The race for strategic minerals: toward a reconfiguration of supply chains?

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Confidential

Summary

So-called "strategic" minerals, essential to the energy and digital transition, are at the heart of a supply chain largely dominated by China. This dominance stems from its near-monopoly on refining these resources, including those not directly extracted on its territory. To secure upstream supplies of raw minerals, China has significantly increased investments in producer countries, totaling over $200 billion in the past 20 years. Africa remains the primary destination for these investments, which continue to grow. While Western nations seek to reduce their dependence on China, Beijing is expanding its stakes in mining projects to maintain its preeminence. Against the backdrop of technological and trade tensions with the U.S., China has imposed several restrictions on the export of strategic minerals since 2023. Though their industrial impact remains limited for now, the return of Donald Trump to power and the risk of further escalation raise concerns over the introduction of more radical restrictions.

In response, the West is striving to redefine its supply chains. In the United States, revitalizing the strategic minerals industry has become a rare point of bipartisan agreement. While focusing on reopening mines and refining plants domestically, U.S. authorities are also ramping up investments abroad. As tensions with China intensify, securing strategic mineral resources is a priority for the new Trump administration, which is particularly interested in reserves in Ukraine and Greenland. In Europe, the passage of the Critical Raw Materials Act *in 2024 aims to diversify supply sources while strengthening local extraction and refining. However, despite ambitious targets, Europe's response remains in its early stages, with the EU struggling to develop its extractive capacities.*

Meanwhile, mineral-rich countries are seeking to move up the value chain by developing local refining industries and limiting raw ore exports. Success varies by region: Indonesia, backed by Chinese capital, now accounts for more than half of the world's refined nickel supply. However, African and Latin American nations continue to struggle in developing their local industries, despite their push for mining sovereignty.

Finally, the recycling of strategic minerals is increasingly viewed as a viable alternative. Yet, despite ambitious initiatives, current recycling capacities remain insufficient to meet growing demand.

1. A long-standing player in strategic minerals, China seeks to strengthen its grip on the value chain

1.1. From extraction to refining, a sector dominated by China

At the heart of the energy and digital transition**, critical minerals are used today in strategic sectors such as energy, electronics, the automotive industry and defense**. Now regarded as the inputs of the industrial society of the 21st century, they encompass a wide range of minerals (34 for the European Union, 50 for the United States), including cobalt, copper, lithium and rare earths, the latter grouping 17 metallic elements that are particularly strategic for low-carbon energy technologies. Although they are present throughout the earth's crust, strategic minerals are unevenly distributed. Some countries, like China, have abundant reserves. Endowed with a subsoil rich in minerals (34% of the world's rare earth reserves, 37% of vanadium reserves[1]), **Beijing enjoys a privileged position among the extractors of some of them** (70% of the world's rare earth extraction, 65% of the world's graphite extraction[2]).

Thanks to an active government policy, substantial subsidies and tax incentives for industrialists[3] (low-interest loans, tax breaks, subsidies for the purchase of land and equipment, etc.) and environmental legislation that was for a long time not very restrictive, **Beijing rapidly developed mining activities on its own soil**. China has also set about securing its supplies of raw minerals that it does not have by **multiplying foreign direct investment (FDI)**. This strategy of internationalization has enabled China to gain **a large share of the world's raw minerals production** (see section 1.2).

However, it is at the crucial refining stage that China's dominance becomes most indisputable**. Over the past three decades, Beijing has acquired a near monopoly on the refining of critical minerals - including those that the country does not mine on its own soil - in order to capture the added value**. By 2023, China will hold nearly 65% of the world's cobalt refining capacity, compared with 58% for lithium and **up to 90% for the highly strategic rare earths** (see table 1 in appendix).

Taking advantage of the relocation of refining and production capacities, Beijing has used a dual strategy of social and environmental *dumping* to **integrate the entire value chains**. While building vast industrial complexes capable of processing large quantities of minerals, the country has also taken advantage of its **high-quality transport infrastructure** and **affordable electricity tariffs** (USD 8.9/MWh by the end of 2022, around half the average American tariff and almost a third of the European Union average)[4]. With the support of the authorities, Chinese industrialists have also invested massively in research related to the refining of critical minerals: from 2014 to 2023, the country was responsible for 36% of patent filings worldwide for cobalt refining, 69% for aluminum, and 79% for rare earths[5].

1.2. To secure supplies, China is stepping up investments in producer countries

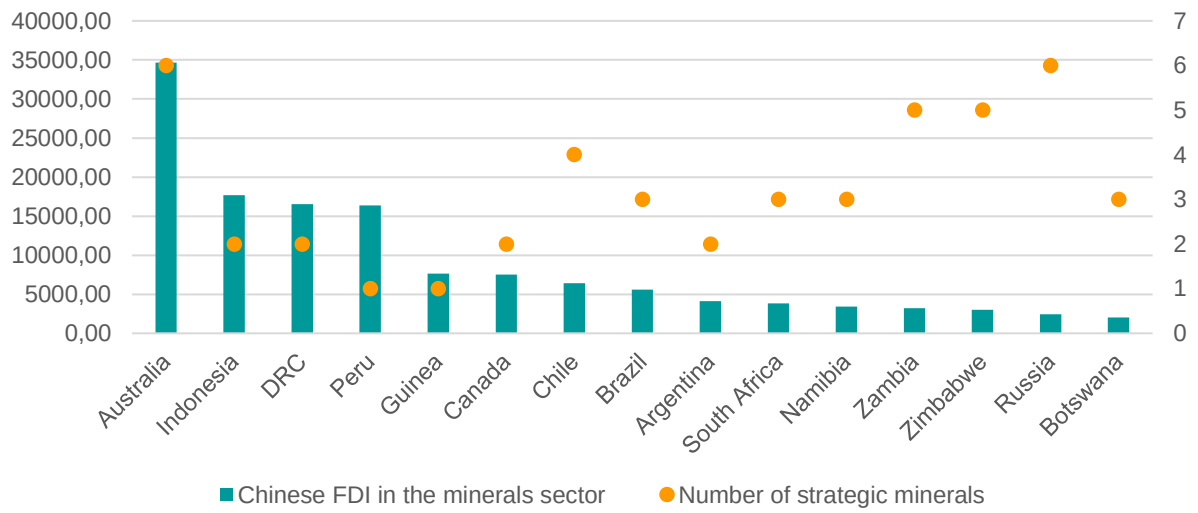
1.2.1 Over 200 billion in FDI in 20 years

To secure its grip on the world's strategic mineral resources, China is developing or exploiting numerous deposits abroad. To this end, Beijing has stepped up its FDI, acquisitions and shareholdings in mining projects. Chinese companies hold stakes in mining companies on five continents, while **Chinese**

[1] China's role in accelerating the global energy transition through green supply chains and trade, *Grantham Research Institute on Climate Change and the Environment, LES, Energy Foundation*, 02/2024
[2] *Ditto*
[3] Strategic minerals: refining, the key to Chinese domination, *GSA*, 02/07/2023
[4] Strategic minerals: refining, the key to Chinese domination, *GSA*, 02/07/2023
[5] *World Property Office*

financial FDI in the metals sector reached 203 billion USD between 2005 and 2022[6], according to *the American Enterprise Institute*[7]**. Thanks to this strategy, China now holds over 80% of magnesium production, 70% of graphite, 60% of lithium and 50% of cobalt**[8]**. And while the West is striving to reduce its dependence on Chinese strategic minerals, Beijing is stepping up its investments in producer countries.**

Figure 1: Distribution of Chinese FDI in the mining sector (left axis, 2005-2024, in millions of USD) and number of strategic minerals per country (right axis)



Sources: USGS, China Global Investment Tracker (American Enterprise Institute), International Trade Administration

This vast strategy of acquiring interests abroad, accompanied by the state apparatus, was initiated in the early 2000s with the **"Go Out Policy"**, which encouraged Chinese companies to invest abroad. This policy was reinforced by the **National Mineral Resources Plan**[9], published in 2016 and updated in 2021, which establishes a direct link between securing overseas supplies and the **Belt and Road Initiative (BRI)** strategy.

However, Beijing does not hesitate to invest in non-signatory countries of the BRI**:** over the last 20 years, **Australia has been the main recipient of Chinese FDI in the metals sector**, with 34.6 billion USD between 2005 and 2024 (see figure 1). Chinese FDI, in the form of capital or shareholdings in Australian mines by giants such as **Tianqi Lithium** or **Ganfeng Lithium**, has enabled Australia to supply almost 60% of China's demand for lithium[10]**. But Chinese FDI in Australian mining projects is now in sharp decline, as Canberra strives to strengthen its control over its minerals** and develop a supply chain separate from Beijing's (see below).

Indonesia, with the world's largest nickel reserves (55 million tons in 2024 according to the USGS), is currently the focus of much of China's FDI. Beijing has invested 7.6 billion USD in the metals sector since 2020. While most Indonesian nickel used to be sent to China for refining, ex-president Joko Widodo banned raw nickel exports in 2020 to strengthen Jakarta's presence in the value chain (see below); **Chinese companies, already present in mining activities, then invested in the local**

[6] These figures concern the metals sector in general, not just strategic ores.
[7] China, Australia, Europe... The battle for critical minerals - Challenges, *Challenges*, 05/10/2024
[8] China, Australia, Europe... The battle for critical minerals - Challenges, *Challenges*, 05/10/2024
[9] National Plan for Mineral Resources (2016-2020) - Policies - IEA, *IEA*, 30/10/2022
[10] How long will Australia's mining exports to China last? - Mine Australia | Issue 48 | October 2024, *Mine Australia*, 23/10/2024

refining sector. Colossal investments were made by Chinese companies such as **Tsingsha** and **Jiangsu** to develop local nickel processing facilities. Chinese FDI has thus played a crucial role in the Indonesian nickel industry's "boom": **in 2023, Jakarta accounted for 61% of the world's refined nickel supply, compared with just 6% in 2015**[11]. And according to the *Center for Advanced Defense Studies*, **Chinese companies control 75% of the country's nickel refining capacity**[12] – a growing dominance that is not without concern for Western companies.

China's presence is also felt in Latin America, particularly in the "lithium triangle" that spans Bolivia, Chile and Argentina. Chinese FDI there has redoubled in recent years: at the end of 2024, the Bolivian government signed a 1 billion USD agreement with CBC, a subsidiary of Chinese battery producer **CATL**, for the construction of two lithium production facilities[13]. In Argentina, Beijing is a major player in the lithium industry, owning or participating in 6 major production projects[14]. And despite episodes of tension with China, Argentine President Javier Milei is seeking to attract new Chinese investment[15]. These are continuing: in February 2025**, Ganfeng** announced that it had begun lithium production operations at its Mariana plant, located in the province of Salta[16]. In Chile, Chinese EV manufacturer **BYD** is one of six companies eligible to develop a project in the Altoandinos salt flats with state-owned ENAMI, which hopes to formalize a public-private partnership by March 2025[17]. In early 2025**, BYD** also announced that it had secured the rights to exploit the large Brazilian lithium deposit at Coronel Murta[18]. This acquisition is in line with the Chinese automaker's **policy of vertical integration**, especially as the deposit is less than a thousand kilometers from its Brazilian EV manufacturing plant.

While Chinese FDI is mainly focused on lithium, cobalt, nickel and bauxite resources, it is also targeting certain minerals already abundant on its soil. **Shenghe** is part of the consortium that revived **Mountain Pass**, the main rare earths mine in the United States (see below). The same group also has a stake in the Kvanefjeld (Greenland) and Ngualla (Tanzania) rare earth projects[19].

1.2.2 Africa remains the preferred location for Chinese investment

With 90% of platinum reserves, 85% of manganese reserves and 58% of cobalt reserves[20] (see figure 2), **Africa is brimming with strategic minerals that remain largely untapped**. The continent is already home to numerous mining operations (figure 3), and some countries are even among the world's leading producers: the Democratic Republic of Congo (DRC) is the world's leading cobalt producer (73% of the total), South Africa is the leading manganese producer, Madagascar and Mozambique are among the leading graphite extractors, and Guinea mines large quantities of bauxite. **As a key mining continent, Africa is at the heart of the geopolitical battle being waged by Chinese and Western companies to get their hands on its strategic mineral resources.**

[11] The Opec of nickel': Indonesia's control of a critical metal, *Financial Times*, 13/02/2025
[12] Refining Power - C4ADS, *C4ADS*, 04/02/2025
[13] Bolivia signs $1 billion lithium deal with China's CBC Investments, *S&P Global Commodity Insights*, 26/11/2024
[14] China's Lithium Investments in South America Expand Influence - 3GIMBALS, *3GIMBALS*, 14/02/2025
[15] Argentina: Milei's economic record after just over a year in power, *GSA*, 26/01/2025
[16] China's Ganfeng starts lithium production at Argentina's Mariana project | Reuters, *Reuters*, 12/02/2025
[17] Avanza el proyecto de litio Salares Altoandinos de ENAMI con ingreso de CEOL a Contraloría, *Enami*, 05/02/2025
[18] China rompe el mercado y pisa los talones a Estados Unidos al robar el megayacimiento en Sudamérica del mineral del futuro - AS.com, *Diario AS*, 20/02/2025
[19] Strategic minerals: refining, the key to Chinese domination, *GSA*, 02/07/2023
[20] La course mondiale aux métaux " stratégiques " dans les sous-sols encore inexploités de l'Afrique, *Le Monde,* 03/02/2025

Figure 2: Africa's share of the world's strategic mineral reserves (in %)

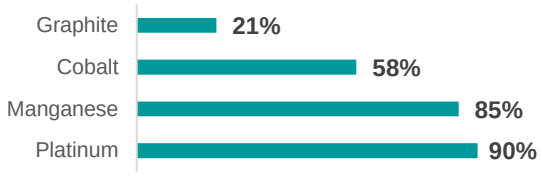
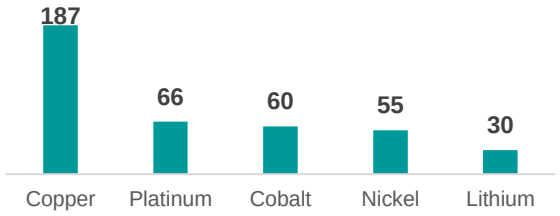


Figure 3: Number of strategic mineral exploration and production projects in Africa (2024)



Source: Le Monde, EY, Africa Business+, CSIS, USGS

In the DRC, Chinese operators own most of mining operations. **In 2019, 80% of Congolese mining exports were shipped to China[21], which also held nearly 72% of the country's copper and cobalt mines in 2022[22]**. The presence of Chinese companies in the DRC is largely due to the "contract of the century", signed by Kinshasa and Beijing in 2008 – and revised in 2024 at the instigation of President Félix Tshisekedi – to finance infrastructure in exchange for mining investment. The **China Molybdenum** Group (CMOC), now the world's leading cobalt producer, has been operating the huge Kisanfu deposit since 2023, in addition to owning a majority stake in the Tenke Fungurume mine.

China is also working to secure its bauxite supplies: in 2017, Beijing granted a 20 billion USD loan to **Guinea** – endowed with the world's largest reserves – in exchange for mining concessions. These massive investments have made Conakry China's main bauxite supplier, reducing its dependence on Australia. And at the end of 2024, SPIC signed an agreement with the Guinean authorities for the construction of a bauxite processing plant, scheduled to start up in March 2025[23]. At the end of 2023, the Chinese **MMG** group also took control of the Khoemacau copper mine in **Botswana[24].**

But in recent years, China's most substantial investments have been in the lithium sector, as demand for this essential metal for the EV industry continues to grow. Chinese companies have invested massively in African deposits. Since 2021, **Zimbabwe**, Africa's leading lithium producer, has attracted over 1 billion USD in FDI for mining projects, mainly from Chinese groups such as **Sinomine** and **Chengxin**. At the end of 2024, **Huayou** and **Tsingshan** announced that they were joining forces with Zimbabwean state-owned Kuvimba Mining to exploit a lithium deposit at Sandawana[25] ; the agreement is expected to be finalized in the first half of 2025. In **Mali**, the Goulamina mine has been operated since December 2024 by the Chinese company **Ganfeng Lithium[26]**, while a joint venture between **Canmax** and **Jiangxi Jiuling** has secured a 75% majority stake in a lithium refinery project in northern Nigeria[27].

But while control over the production of strategic minerals is exacerbating competition between the great powers, **Western companies are trying to catch up with China by multiplying their investments in Africa** (see below) and today control almost a quarter of the continent's mining production[28].

[21] La Chine en RD Congo : présence économique, financements et les créances | Direction générale du Trésor, *Direction générale du Trésor*, 20/03/2019
[22] Addressing China's Monopoly over Africa's Renewable Energy Minerals | Wilson Center, *Wilson Center*, 02/05/2024
[23] Chinese firm to build Guinea's biggest alumina processing plant - MINING.COM, *MINING.COM*, 02/01/2025
[24] Botswana: China's MMG to pay $1.9 billion for Khoemacau copper mine and owner, *Agence Ecofin*, 02/08/2023
[25] Zimbabwe anticipates lithium prices to justify $270 mln project with China | Reuters, *Reuters*, 20/01/2025
[26] Mali: A new economic era thanks to lithium mining at Goulamina - Afrique sur 7, *Afrique sur 7*, 16/12/2024
[27] Chinese Lithium Firms Take Over Copycat Nigeria Refinery Project - Bloomberg, *Bloomberg*, 12/02/2025
[28] La course mondiale aux métaux " stratégiques " dans les sous-sols encore inexploités de l'Afrique, *Le Monde*, 03/02/2025

1.3. Beijing further tightens export restrictions

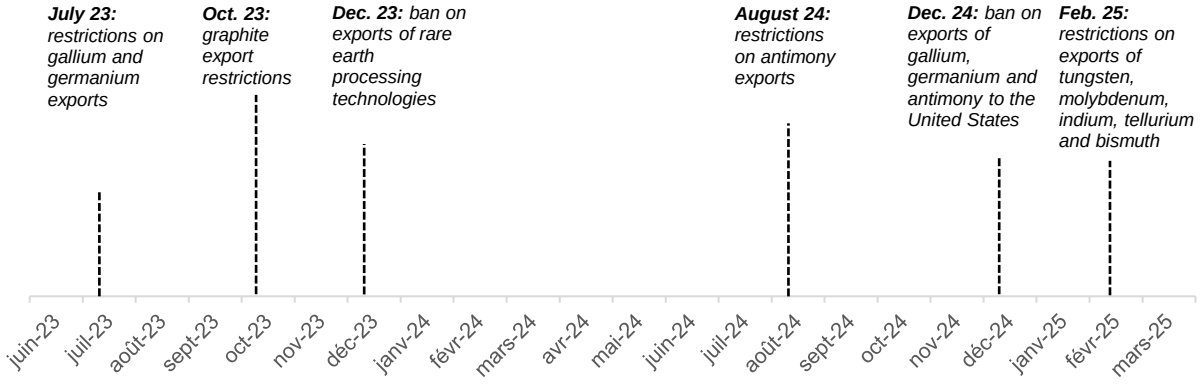
Beijing's control of the strategic minerals value chain gives it major diplomatic and economic advantages, while at the same time **raising fears that supply restrictions – or even stoppages – could penalize the world's major economies**. In 2010, following a diplomatic incident with Japan, **Beijing briefly announced the suspension of its rare earth exports to Tokyo**, impacting the country's industry and fueling Western concerns. However, China had been using a quota policy on exports long before 2010: from the early 2000s, the country voluntarily reduced its exports to consolidate its commercial dominance, causing prices to soar several times. The matter was referred to the World Trade Organization (WTO) in 2015 by the United States, the European Union and Japan, forcing the country to rescind its restrictive measures.

But rising technological and trade tensions between China and the United States are raising new concerns. **Against a backdrop of escalating technological warfare between the two countries, Beijing has put in place several export restrictions on certain strategic minerals whose production it dominates since 2023:**

- **July 2023**: restrictions on gallium and germanium exports.
- **October 2023**: graphite export restrictions.
- **December 2023**: ban on exports of rare earth extraction and separation technologies.
- **August 2024**: restrictions on antimony exports.

The restrictions announced by Beijing initially had only **limited industrial effects**, only marginally reducing US supplies of graphite, germanium and gallium from China[29]**. In December 2024, however, the Chinese government took a further step by announcing a ban on exports of gallium, germanium and antimony to the USA** (the only country concerned), while tightening controls on graphite deliveries. While Beijing justifies this measure by defending its security and national interests, it is also a response to the numerous American restrictions announced against it, aimed at the Chinese semiconductor industry.

Figure 4: China's export restrictions and bans on strategic minerals



Source : GSA

And Chinese restrictions could be extended to other strategic minerals: in February 2025, shortly after US President Donald Trump announced a 10% increase in tariffs on all Chinese products, **the Chinese Ministry of Commerce announced export restrictions on five minerals (tungsten,**

[29] China's export controls on critical minerals aren't starving the United States-at least so far | PIIE, *PIIE*, 31/10/2024

molybdenum, indium, tellurium, bismuth) used notably in defense and renewable energies. But with the Trump administration considering new restrictions on China's semiconductor industry[30], the risk of escalation between the two countries could prompt Beijing to block exports of these minerals to Washington. While the United States produces molybdenum and American companies mainly source indium from Japan and South Korea, the country remains dependent on imports of Chinese tungsten and bismuth.

If Chinese trade restrictions and the risk of more drastic measures are causing concern among Western manufacturers, Beijing's weapon is double-edged. **The risk of stricter controls and a drop in Chinese exports could prompt Westerners to diversify their supplies, thereby diluting the impact of the restrictions.** But faced with potential alternatives, China could also use its dominant position to flood the market with strategic minerals and push prices down to maintain its hegemony.

2. To counter China, the West is beefing up its strategies

2.1. Washington redefines its supply chain

2.1.1 Bipartisan support between subsidies and tax incentives

To reduce its dependence on rival China, **Washington has been developing a national strategy this area for the past decade**. Back in 2017, the Trump administration issued an executive order aimed at reducing the country's vulnerability mineral supply disruptions. This measure also ordered the *U.S. Geological Survey* (USGS) to identify minerals critical to Washington and propose measures to secure their supply. Updated in 2022, this list was supplemented in 2023 by a list of critical materials[31].

From 2021 onwards, the Biden administration, supported by Congress, also took several measures to **encourage the emergence of local refining**, notably through the *Bipartisan Infrastructure Law* (BIL) of 2021 and *the Inflation Reduction Act* (IRA) of 2022. In particular, the BIL ordered the *Department of Energy* **to allocate 3 billion USD to industrial projects linked to the refining, processing or recycling of critical minerals[32]**. Above all, one of the IRA's key provisions linked the allocation of part of the **subsidies and tax credits for EVs** to the presence, in their batteries, of a **percentage of critical minerals extracted or processed in the United States** or in a country signatory to a free-trade agreement. Set at 40% in 2023, this percentage was to be raised to 80% in 2027. And while Donald Trump, in line with his campaign promises, has suspended the disbursement of IRA-related funding (including EV tax credits, which are set to be scrapped), **he seems intent on prioritizing domestic production of strategic minerals by stepping up tariffs aimed at Beijing and easing regulations in the mining sector**. Securing strategic mineral resources along the entire value chain **is one of the few areas where there is bipartisan consensus**: both Democrats and Republicans recognize their importance for energy, the economy and national security.

2.1.2 A new integration of value chains on American soil

To empower itself, **Washington is banking on the reopening of mines and refining plants on American soil**. The most emblematic project is that of **Mountain Pass** (California), the country's only rare earths extraction mine, which today supplies **almost 15% of global production** (45,000 tons of rare earth oxides in 2024)[33]. The world's main source of rare earths until the 1990s, the facility was shut

[30] Trump Administration Seeks More Restrictions on China Tech, Weighs Nvidia Curbs - Bloomberg, *Bloomberg*, 25/02/2025
[31] What Are Critical Materials and Critical Minerals? | Department of Energy, *US Department of Energy*
[32] Biden Administration, DOE to Invest $3 Billion to Strengthen U.S. Supply Chain for Advanced Batteries for Vehicles and Energy Storage | Department of Energy, *US Department of Energy*, 11/02/2022
[33] What we do, *MP Materials*

down in 2002 under pressure from Chinese competition and resumed production in 2019 under the management of operator **MP Materials**. The conditions of the Mountain Pass reopening illustrate, however, the limits to the attempt at American emancipation: **China's Shenghe is a minority shareholder in MP Materials, while almost all the rare earths from the mine are still shipped to China for refining**. With the support of the American authorities, MP Materials is working to build a complete supply chain in the USA: a rare earths' processing facility, still in its infancy, is due to open in Mountain Pass in 2023. At the same time, in January 2025, its Texas plant began commercial production **of neodymium-paseodymium magnets** (with a capacity of 1,000 tons per year)[34], essential for the manufacture of EV motors. Symbolizing this new integration of value chains, MP Materials has teamed up with automaker **General Motors** to supply the magnets needed to produce 500,000 electric motors.

Other companies are following suit: ***Rare Earths***, based in Colorado, has been refining rare earth ores since January 2025, a first on American soil[35], while producer **Energy Fuels** began commercial production of neodymium-paseodymium in 2024[36]. Carmakers are not to be outdone**, with Tesla** building a lithium refinery in Texas. Production, which could eventually supply a million EV batteries, is scheduled to start in 2025[37].

2.1.3 Faced with Beijing, the United States relaunches the race for minerals

The United States is stepping up FDI to secure supplies of strategic minerals from producer countries – particularly in Africa. **In a report published in April 2024*, the United States Institute of Peace* (USIP) called on the American authorities to become more aggressively involved in the strategic minerals sector in Africa to counter China[38].**

American producers are already present on the continent: **Lifezone Metals** has launched a nickel production project in **Tanzania**, while **KoBold Metals** has announced investments in a copper deposit in Zambia[39]. In **Mozambique**, the U.S. International Development Finance Corporation (DFC) has granted a 150 million USD loan to Australia's Syrah for the development of a graphite mine, which will be processed in Louisiana[40].

Alongside the EU, Washington supports the strategic **Lobito Corridor** project, which aims to facilitate the transport of critical minerals (copper, cobalt) mined in the DRC and Zambia to the Angolan port of Lobito, from where they are then exported to Western countries. **The aim of this rail connectivity project is to secure supplies, while cutting the ground from under the feet of a rival initiative by China**, which intends to renovate the railway to Dar Es Salaam (Tanzania). In June 2024, the U.S. DFC approved a loan of over 550 million USD for the project, which also received co-financing from the U.S. Agency for International Development (USAID). **But its promoters now fear that the Trump administration's dismantling of USAID will threaten its expansion and impact US strategy in the region[41]**, even though its funding could be transferred to the DFC[42].

Washington eyes Congolese resources

The USA is stepping up investment in the DRC, at a time when the country's vast resources are largely exploited by China. **Washington is notably counting on the Congolese authorities' desire to move**

[34] MP Materials Restores U.S. Rare Earth Magnet Production, *MP Materials*, 22/01/2025
[35] Behind the Trump offensive, a quiet struggle for control of strategic metals, *Le Monde*, 21/02/2025
[36] Energy Fuels starts commercial production of separated rare earths in Utah, *Mining Technology*, 11/06/2024
[37] Tesla fires up its South Texas lithium refinery for first time, *San Antonio Express-News*, 16/12/2024
[38] Why Africa's Critical Minerals Are Key to U.S. National Security | United States Institute of Peace, *United States Institute of Peace*, 09/04/2024
[39] Growing US interest in critical minerals presents Africa with unprecedented opportunity (report), *Agence Ecofin*, 19/01/2024
[40] Mozambique: U.S. government lends $150M to graphite mining operation | Club of Mozambique, *Mozambique*, 31/10/2024
[41] Trump USAID Freezes Risks Curbing Africa Critical Mineral Flows - Bloomberg, *Bloomberg*, 18/02/2025
[42] Trump Advisers Look to Shift US Foreign Aid to Wall Street Ally - Bloomberg, *Bloomberg*, 12/02/2025

up the value chain and renegotiate their contracts with Beijing to position themselves in the country. In June 2024, USAID announced a 2 million USD investment to expand the **Lisaki** copper and cobalt processing mine, whose production is destined for export to the American market[43]. The USA is also supporting **the joint DRC-Zambia initiative to develop an integrated EV battery value chain**; in December 2022, a memorandum of understanding was signed between the three countries to promote the investment opportunities offered by the initiative to the US private sector[44].

To counter Chinese influence, the United States is even said to have put pressure on the DRC and its state-owned company **Gécamines** to prevent the sale of copper and cobalt producer **Chemaf** to the Chinese group **Norin Mining**, a subsidiary of state-owned defense contractor Norinco[45]. The American authorities are now looking for a Western company interested in buying Chemaf[46]. The United States has also reportedly approached Israeli tycoon **Dan Gertler**, who has been under US sanctions since 2017 and holds significant interests in the Congolese mining sector. At the end of 2024, negotiations were reportedly held with the businessman to allow Washington to re-enter the Congolese minerals market in exchange for the lifting of sanctions[47].

The Congolese authorities are also trying to capitalize on American interest in their resources. As the Rwandan-backed M23 rebels continue to gain ground in the Kivu region, **President Félix Tshisekedi is seeking to conclude a strategic minerals agreement with the USA[48]. At the end of February 2025, the Congolese head of state invited American and European companies to invest directly in the DRC, hoping in return that the West would reduce their supplies from Rwanda and step up their pressure on Kigali. According to the Congolese president, the Trump administration – which recently imposed sanctions on Rwanda – has expressed an interest in a deal.**

2.1.4 From Ukraine to Greenland, securing resources is among the Trump administration's foreign policy priorities

Boosting the US critical minerals industry was a priority of the first Trump administration (2017-2021) and the Biden administration (2021-2025). **Today, the Republican president is making securing US supplies one of the top priorities of his foreign policy**. Absorption of Canada as the 51st U.S. state, takeover of the Panama Canal, acquisition of Greenland... since his election, Donald Trump has multiplied his declarations on regions rich in natural resources and essential to their transportation.

In the weeks leading up to his inauguration**, Donald Trump spoke of the need to acquire Greenland, in the name of US national security**. Although derided by many countries, this proposal was primarily motivated by the geostrategic importance of the island, at a time when China and Russia are strengthening their economic and military presence in the Arctic[49]. Secondly**, Greenland abounds in yet untapped strategic minerals** (notably rare earths), the reserves of which are made accessible by melting ice. The Australian company **Energy Transition Minerals (ETM**) – known as Greenland Minerals until 2022 – estimates that **Greenland could become the leading Western producer of rare earths**[50]. Until 2021, ETM operated the large **Kvanefjeld** rare earths deposit; however, the Chinese company Shenghe, now a strategic shareholder in ETM, had signed a memorandum of understanding with the Australian company **to purchase the mine's entire output for refining in China[51]**. Although

[43] Development of the mining industry in the DRC: the USA announces an investment of 2 million USD | DeskEco, *Deskeco*, 17/06/2024
[44] The United States Releases Signed Memorandum of Understanding with the Democratic Republic of Congo and Zambia to Strengthen Electric Vehicle Battery Value Chain, *United States Department of State*, 18/01/2023
[45] US intervened in Congo mine sale to Chinese arms group, *Financial Times*, 05/07/2024
[46] Exclusive | How the U.S. Is Trying to Challenge China's Cobalt Chokehold - WSJ, *WSJ*, 15/10/2024
[47] En RDC, pour revenir dans la course aux minerais stratégiques, les Etats-Unis négocient avec Dan Gertler, *Le Monde,* 17/10/2024
[48] As Conflict Rages in Congo, President Offers U.S. Minerals Deal - The New York Times, *New York Times*, 22/02/2025
[49] Russia 'fully ready' for Arctic war with NATO - POLITICO, *POLITICO*, 20/09/2024
[50] Kvanefjeld Project - Energy Transition Minerals, *Energy Transition Minerals*
[51] China Steps up Its Mining Interests in Greenland - The Diplomat, *The Diplomat*, 12/02/2019

the project was halted in 2021 by the Greenland government, which is hostile to mining, the Chinese incursion has raised concerns in the United States. With Greenland's parliamentary elections just a few days away on March 11, and a referendum on the island's independence scheduled for 2025, Washington fears that Beijing could end up regaining a foothold. **A U.S. takeover of Greenland would enable the U.S. supply chain to reap the benefits of mineral exploitation**. Despite Greenland's attachment to Denmark, the EU has little to say on the subject and does not own any mines on the island.

At the beginning of February 2025, Donald Trump also announced **his intention to "trade" Ukraine's natural resources for continued US military and financial assistance to Kiev**. While the American president believes that the exploitation of Ukrainian resources by American companies would repay the aid committed by Washington since the start of the conflict, the motivations are also geostrategic: **Ukraine is said to have abundant reserves of strategic minerals** – including Europe's largest reserves of lithium, in addition to graphite, cobalt and rare earths. **On 25th of February 2025, after several weeks of friction and negotiations, Kiev and Washington signed a mining agreement covering, among other things, the exploitation of Ukraine's strategic minerals**. Although still vague, the agreement provides for the establishment of a *Reconstruction Investment Fund* held by the two countries, into which Ukraine would inject 50% of revenues from the future exploitation of its natural resources (strategic minerals, but also hydrocarbons)[52]. This measure, which offers no explicit guarantee of security for Ukraine, does not consider the fact that 30% to 40% of strategic mineral deposits are located in Russian-occupied territories. On the other hand, Moscow, which is in the midst of a rapprochement with the Trump administration, takes a dim view of this agreement, which could support the reindustrialization of Ukraine while ensuring an American presence there. **President Vladimir Putin has also expressed support for American investment in strategic minerals in Russia and the occupied Donbass** region[53]. Adding its voice to the debate, the EU is also seeking to conclude agreements with Kiev on its minerals[54].

2.2. In Europe, the response is still a work in progress

2.2.1 A desire to secure European supplies of critical minerals

European demand for critical materials is growing: European demand for lithium is set to increase twelvefold by 2030, while demand for rare earths is set to increase sixfold by the same date[55]. However, despite publishing a list of critical minerals since 2011, updated for the last time in 2023 to include a total of 34 elements[56]**, the European Union (EU) appears to be far less advanced than the USA in responding to China's pre-eminence in refining them**. The EU is heavily dependent on foreign supplies: in 2023**, 100% of processed rare earths imported by the EU came from China**. The level of dependence is on average higher at the extraction stage but remains very high for certain minerals at the refining stage, notably for lithium and rare earths (table 1).

In response to China's Belt and Road initiative, and with the aim of securing supply chains for strategic minerals, the EU launched its **"Global Gateway**" strategy in December 2021. **Brussels plans to mobilize up to 300 billion euros between 2021 and 2027 for infrastructure development in emerging countries**, via public and private financing. Of these funds, **150 billion euros are to be**

[52] Ukraine to Sign a Minerals Deal With Trump: Here Are the Details - Bloomberg, *Bloomberg*, 27/02/2025
[53] Putin offers Russian and Ukrainian rare minerals to US, *BBC*, 25/02/2025
[54] France and the EU enter the debate on Ukrainian rare earths | Les Echos, *Les Echos*, 27/02/2025
[55] Green Deal: four years after its announcement, what impact and what future?, *GSA*, 02/06/2024
[56] Publication of the European regulation on critical raw materials | MineralInfo, *BRGM*, 16/03/2023

dedicated to investments in Africa. The strategy focuses on supporting and facilitating projects to exploit and refine strategic minerals in countries with vast reserves.

With the adoption of the **Critical Raw Materials Act (CRMA**) in 2024, the EU marked a new milestone in securing its supplies. The aim of this initiative is to reduce external dependence - notably on China - by **diversifying sources of supply**, while **strengthening production and refining activities in Europe**.

The CRMA sets ambitious consumption targets to be achieved by 2030[57]:

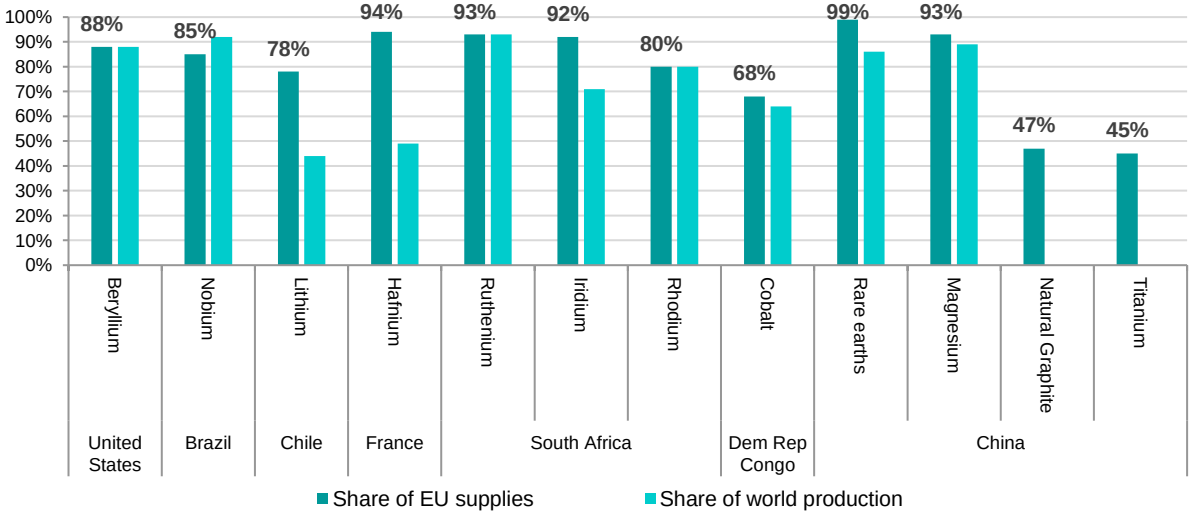
- At least 10% of annual EU consumption from local extraction.
- At least 40% of annual EU consumption from local refining.
- At least 25% of annual EU consumption from recycling.
- No more than 65% of the EU's annual consumption of each strategic mineral may be sourced from a single third country.

Table 1: European Union's level of dependence on 6 strategic minerals, 2023

	Copper	Cobalt	Graphite	Lithium	Nickel	Rare earths
Processed critical raw materials - share of extra-EU imports	17%	9%[58]		100%	75%	100%
Extraction - share of extra-EU imports	48%	81%	99%	81%	31%	90%
Global production (concentration, HHI)	0,12	0,48	0,46	0,33	0,28	0,52
Global reserves (concentration, HHI)	0,13	0,28	0,17	0,22	0,16	0,2

Sources: USGS, European Commission, IFPEN, Banque de France calculations
Note: concentration is measured by the Herfindahl-Hirschman index, ranging from 0 (not concentrated) to 1 (highly concentrated). A market is considered concentrated when it reaches 0.4.

Figure 5: Main countries producing critical minerals for the EU (in %, 2020)



Source: CEA, Commission

[57] European Critical Raw Materials Act - Policies - IEA, *IEA*, 28/10/2024
[58] Most of the refined cobalt used in the EU comes from Finland (10% of global ore refining) and Belgium (4.5%). (Ecological transition: the EU faces the challenge of critical metals | Groupe Caisse des Dépôts, *Groupe Caisse des Dépôts*, 31/10/2024)

2.2.2 Europe in search of new partnerships

The EU is seeking to reduce its dependence on China by adopting a strategy of diversifying supplies, without making a sudden break. **Europeans wish to "de-risk" their relations with Beijing, rather than totally "decouple" their trade**. Brussels has thus opted **for an approach based on *friendshoring***[59], which involves securing diversified and long-term supply chains with strategic partners sharing common values.

The EU has thus multiplied its trade agreements on critical minerals, with **Canada** and **Ukraine** in 2021, **Kazakhstan** and **Namibia** in 2022 and, more recently, **Mexico**, **New Zealand** and the **UK**[60]. The CRMA enables the EU to justify certain subsidies based on compliance with the text's quantified objectives, notably a dependence of less than 65% on a single third country. However, the success of this *friendshoring* strategy is conditional **on the implementation of massive FDI** which would enable the EU to actively participate in the desired projects.

As in the case of China and the USA**, Africa occupies a predominant place in European strategy**. As early as 2023, Brussels began negotiations with the **DRC**, **Uganda**, **Zambia** and **Tanzania**[61]. In February 2024, the EU signed a **memorandum of understanding with Rwanda to develop sustainable value chains** for critical raw materials. However, in February 2025, the European Parliament adopted a resolution calling for the **suspension of this agreement**, due to the Rwandan authorities' support for the M23 rebels[62] (see above).

In addition to ongoing agreements and negotiations, the EU has also launched **joint initiatives with local partners.** The **Africa MaVal** (Africa Mineral Value Chains) project[63] aims at building partnerships between the EU and Africa to **ensure a responsible supply of critical minerals for** European **industry**. Established in 2022, this initiative coordinated by the French *Bureau de Recherches Géologiques et Minières* (BGRM) brings together 18 partners from 11 different countries.

2.2.3 Towards the reopening of mines on European soil?

Although little exploited, numerous deposits of strategic minerals (lithium, graphite, cobalt and nickel) have been identified on European soil, and extraction projects are multiplying. In **France**, **Imerys** plans to open a lithium mine in the Allier region as early as 2027[64]. In **Sweden**, the **Kiruna** rare earths deposit, discovered in 2023[65], could become a major source for Europe. Portugal and Spain have significant lithium reserves, while Norway and Finland are rich in nickel and cobalt. And the mining potential of Greenland and France's overseas territories could also enable the EU to meet its CRMA targets. European production backed by **strict environmental standards** could also limit emissions linked to imports of strategic minerals.

However, the EU is struggling to develop its extractive capacities. European ambitions are hampered by a crying lack of investment, sluggish administration, non-harmonization of procedures at a supranational level and low levels of social acceptance. **It can take up to 10 years to obtain a mining permit**[66]**. Local resistance to mining projects can be very strong**, as demonstrated by the protests

[59] What European strategy for critical materials? | Alternatives Economiques, *Alternatives Economiques*, 14/02/2024
[60] *Ibid.*
[61] EU plans talks with African countries to boost supply of critical raw materials | International Institute for Sustainable Development, *International Institute for Sustainable Development*, 31/01/2025
[62] The EP wants to suspend the EU-Rwanda agreement on critical raw materials | News | European Parliament, www.europarl.europa.eu, 13/02/2025
[63] AfricaMaVal - EU-Africa Partnerships on sustainable Raw Materials Value Chain, *africamaval.eu*, 2024
[64] The Imerys group announces the development by 2027 of a lithium mine in the Allier region to manufacture batteries, *Franceinfo*, 24/10/2022
[65] Europe's largest rare earth deposit discovered in Sweden, *Reporterre, le média de l'écologie - Indépendant et en accès libre*, 16/01/2023
[66] Europe's mining slump leaves the continent vulnerable | Euronews, *euronews*, 12/03/2024

in Serbia in the summer of 2024 against a lithium mine project promoted by the Anglo-American company Rio Tinto[67].

What's more, the pursuit of *Net Zero* objectives[68] makes it more difficult to maintain public support for existing and future mines. Even more so as the environmental impact of mining (soil and water pollution, deforestation or destruction of ecosystems) is likely to run **counter to the objectives of the Green Deal**. All in all, **the EU is encountering difficulties in reconciling mining and ecological ambitions**, against a backdrop of opposition from part of civil society to the return of mines to European soil.

Australia, the next growth driver for Western production?

Resource-rich Australia plays a central role in the global supply chain for critical minerals. Faced with rising geopolitical tensions between the USA and China, **Canberra has adjusted its strategy to strengthen its sovereignty in this area and diversify its partnerships**. Previously predominant (see above), **Chinese FDI is now in sharp decline, as Canberra strives to strengthen its control over this strategic sector.** In recent years, the Australian authorities have blocked two Chinese investment projects in Australian lithium, citing national security concerns[69]. In June 2024, the Australian Finance Minister also ordered several China-linked investors to divest their shares in Australian giant Northern Minerals[70]**. The USA has also encouraged Australia to reduce the Chinese stranglehold on its lithium resources**, by offering them access to IRA funding to promote the development of mines and infrastructure.

To position the country at the heart of value chains**, Australia's mining sector is also looking to accelerate production**. With financial support from the government, **Iluka Resources** has begun construction of a rare earths' refinery at Eneabba, with production scheduled to start in 2026[71]**. Northern Minerals** (Browns Range mine), **Alkane** (Dubbo) and **Arafura** (Nolans) are also planning to exploit rare earth deposits. At the same time, Australian companies are also investing in Africa, such as **Peak Rare Earths** in Tanzania and **South32** in South Africa.

Finally, like the EU, Canberra is banking on mining collaboration with "like-minded" partners. **In March 2024, Australia and Canada signed a joint declaration to strengthen their cooperation in the critical minerals sector[72].**

3. Producer countries target the entire value chain

Mining countries are trying to **move up the value chain of the minerals they produce**, to develop local industrial processing capacities that will enable them **to export higher value-added materials**. To assert their weight in global value chains, these countries resort to a variety of strategies: export restrictions, nationalization of national companies, attracting FDI, etc.

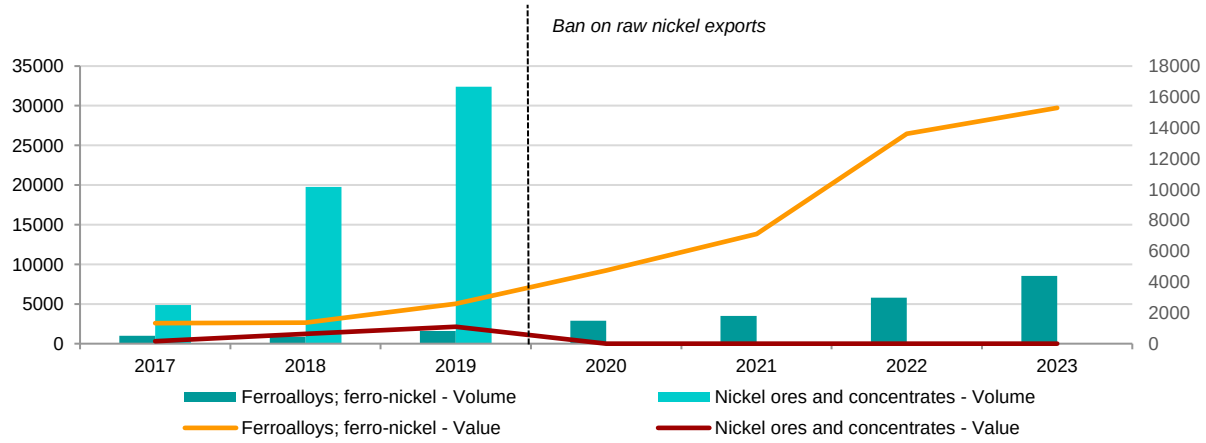
[67] Serbia: the population mobilizes against a controversial lithium mine project, *RFI*, 10/08/2024
[68] Net Zero corresponds to a strategy emanating from the Paris Climate Agreement. To limit temperature rises to +1.5°C, economies must achieve "Net Zero" by 2050, i.e. a situation in which anthropogenic greenhouse gas emissions are offset by removals to achieve zero emissions into the atmosphere.
[69] Australia blocks the takeover of lithium miner by China-linked firm, *Mining Technology*, 21/07/2023
[70] Chinese rare earths investor fails to win seat on Australia's Northern Minerals board | Reuters, *Reuters*, 06/06/2024
[71] Australia provides additional $258 million funding for Iluka rare earths refinery -Le 06 décembre 2024 à 04:32 | Zonebourse, *Zonebourse*, 19/02/2025
[72] JOINT STATEMENT - Canada-Australia Critical Minerals Cooperation - Canada.ca, www.canada.ca, 04/03/2024

3.1. With its export restrictions, Indonesia is moving up the value chain without breaking out of its dependence on China.

With a key position in global nickel production, Indonesia was one of the first countries to implement a strict ban on the export of raw ore to encourage companies to invest locally and maximize the added value of its mineral resources. **In January 2020, Indonesia implemented a total ban on the export of nickel ore**, initially announced in 2014. **This measure was intended to encourage foreign investment in the nickel processing sector on Indonesian territory**. The country has set up **specialized industrial parks** to facilitate investment in mineral processing. These zones offer key infrastructure such as power plants, processing plants and easy access to mining permits[73]. To maximize its attractiveness, the government has introduced **attractive tax incentives**, including **tax exemptions** on equipment and raw materials, **tax credits** and **duty reductions** for companies investing in local processing[74]. As a result, mining companies – mainly Chinese – have invested heavily in the construction of refineries and smelters. This strategy has enabled Indonesia to assert its control over global nickel production, with around **60% by 2025**. However, Jakarta remains dependent on China, the country's main investor (see part 1).

The country saw **strong growth in the value of exports of Indonesian ferro-nickel** (an iron-nickel alloy used primarily in the production of stainless steel), which rose faster than the volume of exports (figure 6). This trend can be explained by the **rise in world nickel prices in 2022**, as ferro-nickel has become an essential component in the EV value chain. **The ban on raw nickel exports has therefore enabled Indonesia to capture a share of the value added linked to ore processing**.

Figure 6: Indonesian nickel exports in thousands of tons (left axis) and in billions USD (right axis)



Source: UN Comtrade

Although the ban on raw nickel exports has boosted the local industry, it has also led to an **oversupply of nickel** worldwide, causing **nickel prices to plummet** (**down 40% by 2023**[75]) and putting pressure on the profitability of local and international players in the sector. Buoyed by its success, the Indonesian government has extended this policy to other critical minerals. In December 2022, former president Joko Widodo announced **a ban on bauxite exports from June 2023**, with the aim of developing a local

[73] What African producers of critical minerals can learn from Indonesia's experience - Atlantic Council, *Atlantic Council*, 19/12/2024
[74] *Ibid*.
[75] Minerals. En Indonésie, l'âge d'or du nickel est terminé, *Courrier international*, 04/02/2024

aluminum processing industry[76]. In addition**, similar bans on copper were envisaged for 2024**[77], although their implementation has yet to be confirmed.

3.2. More complex initiatives in Latin America

Latin America is particularly rich in critical minerals, with 40% of copper reserves, 17% of nickel reserves and between 60 and 80% of the world's lithium reserves[78]. Brazil, Chile and Peru account for over three-quarters of mineral exports. With 20% of the total in 2023**, China is the leading destination for these exports** (figure 7). The stakes of mining sovereignty are particularly high for this region which is subject to Sino-American rivalry. Among governments, three main trends are emerging to capture part of the benefits of mining rents on land: **the promotion of downstream processing**, the **revision of mining royalties** and **the auctioning of mining rights**[79]**.**

As a result, governments are encouraging the development of local processing industries to increase added value before export. For example, **Peru has declared the industrialization of lithium a "public necessity"**, while **Argentina has signed agreements to build lithium battery factories**[80]. Other countries are also reassessing their tax policies to secure a fairer share of mining revenues**; Peru has proposed a fixed 10% royalty rate on lithium and uranium in 2021** (compared with a variable rate of between 1% and 12%), which would enable it to better capture part of the rent and thus increase its revenues. Finally, to attract investment while retaining control over their resources, some states opt for public auctions of exploitation rights. In Argentina, contracts with Ganfeng Lithium[81] and Rio Tinto[82] include strict commitments to local development

In **Chile**, a country with **22% of the world's lithium reserves and 30% of global production by 2022**[83], the government adopted a major reform in 2023 aimed at strengthening the role of the State in the exploitation of this strategic metal. The Chilean state must now **be the majority shareholder in all new lithium operations**[84]. The stated aim is to gain direct control over lithium revenues, and Santiago is committed to ensure that profits from this resource fund national development (education, infrastructure, energy transition). However, the requirement of a majority state shareholding could deter some investors, who might turn to more flexible investment environments in neighboring countries such as Argentina and Bolivia. In **Mexico**, the government enacted a law in 2022 **nationalizing its lithium reserves**, declaring this resource to be the exclusive property of the state, and the public company **LitioMx** was created in August 2022 to manage the exploration, exploitation and commercialization of lithium on national territory[85]. This initiative aims to protect the country's energy sovereignty and ensure that the benefits of this resource accrue to the national economy.

[76] After nickel, Indonesia bans bauxite exports, Courrier international, 23/12/2022
[77] The Indonesian nickel boom and its prospects in the face of the systemic challenge of coal | Ifri, www.ifri.org, 05/02/2024
[78] Latin America: "Green" raw materials to achieve net zero - La Vie économique, *dievolkswirtschaft.ch*, 08/24/2024
[79] Three emerging policy trends for critical minerals in Latin America - Forum intergouvernemental, *Intergovernmental Forum*, 09/08/2021
[80] *Ibid*
[81] Ganfeng Lithium's Mariana project begins production - Shanghai Metal Market, www.metal.com, 02/17/2025
[82] [SMM Analysis] Rio Tinto plans to invest $2.5 billion in Rincon salt lake project - Shanghai Metal Market, www.metal.com, 12/17/2024
[83] Chile: the lithium industry - Team France Export, *Team France Export*, 23/08/2024
[84] Comment le Chili veut devenir le premier producteur mondial de lithium, métal essentiel à la transition énergétique, *Le Monde.fr*, 09/06/2023
[85] Mexico Nationalizes Lithium; Sets Up State-Owned Company | White & Case LLP, www.whitecase.com, 09/09/2022

Figure 7: Latin American mineral exporters and importers in 2023 (in thousands of USD)

Source: TradeMap
Note: analysis based on "ores, slag and ash" products.

3.3. At the heart of the battle for influence between China and the United States, Africa wants to redefine its mining partnerships

Africa, endowed with exceptional mineral resources, is today **a geopolitical and economic battleground between China, the United States and Europe**, all seeking to secure their supplies of strategic minerals. But at a time when**, according to the World Bank, the countries of sub-Saharan Africa are capturing only 40% of the potential revenues from their resources**[86], the continent's governments are reviewing their mining strategies by renegotiating their contracts or seeking to develop local processing infrastructures. On a continental scale**, the African Continental Free Trade Area** (AfCFTA) is seen as a key lever for structuring a single market for raw materials in Africa and attracting capital for industrial development. Its aim is to eliminate trade barriers and create processing infrastructures capable of competing with Asian refineries.

As the world's leading cobalt producer, the **DRC** is attempting to reinforce its strategy of mining sovereignty**. At the end of February 2025, Kinshasa announced a four-month suspension of unprocessed cobalt exports**[87] - a decision taken against a backdrop of crisis with Rwanda (see above) and falling cobalt prices, which have dropped from 80,000 USD per ton in 2022 to 20,000 in early 2025.) **With cobalt ore accounting for between 15 and 20% of the country's exports, the drop in prices is having a major impact on public finances**. By banning cobalt exports, the DRC is seeking to reduce supply and boost world prices. This measure also provides **diplomatic leverage** for the country, which is determined to move up the cobalt value chain. More so as, **in 2023, the DRC has launched a renegotiation of the mining contracts signed with China in 2008**[88], believing that it does not benefit sufficiently from the economic spin-offs of these contracts, while at the same time drawing closer to the EU and the USA (see above). **Kinshasa has also entered a strategic collaboration with Zambia to develop a local EV battery manufacturing value chain.** This agreement has led to the creation of special economic zones focusing on nickel, manganese and cobalt refining[89]. Despite the creation in 2022 of a Congolese Battery Council to coordinate the efforts of the two countries, the project remains in its infancy.

In 2023, **Zimbabwe** decided to ban raw lithium exports, with the authorities' estimating losses of 1.7 billion euros. Harare, which wants to refine its lithium locally, has signed a project to build a lithium battery factory in 2023 with Chinese companies Eagle Canyon and Pacific Goal. However, the country

[86] James Cust and Albert G. Zeufack, Africa's Resource Future: Harnessing Natural Resources for Economic Transformation during the Low-Carbon Transition, World Bank, 2023.
[87] DRC suspends cobalt exports for four months, *RFI*, 26/02/2025
[88] La RDC veut revoir les termes d'un contrat minier avec la Chine, *Challenges*, 24/05/2023
[89] What African producers of critical minerals can learn from Indonesia's experience - Atlantic Council, *Atlantic Council*, 19/12/2024

hopes to attract more diversified FDI. **Ghana**, on the other hand, has moved closer to Western investors: Accra, which has also banned raw lithium exports, has agreed to the launch of a mine by Australia's Atlantic Lithium in 2023.

But these initiatives come up against several major challenges, starting with the lack of local processing infrastructure, a major brake on industrial development. For example, **Guinea**, the world's second-largest producer of bauxite, is struggling to process the mineral locally into aluminum due to a glaring lack of facilities[90]**. Mining companies also exert a significant influence on African mining policies**; attempts at renegotiation or partial nationalization often come up against threats of disinvestment or financial pressure.

4. Recycling, still a limited alternative

4.1. Alternatives to bypass Chinese domination

Faced with the concentration of the supply chain in China, several governments and companies have launched projects to recycle strategic minerals to diversify their sources of supply. With demand exploding, mineral resources will rapidly come under pressure, and recycling is emerging as a solution to potential shortages. This market promises significant growth, with annual revenues from EV battery recycling **set to rise from 2 billion USD in 2022 to 95 billion USD in 2040**[91]. Investments in recycling plants are therefore plentiful. In Morocco, **Managem** entered into a partnership with Glencore in 2022 to produce cobalt from recycled materials. This project will produce 1,200 tons of recycled cobalt a year, contributing to a sustainable supply for the EV industry[92].

In Asia, **Japan** and **South Korea** have implemented advanced recycling policies. Tokyo has invested in technologies to recover minerals from used electronic devices, thus exploiting the potential of **"urban mines"**[93]. Seoul, for its part, has developed infrastructures for recycling lithium-ion batteries, contributing to a circular economy and securing its supplies. Its technology is well advanced, enabling it to recycle **95% of one used battery**. So, as well as being one of the world's leading battery producers, the country is also one of the main recyclers in the sector[94].

4.2. In Europe, ambitious targets but projects struggling to materialize

In addition to the development of mining projects and the transformation of its soil, the EU wants to increase the proportion of recycling to 15% by 2030. In France, Eramet and Suez initiated the **"Relieve"** project to develop a large-scale lithium-ion battery recycling chain in France. However, in October 2024**, Eramet suspended its battery recycling project at Dunkerque**[95], due to uncertainties over the supply of raw materials and outlets for its recycled products, reflecting the inherent difficulties of the recycling sector. Other companies, such as **WEEE Cycling** and **Sanou Koura,** focus on extracting critical metals from electronic waste. Their projects **won the France 2030 call for projects** (along with those of Eramet and Imerys), guaranteeing public support of up to 100 million euros[96].

[90] African countries rely on local processing of their mineral resources for development - Business & Human Rights Resource Centre, *Business & Human Rights Resource Centre*, 15/03/2023
[91] Recycling crucial to overcoming looming battery shortage - Pharm-Alliance, *Pharm-Alliance*, 01/03/2024
[92] MOROCCO: Recycled cobalt: Managem and Glencore refine their partnership - 03/01/2023 - Africa Intelligence, *Africa Intelligence*, 02/25/2025
[93] Rare earth recycling in Japan: the potential of urban mines | Direction générale du Trésor, French Treasury *Department*, 19/06/2019
[94] South Korea, leader in battery recycling, looks to Europe, www.usinenouvelle.com, 18/04/2024
[95] Faux pas pour la vallée de la batterie à Dunkerque : Eramet se retire du grand projet de recyclage, *Le Monde.fr*, 25/10/2024
[96] France 2030: the first 5 winners of the "Critical Metals" call for projects | Direction générale des Entreprises, *Direction générale des Entreprises*, 25/10/2022

4.3. Insufficient capacity

Despite these initiatives, recycling critical metals remains insufficient to meet growing demand. According to a BRGM report[97]**, less than a third of the 60 metals studied are recycled at 50% or more, and 34 elements have end-of-life recycling rates of less than 1%**, including metals such as lithium, beryllium, gallium and germanium. This situation can be explained by the **complexity of recycling processes**, the **lack of suitable infrastructures** and the **dispersion of metals** in end-of-life products. What's more**, the exponential rise in demand for critical ores is outstripping current recycling capacities**, making this alternative insufficient to bridge the gap between supply and demand. Finally, the complexity of the battery alloys used limits recycling opportunities.

APPENDIX

Table 1: China's strategic mineral reserves and share of extraction and refining activities (2023, as % of world total)

Ore	% of reserves in China	% extracted by China	% of refining by China	Usage
Aluminum			58%	*Concentrated solar power (CSP), electric vehicles (EV), hydroelectricity, wind power, photovoltaics*
Cadmium	15%		42%	*Photovoltaic*
Cobalt	1%		65%	*Carbon capture and storage (CCS), EVs, electrical storage*
Copper	3%	9%	42%	*CSP, electric storage, EV, geothermal energy, electricity grids, hydroelectricity, nuclear, photovoltaic, wind power*
Graphite	16%	65%		*Electric storage, EV*
Indium			59%	*PV, nuclear*
Lithium	8%	15%	58%	*Electric storage, EV*
Manganese	16%	5%		*CCS, electric storage, EV, geothermal, hydroelectric, nuclear*
Molybdenum	31%	40%		*CCS, geothermal, hydropower, nuclear, and wind power*
Nickel	2%	3%	35%	*CCS, electric storage, EV, geothermal, hydro, wind, nuclear*
Rare earths	34%	70%	87%	*EV, wind power*
Selenium	8%		41%	*Photovoltaic*

[97] Metal recycling in France: what is being done today? | BRGM, *BRGM*, 09/08/2022

Silicon			68%	*Photovoltaic*
Vanadium	37%	70%		*Electrical storage*

Source: Grantham Research Institute on Climate Change and the Environment, LSE, Energy Foundation, Grantham Foundation