Extracting Power

How the Geopolitics of Rare Earths and the Clean Energy Transition Sustain Traditional Global Power Relationships and Unnatural Capitalism

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Overview

Every day, people around the world use products made with rare earth elements, yet these materials are largely unknown outside of niche academic or industry fields. Modern life is structured around usage of these critical elements. They are essential for our smart phones and computers, cars and lights, intercontinental ballistic missiles and spacecraft, solar panels and wind turbines. We live in a minerals-dependent world; with dependence, comes power. Where rare earths are extracted and processed, who bears the environmental burden of their development, who turns them into high-technology, and who reaps the reward of that technology is politically and economically constructed. Rare earths are a unique vehicle to consider the competing hegemonies of global powers as expressed in mining, knowledge acquisition, and technological innovation. As the clean energy transition scales up, with clean energy technology beholden to rare earth geopolitics and markets, broader questions around power of access, use, and distribution of these raw materials will become increasing important.
A rare earths-focus grounds the sustainable development conversation in an oft-overlooked component of clean energy: mining and raw materials. Climate change has brought a new urgency to the need for low- and no-emissions technology, with environmentalists, policy-makers, and industry-leaders recognizing the needed shift away from carbon dependency. However, moving full speed towards clean energy technologies without assessing underlying power dynamics of raw materials extraction means the same economic and power structures of carbonized development strategies will be replicated in a no-carbon system. This is a reinforcement of the center-periphery model, a theory that seeks to explain center, or developed, states relationships with periphery, or developing, states. Clean energy technology reinforces power (in the form of low- and no-emissions energy) for center-states and sites of environmental degradation (in the form of mining and extraction) for peripheral states; the periphery supports the “clean” development of the center.

This research takes a political ecological approach to connect political and economic power dynamics of rare earth elements’ extraction and processing with the clean energy transition. This paper aims to explore the following inter-connected research questions: First, what are the geopolitics of rare earths and how does extraction advance states’ development strategies and nation-building narratives? Second, how does so-called sustainable development via the clean energy transition deepen center-periphery power dynamics?

Sustainable development with clean energy technology is neither wholly sustainable, particularly clean, or truly revolutionary in its current iteration because of its reliance on rare earths. Local environmental and human rights degradation for some is the price paid for the benefit of a cleaner environmental whole. In China, state-centric development strategy has co-evolved with the cultural concept of chiku (吃苦), or eating bitterness: one must eat bitterness and accept a certain level of suffering from the greater benefit of the state. This concept of chiku has been adopted globally in the development and deployment of zero-emissions technology.

Exploring how degradation in the name of clean energy is outsourced is the primary goal of this paper. Like “rare earths,” which are not geologically rare, “sustainable development” and “clean energy revolutions” have taken on misnomers. These technological fixes, via deployment of clean energy technology, to environmental degradation, address greenhouse gas emissions while neglecting localized exploitation. Raymond Bryant and Sinéad Bailey, in their primer on political ecology, note that “technical fixes” to environmental issues typically lead to failure because environmental problems have political and economic roots. By understanding the geopolitics of rare earths and clean energy technological development in this light, environmental challenges associated with climate change challenges and solutions must be refocused as political and economic challenges and solutions. Rare earths, in this vein, are political and economic challenges, not geographic or geologic challenges; clean energy technology is, by extension, a technical fix for environmental issues that reinforces preexisting political and economic power structures.

**Rare Earth History, Mythology, and Context**

Rare-earth elements are a set of seventeen chemical elements found throughout the earth’s crust. They are a “family of soft, ductile metals” with “exceptional magnetic and conductive properties” “essential to an expanding array of high-technology applications fundamental to globalized modernity as we know it.” They are not “rare” in terms of quantity, but their production is not economically viable unless mined in

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sites where large concentrations exist. The word “rare” has become infused in rare earth elements (REE) discourse, however, and plays a part in public interest in and economic and political policy around REE.

When first discovered in Ytterby, Sweden, in 1788, these minerals were presumed to be rare because they had not been found anywhere else. Despite the correction of the misnomer 125 years later during a series of visits to mining centers by researchers in search of REE, the narrative of perceived scarcity has been fundamental to rare earths’ understanding. Dr. Julie Michelle Klinger’s work on rare earth elements describes the co-evolution of geological and mining infrastructure with political power structures, examining the historic legacy of rare earths in imperial and colonial exploits from the 1880s onward. Political policy and corporate and military action have driven rare earths development more so than geological rarity.

The narrative of scarcity has driven the search for and production of rare earth elements in exceptional ways. The REE pursuit since the late 1800s has emboldened colonial exploits, as technological advances defined early electrification of Europe. From their discovery through 1880, no application or industrial usage came out of research efforts, until Carl Auer von Welsbach’s invention of gas mantles. New urban industrialization had created a need for cheap light which could maintain production after sunset, especially in Europe’s dark, winter months. The gas mantle lantern contained 1 percent of the REE cerium, but by the 1930s, five billion lanterns had been sold, developing lighting grids across the continent, and boosting production of cerium. But gas mantles were hard to light, and unseparated REE waste was prone to combustion. Welsbach mixed these REE wastes with iron, developing the *mischmetall* alloy, patented as the flint stone, which redefined lighting in the late 1800s and is still used in ignition switches today. This time of rare earths production from the 1880s to 1960s is known as the Monazite Placer era, named for sand deposits, placers, rich in monazite, which contained lanthanides.

The new demand for rare earth elements co-developed alongside new “political life” with the colonization of non-European land. Rare earth production became entangled with other raw materials extraction from South and Central Asia, Africa, and Latin America to “feed the expanding gas mantle and flint stone industry.” British, German, and Austrian companies developed mining sites in the United States, Brazil, and India from 1887 through 1909. Welsbach’s success drove research of greater application of REE, expanding the industry and driving the raw materials’ pursuit to the Americas, India, and China. German, Japanese, Soviet, and Chinese geological survey teams, in the early 1900s, surveyed what would later become Inner Mongolia, where the current Bayan Obo mines – which produce the majority of the world’s REE reserves – exist. In imperial China especially, European and American colonial powers surveyed geological territory under pretenses of exploring and “rationalizing a mysterious empire.” Klinger notes, “The industrial orientation of geological survey activities, the cartographic portrayal of mineral wealth and the construction of the infrastructure required to extract it were cited as symbols of progress and modernity for imperialist, nationalist, capitalist and communist interests alike.”

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Rare earth geopolitics were redefined in the mid-20th century by atomic research and Cold War politics. Rare earths are both the “inputs and outputs of the nuclear war effort.” Thorium and uranium can be found in the same earths as REE and are also byproducts of the separation and extraction processes. In the early 1940s, the United States and Britain established an agreement to control as much of the world’s uranium and thorium as possible. Trading American intelligence capacities for British supplies from colonial territories, the two states developed mines and supplies primarily in Brazil and India. Russia, upon learning of this collaboration, opened a rare earth-thorium-uranium mine in Ak-Tyuz, Kyrgyzstan to keep pace. The Shinkolobwe mine in the Democratic Republic of the Congo, then the Belgian Congo, began supplying uranium to the United States in mid-1945, fueling the nuclear arms race that would come to define the latter half of the 20th century. India, a British colony from 1858 to 1947, ended supply of thorium-rich monazite to the United States upon independence, as thorium was a source of atomic energy and nuclear weapons bearers “were seen as guarantors of sovereign power.” Brazil’s supply was unable to match American and British demand. As a result, the Indian embargo and supply disruption led to rare earth and thorium prices rising between 1948 and 1952.

In the 1950s, Molybdenum Corporation opened the only domestic rare earth mine in the U.S. in Mountain Pass, California. By 1982, Mountain Pass in California was producing 70 percent of the world’s rare earth oxides and had just completed a $15 million separation plant that would increase production 35 percent. But new environmental regulations from the newly created Environmental Protection Agency added operational complications. Rather than address environmental and security liabilities on American soil by improving mining technology and security systems to reduce environmental impact, Edward Nixon, President Nixon’s younger brother who worked in a number of resource-based corporations, encouraged American mining executives to ship ore to China for processing. China would produce cheaper rare earth magnets from American ore and shoulder the environmental cost. In doing so, Nixon also facilitated the transfer of technology from international corporations to Chinese ones. Meanwhile, China was undergoing a radical transformation which further facilitated Chinese global market capture of rare earths.

Program 836, from 1986 on, helped China “catch up” in the international technology race. The original program specifically targeted seven high-tech sectors in which Chinese development lagged: “biotech, space, information, laser, automation, energy, and new materials.” Rather than rely on innovation alone, they sought to purchase the technology. American defense and commercial technology, called dual-use technology, had been safeguarded from global markets for decades. Changed American export policy in the years following the end of the Cold War incentivized the Chinese to welcome American military and technology companies on Chinese soil. Meanwhile, Chinese state-owned companies (SOC) bought U.S.
companies that held patents to products produced with funding from the U.S. government and re-opened them in China.\footnote{Bruce, Victoria. Sellout: How Washington Gave Control of American Defense Technology to China, and One Man's Fight to Take It Back. New York: Bloomsbury USA, an Imprint of Bloomsbury Publishing Plc, 2017.}

**The Rare Earth Crisis and the Global Response**

In 2010, a territorial incident between Japan and China became cause for global concern of the weaponization of rare earths, highlighting the intricate linkages of geopolitics, economics, and geology. In the South China Sea, a group of contested islands known as the Daoyu Islands in China and Senkaku Islands in Japan (hereafter referred to as the Daoyu/Senkaku Islands) set the stage for a global rethinking of economic policy and Chinese monopolization of rare earths. On September 7, 2010, a Chinese fishing boat collided with Japanese patrol vessels, resulting in the Chinese captain’s arrest for “obstructing public duties.”\footnote{Associated Press. “Japan, China Tensions Rising Over Boat Collision.” CBS News. September 7, 2010. www.cbsnews.com/news/japan-china-tensions-rising-over-boat-collision/.} The geopolitical territorial issue rapidly escalated. China responded to the captain’s detainment by stalling shipment of rare earth oxides to Japan, though confusion emerged as to who had authorized the restrictions; “some theorized that the action might have been taken by Chinese customs agents, rather than as a formal trade embargo imposed by commerce ministry regulations, to give Beijing more negotiating room with Japan.”\footnote{Bradsher, Keith. "China Is Said to Be Restricting Rare Earth Exports." The New York Times. September 23, 2010. https://www.nytimes.com/2010/09/24/business/energy-environment/24mineral.html.} Looking back, it was a group of port workers and officials who had held up the shipments, not formal export controls authorized by the Chinese government, but the global awakening had occurred, regardless.\footnote{Klinger, Julie Michelle. "Rare Earth Elements: Development, Sustainability and Policy Issues." The Extractive Industries and Society\textsuperscript{5}, no. 1 (2018): 1-7. doi:10.1016/j.exis.2017.12.016.} The market panic that ensued, while overblown, solidified the rarity narrative of rare earth materials which were largely unknown to those outside relevant industries. “People concluded that because China produced 97% of the global supply, it must then also possess most of known global deposits. Others presumed that the disruption in exports to Japan indicated that China intended to embargo rare earth exports to place the rest of the world in a ‘stranglehold.’”\footnote{Klinger, Julie Michelle. "Rare Earth Elements: Development, Sustainability and Policy Issues." The Extractive Industries and Society\textsuperscript{5}, no. 1 (2018): 1-7. doi:10.1016/j.exis.2017.12.016.} Between Spring 2010 and May 2011, world prices soared. Neodymium sold for $42/kilogram in 2010 and $283/kilogram in 2011. Samarium jumped from $18.50/kilogram to $146/kilogram, respectively. Countries and companies, now clued in that Chinese officials, regardless of formal authorization from Beijing, could embargo critical materials, began to look elsewhere for raw materials. They were further outraged by China’s newly raised taxes on rare earth mining companies. China, long-willing to accept the environmental and human rights externalities of rare earth mining and processing, had attempted to lower production rates and export quotas.

China cited the environmental hazards associated with mining and processing – dirty activities which had incentivized corporate moves to China in the first place – but found itself in a World Trade Organization (WTO) dispute regarding export restriction violations.\footnote{Bradsher, Keith. “Rare Earth Prices Soar as Efforts to Increase Supplies Falter.” The New York Times. May 2, 2011. www.nytimes.com/2011/05/03/business/03rare.html.} The dispute began in 2012, with the United States, European Union, and Japan establishing a complaint against China for “export restrictions on a number of rare earths, tungsten, and molybdenum. The export restrictions comprised export duties, export...
quotas, and certain limitations on the enterprises permitted to export the products.”

China had won its 2009 and 2011 WTO disputes on export quotas, but the 2012 suit (finalized in 2014) was won by the complainants, with the United States at the helm. China had cited the finiteness of its rare earth resources and the environmental degradation of mining and processing REE, but had not imposed the same production restrictions on native industries as it had on foreign ones, weakening its case by the third dispute. Despite the dispute’s resolution, and significant price drops from 2014 on, global prices for rare earths have not resumed their pre-2010 pricing, reflecting perceived instabilities in the market for increasingly-demanded materials.

These market instabilities are interestingly not priced into the new generation of consumer goods which are driving the extraction and processing of these materials in the twenty-first century. From lighting to industrial processing, and magnets to atom bombs, rare earths have featured prominently in the technohistorical development of modern states. Now, another transition is underway. Increasing concern around the impact of carbonized development on the earth’s natural systems, and humankind’s ability to mitigate or adapt to those effects, are steering new technological innovation towards “clean energy” and “smart” systems, both of which will exponentially impact rare earth supply, processing, and the outsourcing of modern development to those states willing or coerced into accepting the environmental and human cost.

**The Energy Transition**

The clean energy revolution, with particular emphasis on digitized smart systems and renewables technology, while necessary to achieve zero emissions goals, serves to perpetuate the outsourcing of localized environmental and human degradation in the name of climate change mitigation. A new Not In My Back Yard (NIMBY) mentality underlines the clean energy transition, with rare earths extraction and processing offering a nouveau understanding of the resource curse as it pertains to middle- and high-income states’ development at the expense of politically disenfranchised states.

**The Center-Periphery**

Center-periphery modeling is a theoretical concept to explain both global and local power systems. The center has political, economic, and military strength that can be used to wield influence over the periphery. Center-periphery relationships can be both micro and macro. For example, a micro-level relationship would be, within New York City, financial and political power is yielded to Manhattan, with outer boroughs dependent on Manhattan for that power. However, Manhattan is dependent on the outer boroughs for shipping and transportation access, raw materials, and so on. Macro, global-level examples will be used in the context of rare earths and clean tech development. Center-periphery theory, overall, seeks to explain the relationship between states with different forms and levels of power, recognizing codependency between them, whether willing or coerced.

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Center-periphery relationships can be understood in the taking of raw materials used for the good of the center, at the expense of the periphery. This center-periphery model has explicit links to colonialism and imperialism and has been expressed in political, educational, and cultural systems meant to reinforce the center-periphery power structure. The center-periphery is a feature of dependency theory, and while dependency theory does not have a fully unified approach or set of outcomes, here, it serves to examine the current state of “sustainable development” in a new light.

Dependency theory typically identifies international capitalism “as the motive force behind dependency relationships,” though some theorists prefer to consider dependency as “power disparity” rather than a specific economic system.\(^{27}\) Dependency models assume global political and economic power is centralized in industrialized states, therefore ridding the need to distinguish between the economic and the political, as it assumes governments will use political power to protect the economic interests of the state, including corporate interests. Dependency theory seeks to explain underdevelopment in many parts of the world, identifying the center-periphery relationship as a set of political, economic, and cultural dimensions that reify power in the center. Underdevelopment refers to the use of natural resources for the benefit of dominant, center, states, rather than the less powerful periphery states where resources are extracted. In the clean energy context, this section will refer explicitly to the act of mining and processing of rare earths and other strategic materials.

Privatizing Joint Military-Mining Operations in Afghanistan

Almost seventeen years after then-President George W. Bush’s invasion of Afghanistan in the aftermath of September 11, President Donald Trump has not decided how to proceed in the region. Aspects of his foreign policy strategy towards Afghanistan have remained unpredictable; he called for political talks with the Taliban in 2017,\(^ {29}\) then rejected the talks months later.\(^ {30}\) On April 10, 2018, CBS News reported

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that the Pentagon had removed troop numbers from its Defense Manpower Data Center on Iraq, Syria, and Afghanistan, following through on a 2017 commitment to sow uncertainty about military operations, but complexifying public awareness of American military involvement abroad. While Trump’s Middle East strategy has been determinably unpredictable, one thing his foreign policy seems to maintain is tit-for-tat certainty. Missiles for missiles. Tariffs for tariffs. And perhaps continued deployment in Afghanistan in exchange for critical materials.

Rare earths, and new economic arrangements between private contractors, the U.S. government and military, and Afghanistan, may be the strategic component that keeps the Trump Administration’s attention on continued deployment in Afghanistan. President Trump has entertained White House meetings with individuals, some of whom he knows personally, whose companies would profit from an extractive relationship with the country. The “discovery” of and interest in economically viable rare earths in Afghanistan is not new to the Trump presidency, however. Interest in Afghan minerals dates back to the 1980s for the Soviet Union and 2000s for the United States.

An internal Pentagon memo in 2010 referred to Afghanistan as the “Saudi Arabia of lithium.” In 2004, a team of American geologists found 1980s Soviet geological data at the Afghan Geological Survey library in Kabul. This spurred aerial geologic surveys in 2006 and 2007, resulting in Pentagon officials and geologists noting the vast mineral wealth and joint economic opportunities for the U.S. and Afghanistan. Complexities of Afghan geography, corruption, and infrastructure hampered both the Bush and Obama administrations, despite the alleged $1 trillion value (a disputed figure that has likely fallen with diminishing commodities prices.) Despite known risks, $488 million were spent on mining projects but “a combination of corruption, incompetence, lack of infrastructure, and a deteriorating security environment” led to unsuccessful returns on investments. Importantly, Afghanistan has no large-scale mining culture because of these conditions. There is no existing industry or infrastructure in place that would support large-scale extractive mining. In fact, the majority of mines in Afghanistan are artisanal or small-scale, identified by the Ministry of Mines as a “poverty driven activity…bringing with it serious social, environmental problems and loss of revenue.” To make matters worse, Afghanistan has little history of environmental protection. Decades of war, including America’s longest-running conflict, have had massive human and environmental impacts on the country. The pre-existing, known hurdles of the

The last two American presidential administrations have not been remedied, but the Trump Administration still sees opportunity.

A firm believer in free-market economies, the Trump Administration has opened the door to contractors looking to privatize government programming from education to war. Erik Prince, founder of special forces’ training center, Blackwater, is capitalizing on the opportunity. Blackwater, “the Pentagon’s mercenary army of choice in Afghanistan and Iraq,” was responsible for a number of civilian murders, which contributed to Prince’s rebranding and sale of the company in 2010. Prince took that opportunity to relocate to the United Arab Emirates, where his new energy-and-mining firm, Frontier Resource Group, developed. Frontier Resource Group works explicitly with companies in “frontier markets.” As Figure 8 shows, Prince has constructed elaborate private enterprises for both security and extractive development services around the world. His early support for Donald Trump’s presidential campaign gave him an initial in with the candidate. His sister, Betsy DeVos, Trump’s Secretary of Education, has bolstered the family’s loyalty to the administration, and Prince’s 2017 Wall Street Journal op-ed on privatizing military operations in Afghanistan was allegedly well-received by the president.40

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Prince’s proposal “revolves around a private force of 6,000 contractors, supplemented by 2,000 U.S. special operations troops and support personnel, who would embed with local Afghan units. Air power would be led by Afghan pilots, paired with contractors. All would be overseen by a ‘viceroy’ who ultimately reports to the president.”\(^{42}\) Importantly for Prince, his two in-White House critics, former-Secretary of State Rex Tillerson and former-National Security Advisor H.R. McMaster, are gone, paving the way for greater maneuverability for Prince.\(^{43}\)

![Figure 3: Slides 9 and 10 of Erik Prince’s "An Exit Strategy for Afghanistan," Dec. 17, 2017.\(^{44}\)](image)

Prince’s explicit interest in marrying his mining and security ventures on the Afghan stage underscores two critical arguments that rare earths contribute to center-periphery relationships globally. First, Prince’s ventures highlight a neo-frontiersmanship reminiscent of both the American gold rush and Chinese-Soviet development of Mongolia. Both projects operated as strategic nation-building opportunities, and in fact, both the United States and China have invested in Afghan mining industries, highlighting development-through-extraction agendas, though both have had limited success. This shows the peripheral reliance of Afghanistan on semi-peripheral (China) and center (United States) powers to develop the Afghan interior. While mercenaries may stabilize economically prosperous regions for the state, Afghanistan is ceding economic development of strategically valuable territory to foreign powers, not because Afghanistan is the only country with retrievable deposits of rare earths, but because of the “social and cultural preparation” of colonialism and reliance on foreign aid and investment.\(^{45}\)

Second, extraction sites are chosen to achieve broader geopolitical goals than those explicitly defined by the localized project, confirming that peripheral states’ needs are ancillary to the political agendas of center states. On this, Klinger notes,


“The fact that we [the United States] have the technology and the lucky geology to produce rare earth elements in a sustainable and conflict-free manner; yet, we are overwhelmingly failing to do so, indicates that the contemporary geography of rare earth prospecting and production is driven by secondary interests which are sometimes only marginally related to rare earth elements.”

Mining abroad serves a number of functions, including dependency of a peripheral state on more technologically-advanced states for industry and access to global markets, in exchange for center states outsourcing environmental or labor degradation to peripheries with loose regulations or greater corruption. That localized degradation is further made invisible to consumers through globalized supply-and value chains who need not think about product origins. The peripheral state then exists outside of the machinations of the public, political will of the center. This incentivizes center states and corporations to move to peripheral localities that are at a political disadvantage. This disadvantage is exploitable by the center. In the clean energy context explicitly, technologies for sustainable development, when considered from cradle to grave, place undue burden on the periphery to supply clean technologies for the center, enacting all of the social and environmental costs but few of the real benefits.

Conclusion

This paper set out to explore industrial, environmental, and political narratives related to rare earths development for clean energy technologies, focusing on geopolitics, extraction as a form of nation-building, and clean energy technological development and deployment as a replication of center-periphery power structures. The geopolitics of rare earths today have been carefully structured for decades, occurring as a result of political, economic, and social controls put in place by center powers. These controls are reinforced in states’ mythologies on frontiers, state-building, and border-taming through concretized extraction. This geopolitical mythology then informs local and global power dynamics in the form of center-periphery relationships.

Environmental issues have political and economic roots. Using clean energy technology to solve environmental issues fails to address those political and economic roots. Rather, it replicates them. Climate change requires a rapid response, but only in rethinking the center’s reliance on political and economic disenfranchisement of the periphery can a transition to clean energy be truly revolutionary.

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Works Cited


