



Francesca Maremonti

› Transatlantic Critical Materials Supply Chains: Rock-Solid?*

- › The EU and the US are ramping up their effort to build resilient supply chain for critical minerals, through domestic measures, bilateral partnerships and multilateral.
- › China's growing capabilities in exploration and extraction technologies introduce a layer of growing dependencies for the EU and US.
- › Beijing's growing role in shaping a China-centred supply chain governance architecture could undermine transatlantic cooperation on "responsible mining" and rapid response mechanisms for mineral supply chains.

As states become more adept at identifying and exploiting chokepoints and asymmetric dependencies, access to strategically important inputs can no longer be treated as a purely commercial concern. Critical minerals – which underpin batteries, semiconductors, permanent magnets, energy infrastructure and defence technologies – fit squarely into such concerns. Securing these strategic inputs is vital as global demand for critical minerals is projected to roughly double by 2040.¹

The central vulnerability concerning critical raw materials (CRMs) rests in concentration of supply. China remains the dominant processor of many of the minerals on which advanced economies depend. Its share of global rare-earth refining, although declining, stood at approximately 85 per cent in 2025. China is also home to roughly 70-95 per cent of minerals such as lithium, cobalt and graphite.² Dependence is particularly acute in Europe, as China is still the supplier of 100 per cent of the EU's heavy rare earth elements.³ The United States is also heavily exposed, as China accounted for about 70 per cent of US imports of rare-earth compounds and metals between 2021 and 2024.⁴

* This brief was produced in the context of the 2026 Transatlantic Symposium, IAI's annual forum bringing together diplomats and experts from the United States and Europe to discuss the main issues on the transatlantic agenda behind closed doors. The 2026 edition was organised in cooperation with the Policy Planning Unit of the Italian Ministry of Foreign Affairs and International Cooperation, which hosted the event on 28 September 2026. The Symposium was made possible thanks to the support of Fondazione Compagnia di San Paolo.

¹ International Energy Agency (IEA), "Outlook", in *Global Critical Minerals Outlook 2026*, July 2026, <https://www.iea.org/reports/global-critical-minerals-outlook-2026/outlook>.

² Rochas, Anna Flávia, "US Invests in Critical Minerals but China Maintains Grip", in *Reuters*, 14 September 2026, <https://www.reuters.com/business/energy/us-invests-critical-minerals-china-maintains-grip-reeii-2026-09-14>.

³ European Commission DG for Internal Market website: *Critical Raw Materials*, https://single-market-economy.ec.europa.eu/node/279_en.

⁴ Johnston, Shelby N., "Rare Earths", in US Geological Survey, *Mineral Commodity Summaries*, updated May 2026, p. 152-153, <https://doi.org/10.3133/mcs2026>.



»» Despite ongoing tensions, CRM supply chains still see a degree of transatlantic cooperation

Over the course of 2025, with the escalation of trade tensions between the United States and China, Beijing has leveraged its heft, proving how geographic concentration of supply can translate into a strategic chokepoint. The Chinese government imposed licensing controls on seven categories of medium and heavy rare earths in April and announced a further expansion of its regime in October 2025. Although the October measures were subsequently suspended for one year, these episodes exposed the vulnerability supply chains and the ripple effects on downstream industries such as the defence and automotive sectors on both shores of the Atlantic.

The EU and United States have consequently intensified efforts to diversify their critical mineral supply chains through domestic measures, bilateral partnerships and multilateral cooperation. The EU's Critical Raw Materials Act of 2024 establishes a framework for expanding domestic extraction, processing and recycling, while diversifying external supplies.⁵ The December 2025 RESourceEU Action Plan accelerated this strategy, prioritising greater resilience for supply of rare-earth permanent magnets, battery materials and defence-related raw materials.⁶ The United States has pursued a more explicitly national-security-oriented strategy, seeking to accelerate domestic mineral production, permitting and financing, while subsequent measures have expanded support for processing capacity and strategic stockpiling.

Despite ongoing tensions, CRM supply chains still see a degree of transatlantic cooperation. In April 2026, the EU and the US signed a memorandum of understanding (MoU) establishing a strategic partnership on critical minerals and agreed on a Critical Minerals Action Plan. The MoU lays out the frameworks for cooperation across the entire value chain – from exploration to recycling – while the Action Plan additionally explores coordinated trade instruments, including standards-based markets, price floors and offtake arrangements. Additionally, transatlantic cooperation is increasingly embedded within a broader network of mineral partnerships. The 2025 G7 Critical Minerals Action Plan committed members to diversify responsible production and supply, mobilise investment and develop standards-based markets while coordinating responses to deliberate market disruption.⁷ In February 2026, the United States also launched the Forum on Resource Geostrategic Engagement (FORGE), providing a wider platform through which partner countries as Australia, Canada and Japan can coordinate mineral projects, policies and investment.⁸

These initiatives represent a substantial attempt to reduce vulnerabilities and build more resilient supply chains. However, two less dimensions could undermine their effectiveness. The first is the growing dependence on Chinese mining technologies. As exploration and extraction become increasingly reliant on artificial intelligence (AI), autonomous machinery, batteries, industrial

⁵ European Commission DG for Internal Market website: *Critical Raw Materials Act*, https://single-market-economy.ec.europa.eu/node/2053_en.

⁶ European Commission, *Factsheet: RESourceEU Action Plan*, 3 December 2025, https://ec.europa.eu/commission/presscorner/detail/en/fs_25_2888.

⁷ G7, *G7 Critical Minerals Action Plan*, Kananaskis, 17 June 2025, <https://www.g7.utoronto.ca/summit/2025kananaskis/250617-critical-minerals.html>.

⁸ US Bureau of Economic, Energy, and Business Affairs, *Forum on Resource Geostrategic Engagement Guiding Principles*, 10 July 2026, <https://www.state.gov/releases/bureau-of-economic-energy-and-business-affairs/2026/07/forum-on-resource-geostrategic-engagement-guiding-principles>.



>> China's growing capabilities in exploration and extraction technologies are introducing a layer of growing dependencies for the EU and the United States

connectivity and digital operating systems, diversification away from Chinese minerals may coexist with growing reliance on Chinese technologies used to discover and produce them. The second concerns mineral governance: the standards, information flows, due-diligence mechanisms and institutional arrangements that determine how mineral supply chains operate.

A neglected layer of resilience

Efforts by the EU and United States to build more resilient critical-mineral supply chains have concentrated primarily on the segments where dependence on China is most visible and where Beijing has demonstrated its capacity to exercise leverage, particularly processing and refining. Transatlantic cooperation has largely followed this logic, combining investment support, trade instruments and partnerships intended to diversify supply and improve the commercial viability of alternative value chains.

The April 2026 EU-US strategic partnership reflects this approach: its MOU covers the full value chain from exploration and extraction through processing, refining and recycling, while the accompanying Action Plan envisages common standards, investment promotion and stockpiling. Yet resilience begins before a mine enters production and increasingly depends on the technologies required to discover and operate mineral resources. China's growing capabilities in exploration and extraction technologies are introducing a layer of growing dependencies for the EU and the United States, potentially undermining their cooperation effort to build more resilient mineral supply chains.

The technological transformation of mining is making the 'upper-upstream' – the capabilities required to locate deposits, assess their commercial viability and operate mines – an increasingly strategic part of the supply chain. Additionally, digitalisation is transforming virtually every stage of mine development.⁹ During the exploration phase, AI systems can combine historical drilling records, geochemical surveys, satellite imagery and geophysical data to identify mineralisation patterns¹⁰ and improve exploration targeting, while advanced sensing technologies allow for a more precise characterisation of deposits that are deeper or more difficult to locate. Once mines become operational, autonomous haulage and drilling, remote operating centres (ROCs) and real-time analytics increasingly integrate vehicles, workers and production systems into digitally managed operations.¹¹ Resilience therefore no longer depends solely on access to mineral deposits and processing capacity, but also on access to connectivity, software and the data platforms through which increasingly automated mines operate.

China is building an increasingly competitive environment for mining operational technologies, which can more rapidly develop an integrated ecosystem that combines capabilities acquired in adjacent sectors,¹² such

⁹ Safonova, Anastasiia, "Mining Digitalization: Turning Challenges into Opportunities", in *AFRY Insights*, 27 August 2024, <https://afry.com/en/node/8661>.

¹⁰ Gupta, Sunena, "Rock Solid AI: How Digital Tools Are Unearthing a New Era of Mining Exploration", in *Cleantech Group Perspectives*, 7 July 2025, <https://cleantech.com/?p=70247>.

¹¹ Safonova, Anastasiia, "Mining Digitalization", cit.

¹² Congo Mining Network, *China's Autonomous Mining Technology Is Preparing for Global*



»» Australia occupies a central position in both the EU and US efforts to reduce dependence on China

as electric vehicles, batteries, telecommunications and industrial automation. The Yimin open-pit mine in Inner Mongolia¹³ illustrates this convergence. In May 2025, China Huaneng, XCMG, Huawei and State Grid launched a fleet of a hundred autonomous electric mining trucks operating through a 5G-Advanced network. Huawei provides cloud-based autonomous-driving services and AI algorithms, while the network links vehicles with cloud-based dispatch and sensing systems. Shanghai Qiyuan Core Power, a Chinese company specialising in new-energy heavy-duty transport, has been developing battery solutions that bring vehicle electrification and intelligent transport technologies into industrial applications, making mining operations more efficient. More broadly, Chinese smart-mining initiatives are integrating 5G connectivity, autonomous driving and advanced sensing to enable increasingly automated operations, while Chinese battery industry is contributing to the electrification of heavy mining equipment. The significance of these developments lies less in individual pieces of machinery than in their integration of these technologies into increasingly comprehensive operational systems.

This progressive integration can not only generate substantial efficiency gains, but also make technological substitution progressively more difficult once a particular tech ecosystem has been embedded in a mine's operations. In other words, a 'a rip-and-replace approach' – where risky Chinese operation technologies are removed – becomes a less viable option when mining technologies are embedded in Chinese telecom infrastructure. As the global mineral industry is increasingly reliant on these ecosystems, this potential for lock-in effects introduces an additional layer of dependence. In summer 2026, it was reported by Chinese autonomous-mining specialist CiDi that its equipment was already deployed in Australia while Europe, South America and the Middle East were indicated as prospective markets.¹⁴

The case of Australia is especially interesting. Leading Australian mining companies have reportedly begun cooperating with Chinese suppliers on smart-mining technologies and have acquired Chinese equipment – including batteries for heavy mining machinery as well as charging infrastructure. As a major mineral producer and a trusted partner in supply-chain diversification, Australia occupies a central position in both the EU and US efforts to reduce dependence on China. Yet the growing integration of Chinese technologies into Australia's mining industry reveals a potential paradox: efforts to diversify mineral production away from China may create or reinforce dependencies on Chinese technologies needed to make that production possible.

The EU-US current cooperation framework does recognise this dimension. The existing MoU includes exploration, innovation and geological mapping as sector for cooperation. However, geological mapping and innovation should be treated as interconnected elements of supply-chain security rather than stand-alone areas of cooperation. Identifying new deposits is of limited strategic value if the technologies required to exploit them become concentrated in

Expansion, 18 August 2026, <https://congominingnetwork.com/chinas-autonomous-mining-technology-is-preparing-for-global-expansion>.

¹³ "Qiyuan Green Power on Xilinhote Auto & Battery Swap Mining Truck Fleet", in *International Mining News*, 10 February 2025, <https://im-mining.com/?p=107937>.

¹⁴ Li, Qiaoyi et al., "China's CiDi Eyes Overseas Sales of Autonomous Mining Machines This Year", in *Reuters*, 24 July 2026, <https://www.reuters.com/business/autos-transportation/chinas-cidi-eyes-overseas-sales-autonomous-mining-machines-this-year-2026-07-24>.



»» **China's greater scrutiny on strategic sectors such as semiconductors, critical minerals and dual-use technologies is expected**

suppliers vulnerable to coercion or disruption. Additionally, these segments are not yet matched by a similarly developed agenda for assessing technological concentration, dependence on foreign mining-equipment suppliers, or vulnerabilities embedded in operational software and connectivity. This challenge is therefore not entirely absent from transatlantic cooperation but remains comparatively underdeveloped as a dimension of economic security.

Governance as a component of resilience

The April 2026 EU-US Critical Minerals Action Plan envisages common standards for “responsible mining” and rapid response to supply disruptions among the objectives of the transatlantic mineral partnership. These objectives make governance and information access intertwined to supply security. Responsible mining regimes depend on sourcing where minerals originate, how they are processed, and whether environmental, labour and human-rights risks have been addressed. The Responsible Minerals Initiative (RMI), for example, aims to facilitate responsible mineral sourcing by equipping companies with internationally aligned standards, tools, data and assurance programmes that support due diligence across primary and secondary mineral supply chains.¹⁵

China's centrality to many mineral supply chains therefore makes Chinese companies indispensable participants in such systems. Yet tension is emerging between international demands for greater traceability and Beijing's increasingly security-oriented approach to supply-chain information. This friction was reflected in the remarks by Jiang Hui, chairman of the China Chamber of Commerce of Metals, Minerals and Chemicals Importers and Exporters (CCCME). In a speech at the 2005 Organization for Economic Co-operation and Development (OECD) Forum, he said that information-security concerns made some Chinese companies unwilling to accept foreign audits and encouraged Western firms to participate in China's emerging supply chain governance.¹⁶

Legislative developments in 2026 give this tension greater significance. In spring 2026, the Chinese State Council announced the introduction of the Regulations on the Security of Industrial and Supply Chains and the Regulation on Countering the Inappropriate Extraterritorial Jurisdiction of Foreign Countries. The former provides authorities with substantial powers to respond to foreign actions deemed harmful to Chinese supply-chain security.¹⁷ Despite the degree of blurriness on the “disposition measures” available, greater scrutiny on strategic sectors such as semiconductors, critical minerals and dual-use technologies is expected.¹⁸ This concern is reinforced by the “inappropriate extraterritorial jurisdiction”, as Beijing is prepared to restrict

¹⁵ See the official website: <https://www.responsiblemineralsinitiative.org>.

¹⁶ Li, Qiang, “Will China Rewrite the Rules of Global Supply Chains?”, in *The Diplomat*, 25 August 2026, <https://thediplomat.com/2026/08/will-china-rewrite-the-rules-of-global-supply-chains>.

¹⁷ Freshfields, “China's New 2026 Supply Chain Security and Counter-Extraterritoriality Rules: What Companies Need to Know and How to React”, in *Freshfields Sustainability Blog*, 11 June 2026, <https://www.freshfields.com/en/our-thinking/blogs/sustainability/chinas-new-2026-supply-chain-security-and-counter-extraterritoriality-rules-wha-102n2b2>.

¹⁸ AHK Greater China, *Advocacy Alert: China Takes Further Steps on Supply Chain Management*, 6 July 2026, <https://china.ahk.de/en/news/advocacy-alert-china-takes-further-steps-on-supply-chain-management>.



>> Resilience increasingly depends on the rules governing extraction, traceability, information-sharing and responsible sourcing of minerals

compliance with foreign regulatory information requests where it considers them an illegitimate exercise of extraterritorial authority. These regulatory frameworks can therefore make foreign regulatory information requirements harder to gather from Chinese entities, ultimately complicating supply chain mapping and audits conducted in China.

At the same time, China is not simply restricting access to information from foreign entities. It is seeking a larger role in defining the rules governing international investment and mineral supply chains. Beijing's new outbound-investment regulation, introduced in July 2026, calls for China to "actively participate in the formulation of international investment rules" and deepen international industrial and supply-chain cooperation.¹⁹ This regulatory effort has been coupled with an intensification of activities carried out by the CCCMC. These include the Forum on Sustainable Mineral Supply Chains, which China hosted in 2020, 2023 and 2025, with the participation of major stakeholders and international organisations such as the OECD. Overall, the recent integration of a toolbox encompassing investment screening, anti-sanctions instruments, measures and initiatives supporting supply chain governance speak of an emerging architecture giving China greater capacity to shape how mineral production is governed.

Industrial policy alone cannot grant resilient supply chains alone. As EU and US diversification efforts remain a core pillar of transatlantic cooperation, resilience increasingly depends on the rules governing extraction, traceability, information-sharing and responsible sourcing of minerals. Aiming to promote common standards will have limited value without auditability, trusted data and sufficiently interoperable due-diligence systems. Rapid-response mechanisms will likewise be weakened when visibility over inventories, suppliers and processing networks is incomplete. This leaves a subtle vulnerability intact, namely growing dependence on China for the information and governance structures through which mineral supply chains are understood and managed. For the EU and the United States, this raises questions about the extent to which diversification initiatives can reduce strategic dependencies if the frameworks governing emerging supply chains is increasingly embedded on Chinese mining governance.

Conclusion

Resilience in critical mineral supply chains cannot be measured solely by where minerals are mined, processed or refined. Geographic diversification remains essential to reducing the concentration risks created by China's central position in critical mineral supply chains, but it does not necessarily eliminate strategic dependence. A supply chain diversified away from Chinese production may remain vulnerable if the technologies required to discover and operate alternative resources, or the governance arrangements through which those supply chains are monitored and managed, remain concentrated or difficult to substitute.

¹⁹ "China Unveils Regulation on Outbound Investment", in *Xinhua*, 1 June 2026, https://english.www.gov.cn/policies/latestreleases/202606/01/content_WS6a1d2e29c6d00ca5f9a0b59e.html.



»» Transatlantic cooperation should work towards greater coordination on mining technologies and mining governance

Transatlantic cooperation should work towards greater coordination on two neglected dimensions, namely mining technologies and mining governance. For the first case, establishing extraction and processing capacity outside China may provide only partial resilience if new operations remain dependent on Chinese equipment, software, industrial connectivity. As mining becomes increasingly digitalised and technologically integrated, new dependencies may emerge across the supply chain. China's restrictions on the export of certain mineral-processing technologies demonstrate that technological capabilities can themselves constitute strategic chokepoints, independently of the location of mineral deposits or production facilities. Greater visibility over supplier concentration, combined with interoperable technologies, data portability and alternative suppliers, would reduce the risks associated with difficult-to-replace technological ecosystems.

The second dimension is governance. Resilient supply chains depend not only on physical production but also on the standards, information and institutional arrangements through which mineral markets operate. As China develops its own regulatory frameworks and assumes a greater role in international mining governance, the challenge for the EU and United States is not to exclude China from these processes, but to avoid dependence on any single actor's standards, verification mechanisms or information architecture. Cooperation with mineral-rich countries should therefore combine investment in mines and processing facilities with interoperable standards, independent verification and reliable mechanisms for sharing supply-chain information.

These technological and governance dimensions are ultimately interconnected. Technologies shape how supply chains are operated, while standards and regulatory frameworks influence which technologies and commercial practices become embedded in new projects. Transatlantic critical-mineral cooperation should consequently move from a predominantly geographic understanding of diversification towards a more comprehensive assessment of dependency across the entire value chain.

The Istituto Affari Internazionali (IAI) is a private, independent non-profit think tank, founded in 1965 on the initiative of Altiero Spinelli. IAI seeks to promote awareness of international politics and to contribute to the advancement of European integration and multilateral cooperation. Its focus embraces topics of strategic relevance such as European integration, security and defence, international economics and global governance, energy, climate and Italian foreign policy; as well as the dynamics of cooperation and conflict in key geographical regions such as the Mediterranean and Middle East, Asia, Eurasia, Africa and the Americas. IAI publishes an English-language quarterly (*The International Spectator*), an online webzine (*AffarInternazionali*), two book series (*Trends and Perspectives in International Politics* and *IAI Research Studies*) and some papers' series related to IAI research projects (*Documenti IAI*, *IAI Papers*, etc.).

Via dei Montecatini, 17
I-00186 Rome, Italy
T +39 06 6976831
www.iai.it



Latest IAI Briefs

Editor: **Lorenzo Biondi** (l.biondi@iai.it)
ISSN 3103-4071 | DOI 10.82088/IAIbrief2651

- | | |
|-------|---|
| 26 51 | Francesca Maremonti, <i>Transatlantic Critical Materials Supply Chains: Rock-Solid?</i> |
| 26 50 | Beniamino Irdi, <i>Rethinking European Security When the American Anchor Slips</i> |
| 26 49 | Stefan Ristovski, <i>Between Geopolitics and Enlargement: Reconfiguring Pre-Accession Assistance in the Next EU Budget</i> |
| 26 48 | Federica Marconi, <i>Breaking the "Walled Garden": The Challenge of Interoperability under the EU's Digital Markets Act</i> |
| 26 47 | Matteo Bursi and Ettore Greco, <i>The Digital Euro at a Critical Juncture</i> |
| 26 46 | Ayşe Betül Çelik, <i>Women Negotiators' Strategies to Overcome Gender Inequality at the Table</i> |
| 26 45 | Anton Peez, <i>The Growing Transatlantic Sanctions Divide</i> |
| 26 44 | Alicia García Herrero, <i>China's Building Blocks for an Alternative Monetary System</i> |
| 26 43 | Eva Ziedan, <i>Negotiating Heritage: Local Mediation and the Reconstruction of Social Space in Today's Syria</i> |
| 26 42 | Nazanine Moshiri, <i>From Recognition to Alignment: The Next Challenge for European Climate, Peace and Security Policy</i> |