– Check against delivery –

Part of the Ottawa University Institute of Environment 2006-07 Lecture Series
"Elemental Environmentalism: Water, Air, Fire and Earth"

Earth: What is Mining All About? The Up and Down Sides

"Mining Is Unsustainable"
Jamie Kneen, MiningWatch Canada,
responding to Pierre Gratton, Mining Association of Canada

February 28, 2007

Exposition

Good afternoon. I am pleased to join my learned colleague here to debate mining. My position today is that mining is inherently unsustainable: it is destructive to the biophysical environment and its contributions to human well-being are uneven and often overwhelmed by the damage it inevitably inflicts. Mining must be drastically scaled back; restricted, not expanded; and where it cannot be avoided it must be carried out carefully and responsibly.

This position is often caricatured as being "anti-mining" and "anti-development" rather than addressing the facts: first, mining does not equal development, and in reality often negates real human development efforts; second, as I will show, it is a matter of observation, not argument, that modern mining is unsustainable by any measure and needs no help from the likes of me to engineer its own downfall.

Let me make my assumptions clear. Humans are part of the ecology of this planet, and are incapable of understanding much less managing its natural systems. Our ecological interventions are almost always ill-planned if not ill-considered, and while we may on occasion achieve our immediate objective, the unforeseen ripple effects can be extremely serious.

It is this understanding that has led to a broad range of scientific, political, philosophical, and even theological investigations. Many of you will remember the Brundtland Commission, and the definition of "sustainable development" as "meet[ing] the needs of the present without compromising the ability of future generations to meet their own needs". The concept was widely adopted, if not widely understood, and is still very much alive today. United Nations texts[1] refer to the "interdependent and mutually reinforcing pillars" of sustainable development as: economic development, social development, and environmental protection. The Brundtland Commission was hardly the first modern expression of the need to balance consumption. Some of you may remember the Club of Rome's 1972 report *The Limits to Growth*, which concluded that "the state of global equilibrium could be designed so that the basic material needs of each person on earth are satisfied and each person has an equal opportunity to realize his individual human potential."

However, the notion that people – individuals, communities, governments, corporations – cannot simply exploit Nature at will has a much longer history. Primitive societies understood the need for balance, and subsistence-based cultures today have a huge variety of myths and cautionary tales warning against taking more than you need. Modern western ecological philosophies and theologies have found

[1] Most recently the 2005 World Summit Outcome Document.

agreement with ancient Eastern traditions that place a central importance on people's responsibility to practise careful stewardship of Nature, or as expressed in many Aboriginal philosophies, to "walk lightly on the Earth". We may have the ability but do not have the right to abuse, waste, and destroy. Human intelligence and technologies, and our overwhelming numbers, put that power in our hands. Even comic book heroes understand that with great power comes great responsibility.

The point I want to emphasise here is the question that is often begged: what are our "basic material needs"? Certainly the current debates about climate change have highlighted the conclusion that the planet cannot sustain the energy consumption of too many people living an average North American lifestyle, even if they all wanted to. This also applies to the use and consumption of most metals.

But what is mining? Mining is the search for, and extraction of, minerals and metals from the Earth's crust. In its broad definition it includes mining for diamonds, placer mining, quarrying, and tar sands mining; for my purposes I will focus on metal mining, as this is the most economically significant element of the mining sector, and the most significant in terms of materials consumption and flows.

Mining is the first stage in the life cycle of metals; ore is blasted and dug from the earth before being crushed and processed with chemicals, heat, or electricity to separate and purify the metal it contains. Mining is not the only stage of metals' life cycles that has serious environmental and social effects; clearly the manufacturing and use of various metal products have enormous consequences, as does their disposal, whether we're talking about coins, cars, buildings, computers, medical instruments, tanks, battleships, or bullets. But mining is where it all starts.

Environmental protection

Mining is essentially a waste management industry. Whether a mine is underground or open-pit, most of what is mined is discarded, leaving millions of tons of waste rock and sand-like "tailings" loaded with dangerous heavy metals that had previously been more or less safely bound up in the rock. When uranium is mined, 85% of the radiation is left behind in the tailings. Sulphides exposed to weathering by air and water can generate acid drainage, which, in addition to being deadly to aquatic life on its own, also helps leach heavy metals from tailings and mine workings. Arsenic, cadmium, nickel and so on make their way into ecosystems with deadly results. Canada has been a leader in trying to find solutions to this problem, and while improved management techniques have been developed, mines are still being built that require the sacrifice of natural water bodies to create tailings dumps, and whose effluent will have to be monitored – and often treated – in perpetuity. The industry is fond of saying its harmful practices are all in the past, yet it continues doing basically the same things.

In other countries, especially underdeveloped or "third world" countries, governments' capacity to create, monitor, and enforce environmental regulation is weak or absent, and in the interest of low-cost production, mining companies routinely engage in practices that are illegal in Canada and may well be illegal in the country they are operating in as well – practices such as dumping effluent and sewage directly into streams and rivers, dumping tailings into rivers or oceans, or smelting ore without any effort to scrub acid and toxins from the smokestacks.

It's important to note that while practices have improved in Canada, they are still far from ideal. Jurisdiction for mining in Canada is mostly provincial, leading to a patchwork of requirements and regulations, and inconsistent enforcement – if not a complete absence of enforcement. For example, the federal Fisheries Act prohibits the dumping of deleterious substances into waters frequented by fish except as permitted by regulation, effectively creating a permit to pollute within those restrictions. However, it seems that the regulation is treated more as a guideline or target to be met when it is convenient. Enforcement has been handed over to the provinces, and a 1998 federal government report

on compliance indicated that almost half of the mines subject to the regulation were in violation. Between 1977 and 1998 there was not a single prosecution. This is hardly surprising given the intensity of enforcement efforts: in Ontario, home to dozens of mines, government funding cuts have reduced the number of mine inspectors in the North from fourteen to two over the last decade.

One of the noteworthy oddities of this situation is that the regulations themselves are subject to negotiation. In other words, scientific evidence is collected and analysed, but rather than allowable levels being based on an assessment of toxicity or of the potential for harm to the environment, there is a consultation process and the regulations are based on a compromise that will not pose an undue challenge to the profitability of the mining operations. The "best available technology" standard, or BAT, becomes one of "best available technology economically achievable" or BATEA – also described as "best available technology not entailing excessive cost", or BATNEEC, but perhaps better characterised as CATNAP – "cheapest available technology narrowly avoiding prosecution".

Mining is inherently damaging to the environment, and sometimes disastrously so. Beyond the diversion and contamination of water, the persistent toxic leaks, and periodic catastrophic spills, mining also plays an important role in opening remote wilderness areas to industrial development, as prospecting pushes roads and seismic lines into forests, mountains, and tundra, followed by highways, electrical transmission lines, hydroelectric dams, and even ore slurry pipelines and port facilities. Deforestation and despoilation result as trees and wildlife alike suffer direct damage but are also are made accessible to those who would exploit them but just don't have the wherewithal to build their own roads.

Social development

Mining is also dangerous to people's health. Despite the technological advances that have made mineworkers' jobs hugely safer than in the past, it is still a dangerous job. In addition to the immediate dangers of explosives, heavy machinery, underground floods, and rock falls, there is the invisible threat of industrial disease. But if you live in a mining town, home is hardly a haven. Current studies in Sudbury show areas of intense – and unsuspected – contamination. Neighbouring communities suffer too, as air- and water-borne contamination bring a multitude of illnesses. Even in the absence of significant contamination, the psychological effects of living near a massive mining project can be debilitating as people lose confidence in the fundamental elements of their health and well-being: the water they drink, the food they eat, and the air they breathe. Even when the contamination is marginal, or "within acceptable parameters", can you trust the people who are telling you this when they are on the company payroll, or work for the government?

Economic development

So there you have two of the three legs of the sustainability "stool" collapsing. But as my esteemed colleague has pointed out, mining contributes to economic development even if it does not, in the end, contribute positively to social development and environmental protection. This is certainly true, although the magnitude and nature of that contribution is not what industry spokespeople would like us to believe.

Mining's contribution to the gross domestic product (GDP) is substantial, but it's widely recognised that GDP is a terrible measure of economic well-being. A house contributes nothing to GDP, although it is of significant value to its inhabitants. A house destroyed by fire contributes to the GDP through fire and paramedic services, insurance payouts, and reconstruction, and the more serious the fire the greater the contribution. If oil spills are good for the economy, then there is something seriously wrong with our definition of "good" as well as our definition of "economy". So it is with mining: productivity means

converting a pristine wilderness, or farmers' fields, into tools and machines – and gaping holes in the ground, and immense piles of toxic waste.

Of course mining also provides jobs; the problem is that these jobs are becoming fewer and more specialised as the industry becomes more high-tech and capital intensive. In 2001 the number of people employed the entire Canadian metal mining industry was about the same as the number of people employed in Sudbury alone in 1970 – about 30,000. By 2006, it was less than 24,000, although production has been more or less constant.

Mining companies are not social agencies. Their purpose is to make money for shareholders, not to provide jobs or social benefits, and they will avoid paying any more than necessary, whether in royalties, taxes, labour, energy, or equipment. Mining is also one of the least efficient public investments in terms of providing jobs, as we showed in *Looking Beneath the Surface: An Assessment of the Value of Public Support for the Metal Mining Industry in Canada*. Likewise, mining training is only transferable to other mining jobs; doesn't help people find other jobs or start their own businesses.

What mining really creates is profit. Mining companies often say they are "mining the market" more than mining ore, and what they mean is that mineral exploration and mine development depend on banks, brokers, fund managers, and individual investors putting their money forward. That's why tax benefits are so important.[2] Mining companies are careful to spread the risk; there are very few private mining companies, and even large and incredibly wealthy companies do not use their own money to finance their projects, preferring share issuances and loans, and securing loan guarantees and political risk insurance.

The risk of mining investment is balanced by exceptionally high rates of return on successful ventures. This creates wealth, all right, but not in mining communities, or even mining jurisdictions.[3] The money always gravitates back to Bay Street. Studies in countries such as Peru have shown that mining regions are poorer than the rest of the country because of mining, not despite its generous contributions. Mining development displaces other land uses, and is economically harmful to incompatible land uses like farming, fishing, and tourism. The environmental impacts also have economic effects. Even if studies confirm that the fish caught right next to a uranium mine are safe to eat, how many people will want to buy them? Neither humans nor cattle should drink water contaminated with arsenic, or cyanide, and most tourists don't want to see "24-hour-a-day" blasting and shovelling and trucking.

But the most important economic effect is the distortion of development priorities. Governments, banks, and multilateral institutions like the World Bank love big glamorous capital-intensive projects that they can relate to. It really looks like development when the shovels start working, and the big announcements make for great public relations. But as people who've worked in development know, it's the small things that can make the biggest difference for the largest number of people – clean water, medical and veterinary services, or improved transportation and marketing for local products. Rather than looking at people's development needs and trying to respond to them, mining development drops a project on top of people and then hopes it will fill their needs.

This distortion is actually codified in many jurisdictions, where not only does the State claim ownership of all mineral resources, but sets mining as the "highest and best use of land", and provides a right of

[2] Exploration does not always lead to mining, and in fact entire exploration booms have collapsed without creating a single mine, as happened in the Yukon in the 1990s.

[3] It's the bankers, the brokers, and the shareholders who benefit most, including pretty much everyone in this room since the Canada Pension Plan started investing in the stock market. The CPP Investment Board now holds hundreds of millions of dollars in mining stocks, and has only recently discovered the idea that it should include social and environmental factors in its investment decisions.

"free entry" for prospectors and mining companies on both public and private land. Farmers and cottagers in many parts of Canada are finding out the hard way what Aboriginal people have known for a long time: if they don't own the mineral rights there is little or nothing they can do to protect their land from bulldozers, backhoes, and drill rigs. This tradition goes back to medieval Europe when cannons were being developed. Monarchs wanted to ensure a supply of iron, bronze,[4] and lead, so they granted free entry rights to miners. Farms and forests made way for mining, and unfortunately the free entry system has persisted, even though national security is rarely used to justify mining these days.

It really depends on what mining is displacing: in general, large-scale mining projects are rejected by communities that have already established other, incompatible, development priorities, wherever they are given the choice. Mining proponents often claim this is because people don't understand the benefits, but it's obvious in many cases that they do. In northern Peru, for instance, the people of Tambogrande overwhelmingly rejected a mine that would have displaced their town and diverted their water supply. In essence they were refusing to give up their town and the agricultural livelihood of 30,000 people for a project that would employ maybe 300 people for less than 15 years. Likewise, in places as different as the Huasco Valley in Chile, Intag, in northwestern Ecuador, and Esquel, in southern Argentina, people have rejected mining projects that would either imperil or simply destroy their efforts to build local development on a base of agriculture, cottage industries, and eco-tourism.

"Sustaining Mining"

Mining is an extractive industry, based on non-renewable resources, and so by definition unsustainable. Ore that is extracted today will not be there tomorrow, nor will it be replaced any time soon. By this measure, mining can only be sustainable on a geological time scale, where ore is extracted only as fast as geological processes can replace it.[5] More frequently, the mining industry defines sustainability as being able to find new ore reserves at the same rate it gobbles up the existing reserves – sustaining the mining industry, rather than making it sustainable.[6]

My esteemed colleague's employer is very careful in its use of the s-word. It talks optimistically about "sustaining mining's role as a leading economic player by increasing public trust". At the same time, industry leaders are not shy about recognising that the resources they are exploiting are scarce and getting rapidly more scarce. The head of exploration for the world's largest gold mining company, Barrick Gold, recently told a mining conference that all the easy gold deposits have already been found,

---

[4] Bronze is an alloy of copper and tin – brass is an alloy of copper and zinc,

[5] There are other measurements that could allow mining to be defined as "sustainable". For example, the Marmato gold deposit in Colombia is being mined by thousands of small-scale miners at a rate that would take thousands of years to deplete the ore, and it has been suggested that if they could do this in an environmentally sound way with improved technology, it could be considered sustainable development.

[6] From the Mining Association of Canada presentation to the 2006 Mines Ministers meeting in Whitehorse:

> "Canadian mineral reserve levels are declining, and have been declining for over two decades. Copper reserves have declined from 17 million tonnes in 1980 to less than 6 million tonnes at present. Zinc reserves have fallen from 28 million tonnes to 5 million tonnes, while silver and lead reserves have shown similar 80% declines during this quarter-century period. Gold reserves increased in the 1980s, reaching a new peak in 1996, but have since dropped by 40 percent and have now returned to the lower levels experienced in the early 1980s. At current rates of production, Canada has 5.5 years of lead reserves remaining, seven years of zinc, 10.5 years of copper, 15 years of gold and 21 years of nickel reserves."

The Canadian mining industry approaches this problem by asking for more government support to the exploration industry, so that more reserves will be discovered and in turn, depleted. Without policies and incentives to protect remaining reserves from immediate and total pillage, future generations are likely to find themselves with no metals left to mine at all.

and the industry will have to look to more remote areas of the world at greater cost and greater political risk.[7,8]

This limited supply business is serious. The industrial ecology group at Yale University[9] has been looking at metal stocks and sustainability, and their conclusions are stark. Metals are common in the Earth's crust, but whether they are in a form and location where they can be exploited is another matter. Looking at production and recycling of a range of metals, they found that while iron, aluminum, magnesium, and titanium are relatively plentiful, almost all other metals are geologically scarce. They estimate that if the entire world were to use as much copper as the United States – about 200 kilograms per capita – it would take more copper than is accessible in the Earth's crust – social and environmental concerns notwithstanding.

What we are doing is essentially taking geologically concentrated metals and dispersing them. For example, according to the calculations, about a quarter of the world's copper ore has already been used and deposited as waste, in landfills and dumps. You can mine landfills, of course, but it's messy and the ore grade is extremely low. As natural ore becomes scarce, people will respond by finding ways to recycle more, substitute other materials, or make do with less. In poor countries people recycle because they can't afford to throw things away; it is only a matter of time before people in rich countries come to the same realisation. Europe is far ahead of North America in terms of paying attention to material life cycles and balancing material use, energy use, and waste production. This is manifested in greater efficiency, better design, and less waste. Nanotechnology has the potential to revolutionise material use, as simple carbon atoms are manipulated to emulate whatever properties are desired.

The problem is that in the absence of specific social objectives and rational and coherent policy-making, social and environmental conflicts around mining development will increase until they are a limiting factor in metals' availability. National security will once again be used to justify mining projects, and the level of militarization will make what is happening now in various parts of the world[10] look like a picnic. Markets will respond to scarcity by driving up prices, and manufacturers will look for alternative sources or alternative materials. Mining will be increasingly vulnerable to unplanned and unpredictable shifts in markets and technologies, leading to more bankruptcies, abandoned mines, and stranded liabilities, where the host community is left to look after the mess that's left behind. Industry will establish new equilibria that will require less – or no – mining of virgin metals and are closer to real sustainability.

We can wait for that to happen or we can start to change things now and try to maintain some control over the process. This means placing a real value on our precious and irreplaceable geological resources, recognising that they may be worth more to society if they are left in the ground until they are truly needed, and extracted with great care and respect.

My conclusion is in the nature of an observation: if mining is to continue very far into the future it will have to look very different than today's vast – and expanding – raw industrial operations.

Thank you.

---

[7] Alex Davidson, speaking at the Roundup '07 conference, quoted in *The Northern Miner*, January 31, 2007.
[8] Gold is unique in some ways because most of the gold ever mined is still in circulation, and because only 15% of production goes to industrial use. Existing hoards of gold could meet current industrial needs for perhaps a hundred years.
[9] "Metal Stocks and Sustainability", R.B. Gordon, M. Bertram, and T.E. Graedel, *Proceedings of the National Academy of Sciences*, January 31, 2006 www.pnas.org/cgi/doi/10.1073.pnas.0509498103
[10] Indonesia, Papua New Guinea, the Philippines, Ecuador, Guatemala, Peru, the Democratic Republic of Congo, Ghana, Guinea,…