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Socially Responsible Mining: the Relationship between Mining and Poverty, Human Health and the Environment

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Abstract

Increasing global demand for metals is straining the ability of the mining industry to physically keep up with demand (physical scarcity). On the other hand, social issues including the environmental and human health consequences of mining as well as the disparity in income distribution from mining revenues are disproportionately felt at the local community level. This has created social rifts, particularly in the developing world, between affected communities and both industry and governments. Such rifts can result in a disruption of the steady supply of metals (situational scarcity). Here we discuss the importance of mining in relationship to poverty, identify steps that have been taken to create a framework for socially responsible mining, and then discuss the need for academia to work in partnership with communities, government, and industry to develop trans-disciplinary research-based step change solutions to the intertwined problems of physical and situational scarcity.

Keywords

mining; poverty; socially responsible mining; situational scarcity; physical scarcity

INTRODUCTION

The following commentary summarizes the key themes of the session entitled “Developing a Framework for Socially Responsible Mining” held at the 15th International Conference of

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the Pacific Basin Consortium for Environment and Health. The focus of this session was on how society will deal with the present and future impacts of hardrock mining on human health and welfare, particularly in developing countries. Maintaining functional global supplies of metals produced by hardrock mining is expected to pose increasing difficulties in the coming decades. This is due to both the challenge of our physical ability to meet the expected large increase in demand for metals (physical scarcity) as well as the disruption of supply flows which are caused by a variety of reasons leading to local social conflict and disruption of the mining process (situational scarcity). Straddling both physical and situational scarcity are issues concerning the impact of mining on both human health and the environment.

PHYSICAL SCARCITY: GROWTH OF THE MINING INDUSTRY AND ITS RELATIONSHIP TO POVERTY

Overcoming issues related to physical (and situational) scarcity is important because of the relationship of mining to poverty. Globally, approximately one billion people have moved out of extreme poverty since 1990 with China's rapidly growing economy accounting for 75% of this reduction (1). A further 1.1 billion people (ca. 15% of the world's population) remain in extreme poverty, most in the developing world, with economic growth the clearest path to remedying the situation. Rapid economic growth of the magnitude needed to achieve this goal has domino-like consequences one of which is an exponential increase in mineral consumption (2). Menzie et al. (3) have explained that such economic growth in developing countries is accompanied by the need for infrastructure creation and the demand for capital and consumer goods which creates a development cycle. In this cycle consumption of various commodities increases diagnostically during five consecutive stages of development: 1) infrastructure building as indicated by the use of cement; 2) light manufacture as indicated by the use of copper; 3) heavy manufacture as indicated by use of aluminum and steel; 4) demand for consumer goods as indicated by use of industrial minerals; and 5) demand for services which leads to static rates of commodity consumption (3). Generally each stage in this cycle takes twenty years to complete but the stages can run concurrently beginning at five-year intervals with a complete cycle taking 30 to 40 years. As predicted by this cycle, there has been a dramatic increase in demand for materials such as cement and metals such as copper in developing countries in the Pacific Basin generally and in China specifically. As China has moved enormous numbers of people out of extreme poverty since 1990, its demand for copper has increased exponentially. It has been estimated that China is 20 to 30% of the way through the second stage of the development cycle, for which copper is diagnostic (3). Examination of copper consumption in China compared to the US, which is in stage five of the cycle, illustrates the rapid increase in copper consumption that accompanies the second stage in development (Fig. 1). Exacerbating the situation is that India, with a comparable population to China, is just at the beginning of the development cycle.

Trends like those discussed in the previous paragraph have led to estimates of a 10 million ton/year copper supply shortage by 2020 (4). Addressing this physical scarcity challenge will require an increase in the global capacity for mining. Since 1900, the daily milling

capacity has increased 10-fold every 30 years and accompanying this milling capacity increase has been a similar increase in waste generated (5). From the milling perspective, new engineering technologies and infrastructure will be required to extract and process ores to meet the next 10-fold increase in milling capacity. From the waste perspective, new technologies will be needed to manage sites that are ever closer to increasingly populated areas.

SITUATIONAL SCARCITY: SOCIAL CONSIDERATIONS FOR MINING

Recent disruptions of the mining industry in developing areas in, e.g., Africa (6), Pacific Island Countries (7), and South America (8) have had enormous costs in terms of human life and lost mining revenues. Peru is a good illustration of the social issues driving such disruptions. Mining represents 12% of Peru's gross domestic product (GDP) and this country is globally important in the production of a variety of metals including silver (#1), copper (#2), zinc (#2), tin (#3), lead (#4), molybdenum (#4), and gold (#5) (8, 9). The last decade has seen a large increase in metal mining in Peru engendering an increase in economic growth of more than 6% annually. Accompanying this increase in mining activity has been a pushback by local communities that are largely poor and fear that mining projects will contaminate the land and water on which they subsist (10). Because of the economic value of mining to the country as a whole, the government has responded to this pushback by criminalizing social protests and mining companies have used private security forces not always respectful of human rights to protect their activities, actions which have further inflamed tensions on all sides of the issue (10).

There are no easy solutions to this type of complex problem because it is contributed to by local and regional issues related to culture, economics, environmental concerns, government, and politics and the situation in each country is different. The benefits of mining are clear; many developing countries are currently successfully diversifying and growing their economies through mining. For example in 2010 forty countries, of which three quarters were low and middle income, relied on mineral resources for over 25% of their exports (9). But there are some common themes that result in negative impacts in many of these countries. Perhaps the most important is a disparity in the distribution of economic benefits that accrue from mining. The status quo for the mining industry in developing countries has been dominated by wealth creation for those in power while local communities, usually poor, that are directly impacted by mining activity bear the burden of the environmental consequences of mining; polluted air, soil and water as well as degraded landscapes (11). Further, these communities have not equitably shared in the lifestyle and educational benefits that accompany the exploitation of natural resources through mining. These benefits are inextricable from modern life (e.g., airplanes, cell phones, computers) but often not affordable for poor communities. In order for the mining industry to thrive and meet the growing demands imposed by physical scarcity, it is imperative that issues leading to situational scarcity be addressed.

ARTISANAL MINING

Artisanal and small-scale mining (ASM) are low technology labor intensive efforts that are widespread in the developing world and taken together have a major impact on mineral supply. It is estimated that 20 to 30 million people worldwide are directly involved in ASM, approximately ten times the workforce associated with large-scale mining. ASM operators extract more than 30 minerals from primary and secondary ores contributing a total of 15 to 20% to the global production of minerals and metals (12, 13). It is carried out with low technology operations and is characterized by a lack of development capital and poor access to markets and support services (12, 14). These operations require more manual labor and generally have lower standards of health and safety than do their large-scale mining counterparts. ASM involves some of the world's poorest people and is largely unregulated and informal - operators often do not have a legal claim for the lands they are mining. For these reasons ASM has been associated with the use child labor, unsafe working conditions, and large potential for environmental damage (12).

A significant proportion of ASM takes place in proximity to large-scale operations to exploit marginal or small mineral deposits. As a result, there is often conflict and mistrust between large-scale mining efforts and ASM over land and resources (12). This is partly because the economic benefits of these two efforts are distributed quite differently. As discussed earlier, large-scale mining contributes disproportionately to centralized government and those in power while ASM, which operates on the fringe and is therefore not taxed, contributes more at the local scale.

A good example of both the environmental and health issues surrounding ASM is gold mining. There are 10 to 15 million artisanal gold miners in 70 countries that produce 350 tons of gold annually. Two million of these workers are children. The ultimate reach of this industry is much larger with approximately 50 to 100 million people either directly or indirectly affected by artisanal gold mining. The gold is recovered through mercury amalgamation creating both health and environmental issues. Currently ASM is the largest contributor to global anthropogenic emissions of mercury (Fig. 2) with these emissions doubling from 2005 to 2010. Often it is difficult to evaluate the extent of health impacts of ASM (or large-scale mining) in poor communities and particularly in indigenous communities. There are often incomplete or nonexistent birth records and health care is minimal. However a recent study by Caravanos et al. (15) suggests that the environmental health risks posed by mining operations are substantial. In this study a rapid assessment instrument was used to evaluate risk at 131 ASM gold mining and 275 industrial mining sites in 45 different low and moderate income countries with mercury, lead, and arsenic as the major contaminants of concern. Results estimate that mining impacts the health of more than seven million people in the 406 sites studied. These findings are consistent with a report on extractive industries by S. James Anaya (16), the United Nations Special Rapporteur on the rights of indigenous peoples which draws particular attention to human rights violations in regard to indigenous communities that "have suffered repression for their opposition to extractive projects."

FRAMEWORK FOR SOCIALLY RESPONSIBLE MINING – A CALL TO ACTION

Acknowledging the need for action to make mining more sustainable, Tiffany & Company, World Wildlife Fund, and Earthworks partnered to host a meeting in 2003 for NGOs, retailers, investors, insurers, and technical experts in the mineral sector to discuss a framework for improving the social and environmental impacts of mining. One outcome of the meeting was a research document prepared by the Center for Science in the Public Interest and the World Resources Institute entitled: “Framework for Responsible Mining: A Guide to Evolving Standards” (17).

Key findings and recommendations in this report include the need to:

- Protect natural water bodies from mine tailings and wastes;
- Respect the need to preserve ecologically and culturally significant areas;
- Establish environmental protection and management standards for operating mines;
- Develop protocols and implement practices for informed community decision-making;
- Promote the use of recycled content and life-cycle analysis.

Additional recommendations include the need for sharing information with stakeholders in the interest of transparency and assisting communities to make informed decisions. Retailers were particularly encouraged to track their supply chains to ensure that only responsible supplies of minerals are used, ones which do not contribute to conflict in conflict-affected and high-risk areas. This recommendation has already borne fruit. Recently, the Organization for Economic Co-operation and Development (OECD) a cohort of 34 countries has published a due diligence guidance to help companies ensure responsible supply chain management of minerals from conflict-affected areas (18). In the US specifically, a supply chain recommendation has been enacted for US companies under Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act for conflict minerals sourced from central Africa. However, it should be noted that Dodd-Frank 1502 only requires disclosure by US companies as to whether their products contain conflict minerals but does not ban or penalize their use.

ANSWERING THE CALL TO ACTION - INDUSTRY

Increasing industry recognition in the late 1990's and early 2000's that mining must become more sustainable engendered the emergence of a number of important industry-led and industry-partnering initiatives (including the Framework discussed in the previous paragraph). The International Council on Mining and Metals (ICMM), formed in 2001, is a partnership between the major trans-national large-scale metal mining companies. The ICMM has worked to develop codes of conduct and establish best practices for their industry. Their sustainable development framework has 10 guiding principles (19):

1. Implement and maintain ethical business practices and sound systems of corporate governance;

2. Integrate sustainable development considerations within the corporate decision-making process;
3. Uphold fundamental human rights and respect cultures, customs and values in dealings with employees and others who are affected by our activities;
4. Implement risk management strategies based on valid data and sound science;
5. Seek continual improvement of our health and safety performance;
6. Seek continual improvement of our environmental performance;
7. Contribute to conservation of biodiversity and integrated approaches to land use planning;
8. Facilitate and encourage responsible product design, use, re-use, recycling and disposal of our products;
9. Contribute to the social, economic and institutional development of the communities in which we operate;
10. Implement effective and transparent engagement, communication and independently verified reporting arrangements with our stakeholders;

Other examples of initiatives that large-scale mining companies participate in that set codes of conduct include: the International Cyanide Management Code which governs the safe management of cyanide in the gold mining industry (20); the Global Reporting Initiative which has developed a network for sustainability reporting to help industries (such as the mining industry) become more sustainable and contribute to sustainable development (21); and the Extractive Industries Transparency Initiative (22), a coalition of governments, companies and civil society that works to make the revenues accrued from exploitation of natural resources transparent and accountable.

It has also been recognized that an effective way to ensure best industry practices is to incorporate standards of practice into lending agreements. The International Finance Corporation (IFC) and other lenders have established performance standards, known as the Equator Principles, which must be complied with in order to obtain and keep financing for mining projects. More than 60 lenders use these performance standards, accounting for more than 80% of international financing for mining projects (23).

ANSWERING THE CALL TO ACTION - ACADEMIA

Developing a framework for action is the first important step in addressing any global issue of the magnitude posed by mining and its benefits and costs for society. However, such frameworks are necessarily broad in the strokes they brush in seeking to describe the issues of concern and pointing out the need for solutions. Resources are generally not available for solution development and so current practices are applied in ways that are not always efficient but that attempt to meet framework goals. Integral to truly solving our impending physical and situational scarcity problems in the mining industry is the development of step change solutions. This will require research capacity and the development of a new paradigm of operation that holistically considers the complexities of sustainable mining,

from social license to operate to community well-being, life cycle analysis including the production, use, and reuse of metals, and the ecosystem services used to obtain them (Fig. 3). Neither industry nor government are philosophically or physically organized for this type of research. This is the purview of academia.

When considering the ability to accomplish step change solutions that will effectively address physical and situational scarcity in the mining industry, there are relatively few universities in the world that have a critical mass of mining engineering, economic geology, and extractive metallurgy faculty who comprise the core of mineral resources programs that can address physical scarcity. Even fewer have institutes or centers that bring these traditional disciplines together with environmental, social, policy, economics, and law programs that are needed to address situational scarcity. Globally, there are three English-speaking universities that have successfully built interdisciplinary programs for sustainable resource development: University of Arizona (Lowell Institute for Mineral Resources), University of British Columbia (Keevil Mining Institute and Canadian International Resources and Development Institute), and University of Queensland (Sustainable Minerals Institute). Similar programs are being developed in non-English Universities for example, in Mexico the Autonomous University of San Luis Potosi has developed a multidisciplinary Graduate Program in Environmental Sciences. These Institutes have recognized the need for a trans-disciplinary approach to developing research-based solutions as well as the need to partner with both industry and communities to develop and test these solutions.

CONCLUSION

In summary, this conference session was inspiring in its recognition of, on the one hand the importance of the hardrock mining to raising living standards in developing nations, but on the other hand the human health and environmental impact that mining has on neighboring communities. In discussions following the session four areas were identified as extremely important for the future sustainability of mining.

- Human Health: Recognize that certain life stages are more vulnerable to toxicants including fetal exposures and young children. Develop risk assessment and mitigation measures that can be used to identify vulnerable populations and prevent exposure;
- Ecosystem Services: Understand that ecosystems are vulnerable and that ecosystem services are provided by healthy soil and water supplies. Incorporate the value of biodiversity and other measures of ecosystem function and health into financial models. Designate areas that should not be mined because the environmental is too fragile or other environmental resources in the area are too important to disturb;
- Post-Mining Land Use: Improve the design for closure strategy to better guarantee a valuable second life of mine sites and restore ecosystems to productive life cycles;
- Social License: Understand how health and environmental consequences affect social license to operate by establishing baseline and longitudinal studies in affected communities.

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Fig. 1. Copper consumption by the US and China. *projected consumption. Data sourced from 25, 26.

Fig. 2.
Anthropogenic emissions of mercury in 2010. Data sourced from 27.

Fig. 3.

A paradigm for sustainable mining in which global partners from industry, government, communities, and academia all contribute to the pillars (shaded boxes) of a decision-making instrument. Each pillar has several components cutting across scales (data gathering at the micro-scale to systems analysis at larger scales) and expertise. Of critical importance is that ethics and education are built into each component. The goal is to use this instrument to optimize decisions concerning sustainable materials production and then support the decision with a social license to operate.