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# Has The Earth Ever Run Out of a Natural Resource?

## A Monday Morning Musing from Mickey the Mercenary Geologist

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"Has the Earth ever run out of a natural resource?" This intriguing question was posed to me nearly two years ago by producer Niall McGee of Canada's Business News Network (BNN).

Many of you are aware that I am a frequent guest on BNN speaking about supply and demand fundamentals of commodities and evaluation of junior resource companies. At the time I was scheduled to be interviewed on a BNN show, and Niall was working on a special film project concerning natural resources, which unfortunately never made the airwaves. When he asked the question, I said, "Let me think about this and I'll get back to you soon." I had an idea but wanted to do some research before sticking my neck out.

The answer that immediately popped into my brain was this:

Throughout human-kind's history on Earth, we have never exhausted the supply of any mineral or energy commodity, with one notable exception.

But before I make my case, let's cover some historic background:

Beginning about 10,000 years ago, Modern Mankind evolved from nomadic hunter-gatherer societies into permanent settlements supplied by subsistence farming and made possible by domestication of animals and the use of metal tools.

Man initially exploited the highest grade, simplest to extract, and most easily processed of any given metallic commodity. Nine metals were known and mined during prehistoric times including iron, copper, zinc, silver, tin, gold, mercury, lead, and bismuth. As easily obtained metal supplies were depleted, civilizations have progressively mined lower grades, at greater depths, in more remote areas, and/or from minerals requiring more complex processing.

If there is an inherent demand for a particular commodity, humans have repeatedly discovered a way to supply that demand. Demand provides the incentive for new technological advances that lead to increased supply. To my knowledge we have never completely exhausted the supply of any metal, industrial mineral, agricultural mineral, energy mineral, or energy fluid. That is, with one exception.

But before we go there, a caveat must be added:

Niall's question was about *natural resources*, and in that regard, I must restrict this discussion to *non-living* natural resources, i.e., mineral resources. My reasoning is simple:

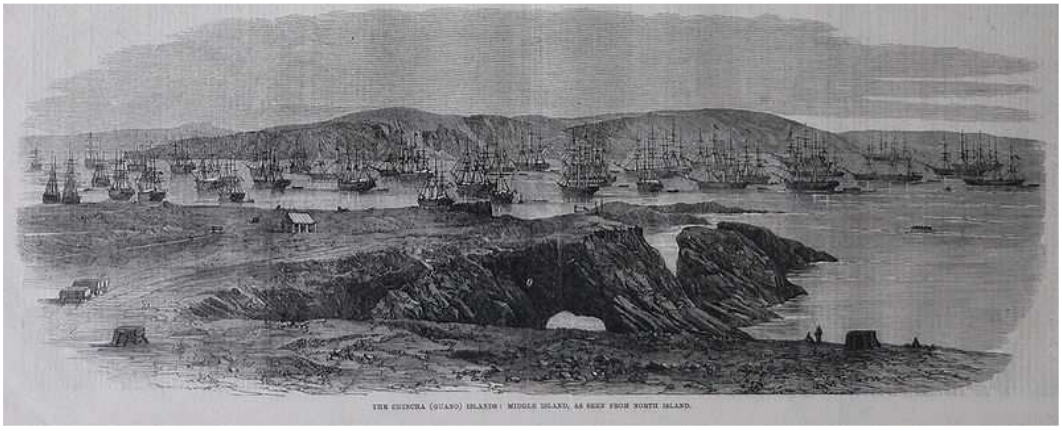
Life has existed on the Earth for a *minimum* 3.4 billion of its 4.5 billion year old history. Very early life forms are documented in the fossil record by stromatolites, a waste product of blue-green algae. I say "minimum" because there are very few outcrops that are older than this age. Present knowledge of Earth history indicates that our planet's surface was 90% covered by water by about 4.0 billion years ago. Employing the fundamental geological principle that "the present is key to the past", where we find water we find life. Therefore, it seems likely that life has existed on the Earth for much longer than 3.4 billion years; we just do not have the rocks to prove it.

Stromatolites are rare today but still form in hypersaline lakes and marine lagoons. With infinitesimal exceptions (e.g., the aforementioned blue-green algae, horseshoe crabs at 425 million years, lobe-finned fish at about 400 million years, and some 100 million year old primitive animals such as sharks and the ubiquitous cockroach), the Earth's species have gone or will go extinct. Therefore, depletion and the ultimate demise of life forms is a natural phenomenon, and in only a very few recent instances have they been caused by activities of man.

With that qualifier, and as with all of **Mickey the Mercenary Geologist's** many Rules of Thumb, there is at least one exception to the idea that mineral resources are inexhaustible. In this case the exception is indeed the first that came to mind: Guano.

*Guano* is the Spanish version of a Quechua Indian word meaning "dung". The term originally referred to huge accumulated deposits of sea-going bird, and to a much lesser extent, bat, and seal droppings along the desert coastal islands of Peru. Guano was used for centuries by the coastal and Andean civilizations of Peru as fertilizer for crops. It was so valued as a fertilizer that the source islands were considered sacred by the Incas, mining was tightly controlled, and trespassers were condemned to death.

In 1804 explorer Alexander Von Humboldt, for whom the ocean current is named, returned to Europe from a voyage to western South America carrying samples of bird guano from these islands. This particular guano source was extraordinarily rich in mineral nutrients and it soon became a sought-after commodity by British farmers. By 1840, world-class guano deposits, mostly from the Chincha Islands near Pisco, were among the most valuable mineral resources in the world:



**Chincha Islands, Peru: The Illustrated London News, 1863**

The Peruvian guano deposits were preserved in extremely thick beds, some over 40 meters high and were by far the highest grading in phosphate minerals, nitrates, and metal nutrients. They were the best in the world in both size and grade due to a number of factors: Remoteness and inaccessibility thus protected from predators, cold upwelling current, rich fisheries, limited land surfaces for birds to roost and nest, massive populations of boobies, cormorants, and pelicans, and cool hyper-arid climate

During the period 1840-1870 Peru's giant deposits of dung were the developed world's major source of nitrogen-phosphorous fertilizer and potassium nitrate (saltpeter) used to make gunpowder; they became the world's first large agricultural mines. Giant US chemical and materials conglomerate W.R. Grace and Company got its start by supplying Peruvian miners and shipping guano in the 1850s.

Guano deposits were so valuable at the time that the United States of America passed the Guano Act of 1856, a law giving US citizens the right to claim newly discovered guano-bearing rocks and islands as their own and authorizing the military to protect the rights of the claimant. Over 100 equatorial Pacific and Caribbean islands were subsequently claimed as US territories and a dozen are currently held including Baker Island, Howland Island, Jarvis Island, Johnson Atoll, Midway Atoll, and Navassa Island.

As the guano trade prospered, the Peruvian government, as most governments are wont to do, borrowed against and spent vast sums of loan money from British and then French financiers before payments derived from mining and processing were received. By 1861, the country was essentially bankrupt. Spain subsequently tried to take the Chincha Islands by force in 1863-1864 but failed, and then the guano market crashed during a long global recession that started in 1870. Regardless of these events, by 1874 the Peruvian deposits were largely mined out.

Meanwhile, more easily exploited, non-organic mineral resources of nitrate were discovered and developed by Chilean and British interests in the Atacama Desert regions of Bolivia and Peru. Disputes over control of these nitrate deposits led directly to the War of the Pacific (1879-1883), in which Chile seized territorial control of the northern Atacama from both Bolivia and Peru. This action left Bolivia landlocked and Peru lost one of the most mineral-laden regions of the Earth, today hosting the world's largest copper-molybdenum, iodine, nitrate, and lithium deposits.

The intensive mining of guano deposits from 1840 to 1870 totaled an estimated 20 million tonnes. Thick and rich deposits that had accumulated over very long periods of time were nearly depleted throughout the world in less than 35 years.

There remain no sizable guano deposits. Bat guano cave deposits are worked on a small scale in many countries and there are small, highly-regulated and managed, hand-dug bird guano mines in Peru and other countries including Chile, Indonesia, and Namibia. The price of guano has soared in recent years as demand for expensive "organic" foods has grown.

**Modern-Day Guano Mining in Northern Peru**
*(Photo courtesy of The New York Times, 2008)*

Due to the disruption of bird nesting habitats and resultant decimation of bird populations by previous mining, and the long time periods required to accumulate substantial deposits, guano must be considered a non-renewable natural resource that was essentially depleted by the exploitation of Man.

At about the same time, discovery of rich nitrate deposits in the Atacama Desert of Chile and a technological breakthrough for processing phosphate rock sealed the fate of guano as a major fertilizer source.

Simple as that, the world ran out of bird poop but soon found alternative sources for fertilizer. As famed cornucopian Julian Simon wrote in The Ultimate Resource (1981):

*No matter how closely it is defined, the physical quantity of a resource in the earth is not fully known at any time, because resources are sought and found only as they are needed. Even if the quantities of a particular resource were exactly known, such measurements would not be meaningful, because humans have a near-limitless capacity for developing additional ways to meet our needs: developing fiber optics, for instance, instead of copper wire".*

To my knowledge, guano is the single mineral resource of which the Earth has ever run out.

Ciao for now,

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The **Mercenary Geologist Michael S. "Mickey" Fulp** is a Certified Professional Geologist with a B.Sc. Earth Sciences with honor from the University of Tulsa, and M.Sc. Geology from the University of New Mexico. Mickey has over 30 years experience as an exploration geologist searching for economic deposits of base and precious metals, industrial minerals, uranium, coal, oil and gas, and water in North and South America, Europe, and Asia.

Mickey has worked for junior explorers, major mining companies, private companies, and investors as a consulting economic geologist for the past 24 years, specializing in geological mapping, property evaluation, and business development. In addition to Mickey's professional credentials and experience, he is high-altitude proficient, and is bilingual in English and Spanish. From 2003 to 2006, he made four outcrop ore discoveries in Peru, Nevada, Chile, and British Columbia.

Mickey is well-known and highly respected throughout the mining and exploration community due to his ongoing work as an analyst, writer, and speaker.

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