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STRENGTHENING THE BRITTLE RARE EARTH ELEMENT SUPPLY CHAIN AMID REVISIONIST ALIGNMENT

Natural Resource Lessons from the Russia-Ukraine War

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The Russia-Ukraine War has significantly affected European energy supplies and demonstrated the varied vulnerabilities associated with a brittle supply chain, leading the International Energy Agency to characterize its impact as "the first truly global energy crisis."[1] In late 2022, Russia reduced gas flows to the European Union (EU) by roughly 80 percent, finding alternate markets in the People's Republic of China (PRC), India, and Turkey.[2] Despite international pressure, Russia persistently pursued alternate markets for energy exports that account for just under one-half of the Russian economy.[3] The Russia-Ukraine War offers a warning about the effect of potential future supply chain catastrophes from monopolies held by unfriendly, authoritarian, and revanchist states, but specifically the PRC's control of critical minerals known as *rare earth elements* (REE).

REEs are required to support numerous sectors across the global economy, most significantly within the defense sector for high technology platforms.[4] Hundreds of thousands of pounds of REEs are crucial to state-of-the-art military platforms such as the Lockheed Martin F-35 Lightning II multirole fighter aircraft and the *Arleigh Burke*-class Aegis guided-missile destroyer.[5] Despite several concurrent efforts by the United States, Canada, Australia, and the EU, the PRC retains a de facto monopoly on processed REEs. Recent business efforts by the PRC along with strained relations between the Eastern and Western worlds could result in a blocked REE supply chain, undermining the advanced defense sectors of the United States and its allies. Currently, there are multiple flashpoints within the First Island Chain—such as Taiwan and the East and South China Seas—that could lead to a situation in which the PRC may pull this lever. The PRC did this in September 2010, when Japan detained a Chinese fisherman near the Senkaku Islands, before reversing course a few weeks later.[6] More concerning is when PRC officials from the technology and commerce ministries in early 2023 updated a "technology export restriction list" that would limit alloy technology exports, impacting development of only high-performance magnets—that is, REEs.[7]

In late 2021, the PRC reorganized its rare earth industry with the establishment of a state-owned enterprise (SOE) called China Rare Earth Group Company, Ltd. This new SOE is a conglomeration of one-half of the largest SOEs in the PRC's REE industry: Aluminum Corporation of China, China Minmetals Corporation, and Ganzhou Rare Earth Group Company, Ltd. PRC control of the REE supply includes anywhere from 55 to 85 percent of global mining and 90 to 95 percent of global processing.[8] The consolidation of one-half of the major REE companies in the PRC places approximately one-third of global REE supply under a single corporation resulting in vertical integration of the preponderance of REE supply.[9]

This consolidation by the Chinese Communist Party (CCP) presents critical issues for a brittle global supply chain in which global demand may increase anywhere from fivefold to eight-

fold between now and the 2030s (and beyond).[10] The PRC's official goal with this consolidation is to ensure "the stability of production and supply chains," but the resulting consolidation enables both price control and malign influence.[11] The new organization could also present cartel-like activities similar to the Organization of the Petroleum Exporting Countries (OPEC).[12]

Partial Deglobalization and Alignment of the Rest

The past decade in international politics saw an increasing convergence of three of the five major security threats to the United States identified in its national security documents, such as the 2018 *National Defense Strategy*, 2021 *Interim National Security Strategy Guidance*, and the 2022 *National Security Strategy*: the PRC, Russia, and Iran. The increasingly competitive and at times fractious relationship between the United States and the PRC was exacerbated under the administration of U.S. president Donald J. Trump, as demonstrated by a trade war and responses to the COVID-19 pandemic.[13] Russia's revisionist activities solidified its position as a pariah state removed from a liberal European order because of its two invasions of Ukraine in 2014 and 2022. The abandonment of the Joint Comprehensive Plan of Action (JCPOA) by the United States in 2018 and the decision to conduct a lethal strike on Islamic Revolutionary Guard Corps Qods Force commander General Qasem Soleimani in 2020 only further fractured the relationship between the United States and Iran.[14]

During the past two years, the PRC, Russia, and Iran have naturally gravitated toward one another for mutual benefit as their circles of allies and partners remain small or shrink with successive parochial actions defined by pursuing their own narrow national interests regardless of negative impacts on other countries. Russia's subversion of international law and revisionism regarding Ukraine's sovereignty in 2014 and 2022 are prime examples of such actions.[15] In the case of the PRC, examples include its militarization and island-building campaign in the South China Sea in the early 2010s for the "safeguarding [of] territorial sovereignty and maritime rights."[16] The PRC's domestic activities forced it to defend its record at the United Nations this year regarding authoritarian crackdowns against both the Uyghurs in Xinjiang as well as pro-democracy activists in Hong Kong.[17]

The early aftermath of Russia's 2022 invasion of Ukraine saw the former redirecting a large portion of its energy exports in response to Western sanctions and by doubling its liquid petroleum gas exports. Russia increased Siberia-delivered natural gas by 50 percent and crude oil exports by 10 percent to the PRC.[18] Russia also closed out 2022 as the second largest supplier of crude oil, coal, and pipeline gas and the fourth largest supplier of liquefied natural gas to the PRC.[19] During 2022, Russian trade in exports to the PRC increased by 43 percent.[20] Russia's Gazprom and the China National Petroleum Corporation SOE also signed a 30-year contract less than a month before the invasion began.[21] During the signing of a 25-year cooperation agreement in March 2021, Chinese minister of foreign affairs Wang Yi said that "relations between the two countries have now reached the level of strategic partnership and China seeks to comprehensively improve relations with Iran."[22]

Russia and Iran also deepened their relations recently by way of Iran supplying armed drones to the Russian war effort in late 2022.[23] The growing ties between the PRC, Russia, and Iran, while presently focused on the conflict in Ukraine, have the potential to spill over into diverse sectors, such as REE supply and beneficial upstream production. Furthermore, the PRC recently forayed into a new role as an international mediator by brokering a tentative Iran-Saudi Arabia rapprochement.[24] Such efforts reinforce the PRC's economic and energy needs throughout the Arabian Gulf in both the context of President Xi Jinping's Belt and Road Initiative as well as his proposed Global Security Initiative.[25] As the PRC shapes its image as a responsible stakeholder and provider of public security goods in the global order, despite persistent efforts to alter it, the current spike in cooperation around the Russia-Ukraine War may hit its upper limit or prove to be temporary.

Rare Earth Element Supply Chain Risk Management

Supply chain risk management (SCRM) became a popular topic during the COVID-19 pandemic due to the pandemic's impacts on global supply chains for consumer items, medical equipment, and food supply. However, prior to the pandemic, the chairman of the Joint Chiefs of Staff, U.S. Marine Corps general Joseph F. Dunford Jr., identified the concept of "brittleness" within the U.S. defense industrial base (DIB), which would reduce the military's ability to "sustain a protracted or simultaneous conflict."[26] This search for efficiency via globalization resulted in new vulnerabilities, with REEs as an "extreme example" identified in a U.S. industrial mobilization report.[27] SCRM is the foundational concept underpinning the need to decouple the U.S.-processed REE supply from the PRC. While the PRC overturned export controls implemented in the early 2010s after they were found to be noncompliant with World Trade Organization regulations in 2014, it has used its monopoly on REEs as a political instrument, previously against Japan in 2010.[28] In July 2023, China announced new regulations on the export of gallium and germanium after years of export restrictions on new technology by America and its allies.[29]

The PRC's use of this advantage against the U.S. alliance network affecting the aforementioned flashpoints is an economic clarion call for the United States and its allies to strengthen the current REE supply chain by reducing its risk to PRC influence. With the initiation of the U.S. trade war with China in 2018, some PRC hardliners suggested weaponizing their REE monopoly for strategic gain.[30] The PRC threatened such action in 2020 due to the awarding of Lockheed Martin contracts to upgrade components of MIM-104 Patriot surface-to-air missile batteries in Taiwan. The immediate reaction from the United States and its Western allies laid the groundwork for distribution of the supply chain outside the PRC, but this was not without residual risk.[31]

U.S. Rare Earth Elements and Alignment of the West

The U.S. government's description and definition of REEs as a part of critical minerals are contained in U.S. Executive Order 13817:

> (i) a non-fuel mineral or mineral material essential to the economic and national security of the United States, (ii) the supply chain of which is vulnerable to disruption, and (iii) that serves an essential function in the manufacturing of a product, the absence of which would have significant consequences for our economy or our national security.[32]

Internationally, REEs include 17 distinct elements.[33] Consequently, the U.S. government has explicitly tied REEs to its national security, creating requirements for the Department of Defense (DOD) to secure the integrity of the DIB.

Historically, the United States was the largest global producer of REEs until 1985. Around roughly the same time that the PRC displaced the United States as the primary global supplier of REEs, it invested heavily in its REE production efforts, eventually becoming the largest REE producer as well.[34] This shift took place under PRC leader Deng Xiaoping as part of his Four Modernizations effort. Through the U.S. Geological Survey's Earth Mapping Resources Initiative, which began in 2019, old production sites in the United States have been examined and new locations identified with "probable" and "proven" reserves, including Mountain Pass, California; Bokan Mountain, Alaska; Bear Lodge, Wyoming; Round Top, Texas; and Elk Creek, Nebraska.[35] Identifying a viable supply is the first requirement for valid SCRM. This includes friendly foreign sources such as Australia, which contains the sixth-largest reserves of REEs in the world.[36] There is also Europe's largest and most recent 2023 discovery of REE deposits in Sweden; however, these are proportionally small in the context of the global supply.[37] While it will take an estimated 10–15 years to establish an effective operation in this case, it remains an important step nonetheless.[38]

Despite variable sources of supply, the largest vulnerability to the United States and its allies is the lack of processing capability and capacity within friendly countries, which gives the PRC real power and control of REEs on a global scale. The Australian Lynas Rare Earths, Ltd.; U.S. MP Materials; and the Canadian Ucore Rare Metals, Inc., are key stakeholders in shoring up the REE processing supply chain. In 2021, Lynas signed a contract with the DOD to develop a REE processing facility at a site in Hondo, Texas.[39] Despite efforts to distribute risk, Lynas may face disruption in the REE processing supply chain this year as the biggest REE processor outside of the PRC. As of July 2023, the corporation will no longer be able to process REE at a longstanding Malaysian processing plant due to concerns of producing slightly radioactive waste, thereby encouraging its domestic efforts to establish facilities within central Australia.[40] Ucore also focused on developing a domestic REE processing capability in the United States. Originally, Ucore sought to develop an aggressively planned "strategic metals complex" in Alaska, to be completed by 2023.[41] Ucore has since changed its focus to the geographic and business advantages offered by the Gulf Coast in Louisiana as the site for the first U.S. strategic metals complex, to be completed by 2024.[42]

Recommendations

Along with U.S. and allied efforts to develop greater domestic supply of and processing capabilities for REEs, leveraging underutilized supplies in Africa could be a beneficial parallel effort. While strategic competition remains a mainstay in efforts by the United States, the EU, Russia, and the PRC in Africa, REEs are a no less strategically vital topic than military access, basing, and overflight. Angola, Malawi, Namibia, and South Africa have active operations spread across various Western mining ventures and domestic subsidiaries.[43] The number of opportunities presented by these rich supplies requires dogged engagement with a collection of countries that generally want to strengthen business relationships and trade ties with the United States, even more so because of the "poor transparency and environmental records of many Chinese companies."[44]

While the United States presents a more attractive partnership for the benefit of any country providing REEs with transparency and concern for the environment, it must deliberately seek tangible economic benefits to respective host nations. A coupled solution may be limited infrastructure investment for collocated processing plants, as pursued by Namibian government mining agreements.[45] The PRC and Russia have already focused on expanding their supply in northern and western Africa, albeit with varying methods. Russia has leveraged its liberal applications of private military contractors such as the Wagner Group to secure special rights and mining agreements, while the PRC provides significant financing through the Belt and Road Initiative.[46] The U.S. government is behind in securing a global REE supply.

A more active hand from the U.S. government may be required to force the executors that would shore up REE national security concerns—that is, directed industry efforts at organizing the supply chain and building redundancies for risk mitigation. One historical precedent with high purchase in attempting to solve the REE issue from upstream exploration, mine development, extraction, processing, and downstream incorporation into advanced technologies is the World War II-era Petroleum Administration for War (PAW). PAW, as conceptualized by the administration of U.S. president Franklin D. Roosevelt in the early 1940s, sought to secure critical energy resources during the war by formalizing the relationship between the U.S. government's strategic direction and industrial stakeholders' technical expertise. A new U.S.-led framework in this vein would draw government representation throughout the executive branch and across the interagency to include the Department of State, the DOD, the Department of Energy, the Department of the Interior, and relevant actors from the intelligence community.[47] As with modern bodies such as the Committee on Foreign Investment in the United States, participation in such an organization to safeguard DIB supply would be crucial.[48] Additionally, the new organization would include rep-

resentatives from key U.S. allies. Finally, it would leverage those same entities with the technical expertise, workforce, and acumen to pursue U.S. strategy in securing a supply of REEs, establishing a durable supply chain for processing REEs, and delivery of REEs to those key corporations for downstream manufacturing. Primary among these corporations would be those discussed above: Lynas, Ucore, and MP Materials.

Risk to the global REE supply chain is another topic to tie to the accelerating and intensifying U.S.-PRC strategic competition. Both countries' respective alliances and partner networks must be considered for risk distribution and vulnerability identification. The United States still has a strategic advantage in messaging to expand its current REE supply chain with both its current allies and additional partners in Africa in a new REE great game to wrest potential suppliers and processors from PRC influence in a responsible manner. The United States and its allies must contend with inhibiting historical legacies to effectively overcome the current hedging calculus of some African nations reaping the benefits of this competition. Any concerted effort cannot be effective without accompanying strategic messaging to amplify the direct benefits that such resource relationships with the United States offer vis a vis the PRC or Russia.

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