You Don't Bring a Praseodymium Knife to a Gunfight

China thinks it can withhold its exports of obscure but important minerals to get its way with its neighbors. Why it picked the wrong weapon.

BY TIM WORSTALL | SEPTEMBER 29, 2010

Last week, the New York Times published a stunning story: China, amid a nasty territorial spat with Japan, had quietly halted shipments of rare-earth minerals to its East Asian neighbor, threatening to escalate a skirmish into a full-blown trade war. China swiftly denied the story, while other journalists rushed to confirm it. The Times reported on Sept. 28 that China, while still not admitting the existence of the ban, may be tacitly lifting it -- but the damage to the country's image as a reliable supplier has been done.
In case you haven't been following this arcane dispute, here's a quick primer: Rare-earth minerals are the 15 elements in that funny box at the bottom of the periodic table -- known as lanthanides -- plus two others. About 95 percent of global production takes place in China, largely at one huge mining complex in Inner Mongolia. The lanthanides are essential to much of modern electronics and high-tech equipment of various kinds. The magnets in windmills and iPod headphones rely on neodymium. Lutetium crystals make MRI machines work; terbium goes into compact fluorescent bulbs; scandium is essential for halogen lights; lanthanum powers the batteries for the Toyota Prius. For some of these products, alternative materials are available (moving to a non-rare-earth technology would make those cute little white earbuds about the size of a Coke can, though). For others, there simply isn't a viable substitute.

For years, analysts have been issuing dire warnings about this situation, casting China's near-total monopoly and its steadily shrinking export quotas as a mortal threat to U.S. national security and global commerce. In 2005 testimony before the U.S. Congress, Frank Gaffney of the Center for Security Policy argued that China's interest in rare-earth elements "falls into a pattern of ... activity around the globe that is clearly deliberate, well thought out, and ominous in its implications." A more recent report written by a military researcher at Fort Leavenworth, Kansas, urges the United States to stockpile the most important rare-earth elements and make studying the minerals a national strategic priority.

But the truth is that though most of the rare earths, both metals and oxides, do come from China, this isn't the same at all as having a monopoly that is sustainable -- as Beijing is about to find out in a fairly painful manner. Now that the specter of a monopoly being exercised for political ends has been raised, there will be sufficient political will to break that monopoly.

Two important facts about rare earths help explain why: They're not earths, and they're not rare. China has reached its dominant supplier position through good old-fashioned industrial aggression, not innate geographical superiority. Cheap labor, little environmental scrutiny, and a willingness to sell at low cost have made other producers give up. For competitors, like the owners of Mountain Pass, a California mine that shut down in 2002 partly due to the China factor, that has been a daunting combination. For the rest of us, it has been fantastic: Affordable rare earths have helped power the information-technology revolution, driving down the cost of everything from hybrid cars...
to smart bombs.

But the non-rarity of the rare earths themselves means that China's position isn't sustainable. That California mine, for instance, could potentially supply 20 percent of world demand, currently around 130,000 tons a year. Another facility, Lynas Corp.'s Mount Weld in Australia, has the capacity to produce a similar amount. In fact, there are enough rare earths in the millions of tons of sands we already process for titanium dioxide (used to make white paint) to fill the gap, while we throw away 30,000 tons a year or so in the wastes of the aluminum industry. There's that much or more in what we don't bother to collect from the mining of phosphates for fertilizers, and no one has even bothered to measure how much there is in the waste from burning coal.

If rare earths are so precious, why isn't the United States working harder to collect them? The main reason is that, for these last 25 years, China has been supplying all we could eat at prices we were more than happy to pay. If Beijing wants to raise its prices and start using supplies as geopolitical bargaining chips, so what? The rest of the world will simply roll up its sleeves and ramp up production, and the monopoly will be broken.

But, of course, it's not that easy. Rare earths aren't found in nature as separate elements; they need to be extracted from each other, a process that involves thousands (really, thousands) of iterations of boiling the ores in strong acids. There is also almost always thorium, a lightly radioactive metal, in the same ores, and it has to be disposed of. (Thorium leaking into the California desert was a more serious problem at Mountain Pass than low prices.) So ramping up production would mean that Western countries would need to tolerate a level of pollution they've been all too happy to outsource to China.

Another possibility is that we find a new and different way to separate rare earths, as we find new and different sources for the ores. The main difficulty is that chemistry is all about the electrons in the outer ring around an atom, and the lanthanides all have the same number of electrons in that outer ring. Thus we can't use chemistry to separate them. It's very like the uranium business: Separating the stuff that explodes from the stuff that doesn't is the difficult and expensive part of building an atomic bomb precisely because we cannot use chemistry to do it -- we have to use physics.

The very fact that China has been supplying us all these years means that while Western academics in their ivory towers have been continuing to research all sorts of lovely things, very few of these findings have been tested in the real world. One possible solution, lightly
investigated in academia but not elsewhere, is adopting the technology used to separate titanium. It might work with the lanthanides, or it might not. But we should try it, along with other high-tech methods, to make the best of our own strengths rather than trying to compete with China -- the land of cheap labor and environmental unconcern -- on its own terms.

In the end, the question of whether China has been using its rare earths access to threaten Japan doesn't matter as much as the possibility that it might -- and the certainty we'd better do something about it.

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