Deep sea mining of rare earths.

written by Jack Lifton | April 17, 2026

The geographic distribution of accessible, economically recoverable, with current technology, rare earths is dependent not only the formation, concentration, and distribution of the mineral forms of the chemical element that are today present in the uppermost strata of the earth's crust as a result of our planet's formation and cooling, but also, uniquely, in their case, of the redistribution and concentration of the rare earths caused by the activity of life forms.

There are two types of general locations that prove this point. One: the sediments at or near the bottom in deep ocean locations that have been such locations for a very long time. The other areas are dry land that was once the bottoms of ancient oceans that existed for a very long time.

I am going to concentrate in this essay on the sediments in the contemporary long-lived oceans.

It turns out that the rare earths are concentrated in the teeth and bones of fish. They are present in the structural mineral for fish teeth and bones, which we categorize and name as apatite.

It is only really recently that analytical chemistry has advanced to the point where chemical elements can be detected and identified in parts per billion. This led many students and professors seeking grants to pay for their education or lifestyle to analyze everything. Ichthyologists even began looking at the chemical composition of fish fossils. Lo and behold, they found in the last twenty-five years that the construction of the teeth and bones of fish features the mineral apatite. Apatite is a mineral of the rare earths.

So what, said the ichthyologists. " 'I'll tell you what,' " said a geologist colleague of mine, "Quote: these teeth and bones have been accumulating on the ocean bottom for millions, perhaps tens or hundreds of millions of years in some locations."

I was part of a study funded by the United States Army Research Laboratory in 2014, where I was asked to identify all of the processes available for separating the mixtures of rare earths found in naturally occurring minerals into individual rare earth chemical compounds for further processing into ultimately end-use rare earth-enabled products.

Part of that study involved looking at the sources of the rare-earth-bearing minerals, and although my geologist friend was not part of that study, I did discuss it with him, and when he told me about what we called "fish bones," I told him that I thought he was nuts. What I didn't tell him was that the geologist in our working group with the Army study had come to the same conclusion.

The Army study, however, focused on the recovery of the so-called manganese nodules that cover many areas of the deep-sea floor in the Pacific Ocean. These "nodules" were being sought as sources of manganese, nickel, copper, and cobalt.

The nodules do not contain Rare Earths, and they are on the seafloor. It turned out, however, that the relatively fluid ocean bottom is just a thin layer over a more solid bottom that has been formed and compressed over millions and millions of years. A significant part of that solid material consists of the bones of the untold numbers of fish that have been born, lived, and died in those oceans for tens or hundreds of millions of years.

In Japan’s territorial waters, there is an island called Minamitorishima. The ocean there drops quickly from 1,000 m to 5,000 m in depth. To assess this drop-off, many sediment samples from beneath the surface were collected and analyzed.

The Japan Geological Agency has published analyses of these sediments, which are significantly enriched in rare earth elements. Even more significantly, the distribution of the rare earths in these sediments is skewed towards the higher-atomic-number, so-called heavy rare earths. In particular, the proportion of dysprosium and yttrium in these sediments is among the highest I have ever seen in any mineral analysis.

It can be argued that a few thousand parts per million of rare earths, although significant in the so-called ionic absorption clays in surface deposits in current and former rainforest parts of the Earth, are not significant when the minerals to be recovered are as much as three miles deep in the ocean.

Those who casually advance the above argument do not know much about contemporary dredging and rare-earth processing technologies.

Japan, which is particularly resource-poor, has targeted rare earths in sediments within its territorial waters for development as sources of these critical materials.

In fact, the Japanese government has already experimentally dredged the seabed off Minamitorishima and is now evaluating processes and technologies to develop these sediments as a source of rare earths.

A second project, sponsored by the private American company Deep Reach Technology and the University of Tokyo, proposes its own agenda for extracting the sediments and recovering the rare-earth values they contain.

Deep Reach Technology is the most advanced deep-sea engineering equipment company on the planet. In fact, its founder, Dr. John Halkyard, is regarded as the guru of deep-sea dredging engineering

Full disclosure: Deep Reach Technology has asked me to look at the technologies required to extract the rare earths from sediments recovered from the deep-sea bottom on the recovery ship. I believe this is possible. It is my opinion that the concentrates so recovered should then be transferred to the land where separation and further downstream operations can be effected.

Japan is determined to become independent of China for its rare-earth-element sources. Japan is the world’s second-largest user of rare earths after China. There are no prospects in Japan for finding economically accessible deposits of rare earths on its dry land.

The Japanese government has invested in the construction of a heavy-rare-earth-focused separation plant and a metal-making operation in France. The initial feedstock for this operation is intended to come from a Malaysian venture, which is now also under construction. The Malaysian Venture is an ionic adsorption clay mining project. It should be providing concentrates containing heavy rare earths and concentrates containing the light rare earths by the end of 2026. I don’t know the proportion of the Franco-Japanese venture’s output that will be consigned to Japan, but I suspect it will be at least half, with the balance going to European end users.

The Deep Sea mining project outlined here, I believe, is Japan’s backup to the Franco-Japanese project. It, the Deep Sea Project, has also attracted the interest of the United States government in its project to secure non-Chinese supplies of the Rare

Earths, and I believe it is being actively discussed with regard to funding by both governments. I will keep the readers of Investornews informed as this happens.

One final note. The sediments discussed here can be readily pumped to the surface and dewatered. They then present as very fine-grained material, with the desired minerals occurring in microcrystalline form. This form is ideal for the beneficiation of the rare-earth-bearing minerals it contains. Of course, the engineering problem is in dredging up and pumping these materials from the ocean bottom to the surface. This is Deep Reach Technology’s expertise.