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Below the Radar
The strategic significance of rare earths for the economic and military security of the West

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Rare earths are raw materials of strategic significance for the economic and military security of the West. They are essential to numerous civilian and military technologies. The People's Republic of China is the world's largest producer of rare earths, which poses a significant threat to the West's security of supply. For far too long, this problem remained below the radar of political decision-makers and has not been addressed. This working paper points out the risks of the Chinese monopoly on rare earths and discusses possible steps towards a solution.

In the current trade war between the United States and China, Beijing has brought rare earths into play as a potential means of exerting pressure. China's dominant position with regard to these strategic raw materials is not a passing geopolitical trend, but has been a structural market problem with technological and security-related implications for the industrialised countries of the West for some time. The mere fact that a single state has the potential to exploit key technological raw materials for the purpose of political negotiations should deeply worry political and economic decision-makers. The example of Russia's blackmail attempts in the field of energy policy immediately comes to mind. The situation concerning rare earths, however, is much more dramatic and far more difficult to solve than in the case of Russia's dominance in energy. Yet the West has failed to adequately address the rare earths problem for far too long and has largely left solving it up to the market.

Why are rare earths so important?

Rare earths are a set of 17 metals, 15 of them in the lanthanide series of the periodic table, which are necessary for numerous technologies due to their physical and chemical properties. They are used in minute amounts, sprinkled into the technology in catalysts, alloys, magnets, solar energy systems and computers. Without them, many devices simply would not work. Together with a number of other raw materials such as cobalt and lithium, they are the fundamental basis for future technologies, especially with regard to the energy transition, such as all-electric cars, batteries and interconnected Industry 4.0 applications.

As all these civilian technologies are also used in the military, they are of strategic importance for the functionality of modern and increasingly interconnected high-tech armed forces. To continue in this vein: a US Virginia-class submarine, for example, requires some four tons of rare-earth materials, an Arleigh Burke-class destroyer requires more than two tons and even an F-35 fighter aircraft requires more than 400 kilogrammes. Further areas of application include aerospace engineering, surveillance systems and lasers. The more modern and technologically sophisticated military equipment becomes, the more diverse the applications and therefore the use of rare earths will be for the armed forces of the future.

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This is a trend that none of the NATO countries' armed forces can afford to ignore. Currently, NATO is almost 100 percent dependent on rare earths imports from China. This is a much higher rate than that of the energy dependency on Moscow, which varies from country to country and for which alternatives are available if necessary. That is why the US and the EU have been classifying rare earths as critical or strategic raw materials for more than ten years. This means that these raw materials are of great economic significance and have a high supply risk. For this reason, it is essential to take a closer look at the Chinese monopoly, potential alternative suppliers and related supply risks.

From the ore to the final product: China controls almost the entire value chain

Most analyses of China's role in the rare earths market overlook the fact that not only does the People's Republic produce the majority of the raw materials, but Chinese companies now also dominate almost all downstream sectors of the value chain up to the final product. At the first stage – mining of raw materials – China currently controls about 80 percent of world production, which corresponds to 170,000 tons of rare-earth materials (mainly oxides) per year. In recent years, the Chinese share has fallen from almost 100 percent to 80 percent as other companies have started production. At the same time, China is the largest consumer of rare earths for its own industry. Its largest foreign competitor, the Australian company Lynas, produces about 20,000 tons of rare-earth materials, accounting for almost twelve percent of the market. Lynas has been heavily indebted for years, however, and only remains solvent because Japan has been supporting the company financially since 2011 in order to have an alternative to supplies from China.

This project may seem absurd from a business standpoint, but the logic behind it is simple: Japanese taxpayers' money goes to an Australian raw materials company to increase the security of supply for Japan's industry. This in turn reduces Beijing's ability to put political pressure on Tokyo. When it comes to raw materials strategies, however, the situation in the West is much more drastic. In the US, Molycorp, the last company in the country to mine rare earths, ceased production in 2015 due to low raw material prices. Two years later, the remainder of the company was taken over by an investment consortium of two partners from the US and one from China. For the time being, Washington has put its last domestic rare earths company partly in Chinese hands. Since then, the US government has once again realised the strategic significance of rare earths for the US economy and military. It remains to be seen whether concrete steps will follow and Washington is prepared to use taxpayers' money to support US producers of rare earths.

In Europe, the situation is as alarming as it is in the US. There not a single mine in the EU producing rare earths for Europe's industry, even though sufficient resources are available, but political decision-makers seem to have simply forgotten the strategic significance of these elements for the energy transition and military autonomy of the EU after the last period of high prices in 2011/2012. To borrow a phrase from the Australian historian Christopher Clark used to describe the path to World War I, the EU seems to be "sleepwalking" into its next resource crisis. While Brussels and Berlin want the energy transition, climate protection and greater autonomy in security policy, political leaders still fail to grasp the full strategic significance of supply with the necessary raw materials such as rare earths and other metals. And yet there are promising deposits in Europe that could be mined. Greenland and Sweden, for example, have documented rare-earth resources or have been exploring them extensively for some time. The only problem is that they are not mined by European companies because prices are too low and the Chinese monopoly is too overwhelming.

With its six state-owned conglomerates, Beijing could flood the market with excess capacities to increase supply, which would ruin any investment.[1] Accordingly, China has several forms of leverage at the first production stage: about 40 percent of global reserves and 80 percent of production, which allows Beijing to influence supply and price trends. What is more, one of the two potential European deposits of rare-earth resources in Greenland is being developed by a Chinese company. Privately owned Western companies are thus facing unequal state-sponsored competition from East Asia.

But that is not all. Chinese companies are increasingly dominating all further steps in production on the global rare earths market. They hold leading positions in the processing of ores, in the manufacture of components and to an increasing extent in the final products such as batteries and computers. Important technologies and expertise in the area of further processing have also been transferred to China in the past two decades. Chinese companies and research institutions have now taken a leading role in areas such as separation and certain patents. The largest segment is the field of permanent magnets made from the rare-earth elements neodymium and dysprosium.

Outside of China, these special high-performance magnets are now only produced in Japan. Almost all of the few remaining European magnet producers have relocated their production facilities to China, where rare earths can be purchased at lower prices. The Chinese share of global magnet production is estimated at over 80 percent, and no other country will be able to challenge China's share for the next two decades. From the ore to the final product, the People's Republic is and will remain a monopolist at several stages. Furthermore, recycling technologies for rare earths either do not yet exist on a large scale or have only low efficiency levels. This state of affairs has a significant impact on the economic and military security of the West and its supply situation in the event of a conflict.

Existing and potential consequences of the Chinese monopoly on raw materials

The Chinese monopoly from the ore to the final product underscores several failures of the West – on both sides of the Atlantic. On the one hand, starting in the 1980s, the US government sat by and watched the People' s Republic invest more and more in basic – and application-specific – research in the field of rare earths. Low production costs, strategic company takeovers, support from the government (subsidies), technology transfers and lax environmental regulations allowed China to replace the US as the leader in rare earths. Despite Washington's early awareness of the strategic significance of secure access to these and other critical metals for its economy and military, Washington only took a supporting role and left it up to companies to ensure a supply of raw materials. The advocates of a market-driven solution retained the upper hand. As a result, the US did not protect its own companies from decline and let them go bankrupt. The market-based approach triumphed – and is still triumphing – over legitimate security concerns.

Japan's experiences in 2010 show that excessive dependence on a single supplier can have an adverse effect on not only individual companies but also on entire economies. After a minor dispute between Japanese and Chinese boats in the contested waters of the East China Sea, all shipments of rare earths from China to Japan were suspended for more than two months. This resulted in unprecedented price increases and frenzied investments in new exploration projects and processing technologies all over the world. Japan survived the supply shortage relatively unscathed, but, since then, major Japanese companies such as Toyota have been even more active in seeking secure access to rare earths outside of China.

[1] These are: China Northern Rare Earth Group, China Southern Rare Earth Group, Chinalco Rare Earths Group, Xiamen Tungsten, China Minmetals Rare Earth Group and Guangdong Rare Earths Group.

In the current trade war between Washington and Beijing, China could once again use rare earths as a temporary means of exerting political and economic pressure. An artificial supply shortage caused by an export ban could lead to an increase in prices and fuel the search for sufficient raw materials for the high-tech industries in the US, Europe and Japan. Especially large consumers such as automobile corporations, but also producers of modern defence systems could be affected by a short-term supply bottleneck. Currently, there are sufficient quantities of rare earths available on the market. However, they are mainly from Chinese sources. Other suppliers either produce too little or are unable to produce sufficient quantities of the necessary quality. Against this backdrop, viable solutions should be considered in order to avoid such a scenario and to increase the West's general security of supply.

What could be done – Possible solutions for the US and Europe

The rare earths problem is in principle one that requires a common assessment of the situation and the solutions in terms of natural resources economics, policy and geostrategy. Relying solely on market forces would be both naive and irresponsible from a strategic standpoint. The hope that privately run Western companies will enter the market controlled by China and develop into serious competitors will not become a reality in the foreseeable future. The past ten years have shown that not too much has happened in this respect and that China has been able to consolidate and expand its monopoly. Western companies shy away from the associated risks. Additionally, it is impossible to predict the earnings outlook for mining projects and processing plants, which usually take years to break even and can only do so if raw material prices and demand are high. What is more, it is unclear which of the rare earths will be needed in five to ten years. Future technologies may require only certain rare earths or new compounds of these and other metals. At present, it looks like the rare-earth elements neodymium, dysprosium, praseodymium, lanthanum and cerium will continue to be very important in the future. Despite this insight, even large, financially sound end consumers such as VW, BMW and Siemens shy away from strategic investments in their own raw materials projects. This is understandable from a business perspective, but questionable with regard to market strategy. Eventually, the entire Chinese-controlled value chain would have to be broken to regain at least some Western natural resource sovereignty.

If the West wants to set a fundamentally new course in this direction, it must perceive the problem as one that links both policy and economics. This would require the the federal government in Germany and the European Commission for European trade issues to take on a more active role. Up to now, the German Federal Foreign Office, the Federal Ministry for Economic Affairs and Energy, the Federal Ministry of Education and Research, and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety have limited themselves to a rather passive supporting role that consists of poorly functioning raw material partnerships (like with Kazakhstan and Mongolia) and selective support for industry and research investments. All these measures are appropriate and important, but even taken together they are not enough to weaken the Chinese monopoly. In any case, it should be of vital interest to Germany to eliminate the unequal conditions of competition between state-sponsored raw materials corporations in China and privately owned companies without significant subsidies in the West.

In concrete terms, this means that Germany and the EU should classify this market as strategic, and reposition themselves with a coherent, interagency strategy for raw materials and industry. With the *Rohstoffallianz* ("raw materials alliance") initiative, Germany already made an attempt to establish a purely private-sector industrial consortium, consisting of leading German companies, with the objective of working together to purchase raw materials for the German market on the world markets. The *Rohstoffallianz* was established after the last period of high prices in 2011/2012, but already discontinued by 2015. The companies involved were no longer interested as prices for rare earths and other raw materials had dropped again and the German government had failed to provide appropriate political support from the outset – a wasted opportunity for German industry to be better prepared for future raw materials crises. The revised German raw materials strategy must build on this and assign the state a stronger strategic role as a partner of industry.

Ideally, there would be long-term cooperation between industry and politics not only in Germany, but also at the European and transatlantic level. The US, the EU and Japan could intensify their ongoing dialogues on raw materials and extend them to include the aspects of security and defence policy that result from their dependence on Chinese rare earths. Up to this point, little attention has been paid to these American-European-Japanese raw materials dialogues involving politics, business and science. In light of the strategic challenge posed by China and the relatively weak role of the World Trade Organization, these dialogues between Washington, Brussels (and Berlin) and Tokyo should be politically strengthened and consolidated. Australia, as a country that still has functioning production of rare earths, should also be included. The objective of this dialogue format could be to seriously consider developing and sustaining rare-earth deposits outside of China and to bring at least part of the value chain, which is now primarily located in China, back to the West.

This would, however, require a precise, continually updated situation picture of the raw materials market, which is relatively small and lacks transparency. One possibility would be for German and NATO planning groups to clarify which raw materials and components for which weapon systems are provided by which companies and suppliers from which mines and processors – and how strong China's dominance is in this context. This information would be an important basis for improving the assessment of existing and future procurement risks along the protracted, complex value chains. As of now, the West still lacks this knowledge. If the West also misses out on this development, it will experience the same situation as with other future technologies, most of which are already produced in Asia (keyword: batteries).

Furthermore, Germany and Europe could increase their domestic extraction of raw materials. Possible options include introducing tax incentives for the extraction of raw materials, speeding up approval procedures, and participation by the federal government or the relevant state government. This would not only strengthen Germany's role as a raw materials producer and increase security of supply for the entire EU, but could also be implemented in accordance with high environmental standards that China does not currently meet. Security of supply, (regional) economic promotion and environmental protection could be combined. By leaving this raw materials market completely to China, the West would not only endanger the security of raw material supplies for its own industry, but also do a great disservice to environmental protection. However, preventing all this would require rethinking and a coordinated change of course at the political level.

Accordingly, if the West wants to substantially increase its security of supply for rare earths, it will have to think and act strategically, counter-cyclically and in the long term. This would require a stronger role for the governments of the leading Western industrialised countries, especially Germany. The German aversion to fundamental debates on industrial and regulatory policy and to uncertain investments must not be used as an excuse to ignore the rare earths problem and let it remain below the radar. Rare earths will be critical raw materials for the foreseeable future – whether we like it or not. The time has come to face this raw materials and security policy challenge.

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