THE CONSUMPTION CONUNDRUM: DRIVING THE DESTUCTION ABROAD[1]

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Our high-tech products increasingly make use of rare metals, and mining those resources can have devastating environmental consequences. But if we block projects like the proposed Pebble Mine in Alaska, are we simply forcing mining activity to other parts of the world where protections may be far weaker? Every time someone pushes the on-button on an electronic device, there is an expectation that the unit will power up quickly and display images in vibrant color. There is the further expectation, especially when using electronic devices for communications such as email access, web downloading, and texting that the response time will be immediate. We live in an age of technological arms races in which manufacturers gain market edge by creating products that are faster, have more applications, have a broader network reach, and generally do more.

The processing capacity of digital electronic devices doubles about every two years (Moore's Law), and this capacity increase is enabled by an expanded use of elements. For example, computer chips made use of 11 major elements in the 1980s but now use about 60 (two-thirds of the periodic table!). And the electronics sector isn't alone. Engine turbine blades for aircraft are made of alloys of a dozen or so metals; motors and batteries of green-technology hybrid vehicles depend on several of the rare earths; advances in medical imaging have come about by the unique band gaps of elements such as gadolinium. It seems that there are no limits to what the imagination can create except for the fact that many of the metals are globally rare and, given the nature of current technology, non-substitutable.

As we clamor for the latest gadgets and products, our increasing dependency on rare metals to support modern technology carries certain responsibilities and ethical obligations. More than ever, we need to understand how our technological demand for elements from the entire periodic table is linked to the environmental consequences of global extraction. This issue is often overlooked in policy decisions because we fail to appreciate the inextricable connectedness between global locations where technology is manufactured and used and the locations that physically provide the key elements.

A case in point is the "mother lode" deposit of gold, copper and molybdenum in Bristol Bay, Alaska, known as the Pebble Mine, which a consortium of mining companies is seeking to develop. The U.S. Geological Survey has estimated the current U.S. and global "reserve base" for these metals. This is the quantity of metal in ore deposits that might someday be mineable, even if not economically promising at present. There are various estimates for the mineable contents of the Pebble Mine, but all are very large. The Pebble Mine deposit would dramatically increase the domestic reserves of copper and gold and would vault the United States into the position of being the world's largest repository of mineable molybdenum. Gold is an investment vehicle and jewelry metal, of course; but it also is close to irreplaceable as an interlayer constituent in printed wiring boards in electronics. Copper is the principal metal used for conducting electricity in power-grid distribution systems, residential wiring, and computers, and in motors that do everything from raise automobile windows to rotate machinery. Molybdenum is an irreplaceable constituent of the stainless steels used in surgical instruments, a variety of other medical equipment, and chemical and pharmaceutical manufacturing.

[1] environment 360, Yale University, April 26, 2010

In most of these applications there are no suitable substitute materials, especially if loss of performance is to be avoided. Reserves such as the Pebble Mine have certain strategic implications for the United States as well, as there is a tendency for countries to hoard their own reserves of rare metals.

The confounding situation for the Pebble Mine is that it is situated in the headwaters of Bristol Bay, and the Bristol Bay region is home to five species of salmon that are among the last unthreatened stocks in the Pacific Northwest. Salmon are known for their mass migrations from the ocean to natal streams where they breed and subsequently die. In this region of the Pacific Northwest, salmon comprise 92 percent of the diet of the 300 to 400 resident killer whales, and salmon carcasses are also important food resources for terrestrial species such as grizzly bears and eagles. A large run of 20 million sockeye in the Bristol Bay region can yield as much as 5.4×10^7 kilograms of body tissue to the natal streams and surrounding riparian zones after the fish spawn and die, thus providing 2.4×10^5 kilograms of phosphorus, 18×10^6 kilograms of nitrogen, 2.7×10^6 kilograms of calcium, and other elements that are important nutrients in sustaining the health and functioning of whole watersheds. For comparison, this nutrient input is equivalent to the amount of fertilizer used to support 140,000 acres of intensive corn production in the U.S. Midwest.

It is small wonder then that local and international environmental groups have initiated efforts to halt the development of the mine based on the need to preserve one of the last relatively untouched wilderness areas on the planet. Such efforts have long been regarded as an ethical position of high merit. Yet, geological reserves like those in Bristol Bay are equally rare globally. So if the ethical environmental position forces mining activity elsewhere, then the rationale for wilderness protection in Bristol Bay becomes murkier, especially if the mining occurs in places where the standards of environmental protection are weaker.

For example, unchecked acid drainage from waste rock and mine tailings at the Bougainville copper mine in Papua New Guinea have seriously compromised the Kawerong-Jaba river system there, and governments in northwest Pakistan have pursued a policy of harassment and coercion of the local populace with the intention of developing a very large gold-copper deposit. Beyond the social and ethical implications of these situations, the use of cyanide for gold extraction is a common environmental challenge in regions where mining is not well regulated.

The potential for displaced environmental damages means that a policy favoring ecosystem protection at the expense of mining in Bristol Bay should be obligated to consider the global implications of that decision by answering the question: Where else in the world will the mining be done, and what environmental damages will be passed to other parts of the world? Alternatively, any policy that favors mining must explain how fishing pressure on other, already declining salmon stocks globally will be affected if the Bristol Bay stocks decline, and even whether declining stocks encourage alternative production systems such as salmon aquaculture that could inflict additional and widespread damage to marine ecosystems.

Local political tugs-of-war between wilderness preservation and mining such as those seen in Bristol Bay address the issue at the wrong scale. The consequence is that the true root causes of these problems are not identified. Anyone who relies on modern electronic technology and favors the development of green technology — environmentalists and technocrats alike — has a shared link to environmental damages ensuing from mining. An appropriate ethical stance then would be to question whether it is appropriate to protect nature and force resource extraction to other parts of the world where standards of environmental protection may be considerably weaker. Alternatively, if we do not wish to inflict damages elsewhere in the world, are we willing

to forego the benefits of modern technology? And ultimately, of course, the livelihoods of local residents who rely on employment in the resource extraction industries — whether fisheries or mining — lie in the balance. The Pebble Mine project is merely the latest example, but a particularly clear one, of the global linkages that create ethical and social conundrums. If modern society is to achieve sustainability in a resource-limited world, these are issues that must be explicitly addressed and overcome.