The Increased Strategic Role of Rare-Earth Metals*

Norbert Szőcs

This feature article guides the reader through the process by which rare-earth metals have become a geopolitical and economic weapon. Their strategic importance stems from their use, as the last decade has seen the proliferation of smart devices and the technological innovations that go with them, with rare-earth metals at their core. Due to today's increasingly severe international trade restrictions, a country with an abundance of rare-earth metals can start from a better bargaining position. I discuss where the global race for rare-earth metals is heading and which countries can benefit the most in the coming years.

1. Introduction

Rare-earth metals are essentially a group of 17 chemical elements. They have similar properties, which means that several rare-earth metals can be found in a single mined deposit. Demand for rare-earth metals skyrocketed in the 1960s, in parallel with the spread of colour television (*Voncken 2016*).

In his 2020 book, taking a historical perspective, *Guillaume Pitron* draws attention to the importance of raw materials and highlights the current situation of rare metals: "From tea to crude oil, nutmeg to tulips, saltpetre to coal, commodities have been a backdrop to every major exploration, empire, and war, often altering the course of history. Today, rare metals are changing the world" (*Pitron 2020:23*). In ancient times, humankind used only seven metals, but since then this number has risen to over 80, with rare-earth metals playing a crucial role. Thus, technological progress leads not only to product innovation, but also to a transformation of raw material needs (*Pitron 2020; Liu et al. 2023*).

Despite their name, most rare-earth metals are relatively widespread in the Earth's crust. The difficulty is in extraction, as they occur in low concentrations. One key challenge to effective mining is to ensure an appropriate technological background and compliance with environmental standards (*Hiskey – Copp 2018; Braun 2018*).

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Norbert Szőcs: Magyar Nemzeti Bank, Analyst. Email: szocsn@mnb.hu

Rare-earth metals are essential to modern industry and are mostly used in the production of electronic devices, automotive industry, batteries and military technologies. Thus, countries with significant refining and storage capacity are more competitive, can benefit from technological advances and can start from a more favourable bargaining position in trade agreements (*Alonso et al. 2012*).

2. Chinese dominance

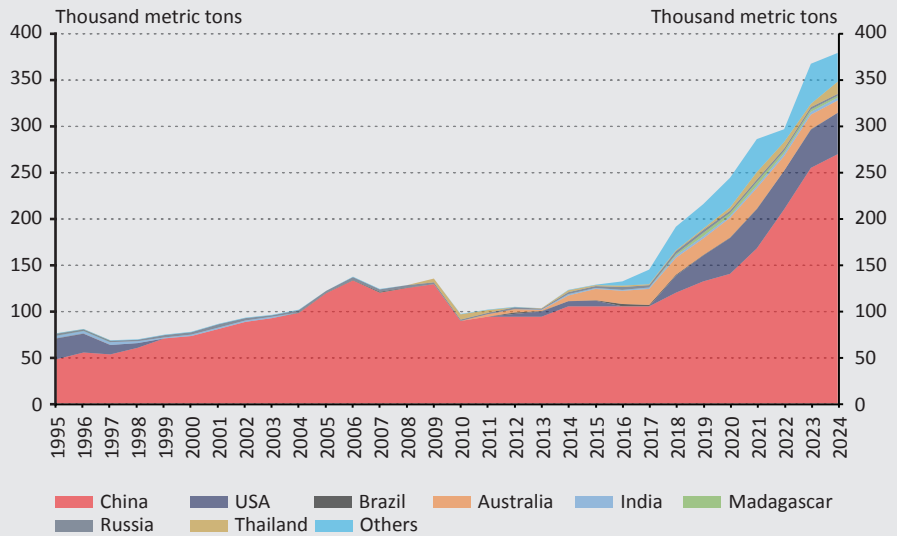
2.1. The strategic commitment

The fact that rare-earth metals are the engine of technological innovation was recognised early on in China. In the mid-1970s, China launched its targeted rare-earth metal strategy, which by the 1990s had given it global influence in the rare-earth metals market. One of the key players in the success of this strategy was the researcher *Xu Guangxian*, who pioneered the first 99.99 per cent pure rare earth separation technology, which he demonstrated in 1974, fundamentally changing international extraction practices (*Braun 2018*). The long-term plan was for China to play an increasing global role in both extraction and stockpiling. The next part of the plan was to use their own manufactured product to make use of the rare-earth metals already in circulation.

For nearly 20 years until the mid-1980s, the United States dominated the market for mined rare-earth metals. However, China's production strategy took advantage of the fact that it could sell its reserves much cheaper, and the United States was no longer able to compete on price, which meant that they virtually stopped mining altogether and withdrew from the market. From that time on, China became dominant in the rare-earth metals market, and it further strengthened its dominance in the 2000s by acquiring majority stakes in several international companies involved in rare-earth metal extraction. Since then, Chinese dominance has continued. In China, rare-earth metals are considered to be "the vitamins of modern industry" (*Hurst 2010a; Hurst 2010b*).

Compared to 1985, global extraction of rare-earth metals has now increased seven and a half times (*Liu et al. 2023*), with a sharp increase in the second half of the 2010s (*Figure 1*). Chinese dominance seemed to be declining, but from 2020 onwards, there was again a significant increase in extraction.

Figure 1
Trends in rare-earth metal production over the past 30 years by major producing countries



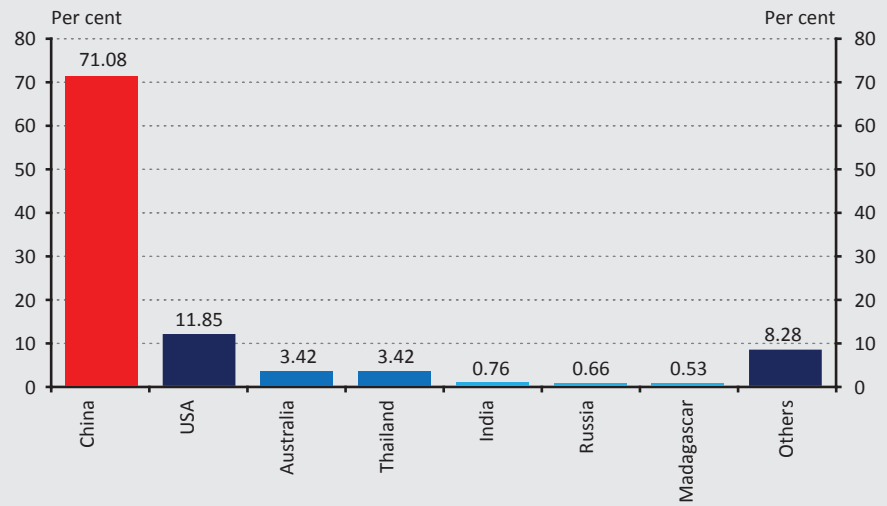
Source: Energy Institute (https://www.energyinst.org/statistical-review. Downloaded: 7 July 2025)

According to data from Energy Institute, China had the largest influence in the production of rare-earth metals in 2005, and between 1999 and 2013, China's share of global production was over 90 per cent. The statistics are distorted by the fact that there are several countries that are extracting but not declaring it, but the Chinese dominance is unquestionable. As it stands, China produces more than 70 per cent of the world's rare-earth metals. After 2015, in particular the United States and a number of countries that had been less involved in extraction increased their capacity, resulting in a decline in Chinese dominance. In addition to the rise in extraction in other countries, the breaking of the monopolistic situation and rapid technological advances, especially in the automobile and defence industries, played a role. China's continued dominance in the production chain is due to the fact that while China increased its extraction more than one and a half times from 2020 to 2024 (from 170,000 tonnes to 270,000 tonnes), the rest of the world's total production increased only slightly (from 104,000 to 110,000 tonnes).

2.2. Production and stockpiling advantage

China thus remains the world leader in rare-earth metal mining (*Figure 2*). Its dominant role is best illustrated by the fact that Chinese extraction is more than 8.5 times higher than that of the second largest producer, the US. The long-lasting research and industrial policy on rare-earth metals put China in such a position that it could supply virtually any country's electronics production with sufficient quantities of rare-earth metals.

Figure 2
Distribution of rare-earth metal production by country in 2024



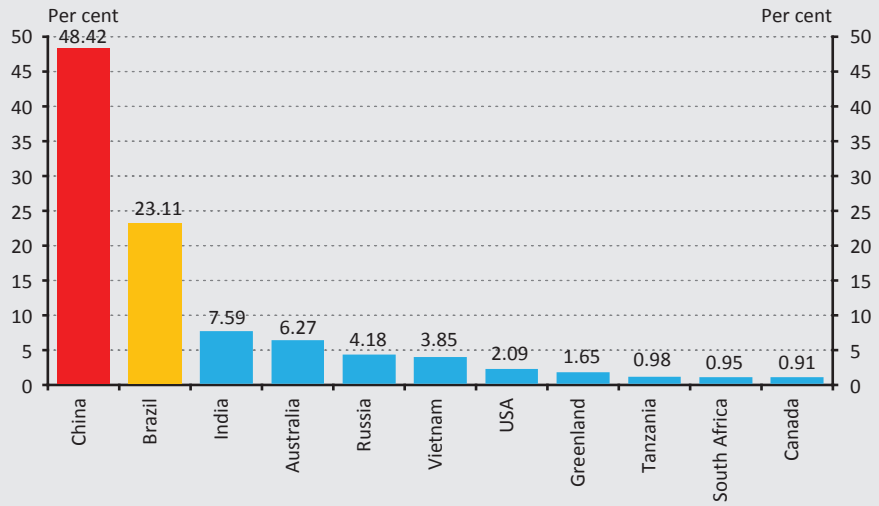
Source: Energy Institute (https://www.energyinst.org/statistical-review. Downloaded: 7 July 2025)

The superiority that China has achieved in recent decades is due to a combination of factors:

- Geographically favourable conditions for mining.
- The early and consistent public strategy mentioned above.
- Significantly less stringent environmental rules for mining, refining and the management of waste compared to other countries.
- Pricing policy: in the initial period, China eliminated competitors by exporting below the market price, thus creating a monopolistic situation, and then started to raise prices.
- In addition to mining and refining, China also focused on technological development, creating high added value manufactured products.

China is also in a prominent position in terms of stocks, holding nearly half of the global stock by 2024 (*Figure 3*).

Figure 3
Distribution of rare-earth metal stocks by country in 2024



Note: Stocks = the estimated amount of rare-earth metal bearing minerals in the earth's crust that can be economically extracted by mining companies.

Source: U.S. Geological Survey – Mineral Commodity Summaries 2025 – Rare Earths (https://catalog.data.gov/dataset/mineral-commodity-summaries-2025-rare-earths-data-release)

3. Market movements in rare-earth metal prices

There are significant differences in the pricing of different rare-earth metals, as prices are affected by the quantities that can be mined and the cost of producing and stockpiling. In addition, the extent to which the rare-earth metals are used in modern technological devices also determines their valuation (*Walters et al. 2011*).

3.1. Historical overview

As early as the late 19th century, the mining of rare-earth metals was already underway. Due to moderate demand, the price of rare-earth metals remained stable until the mid-1950s, after which the volatility of rare-earth metal prices increased due to the opening of more and more mines and technological advances. In the 1960s, with the opening of the Mountain Pass mine in California, prices began to fall, significantly increasing supply. In the 1970s, supply and demand went hand in hand, but by the end of the decade, prices started to rise due to inflation and higher energy costs. The early 1980s brought stability in prices, but in 1985, the petroleum

industry underwent a technological changeover due to environmental regulations, and less rare-earth metals were needed. In response to the fall in demand, mines reduced extraction, which eventually led to a rise in prices (*Hedrick 1997*).

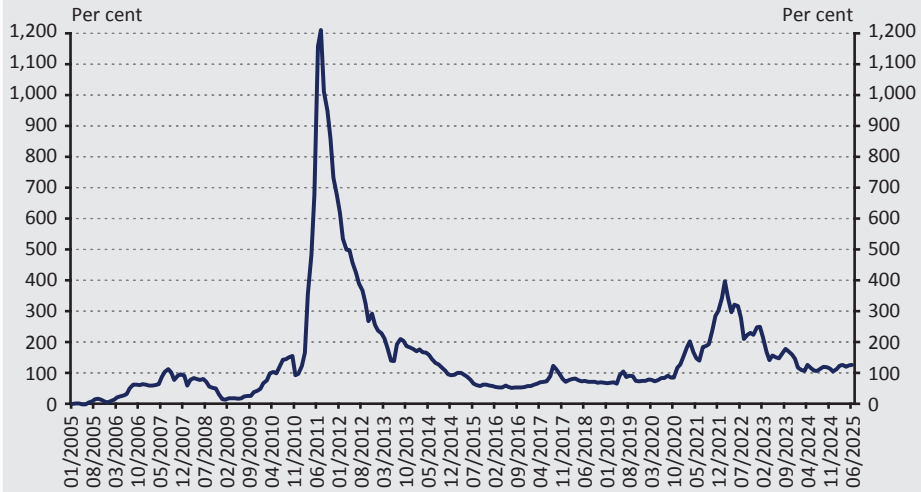
In the 1990s, rare-earth metal prices were depressed by oversupply dominated by Chinese hegemony. After 1995, technological progress led to an increase in demand, which started to push up prices, but China responded by increasing production, stabilising price pressures in a short time (*Naumov 2008*). The 2000s were characterised by a gradual increase in demand, coupled with an increase in supply; however, there was a gradual rise in the price of rare-earth metals. The 2008 crisis also hit the rare-earth metal-based industries, with prices for most rare-earth metals falling back to almost 2005 levels by the end of 2008. In 2010, increased imports from Japan and the widespread use of magnetic applications started to drive up the price of rare-earth metals (*Walters et al. 2011*).

3.2. Market impact of Chinese export restrictions

Price volatility can be significantly affected by Chinese dominance. In July 2010, China announced a 70-per cent cut in its export quota for the second half of the year. For 2011 H1, China announced a further 35-per cent cut in export quotas, but demand remained very strong. As a result, by July 2011, the price of most rare-earth metals had risen to a historic peak (*Figure 4*), meaning that rare-earth metals were on average more than twelve times more expensive than at the beginning of 2010 (*Walters et al. 2011*). The surge in rare-earth metal prices in 2011 also led to a substantial increase in the price of the products made using them (*Nicoletopoulos 2011*).

Following the surge in prices, it took several years for the price of rare-earth metals to return to near pre-2010 levels – following the lifting of China's export quota after the World Trade Organisation's response. During the pandemic period, increased global demand and a high inflationary environment pushed prices back up several-fold in the early 2020s, but the increase was less significant than the surge in late 2010. Today, the pricing of rare-earth metals has stabilised, but even after removing market turbulence, the trend is upwards, with rare-earth metals now costing on average more than twice as much as they did 20 years ago.

Figure 4
Average change in the market price of rare-earth metals since 2005

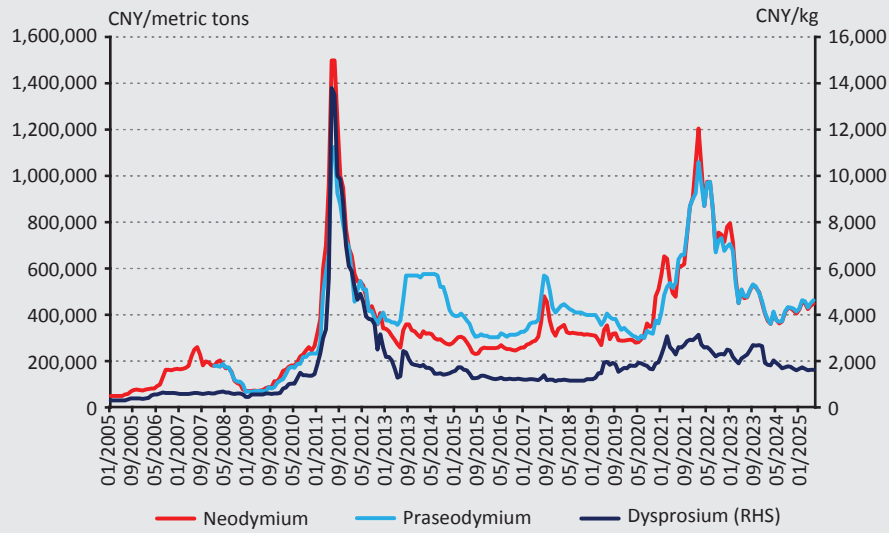


Note: the figure is based on the average of the available prices of the following 15 rare-earth metals: scandium, yttrium, lanthanum, cerium, praseodymium, neodymium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, ytterbium, lutetium. Base: 1 January 2005

Source: Bloomberg

A similar picture emerges when looking at the price trends for some of the key rare-earth metals. The strongest known magnet is neodymium combined with iron and boron. By adding dysprosium and praseodymium, the performance and properties of certain magnets can be changed. Magnets made from these elements are essential for hybrid and electric cars, wind turbine generators, hard disks, mobile phones and other smart devices. The events of 2010 did not spare the market prices of these materials (*Figure 5*), and within a few months, their prices had increased several-fold (*Walters et al. 2011*).

Figure 5
Price trends for some key rare-earth metals over the past 20 years



Source: Bloomberg

Price volatility may persist in the market of rare-earth metals, as price movements continue to be driven by the upward trend in demand. This could be counterbalanced by adding new production sites on the supply side or by reopening mines that have previously closed (*Haque et al. 2014*).

4. Geopolitical and economic weapon

The use of rare-earth metals has played a major role in technological breakthroughs, but during the Cold War, the geopolitically motivated production and stockpiling of rare-earth metals also came to the fore as a result of the nuclear arms race. Recognising this situation, China made the greatest efforts to exploit the foreign trade benefits from its dominance in the production of rare-earth metals (*Kosynkin et al. 1993*). China's main export markets for rare-earth metals are Japan, the US and France. However, meeting foreign demand is not determined by the capacity of the mining industry, but by Chinese ministries setting production and export quotas. In addition to dominating production and supply, China has also become one of the largest consumers. Rare-earth metals are mainly used in the manufacture of

electronic products in China, some of which are exported. China is followed in the consumption competition by Japan and the United States. As competition between the two poles of the world intensifies, geopolitical considerations also play a role in the quantities and prices at which China is willing to export rare-earth metals (*Van Gosen et al. 2017*).

4.1. The situation of the USA

The United States broke into the market of rare-earth metal extraction in the mid-1960s and quickly established a leading role. Technological advances, such as the widespread adoption of colour television, were the main driver of US production growth. In the mid-1980s, China entered the production market and in the early years exported its rare-earth metal reserves at much lower prices than the market, forcing US mines to close down in succession as they could no longer make the profits needed to survive (*Drobniak – Mastalerz 2022*).

By the 2010s, China had taken the lead in terms of total exports, with the United States slipping back to second place, despite its dominance in previous decades. Since rare-earth metals are essential for the production of modern products, the US is strongly dependent on the amount of rare-earth metals it can import from China. If China restricts the export of rare-earth metal resources, as it has already begun to do, US manufacturing and military industries could suffer the most (*Ferreira – Critelli 2022*).

In April 2025, China announced export restrictions on rare-earth metals in response to US trade tariffs, and in the following month, it extended the scope of its rare-earth metal export controls outside its territory, ordering Korean producers to stop exporting to the US articles containing rare-earth metals, putting pressure on the US government (*JP Morgan 2025*).

In May 2025, Chinese exports of rare-earth metals decreased significantly, mainly to the United States, where they fell by 92 per cent (!) compared to May 2024. Vietnam and Germany, major rare-earth metal trading partners of China, have been much less affected by the export restrictions than the US; therefore, it can be assumed that the restriction has a political message much more than it is a supply problem. That is, the trade conflict between the two countries is at the root of the downturn, which supports my assumption, along with others, that China, using its dominance over rare-earth metals, could improve its bargaining position in tariff negotiations.

4.2. The situation of the EU

Europe's mining role in the world has been steadily declining since 1860, and so has the rare-earth metal mining industry, with EU countries together accounting for only a few per cent of global production. It is also worth pointing out that the EU imports almost all of its rare-earth metal imports from China. The EU has successfully implemented technological opportunities in a large part of its Member States, but these technologies are dependent on Chinese inputs, increasing the risk of exposure to China (*Massari – Ruberti 2013; Jancsek 2023; Botos 2025*).

In the European Union, the areas with the greatest potential for some of these extractions are Greenland and the Scandinavian Peninsula. Recognising this, the US administration has made several efforts to strengthen its relations with the Danish autonomous region. However, this is hampered by the fact that the Greenland Parliament has banned mining in the area (*Jancsek 2023*).

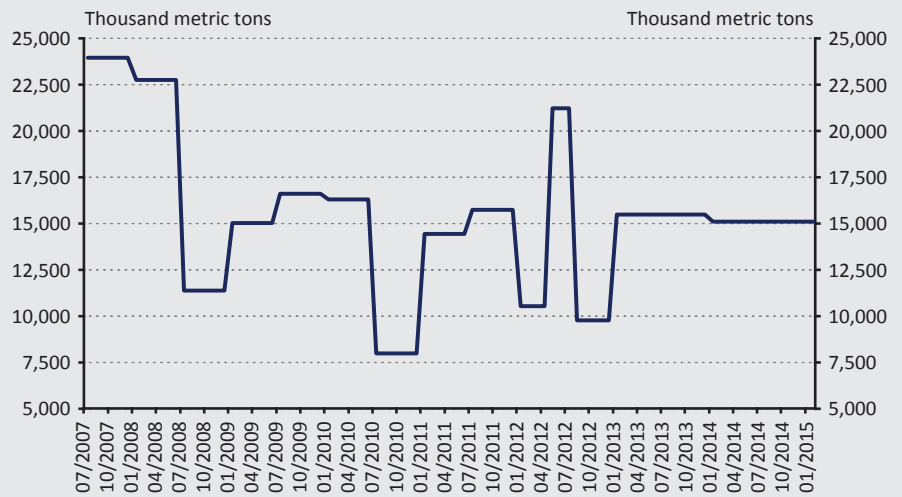
4.3. Supply risks

In general, when a single country controls almost all global supply, all trading partners are at high risk. It can decide to reduce exports or even to impose concentrated restrictions on a single country, which tightens supply and thus raises prices, while a major trade restriction can lead to market panics due to disruptions in the supply chain.

The announcement of Chinese restrictions on rare-earth metal exports, which started in 2010 H2, was sudden and drastic: the export quota was effectively halved (*Figure 6*). The market reaction was that the rate was too high. China justified the decision on the grounds that it wants to secure the supply of rare-earth metals needed for domestic production, and environmental reasons were also cited.

After the announcement, the price of rare-earth metals started to rise sharply, peaking in 2011, when the Chinese ministry increased the quota by one and a half times and kept it at roughly the same level for the following years. The market situation was further exacerbated by the fact that Chinese-owned companies operating in foreign countries received nearly three-quarters of the limited quota for exports, while other internationally owned trading companies had to share the remainder. The restrictions have been challenged by the US, Japan and the EU at the World Trade Organisation. In 2014, the World Trade Organisation enacted a resolution against export restrictions, which led China to suspend the export quota on rare-earth metals in 2015 (*Van Gosen et al. 2017*).

Figure 6
Evolution of the export quota imposed on Chinese rare-earth metals between 2007 and 2015



Source: Bloomberg

International companies responded to Chinese trade restrictions by raising the prices of their products, embarking on projects to find substitutes for rare-earth metals and trading with other rare-earth metal producing countries (*Watts 2011*).

It should be noted that, in addition to the market risks, the environment also suffered from the impact of the restrictions, as the volume of illegal mining activity increased, with the Chinese Ministry of Industry and Information Technology (MIIT) estimating that the annual extraction of rare-earth metals exceeded 40,000 tonnes (*Van Gosen et al. 2017*).

5. Where is global competition heading?

Although China still dominates the market, more and more countries are seeking to reduce their vulnerability. For example, the US is working intensively to open new mines and build processing capacities. According to research by the United States Geological Survey (USGS), the quantity of undiscovered resources is easily sufficient to meet projected demand (*Hedrick 2008*).

There is also a strong focus on alternative sources, such as space mining, which in the longer term could open new dimensions in rare-earth metals supply. Samples taken from asteroids show that they contain high levels of rare-earth metals (*Braun 2018*).

In some developed countries, government measures are being taken to encourage the development of rare-earth metal reserves. For example, a law adopted by the European Commission to fund projects associated with rare-earth metals supply and to speed up licensing deadlines. The Canadian government's strategic objective sets out a commitment to increasing the supply of rare-earth metals. Such efforts are clear evidence that developed countries are seeking to reduce as much as possible China's long-standing dominance, especially in the context of recent geopolitical and trade tensions.

Global competition is made more difficult by the fact that China alone has the knowledge and technology to manage the entire supply chain. Technology development is essential to manage the waste from the extraction of rare-earth metals as cheaply and efficiently as possible (*Liu et al. 2023*). These initiatives can be seen as positive, but as the Chinese example shows, it takes many years to develop a functioning supply chain, and a proper long-term strategy is needed (*Ferreira – Critelli 2022*).

6. Summary

Rare-earth metals are not only industrial raw materials, but can also be used as geopolitical tools. Their role has recently been enhanced, and countries with larger reserves or the ability to produce larger quantities of rare-earth metals may be in a better position in the future in terms of technological innovation and can benefit from the superiority of abundant rare-earth metal resources in international trade, thus improving their long-term competitiveness.

Chinese export restrictions in 2010 encouraged decision-makers in developed markets to reactivate previously closed mines and to work on technological improvements to enable more efficient mining and processing. These could reduce Chinese dominance in the market of rare-earth metals. The difficulty lies in the fact that mining produces substances that are harmful to the environment, in addition to the extracted and refined rare-earth metals. More emphasis should be placed on addressing this in technological developments.

The question arises as to whether there may be a substitute product in the future that can replace rare-earth metals in the production of technology products. This would solve the problem of countries' dependence on China. The experience so far is that in trials where some substitute product has been used, the results have been less effective and ultimately more costly.

References

Alonso, E. – Sherman, A.M. – Wallington, T.J. – Everson, M. P. – Field, F.R. – Roth, R. – Kirchain, R.E. (2012): *Evaluating rare earth element availability: a case with revolutionary demand from clean technologies*. Environmental Science & Technology, 46(6): 3406–3414. https://doi.org/10.1021/es203518d

Botos, K. (2025): *Európa az új multipoláris rendszerben* (*Europe in the new multipolar system*). Világpolitika és a Közgazdaságtan, 4(3): 68–74. https://doi.org/10.14267/VILPOL2025.03.09

Braun, T. (2018): *Kritikus helyzetben a világ ritkaföldfém-ellátása* (*The Global Supply of Rare Earth Elements in a Critical Situation*). Magyar Kémikusok Lapja, 73(4:) 120–126.

Drobniak, A. – Mastalerz, M. (2022): *Rare earth elements: a brief overview: Indiana Geological and Water Survey*. Indiana Journal of Earth Sciences, v.4. https://doi.org/10.14434/ijes.v4i1.33628

Ferreira, G. – Critelli, J. (2022): *China's global monopoly on rare-earth elements*. Parameters, 52(1): 57–72. https://doi.org/10.55540/0031-1723.3129

Haque, N. – Hughes, A. – Lim, S. – Vernon, C. (2014): *Rare earth elements: Overview of mining, mineralogy, uses, sustainability and environmental impact*. Resources, 3(4): 614–635. https://doi.org/10.3390/resources3040614

Hedrick, J.B. (1997): *Rare-earth metal prices in the USA ca. 1960 to 1994*. Journal of Alloys and Compounds, 250(1–2): 471–481. https://doi.org/10.1016/S0925-8388(96)02532-7

Hedrick, J.B. (2008): *Rare Earths*. In: USGS: Mineral Commodity Summaries 2008. U.S. Geological Survey, pp. 134–135. https://doi.org/10.3133/mineral2008

Hiskey, J.B. – Copp, R.G. (2018): *Solvent extraction of yttrium and rare earth elements from copper pregnant leach solutions using Primene JM-T*. Minerals Engineering, 125: 265–270. https://doi.org/10.1016/j.mineng.2018.06.014

Hurst, C.A. (2010a): *China's ace in the hole rare earth elements*. Joint Forces Quarterly, 59(4): 121–126. https://ndupress.ndu.edu/portals/68/Documents/jfq/jfq-59.pdf

Hurst, C. (2010b): *China's Rare Earth Elements Industry: What Can the West Learn?*. Technical Report, Institute for The Analysis of Global Security, Washington DC. https://doi.org/10.21236/ADA525378

Jancsek, K. (2023): *A ritkaföldfém-bányászat jelene és perspektívái a világban* (*The present and perspectives of rare-earth elements mining in the world*). Bányászati és Kohászati Lapok, 156(2): 16–23. https://ojs.mtak.hu/index.php/bkl/article/view/17137

JP Morgan (2025): *Have we reached peak Trump?*. Macro and market questions by the dozen. https://markets.jpmorgan.com/jpmm/research.article_page?action=open&doc=GPS-4977595-0. Downloaded: 10 July 2025.

Kosynkin, V.D. – Moiseev, S.D. – Peterson, C.H. – Nikipelov, B.V. (1993): *Rare earths industry of today in the Commonwealth of Independent States*. Journal of Alloys and Compounds, 192(1–2): 118–120. https://doi.org/10.1016/0925-8388(93)90204-Z

Liu, S.-L. – Fan, H.-R. – Liu, X. – Meng, J. – Butcher, A.R. – Yann, L. – Yang, K.-F. – Li, X.-C. (2023): *Global rare earth elements projects: New developments and supply chains*. Ore Geology Reviews, 157, 105428. https://doi.org/10.1016/j.oregeorev.2023.105428

Massari, S. – Ruberti, M. (2013): *Rare earth elements as critical raw materials: Focus on international markets and future strategies*. Resources policy, 38(1): 36–43. https://doi.org/10.1016/j.resourpol.2012.07.001

Naumov, A.V. (2008): *Review of the world market of rare-earth metals*. Russian Journal of Non-Ferrous Metals, 49(1): 14–22. http://doi.org/10.1007/s11981-008-1004-6

Nicoletopoulos, V. (2011): *Rare earths: supply, demand, and politics*. Industrial Minerals, 526, 19–20.

Pitron, G. (2020): *The Rare Metals War: the dark side of clean energy and digital technologies*. Scribe Publications.

Van Gosen, B.S. – Verplanck, P.L. – Seal, R.R. – Long, K.R. – Gambogi, J. (2017): *Rare-earth elements.* Professional Paper 1802-O, US Geological Survey. https://doi.org/10.3133/pp1802O

Voncken, J.H.L. (2016): *The rare earth elements: an introduction*. Springer International Publishing. Cham, Switzerland. https://doi.org/10.1007/978-3-319-26809-5

Walters, A. – Lusty, P. – Hill, A. (2011): *Rare Earth Elements: Mineral Profile Series.* British Geological Survey, Nottingham.

Watts, M. (2011): *Heavy rare earth prices take off*. Industrial Minerals, July, 8–9.