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Resource Security in a Fragmented World: Supply Chain Nationalism and the Geopolitics of Deep-Sea Mining

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Abstract

Growing recognition that global supply chains are becoming more fragmented, exacerbated by geopolitical tensions and economic nationalism, is raising the profile of resource security. Deep-sea mining (DSM) has become a new battlefield for securing strategic materials for green technology, defense technology, digital technology. This article explores the nexus between supply chain nationalism and the geopolitical dimensions of DSM, in which states and corporates are fighting for space to access seabed resource. Using examples from the Pacific, Atlantic and Indian Oceans, the study underscored the regulatory gaps, environmental threats and strategic considerations of DSM to global resource governance. Without strong international cooperation, the race for deep-sea minerals could worsen geopolitical rivalries and environmental destruction, the findings indicate.

Keywords: deep-sea mining, resource security, supply chain nationalism, geopolitics, critical minerals

1. Introduction

The 21st century has witnessed a resurgence of economic nationalism, with states prioritizing supply chain resilience in response to geopolitical uncertainties (Baldwin & Evenett, 2020). The COVID-19 pandemic and U.S.-China trade wars have accelerated efforts to reduce dependence on foreign mineral supplies, particularly rare earth elements (REEs), cobalt, and nickel (Lee et al., 2020). Deep-sea mining (DSM) has gained prominence as an alternative source for these critical minerals, sparking a geopolitical scramble for underwater resources (Childs, 2022).

This paper explores how supply chain nationalism shapes the geopolitics of DSM, focusing on state strategies, corporate interests, and regulatory frameworks. It argues that while DSM offers a potential solution to mineral shortages, its exploitation risks deepening global fragmentation and environmental harm.

Research Problem

How are states balancing economic nationalism (supply chain resilience) with the global governance challenges of deep-sea mining?

Research questions

1. How does supply chain nationalism drive state interests in deep-sea mining?
2. What are the geopolitical and environmental risks of unregulated deep-sea mining?
3. Can international institutions effectively govern seabed resources in an age of rising economic nationalism?

2. Literature Review

The geopolitics of deep-sea mining (DSM) has garnered increasing scholarly attention amid rising concerns over resource security and supply chain nationalism. Recent literature highlights how states are leveraging DSM to reduce dependence on terrestrial mineral supplies, particularly for critical green technologies and defense applications (Childs, 2022; Klinger, 2021). Scholars such as Hein et al. (2020) emphasize the economic potential of polymetallic nodules in the Clarion-Clipperton Zone (CCZ), which contain high concentrations of cobalt, nickel, and rare earth elements. However, geopolitical tensions complicate international governance, with China, the U.S., and the EU vying for dominance in seabed exploration (Zhang, 2023; European Commission, 2023). The International Seabed Authority (ISA) faces criticism for its weak regulatory framework, which struggles to balance commercial interests with environmental protections (Wedding et al., 2021; Jaeckel, 2020). This body of work underscores the risks of uncoordinated extraction, including regulatory fragmentation and escalating great-power competition over underwater resources.

Environmental and ethical concerns also dominate contemporary discourse on DSM. Marine biologists warn that deep-sea ecosystems, particularly hydrothermal vents and abyssal plains, face irreversible damage from mining activities (Van Dover et al., 2022; Thurber et al., 2021). Legal scholars argue that existing governance structures, such as the United Nations Convention on the Law of the Sea (UNCLOS), lack enforceable mechanisms to mitigate ecological harm (Boschen et al., 2021). Meanwhile, political economists examine how supply chain nationalism exacerbates these challenges, as states prioritize resource autonomy over sustainability (Baldwin & Evenett, 2020; Hurst, 2021). Some researchers propose alternatives, such as circular economy strategies and terrestrial mineral recycling, to reduce reliance on seabed exploitation (IEA, 2021). Collectively, these studies reveal a pressing need for multilateral cooperation to ensure that DSM advances resource security without compromising marine biodiversity or geopolitical stability.

3. Theoretical Framework

In realist terms, states operate in the pursuit of national interest and strategic autonomy. Access to strategic minerals follows this logic particularly, given the increasingly disputed nature of global supply chains (Klare, 2001). The acquisition of resources is thus frequently viewed as a zero sum game, as the advantage to one state necessitates the cost to another. This framing

prompts states to look for new frontiers such as the seabed, where geopolitical rivalries could unfold with less constraint than on land.

Instead, liberal institutionalism refuses to let go of international norms and institutions. ISA and UNCLOS have been established in order to guarantee equitable and sustainable use of the resources of the oceans. Yet its impact is conditioned by state compliance and reform of the institution (Jaeckel, 2017). The liberal view is that multilateral cooperation can solve collective action problems – at the same time, multilateral cooperation is considered meaningless unless institutional deficiencies are resolved.

Such environmental economics also provides a critical angle on a given potential for the sustainability of resource extraction. It questions expansionist paradigms and requires the safeguarding of natural systems, which are hard to repair once tampered with (Levin et al., 2020). That's partly because some say decision makers must think of the deep sea not as a stash house of mineral wealth, but as an intricate ecological wonder that has value just by being what it is. It goes on to claim that the precautionary principle should lead policy while science honestly informs risk assessment.

4. Methodology: Analyzing Resource Security and Deep-Sea Mining Geopolitics

This study utilizes mixed methods to explore the complex dynamics of supply chain nationalism and the geopolitics of deep-sea mining (DSM). The approach combines qualitative and quantitative methods for an analysis of state mechanisms, governance challenges and the environmental consequences of state strategies.

The study adopts a case-oriented comparative approach, examining three key dimensions:

- National strategies of major DSM actors (China, U.S., EU, Pacific Island nations)
- Institutional analysis of the International Sea bed Authority (ISA) governance framework
- Environmental impact assessments of proposed mining zones

Primary data was gathered through:

- Semi-structured interviews with 35 stakeholders (government officials, ISA representatives, mining executives, and environmental NGOs) conducted between 2022-2023
- Analysis of policy documents from national governments and the ISA (2010-2023)
- Mining contract data from the ISA's public registry
- Marine science reports on biodiversity in proposed mining areas

Secondary sources included:

- Academic literature on resource nationalism and ocean governance
- Industry reports on critical mineral supply chains
- Media analysis of geopolitical discourse around DSM

The study applies:
a) Content analysis b) Geospatial analysis c) Comparative case study method

The analysis is grounded in three theoretical perspectives:

- Resource nationalism (Hurst, 2021)
- Ecological security frameworks (Van Dover et al., 2022)
- Critical geopolitics (Childs, 2022)

This methodological approach enables systematic examination of how supply chain nationalism is reshaping deep-sea mining governance while accounting for environmental and geopolitical complexities.

5. Supply Chain Nationalism: Drivers and Cases

States have competing narratives of manufacturing as a national security strategy, and move from passive investment to a protectionist trade manoeuvre, or what I term supply chain nationalism, in the pursuit of critical minerals in an increasingly fragmented geopolitical landscape. This shift has been motivated by three primary drivers: (1) geopolitical competition especially between the U.S. and China, which have weaponized trade dependencies in industries such as semiconductors and renewable (Lee et al., 2020); (2) economic security considerations, manifested through the EU's Critical Raw Materials Act (2023) and the U.S. Inflation Reduction Act (2022) domestic sourcing stipulations; and (3) pandemic-induced supply-chain disruptions, which laid bare risks in fragile, just-intime global value chains (Baldwin & Evenett, 2020). NAVAL MINERALS States are also more likely to look to the deep sea as a way around terrestrial supply choke points, such as China's control of rare earth processing (Klinger, 2021). (This has led to competitive investments in seabed exploration.

For instance, China's state-owned China Minmetals has secured the most International Seabed Authority (ISA) exploration contracts, while the U.S. leverages private-sector partnerships with firms like The Metals Company to circumvent terrestrial dependencies (Zhang, 2023). These actions reflect a broader shift from neoliberal globalization to strategic decoupling**,** where national security priorities override free-market principles (Hurst, 2021).

Case studies illustrate how supply chain nationalism manifests in DSM geopolitics. In the Pacific, China's "Ocean Dream 2030" strategy combines ISA licensing with investments in Pacific Island nations' EEZs, merging resource access with geopolitical influence (Chen & Liu, 2022). Conversely, the Atlantic sees NATO allies like Belgium and the U.K. backing DSM ventures (e.g., DEME Group) to reduce reliance on adversarial suppliers (European Commission,

2023). Smaller states also participate: India's Deep Ocean Mission targets poly metallic sulfides in the Indian Ocean, aligning with its Indo-Pacific security goals (Ministry of Earth Sciences, 2021), while Jamaica host of the ISA—leverages institutional power to sway mining regulations (Childs, 2022). However, such nationalism risks fragmenting global governance, as states prioritize unilateral over collective action. The ISA's inability to finalize mining codes amid competing national interests exemplifies this tension (Wedding et al., 2021), raising questions about whether resource security can be achieved without exacerbating geopolitical and ecological instability.

6. Deep-Sea Mining: Geopolitics and Governance Challenges

Seabed minerals offer an attractive alternative to land-based sources. Polymetallic nodules are rich in cobalt, manganese, and nickel—all essential for green tech. Yet, the rush to mine the seabed has outpaced regulatory development. Multinational corporations, sometimes in partnership with small island nations, are pushing for commercial licenses despite growing calls for a global moratorium.

Environmental dangers include the loss of biodiversity, the disruption of marine food chains and plumes of sediment that can drift hundreds of kilometers. Long-term consequences still remain to be known, and calls for a precautionary principle are increasing (Levin et al., 2020). Environmental NGOs including the Deep Sea Conservation Coalition have called on policy-makers to pause before mining and allow independent scientific advice to offer sufficient guidance.

At the other end of the exploitation and conservation spectrum, the ISA, responsible for striking the balance, is criticized, in fact, as being too heavily influenced by corporate interests. Concerns have been raised about governance equity along with scientific review when companies such as The Metals Company have established partnerships with small island states to pursue accelerated licenses (Jaeckel, 2017). ISA decision-making has also been criticized for being opaque—especially in terms of how environmental regulations are formed and enforced.

Roughly 30 countries primarily from Europe—have expressed support for a temporary halt on deep-sea mining, citing serious concerns about its environmental and geopolitical consequences. Among these nations are the United Kingdom, Germany, Austria, and Canada, all of which argue that stronger scientific evidence is needed before such high-risk activities commence (International Seabed Authority [ISA], 2023). Notably, this movement has seen no backing from African or Asian countries. In Latin America, only Costa Rica and Chile support the moratorium. Costa Rica's stance reflects its consistent emphasis on environmental protection, while Chile fears that extracting seabed minerals could reduce demand for its key export—copper (Heffernan, 2023).

Simultaneously, major global corporations are beginning to draw ethical lines in the sand. Companies such as Google, BMW, Volkswagen, and Volvo have pledged not to source minerals from the deep ocean due to environmental and reputational risks (Deep Sea Mining Campaign, 2022). These commitments reflect growing scrutiny from environmentally conscious consumers and the broader push for responsible sourcing in green technology supply chains.

Conversely, China has adopted an assertive and strategic approach to deep-sea mining. For more than a decade, it has invested heavily in undersea extraction technologies and has emerged as the leading state

actor in this domain. Within the ISA framework, China currently holds five of the 31 exploratory licenses more than any other country (ISA, 2023). These licenses give China preferential access to some of the most mineral-rich areas of the seabed, positioning it to dominate commercial operations once the ISA finalizes exploitation regulations.

This assertiveness has geopolitical implications. On February 15, 2025, China signed a memorandum of understanding with the Cook Islands to collaborate on seabed mineral exploration and potentially extraction in the South Pacific. While framed as a commercial partnership, this kind of bilateral cooperation raises strategic concerns. If China were to deploy vessels to the Clarion-Clipperton Zone (CCZ), a resource-rich region near Hawaii, it would be difficult for observers to verify whether these missions were solely commercial or had strategic or military dimensions (Loy, 2024).

China's pursuit of deep-sea resources complements its dominance in key mineral markets. The country currently supplies about 95% of the world's rare earth elements and produces nearly 75% of all lithium-ion batteries, which are essential for technologies such as electric vehicles, solar power storage, and advanced weapons systems (U.S. Geological Survey [USGS], 2024). Access to deep-sea minerals would further entrench China's control over supply chains critical to the global energy transition.

Ultimately, the debate over deep-sea mining is not limited to ecological risks—it also underscores growing rivalries over technological power and geopolitical influence. As the clean energy race intensifies, whoever controls seabed minerals may shape not only future industries but also the balance of global power in the decades ahead.

7. Case Study: The Pacific & Great-Power Competition

The Pacific Ocean has become a focal point of great-power competition in deep-sea mining (DSM), with China, the United States, and their allies vying for control over mineral-rich seabeds. China has adopted an assertive strategy, securing five exploration contracts from the International Seabed Authority (ISA) - more than any other nation - while simultaneously investing in Pacific Island nations through infrastructure projects and bilateral mining agreements (Zhang, 2023; Chen & Liu, 2022). This dual approach combines formal international governance with bilateral leverage, exemplified by China's 2022 security pact with Solomon Islands, which included provisions for seabed resource cooperation (Filer & Gabriel, 2023). The United States has responded by revitalizing its Pacific partnerships through initiatives like the Partners in the Blue Pacific (2022) and supporting DSM ventures such as those by The Metals Company in the Clarion-Clipperton Zone (Miller, 2023). This competition reflects broader geopolitical tensions, as control over Pacific seabed minerals - particularly cobalt and nickel for electric vehicle batteries - is viewed as critical to technological and military supremacy (IEA, 2021; U.S. Department of Defense, 2022).

The Pacific case reveals how DSM intersects with neo-colonial dynamics and environmental justice concerns. While great powers frame seabed mining as essential for green energy transitions, Pacific Small Island Developing States (PSIDS) face pressure to license exploration in their Exclusive Economic Zones (EEZs) despite limited capacity to regulate or monitor operations (Tilot., 2021). One such example is the Cook Islands, where licences have been given for exploration of manganese nodules in the EEZ but independent environmental review capacity is lacking (Filer, 2022). However, the decision-making processes of the ISA continue to be dominated by developed countries, despite the common heritage of mankind principle in

UNCLOS (Jaeckel, 2020). This asymmetry has opened these external powers to charges of "blue colonialism" in which resources are extracted but environmental risks are borne at home (Childs, 2022). The Pacific case thus shows how DSM multiplies old power differentials and at the same time opens up new geopolitical battlefronts under the sign of supply chain nationalism.

8. The Strategic Promise of the Pacific Seabed

It is one of the world's highest pragmatically valued seafloor resources that possess important reserves of polymetallic nodules, cobalt rich crusts, and seafloor massive sulfides, which are considered as key for the future of renewable energy technologies and for defense purposes as well (Hein et al., 2020). The CCZ holds an estimated 21 billion dry tonnes of polymetallic nodules that are rich in nickel and cobalt (International Seabed Authority [ISA], 2022), more than are contained in all available land-based resources put together, and, as such, is a geostrategic asset in the global transition to the green energy future. Such resources are particularly important as countries attempt to wean themselves off of land-based supply chains, dominated by China, which currently accounts for around 60% of world rare earth element production and 70% of cobalt refining capacity (IEA, 2023). The mineral richness of the Pacific, combined with its strategic position as a crossroad of international shipping has made the region a battleground for competing visions of resource security, with China pursuing its 'Marine Power' strategy, and the U.S. and its allies promoting partnership as a form of resource security, including through the Minerals Security Partnership (European Commission, 2023; U.S. Department of State, 2022).

But the harvesting of Pacific seabed resources poses knotty governance challenges that cut across environmental preservation, indigenous rights and geopolitical security. Although the ISA has approved 17 exploration contracts in the CCZ ((up to) 2023), the regulatory framework for commercial exploitation is not yet defined and the unresolved matters of commercial exploitation have led to conflicts between mining proponents and conservationists (Wedding et al., 2021). Pacific Island countries have particular challenges considering the economic opportunities of deep-sea mining and their potential environmental impacts on the marine ecosystems that support the livelihoods and cultures of local communities (Tilot., 2021).

The Cook Islands, for instance, has established the world's largest marine protected area while simultaneously pursuing nodule mining in its exclusive economic zone a contradiction that highlights the competing priorities facing resource-rich Pacific states (Filer, 2022). These dynamics are further complicated by the "common heritage of mankind" principle under the United Nations Convention on the Law of the Sea (UNCLOS), which requires equitable benefit-sharing but remains poorly defined in practice (Jaeckel, 2020). As technology makes deep-sea mining more feasible, the Pacific seafloor has developed from a remote mining frontier a testing ground for 21st-century resource governance in a time of climate change and ecological destruction into what mining companies call the new gold rush.

9. China's Strategic Deep-Sea Expansion

This is part of a broader and concerted state-led strategy in China to take a leading role in deep-sea mining, that fuses technological development with institutional and geopolitical influence. Deep-sea mining has been identified as a national priority by the Chinese government in its

"marine power" strategy, and China's state-owned China Minmetals Corporation and the China Ocean Mineral Resources Research and Development Association (COMRA) have acquired, through the International Seabed Authority (ISA), five exploration contracts -- the most by any single country (Zhang, 2023; Li & Liu, 2022). This transition is driven by a significant capital investment in specialized equipment, consisting of the world's first dedicated deep sea mining vessel ("Pioneer 1") that can function to 3,000m depth (Chen et al., 2023). Its engagement in Africa goes beyond simple resource extraction; instead, it seeks to engage with countries to control the whole value chain from exploration, mining technology, processing to manufacturing thereby forming, as scholars call it, a “vertical monopoly” in critical mineral supply chains (Klinger 2021). This approach also serves the country’s larger geopolitical aims, as it aims to diminish its reliance on foreign minerals and become an indispensable provider for green energy technologies (IEA, 2023).

China's deep-sea ambitions are further amplified through strategic partnerships with Pacific Island nations, where it has leveraged infrastructure investments and bilateral agreements to secure access to exclusive economic zones (EEZs) rich in seabed minerals (Filer & Gabriel, 2023). The 2022 security pact with Solomon Islands, which included provisions for marine resource cooperation, exemplifies this "resources-for-infrastructure" diplomacy (Yang, 2023). Simultaneously, China has increased its influence within international governance bodies, with Chinese nationals holding key positions in the ISA Secretariat and Chinese delegations consistently advocating for mining-friendly regulations (Jaeckel, 2022). This multi-pronged approach has raised concerns among Western nations, particularly as China's seabed exploration activities increasingly overlap with areas of strategic interest to the U.S. and its allies (U.S. Department of Defense, 2023). However, China's dominance faces challenges, including technological hurdles in commercial-scale mining operations and growing international calls for environmental moratoriums (Childs, 2023). As the race for seabed minerals intensifies, China's strategic expansion continues to reshape the geopolitical landscape of resource security.

10.The U.S. and Allied Response: A Cautious Reengagement

The United States and its allies have adopted a measured yet strategic approach to deep-sea mining (DSM) in response to China's dominance, balancing economic interests with environmental and geopolitical considerations. Unlike China's state-driven expansion, the U.S. has relied on public-private partnerships, notably through companies like The Metals Company (TMC), which holds exploration contracts in the Clarion-Clipperton Zone (CCZ) via partnerships with Pacific island nations such as Nauru and Kiribati (Miller, 2023; U.S. Department of State, 2023). The Biden administration has integrated DSM into broader supply chain resilience strategies, including the Inflation Reduction Act (2022) and the Minerals Security Partnership (MSP), a coalition of Western allies aiming to diversify critical mineral supplies (White House, 2022). However, the U.S. remains cautious, with the Pentagon warning of "strategic overreach" if environmental and regulatory frameworks are not solidified (U.S. Department of Defense, 2023). This ambivalence reflects a tension between securing minerals for clean energy transitions and addressing concerns from environmental groups and scientists, who argue that commercial DSM could cause irreversible ecological damage (Van Dover et al., 2022).

Allied nations have mirrored this cautious reengagement, with the European Union and Japan pursuing DSM as a supplement rather than a replacement—for terrestrial mining and recycling

initiatives. The EU's Critical Raw Materials Act (2023) includes provisions for seabed mineral exploration but emphasizes circular economy principles to reduce dependency on extraction (European Commission, 2023). In contrast to China's ocean mining activities, Japan has made considerable investments in DSM technology, including the first successful recovery of zinc and gold from hydrothermal vents in its EEZ (Ogawa 2023) and funding for research into less harmful mining practices (JOGMEC 2022). These initiatives are coordinated through coalitions such as the G7 Climate Club designed to anchor DSM in high environmental standards (G7 Germany, 2022). Still, the rift remains: France and Germany call for a moratorium, while the U.K. and Canada seeks for the regulated utilization (Wedding et al., 2023). The fragmented response underlines how difficult it is to draw up a united western strategy to challenge China's dominance without breaking environmental or governance standards.

11. Pacific Island Nations: Sovereignty, Sustainability, and Strategy

Pacific Island states find themselves in a difficult position with respect to deep sea mining (DSM) and its relationship with geopolitics, balancing the allure of economic development with the need to safeguard the environment. Nations such as Nauru, Kiribati and the Cook Islands have huge endowments of EEZ in the form of polymetallic nodules and are increasingly courted by mining companies as well as the world's more powerful states(Filer & Gabriel, 2023).

Nauru's 2021 decision to trigger the "two-year rule" under UNCLOS forcing the International Seabed Authority (ISA) to finalize mining regulations highlighted how small states can leverage their legal standing to influence global governance (Jaeckel, 2022). However, these nations face acute dilemmas: while DSM royalties could provide critical revenue for climate adaptation and development, mining risks damaging marine ecosystems central to local livelihoods and cultural identity (Tilot et al., 2021). The Pacific Islands Forum's 2023 call for a moratorium, led by Fiji and Palau, revealed regional divisions, with resource-poor nations prioritizing conservation while others, like Tonga, explore partnerships with Chinese and Western mining firms (Powles & Sovacool, 2023). This tension reflects broader questions about sovereignty in an era of "blue colonialism," where external actors often dictate the terms of resource exploitation (Childs, 2022).

Strategically, Pacific Island nations are navigating competing offers of assistance from China, the U.S., and regional partners like Australia and Japan. China's "resources-for-infrastructure" diplomacy, exemplified by its 2022 pact with Solomon Islands, has raised concerns about debt dependency and loss of autonomy (Yang, 2023). In response, the U.S. and allies have expanded engagement through initiatives like the Partners in the Blue Pacific (2022) and increased funding for marine research (U.S. Department of State, 2023). Some nations, such as the Cook Islands, are pursuing hybrid models: establishing marine protected areas while licensing nodule exploration in their EEZs (Filer, 2022). These approaches underscore the region's efforts to balance immediate economic needs with long-term sustainability goals. Yet, capacity gaps persist many lack the technical expertise to monitor mining operations or negotiate equitable contracts (Tarte, 2023). As the ISA debates global regulations, Pacific voices are increasingly assertive but remain constrained by asymmetries of power, illustrating the challenges of securing equitable benefits from seabed resources in a fragmented world order.

12. Conflict or Cooperation? Governance Pathways in Deep-Sea Mining

The governance of deep-sea mining (DSM) stands at a crossroads between conflictual resource competition and cooperative multilateralism, with the International Seabed Authority (ISA) serving as the primary battleground for these competing visions. While the United Nations Convention on the Law of the Sea (UNCLOS) designates seabed minerals as the "common heritage of mankind," rising supply chain nationalism has fueled zero-sum approaches, particularly as China secures exploration contracts covering over 92,000 square miles of the Pacific seabed nearly 40% of ISA-licensed areas (ISA, 2023; Zhang, 2023). This scramble has triggered regulatory paralysis, with the ISA repeatedly postponing final commercial rules amid disputes over environmental standards and benefit-sharing mechanisms (Levin et al., 2023). Smaller states and civil society organizations increasingly challenge this status quo, as seen in the 2023 Pacific Islands Forum declaration demanding a moratorium and the European Parliament's call for precautionary pauses (Powles, 2023; European Parliament, 2023). These tensions reflect a fundamental governance dilemma: whether DSM will follow a conflict-prone "gold rush" model or a cooperative framework balancing ecological protection and equitable access.

Alternative governance pathways are emerging to bridge this divide, though their viability remains uncertain. The Minerals Security Partnership (MSP) a U.S.-led coalition of 13 nations seeks to establish "high-standard" supply chains that could incentivize responsible DSM practices through market mechanisms (U.S. Department of State, 2023). Meanwhile, scientific consortia like the Deep Ocean Stewardship Initiative (DOSI) advocate for hybrid models incorporating marine spatial planning and block chain-based mineral tracking to enhance transparency (Wedding. 2023). Some scholars propose regional governance bodies, such as a Pacific DSM commission, to give affected states greater decision-making power (Filer & Gabriel, 2023). However, these approaches face significant hurdles, including resistance from mining states and the absence of enforcement mechanisms. The coming decade will likely see a patchwork system emerge, where conflict and cooperation coexist with ISA-governed areas competing with bilateral mining deals and regional initiatives? This fragmented governance landscape mirrors broader trends in resource nationalism, suggesting that without renewed commitment to multilateralism, the "tragedy of the commons" may prevail in the deep ocean.

13. Policy Recommendations

For States: Diversify supply chains responsibly and support international environmental standards. Ensure that policies on critical minerals are aligned with sustainability goals and indigenous rights.

For ISA: Increase transparency, strengthen environmental regulations, and slow license approvals until sufficient data is available. Involve independent scientific bodies in reviewing applications and mandate periodic environmental assessments.

For NGOs and Scientists: Advocate for moratoriums, conduct independent research, and support informed decision-making in small island nations. Build networks of regional cooperation and amplify the voices of affected communities in international forums.

Conclusion

The geopolitics of deep-sea mining (DSM) epitomises what Promethean geographies call the 'antagonistic cooperation' at the core of new resource securities: the need for multilateral collaboration in a context of emergent supply chain nationalism. As this study has shown, the scramble for ocean minerals fueled by the green energy transition and major power competition has revealed the inadequacies in current governance mechanisms — and opened new battlegrounds for geopolitical rivalry. The International Seabed Authority (ISA), conceived to shepherd the "common heritage of mankind," finds it increasingly difficult to reconcile competing interpretations as China's aggressive claims, U.S.-led counter- initiatives, and Pacific Island nations' sovereignty concerns exert contradictory pulls. This fragmentation is also a microcosm of the shifts occurring in global governance, where multilateral architectures are pushed aside in favor of bilateral or regional deals that more faithfully express the national interest than any sense of collective guardianship.

But the costs of anarchy in competition are simply too high to ignore. DSM brings geopolitical risk but also irrevocable ecological damage, endangering marine life and the livelihood of coastal peoples. Realigning governance tools: Empowering the ISA with enforcement measures, incorporating scientific consensus into regulations, and promoting equitable benefit sharing with vulnerable states The road ahead requires the recalibration of governance tools: Empower the ISA with enforcement Strengthening enforcement measures is critical for future ISR activities. Models for achieving this balance between strategic interests and sustainability exist in the Minerals Security Partnership(MSP) and regional initiatives such as the Pacific DSM Commission. But success depends on whether states can prioritize long-term planetary security over short-term resource nationalism. With the ISA closing in on its final mining code, the decisions taken today will determine if the minerals of the deep sea are a source of conflict or a test case for cooperative resource management in a fractured world. The stakes are higher than the mine and the mine field—they determine the future of global environmental governance.

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