupy a structurally critical yet vulnerable position in the reorganized globalization driven by critical minerals, serving primarily as the indispensable upstream suppliers of raw materials for the modern energy and technology industries. They are geologically endowed with resources essential for the 21st century; the Democratic Republic of Congo (DRC) accounts for roughly 70 percent of global cobalt production,[35] while Argentina, Bolivia, and Chile collectively hold significant portions of the world's lithium and copper

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[30] Foroohar, Rana. "How the US Let China Dominate Rare Earths." *Financial Review*, October 20, 2025. https://www.afr.com/world/north-america/how-the-us-let-china-dominate-rare-earths-20251020-p5n3of.
[31] Gulley, Andrew, Nedal Nassar, and Sean Xun. "Assessing the U.S.-China Competition for Minerals Crucial to the Development of Emerging Technologies." *Stanford Center on China's Economy and Institutions*, 2018. https://sccei.fsi.stanford.edu/china-briefs/assessing-us-china-competition-minerals-crucial-development-emerging-technologies#
[32] Thomas, Eve. "The Race Is On for Africa's Critical Minerals." *Mining Technology*, November 28, 2025. https://www.mining-technology.com/features/africa-critical-minerals-us-china/.
[33] Baskaran and Wood, *Critical Minerals and the Future of the U.S. Economy*.
[34] Thomas, "The Race Is On for Africa's Critical Minerals."
[35] Ibid.

reserves.[36] However, the economic relationship characterizing this resource flow is marked by severe structural asymmetry, ensuring that mere national sovereignty over the deposits does not translate into control over the higher-value segments of the chain.

This structural imbalance stems from the pronounced global division between raw material extraction and specialized processing. For African/Latin American countries, sovereignty does not equate to control over value. Their primary role is a feeder system for global manufacturing hubs, evidenced by the disparity in economic valuation - while Central and South America's projected mining market value is substantial, the value captured in the subsequent domestic refining sector is markedly minor.[37] For instance, despite being the world's top copper supplier and holding the largest zinc smelting plant in Latin America, Peru cannot produce critical semiconductor byproducts like gallium and germanium because it lacks the capital and technological expertise in midstream processing capacity.[38]

The history of globalization established a model where industrial powers extracted materials from distant locales as it simultaneously systematically weakened the periphery's capacity for industrial self-sufficiency.[39] This pattern is perpetuated today through the dominance of the midstream sector by external powers; China's strategy is geographically grounded, encompassing the DRC and Indonesia for cobalt and nickel, and investing heavily in projecting across South America for lithium and copper.[40] Similarly, a striking 94 percent of Mexico's

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[36] *Global Critical Minerals Outlook*. International Energy Agency, 2025, p. 268, https://www.iea.org/reports/global-critical-minerals-outlook-2025..
[37] Ibid.
[38] Baskaran and Wood, *Critical Minerals and the Future of the U.S. Economy*, p. 13.
[39] Beckert, *Empire of Cotton,* ch. 6, pp. 205-206.
[40] Sanderson, *Volt Rush*, chs. 6-11.

copper exports are sent to China rather than retaining the material for high-value domestic manufacturing.[41]

The Geopolitics of Mineral Dependence

China's concentrated capacity now functions as a powerful geopolitical tool. China has repeatedly demonstrated its willingness to weaponize this dominance, viewing its mineral advantage as international leverage. The 2010 restriction on rare earth exports to Japan was an initial alarm bell,[42] followed by recent export controls and outright bans (including gallium, germanium, and antimony) targeting U.S. defense and semiconductor industries.[43] This intentional use of trade restrictions, combined with concentrated production, poses a severe national security risk, threatening the ability of the U.S. to rapidly scale up military readiness and technological innovation.[44] Furthermore, China's actions prompted Japan, the EU, and other allied nations to develop critical mineral policies and diversification strategies, signaling a broader reorganization of international economic relations in response to a single decisive actor's monopoly.

Such an unprecedented geographical concentration of resources, in this case critical minerals and their processing capacity, has redefined the logic of modern globalization. A single actor dominating highly specialized midstream segments across essential technological inputs transforms what once theorized as stabilizing mutual interdependence into acute strategic

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[41] Baskaran and Wood, *Critical Minerals and the Future of the U.S. Economy*, p. 95.
[42] Foroohar, "How the US Let China Dominate Rare Earths."
[43] Baskaran and Wood, *Critical Minerals and the Future of the U.S. Economy;* Reiss, Meg. "China's Rare-Earth Dominance Is Secured by American Red Tape." *The Washington Post*, November 28, 2025. https://www.washingtonpost.com/opinions/2025/11/28/rare-earth-minerals-china-us-military/; Baskaran, Grace, and Meredith Schwartz. *The Consequences of China's New Rare Earths Export Restrictions*. Center for Strategic and International Studies. April 14, 2025. https://www.csis.org/analysis/consequences-chinas-new-rare-earths-export-restrictions.
[44] Ibid.

vulnerability for consuming nations.[45] The outcome is a precarious form of economic integration where the ability to maintain resilient supply chains hinges less on free trade and more on navigating complex geopolitical centralization.[46] This historiographical pivot marks the failure of the post-WWII globalization assumption that assured supply could be safely managed without national control over key inputs.[47]

The proliferation of new U.S. - often bipartisan - and allied nations' critical mineral policies fundamentally break with this liberal paradigm, shifting global economic management from a reliance on unchecked market forces to a system predicated on economic security and resilience.[48] This rupture is defined by the normalization of direct state intervention, replacing the former ideal of non-interference with assertive industrial policy aimed at deliberately managing the mineral value chain.[49] Policies enacted now treat reliance on concentrated supply chains not as a natural economic condition manageable by market volatility, but as a grave national security imperative requiring extensive public funding and mandated sourcing strategies.[50] This approach is not a rejection of globalization entirely, but rather a profound reinterpretation: it acknowledges that global interdependence, when structurally unbalanced, generates systemic vulnerabilities necessitating that the state actively reshape international trade flows toward diversified and reliable partners rather than blindly trusting the efficiency of the cheapest global source.

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45 Baskaran and Wood, *Critical Minerals and the Future of the U.S. Economy,* p. 7*; Global Critical Minerals Outlook*, International Energy Agency, p. 257.
46 Ibid.
47 Ibid.
48 Ibid.
49 Naughton, *The Rise of China's Industrial Policy.* ch. 1, p. 14.
50 Baskaran and Wood, *Critical Minerals and the Future of the U.S. Economy,* ch. 16, p. 125.

The Technological Implications

Furthermore, technological revolutions often await material advancements that make them commercially viable and widely applicable. The availability and constraints imposed by critical material or mineral inputs and processing capacity historically exert a profound influence on technological trajectories. For instance, early computing faced a significant material bottleneck in the cumbersome and unreliable vacuum tube, described as a "moth-ridden monstrosity"[51] that often burned out, bringing the entire machine to a halt.[52] The underlying inventive theory for computing existed, but true progress demanded a more reliable, smaller, and cheaper physical medium than the vacuum tube.[53] The resulting path led directly to semiconductor materials like germanium and silicon, driven by the need for a functioning 'switch' that could be practically miniaturized.[54]

The general shift in global technological competition demonstrates that leadership depends fundamentally on mastering the entire value chain, moving beyond the ideational sphere of invention into the material reality of industrial production. In the modern era, high-volume production of devices such as advanced semiconductors or EV batteries demands precision and control over the intricate midstream stage of handling critical minerals.[55] China's control over various critical minerals including the supply of REEs underpins its ability to supply the materials critical for the aforementioned technologies, linking mineral dominance directly to contemporary technological leadership and innovation.

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[51] Miller, *Chip War*. ch. 1.
[52] Ibid.
[53] Ibid.
[54] Ibid., ch. 2.
[55] Ibid., pp. 7-8, 12, 46.

Moreover, accelerating technological change intensifies the challenge of securing mineral inputs on compressed timelines, leading to expedient sourcing that risks reproducing dependency. Competition in sectors like advanced semiconductors and clean energy is rapidly accelerating, creating immediate demand for specific mineral inputs.[56] This urgency collides with the structural reality that mineral supply chains, particularly in mining, processing, and refining, require long lead times to develop, producing a fundamental misalignment between innovation cycles and material production.

This mismatch incentivizes highly expedient sourcing - often taking the path of least resistance to meet immediate volume requirements[57] - rather than the slower construction of resilient and diversified supply chains. This need for fast and high-volume sourcing means efforts to reduce reliance on the dominant supplier (in this case, China) often simply shift dependence to new and readily available, but potentially fragile, suppliers,[58] rather than achieving genuine autonomy.

In practice, this reconfiguration leaves underlying vulnerabilities intact, as the most strategically significant stages of the value chain remain highly concentrated. In this sense, accelerating technological change does not resolve material vulnerability; it deepens it, reinforcing critical minerals as a binding constraint on innovation and power rather than a neutral input that can be easily diversified or substituted. Simply put, the urgency of this technological turning point leaves little room for in-house sourcing, rendering dependence more mobile rather than obsolete.

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[56] *Mission Critical: Securing America's Critical Minerals*. Georgetown University Institute for the Study of Diplomacy, 2025.
[57] Scheyder, Ernest. *The War Below: Lithium, Copper, and the Global Battle to Power Our Lives*. Atria / One Signal Publishers, 2024. ch. 14 (increasing American firm dependence on lithium projects in other locations such as Argentina).
[58] Ibid.

Conclusion

The 21st-century global order is increasingly shaped by the control and processing of critical minerals, a dynamic that mirrors historical patterns of resource dependence and industrial hierarchy. From the United States' postwar reliance on foreign supplies to China's strategic capture of midstream processing, the material foundation of technological and military power has become a decisive factor in shaping national influence. Contemporary globalization is no longer defined solely by open markets and liberal trade; it is structured around the geography of essential inputs, the industrial capacity to transform them, and the policies that secure their flow.

China's dominance over critical minerals demonstrates that technological leadership and economic security are inseparable from material command. Countries without the capacity to process or control these resources remain dependent, highlighting enduring inequalities between producing and consuming nations. At the same time, the U.S. and allied nations' efforts to diversify supply chains and implement industrial strategies signal a recognition that resilience in the modern era requires proactive state intervention. Ultimately, understanding critical minerals as the underlying logic of contemporary globalization reveals that technological innovation, industrial strategy, and geopolitical competition are deeply intertwined, and that the distribution of material power will continue to shape the contours of global influence well into the future.

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