

FEATURE

China could play rare earths card in US clash

They are crucial in today's high-tech world and Beijing could use them as a bargaining chip in the trade war

By [Stanley Mertzman](#)

<https://www.asiatimes.com/2019/05/article/what-are-rare-earths-crucial-elements-in-modern-technology/>
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Rare earths cerioxide, yttrium oxide and neodymium oxide. Photo: dpa

Most people use rare earth elements every day – without knowing it, or knowing anything about what they do. That could change, as these unusual materials are becoming a [focal point in the escalating trade war](#) between the US and China.

1. What are rare earth elements?

Strictly speaking, they are elements like others on the periodic table – such as carbon, hydrogen and oxygen – with atomic numbers 57 to 71. There are [two others with similar properties](#) that are sometimes grouped with them, but the main rare earth elements are those 15. To make the first one, lanthanum, start with a barium atom and add one proton and one electron. Each successive rare earth element adds one more proton and one more electron.

It's significant that there are 15 rare earth elements: Chemistry students may recall that when electrons are added to an atom, they collect in groups or layers, called orbitals, which are like concentric circles of a target around the bull's-eye of the nucleus.

The innermost target circle of any atom can contain two electrons; adding a third electron means adding one in the second target circle. That's where

the next seven electrons go, too – after which electrons must go to the third target circle, which can hold 18. The next 18 electrons go into the fourth target circle.

Then things start to get a bit odd. Though there is still room for electrons in the fourth target circle, the next eight electrons go into the fifth target circle. And despite more room in the fifth, the next two electrons after that go into the sixth target circle.

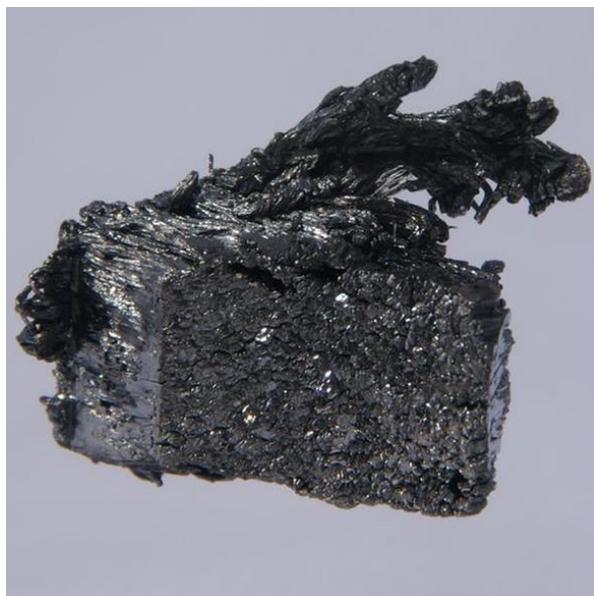
That's when the atom becomes barium, atomic number 56, and those empty spaces in earlier target circles start to fill. Adding one more electron – to make [lanthanum](#), the first in the series of rare earth elements – puts that electron [in the fifth circle](#). Adding another, to make cerium, atomic number 58, adds an electron to the fourth circle. Making the next element,

praseodymium, actually moves the newest electron in the fifth circle to the fourth, and adds one more. From there, [additional electrons fill up the fourth circle](#).

In all elements, the electrons in the outermost circle largely influence the element's chemical properties. Because the rare earths have identical outermost electron configurations, their [properties are quite similar](#).

2. Are rare earth elements really rare?

No. They're much more abundant in the Earth's crust than many other valuable elements. Even the rarest rare earth, thulium, with atomic number 69, is [125 times more common than gold](#). And the least-rare rare earth, cerium, with atomic number 58, is 15,000 times more abundant than gold.



The rarest rare earth element, thulium. Photo: Jurii, CC BY

They are rare in one sense, though – mineralogists would call them “dispersed,” meaning they're mostly sprinkled across the planet in relatively low concentrations. Rare earths are often found [in rare igneous rocks called carbonatites](#) – nothing so common as basalt from Hawaii or Iceland, or andesite from Mount St. Helens or Guatemala's Volcano Fuego.

There are a few regions that have lots of rare earths – and they're mostly in China, which

produces more than 80% of the [global annual total of 130,000 metric tons](#). Australia has a few areas too, as do some other countries. The US has a little bit of area with lots of rare earths, but the last American source for them, [California's Mountain Pass Quarry](#), closed in 2015.

3. If they're not rare, are they very expensive?

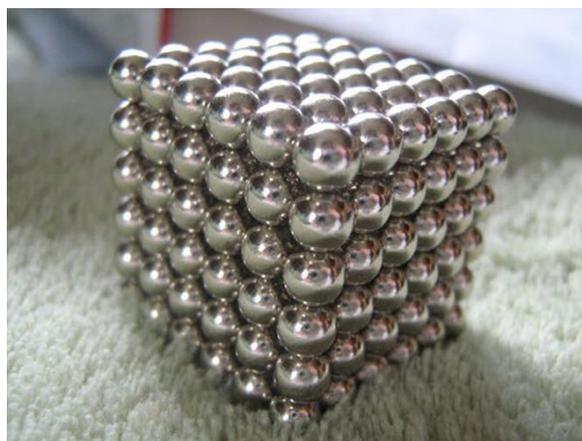
Yes, quite. In 2018, the cost for an oxide of neodymium, atomic number 60, is [\\$107,000 per metric ton](#). The price is expected to climb to \$150,000 by 2025.

Europium is even more costly – about [\\$712,000 per metric ton](#).

Part of the reason is that rare earth elements can be [chemically difficult to separate from each other](#) to get a pure substance.

4. What are rare earth elements useful for?

In the last half of the 20th century, europium, with atomic number 63, came in to wide demand for its role as a [color-producing phosphor](#) in video screens, [including computer monitors and plasma TVs](#). It's also useful for absorbing neutrons in nuclear reactors' control rods.



A cube of small neodymium magnets. Photo: XRDoDRX, CC BY-SA

Other rare earths are also [commonly used in electronic devices](#) today. Neodymium, atomic number 60, for instance, is a [powerful magnet](#), useful in smartphones, televisions, lasers, rechargeable batteries and hard drives. An

[upcoming version of Tesla's electric car motor](#) is also expected to use neodymium.

Demand for rare earths has [risen steadily since the middle of the 20th century](#), and there are no real alternative materials to replace them. As important as rare earths are to a modern technology-based society, and as difficult as they are to mine and use, the tariff battle may put the US in a very bad place, turning both the country

and rare earth elements themselves into pawns in this game of economic chess.

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Read the [original article](#). (It's worth noting that North Korea according to recent studies [may have the largest rare earth deposits in the world](#).)



(Xi Jinping visits rare-earth plant amid trade war <https://www.asiatimes.com/2019/05/article/xi-jinping-visits-rare-earth-plant-amid-trade-war/> By Asia Times staff - May 20, 2019)

Xi's visit to a major rare-earth minerals company in Jiangxi province, came soon after the US government 'blacklisted' Huawei. Handout.

Chinese president Xi Jinping on Monday visited a major rare-earth minerals company in Jiangxi province, [Xinhua News Agency](#) reported. It triggers speculations that the country could stop exporting rare-earth to the US amid an escalating trade war...