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Mining the Seafloor for Rare-Earth Minerals

By **WILLIAM J. BROAD**

For decades, entrepreneurs have tried to strike it rich by gathering up ugly potato-size rocks that carpet the global seabed. Known as manganese **nodules**, the rocks are plentiful in nickel, copper and cobalt, as well as manganese and other elements, but lie miles down in inky darkness. Building giant machines to vacuum them up, despite much study and investment, has never proved to be economic.

Now, the frustrated visionaries are talking excitedly about the possibility of belated success, and perhaps even profits.

The nodules turn out to contain so-called rare-earth minerals — elements that have wide commercial and military application but have hit a production roadblock. China, which controls some 95 percent of the world's supply, had blocked shipments, sounding political alarms around the globe and a rush for alternatives. [China ended its embargo late last month](#), but the hunt for other options continues.

So are seabed miners smiling at last?

“People are quite intrigued,” said James R. Hein, a geologist with the United State Geological Survey who specializes in seabed minerals. Depending on China's behavior and the global reaction, he said, “rare earths may be the driving force in the near future.”

In October, Dr. Hein and five colleagues from Germany presented a paper on harvesting the nodules for their “rare and valuable metals.” They did so at the annual meeting of the Underwater Mining Institute, a professional group based at the [University of Hawaii](#). The paper prompted visions of a fresh start.

“They really do add value,” Charles L. Morgan, chairman of the institute, said of the rare earths in an interview. The result, he added, is that the nodules have taken on a new luster. “People are starting to think, ‘Well, maybe these things aren't so dumb after all.’ ”

Dr. Morgan said he was considering whether to start analyzing a collection he oversees of 5,000 nodule samples from around the globe so as to ascertain their rare-earth content. But he cautioned that the field of seabed mining has a history of ups and downs.

“This new wrinkle may take them over the edge to make them truly economic,” he said of the nodules. “But that remains to be seen.”

The elements known as rare earths number 17 in all and range from cerium and dysprosium to thulium and yttrium.

Their unique properties have resulted in their growing use in many technologies of modern life. Applications include magnets, lasers, fiber optics, computer disk drives, fluorescent lamps, rechargeable batteries, catalytic converters, computer memory chips, X-ray tubes, high-temperature [superconductors](#) and the liquid-crystal displays of televisions and computer monitors.

The United States Geological Survey calls the rare elements “essential for hundreds of applications” and likely candidates in the near future for an “expanding array” of high-tech products. Supply shortages that go on for a long time, the agency warns in a fact sheet, “would force significant changes in many technological aspects of American society.”

Secretary of State [Hillary Rodham Clinton](#) recently called China’s export embargo a “wake-up call” for the world to find new resources.

Despite their name, most rare earths are not particularly rare. But their geochemical properties mean they seldom concentrate into economically exploitable ore pockets. During the last two decades, most production has shifted to China because of lower costs there and the country’s record of lax regulation of environmental hazards. (The processing of rare earths can create toxic byproducts.)

Scientists have known about rare earths in seabed rocks for decades, seeing them as a curiosity. In 1968, Alan M. Ehrlich, a chemist at the [Massachusetts Institute of Technology](#), wrote a Ph.D. dissertation titled “Rare [Earth](#) Abundances in Manganese Nodules.”

In an interview, he expressed surprise at the interest of the seabed miners, saying the concentrations were too low to power a nodule renaissance.

The would-be miners agree. But they say rising global prices for the more common metals found in the seabed rocks are increasing the allure. Investors, they add, see the presence of the exotic elements as icing on the cake.

“The global activity is tremendous,” said Dr. Hein of geological survey, referring to undersea exploration as well as processing assessments on land.

“Right now, rare earths are not the driving force,” he said. “But for copper and nickel, the prices are there.”

Dr. Hein said dwindling supplies of terrestrial copper — a key ingredient of industrialization used in

everything from wires and switches to pipes and roofs — have forced miners on land to go after increasingly low grades of ore and have raised interest in seabed resources.

For instance, ore in the Chilean copper and gold mine that collapsed in August, trapping 33 miners, bears concentrations of copper that measure only a half percent, said Dr. Hein. “The nodules have 1 percent,” he added, “so they’re twice as rich.”

The upshot is a new wave of global interest in vacuuming up the seabed nodules — rare earths and all.

“It’s getting more active,” said Dr. Morgan of the Underwater Mining Institute. “Industrial people are starting to look at it again.”