

Natural Resources and Sustainability: Geoethics Fundamentals and Reality



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Abstract

Ensuring sustainability of economic and social activities in order to assure future generations' supply of energy and other natural resources is the ninth Fundamental Value of Geoethics (Di Capua, et al., 2017). Unfortunately, this statement fails to transparently and forthrightly acknowledge the depletable nature of individual natural resource deposits, thus inhibiting a fully integral and transparent discussion of this geoethics value statement's goal of providing a sustainable supply of natural resources. The depletable nature of individual natural resource deposits is a fact of nature. Deposits are limited in overall size. This paper examines how the finite size of natural resource deposits and other factors can be realistically approached from a geoethical perspective. On one hand, developing a long-term mineral supply would encourage maximum extraction of a deposit's valuable constituents by keeping the costs of production low, allowing for a lower cutoff grade. On the other hand, minimizing costs for environmental mitigation and social impact mitigation can result in unacceptable levels of adverse impacts for those living near the deposit. The costs for environmental and social impact mitigation increase the cut-off grade, the minimum grade that allows for profitable extraction. Dialog between the mining industry and the various environmental and social impact stakeholders is the key to finding the unique appropriate balance for each mineral deposit. The dialog among the various stakeholders about a particular deposit should recognize society's need for mineral products as an important, socially desirable goal. Because individual natural resource deposits are depletable, natural resource supplies can only be sustained by finding new deposits, substitution of one product for another, recycling where possible, along with improvements in mining exploration, extraction, and processing technologies at both current and new mines.

Therefore, the ninth Geoethics Value statement, *Ensuring sustainability of economic and social activities in order to assure future generations' supply of energy and other natural resources*, should be changed to a more forthright and transparent statement. A suggested change is, *Assuring supplies of natural resources for future generations requires recognition that individual natural resources deposits are depletable and that their identification, delineation, extraction, and processing have social and environmental consequences whose mitigation must be balanced with maximizing the recovery of the valuable minerals needed by society from each deposit.* The term "energy" is deleted from the statement because oil and gas, coal, and uranium are adequately covered by "natural resources."

Key words: *geoethics, natural resources deposits, depletion, sustainability*

For the first time since November 1995, no Professional Ethics & Practices column appears in this TPG issue. This peer-reviewed article addresses the 9th fundamental value of geoethics and takes the PE&P column's place because its length is that of a typical PE&P column plus a typical TPG article. PE&P column 176 will appear in January 2021.

Introduction

The Geoethics concept arose from an idea conceived in April 2012 at the European Geosciences Union and developed at the 34th and 35th International Geological Congresses. The Cape Town Statement on Geoethics (Di Capua, et al., 2017) included a list of ten fundamental geoethical values (see side bar).¹ The ninth fundamental value states, “Ensuring sustainability of economic and social activities in order to assure future generations’ supply of energy and other natural resources.” Unfortunately, this statement fails to transparently and forthrightly acknowledge the depletability of natural resource deposits thus inhibiting a fully integral and transparent discussion of this geoethics value statement’s goal of providing a sustainable supply of natural resources. The depletability of natural resource deposits is a fact of nature. Deposits are size limited. This same failure to forthrightly acknowledge and address the depletability of natural resource deposits is a major failing of International Association for the Promotion of Geoethics’ (IAPG’s) *White Paper on Responsible Mining* (Arvanitidis, et al., 2017). As Schendler (2009, p. 9) emphasizes, “The great flaw in the sustainable-business movement today is that few are willing to admit that achieving sustainability is difficult, and maybe impossible, without big changes in the way the world currently operates.”

A significant problem in discussing the sustainable development of natural resource deposits is a clear understanding of what “sustainable development” means. The widely cited UN Brundtland Commission 1987 report’s definition states, “Sustainable development is the kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” Thus, there are no limits on the life of a “sustainable development” as commonly used and understood. The problem is that individual natural resource deposits are finite in size, are depletable, and any extraction of a particular deposit will eventually lead to its exhaustion. This paper examines how the finite size of natural resource deposits and other factors can be realistically approached from a geoethical perspective.

This paper will focus on solid mineral deposits that are extracted using mining methods. But other types of natural resource occurrences such as oil and gas reservoirs, geothermal energy systems, mineral extraction from brines (lithium for example), and the increasing number of “mined” water aquifers are depletable and the general concepts discussed apply to these other types of natural resource occurrences as well.

The development of geoethics

“Geoethics” was defined in 2012 at the 34th International Geological Congress in Brisbane, Australia from an idea conceived during the European Geosciences Union in the preceding April. The Cape Town Statement on Geoethics was published following the 35th International Geological

1. The International Association for Promotion of Geoethics (IAPG) is supported by over 20 associated geoscience organizations, many of which are internationally recognized. Conspicuously absent from this list of associates are major, internationally recognized mining and petroleum organizations including the American Association of Petroleum Geologists, the Australasian Institute of Mining and Metallurgy (AusIMM), the Canadian Institute of Mining, Metallurgy, and Petroleum (CIM), the Institution of Mining and Metallurgy, the Society for Mining, Metallurgy, and Exploration (SME), and the South African Institute of Mining and Metallurgy. These mining organizations are very interested in the social licensing aspects of mining.

The Fundamental Values of Geoethics

1. **Honesty, integrity, transparency and reliability of the geoscientist, including strict adherence to scientific methods.**
2. **Competence, including regular training and life-long learning.**
3. **Sharing knowledge at all levels as a valuable activity, which implies communicating science and results, while taking into account intrinsic limitations such as probabilities and uncertainties.**
4. **Verifying the sources of information and data, and applying objective, unbiased peer-review processes to technical and scientific publications.**
5. **Working with a spirit of cooperation and reciprocity, which involves understanding and respect for different ideas and hypotheses.**
6. **Respecting natural processes and phenomena, where possible, when planning and implementing interventions in the environment.**
7. **Protecting geodiversity as an essential aspect of the development of life and biodiversity, cultural and social diversity, and the sustainable development of communities.**
8. **Enhancing geoheritage, which brings together scientific and cultural factors that have intrinsic social and economic value, to strengthen the sense of belonging of people for their environment.**
9. **Ensuring sustainability of economic and social activities in order to assure future generations’ supply of energy and other natural resources.**
10. **Promoting geo-education and outreach for all, to further sustainable economic development, geohazard prevention and mitigation, environmental protection, and increased societal resilience and well-being.**

Congress in Cape Town, South Africa (Di Capua, et al., 2017). The Cape Town Statement defined geoethics as: “Geoethics consists of research and reflection on the values which underpin appropriate behaviours and practices, wherever human activities interact with the Earth system. Geoethics deals with the ethical, social and cultural implications of geoscience education, research and practice, and with the social role and responsibility of geoscientists in conducting their activities.” The Cape Town Statement on Geoethics stated that its purpose is, “Embracing geoethics is essential: to improve both the quality of professional work and the credibility of geoscientists, to foster excellence in geosciences, to assure sustainable benefits for communities, as well as to protect local and global environments; all with the aim of creating and maintaining the conditions for the healthy and prosperous development of future generations.”

The Cape Town Statement contains ten fundamental values of geoethics. The first six of these values are more or less standard parts of geoscience ethics codes advocating honesty, transparency, competence, verification of information and data, unbiased science, etc. New fundamental geoethics values are:

- Protecting geodiversity as an essential aspect of the development of life and biodiversity, cultural and social diversity, and the sustainable development of communities.
- Enhancing geoheritage, which brings together scientific and cultural factors that have intrinsic social and economic value, to strengthen the sense of belonging of people for their environment.
- Ensuring sustainability of economic and social activities in order to assure future generations’ supply of energy and other natural resources.
- Promoting geo-education and outreach for all, to further sustainable economic development, geohazard prevention and mitigation, environmental protection, and increased societal resilience and well-being.

As Bohle and DiCapua (2019) note, “The recent development of the concept ‘geoethics’ is a response by geoscientists to shape deeper engagement with their professional responsibilities and the wider societal relevance of geosciences. This introductory chapter outlines the development of geoethics to date, as a ‘virtue ethics’ focusing primarily on the role of the geoscientist, describes its meaning and function in relation to neighboring fields and explores how to situate geoethics in relation to a wider range of issues that require ethical consideration.” This widening of geoscience professional ethics can be expected to spread to the ethics codes of other professions. The goal of “further sustainable economic development...and increased societal resilience and well-being” should become part of environmental and social licensing ethics as well.

Natural resource supplies are vital

Everything humans use is derived from natural resource extraction or agriculture (including forestry, livestock, and fishing). The quip, “If it can’t be grown, it has to be mined” may sound trivial but it is true. As our societies become increasingly urbanized and increasingly displaced from the natural resource and agricultural bases for our economies, our societies become increasingly generally ignorant about the foundational importance of mining and agriculture. While at first glance it appears that electricity comes from the plug in the wall, electricity has to be generated by some means. The

copper wire behind the plug does not cause most people to think of the details of copper mining, processing, and refining that occurs prior to the creation of the wire.

The Preamble of the IAPG’s *White Paper on Responsible Mining* (Arvanitidis, et al., 2017) does point out other important characteristics of natural resource deposits:

- Modern societies are dependent on mineral-based products. Energy technology, information and communications technology, consumer electronics, infrastructure, logistics and food production all increasingly rely on an ever-widening array of minerals and metals. For example, production of a personal computer or a smartphone needs over 40 elements.
- Mineral and metal consumption strongly correlates with economic growth and urbanization. Three billion additional people will likely move to cities by 2050. Improved recycling, resource efficiency, better product design and new materials will reduce mineral and metal consumption per capita, but mining of primary resources will continue to play an important role in the future in building sustainable societies.
- Geology defines the occurrence of mineral deposits, so mining is geographically constrained, but the use of the products of mining in down-stream industries or as final products often takes place in continents and countries different from the location of the mine. Therefore, mining communities do not necessarily appreciate the importance of mineral production for the welfare of people living in other countries, particularly if there is no tangible sharing of those benefits.
- Mining cannot choose locations that are logistically, socially, environmentally, or politically optimal, appropriate, or ‘friendly’. This means that companies may have to deal with circumstances that could pose ethical challenges including: the relationship with local communities, position in the landscape/environment, relationship with local and national governments, weak governance and associated increased risk of corruption and bribery. It is necessary to deal with these challenges in a responsible way.

How are these characteristics of mineral deposits and the demands for mineral products now and in the future going to be balanced? These are legitimate geoethical questions. However, as Grennan and Clifford (2017) point out, most proponents of sustainable resources ignore geology, ignore the fact of depletability, and the unequal but worldwide distribution of deposits including locations in countries with less stringent environmental laws and reputations for various forms of governmental corruption.

Figure 1 presents the 2020 edition of the Minerals Education Coalition’s “mineral baby.” The mineral baby predicts that every American born in 2020 will need an estimated 3.19 million pounds of mineral products during its lifetime. Abbott (2017) describes how the estimates shown in each year’s mineral baby are calculated along with graphs of some changes in the amount of particular mineral commodities over time. Although the mineral baby’s data is American, the mineral baby reflects the estimated minerals use of developed countries and the usage goals of under-developed countries. Certainly, modifications are needed to provide worldwide estimates of mineral usage requirements, but Figure 1 remains a useful estimate within its inherent limits. The Minerals Education

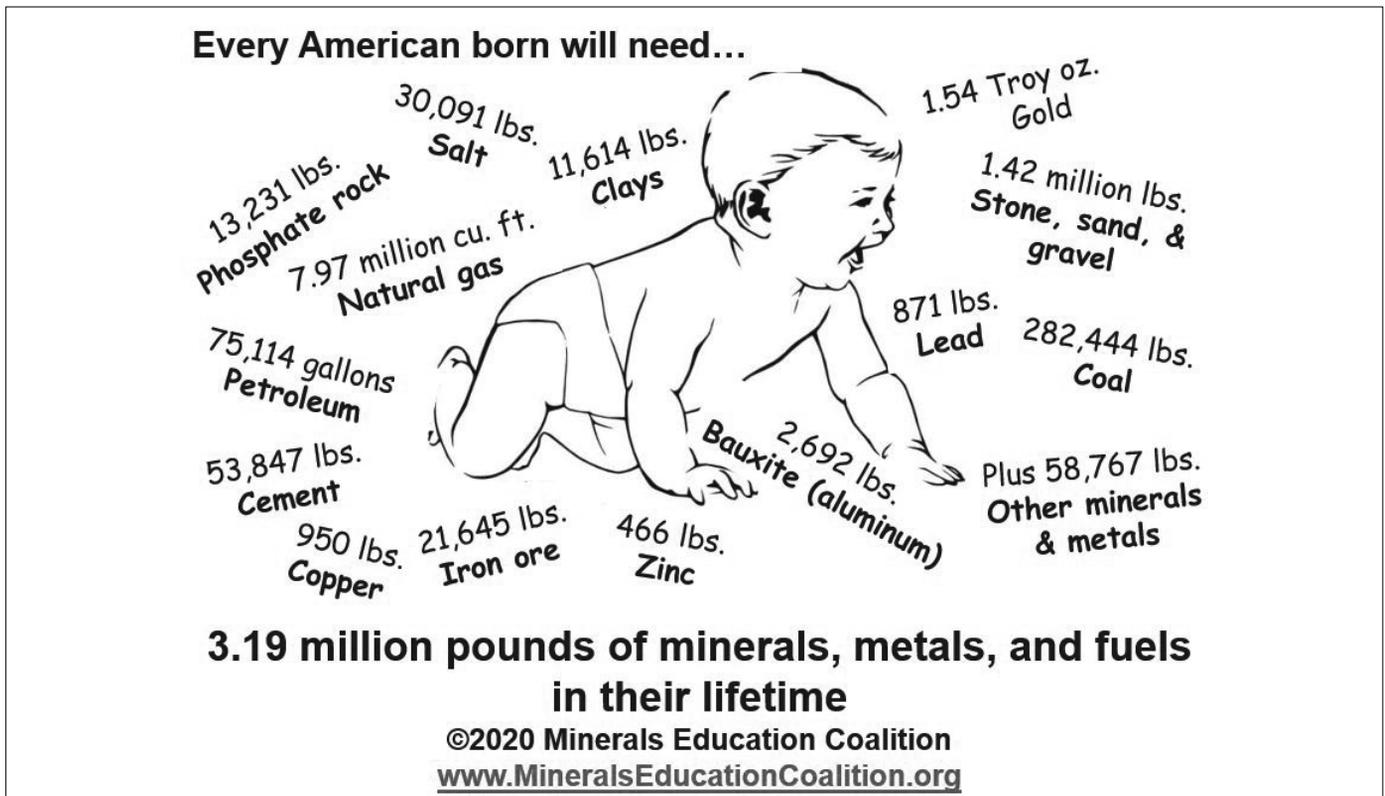


Figure 1 - 2020 mineral baby, www.MineralsEducationCoalition.org.

Coalition encourages the widespread copying and distribution of each year's mineral baby as long as the copyright and web address are retained.

Natural resource deposits are depletable

The concept of sustainable development has been, and still is, subject to criticism, including the question of what is to be sustained in sustainable development. "The production of mineral resources and fossil fuels would seem to be activities that cannot, by definition, be sustainable, but extractive industries provide necessary contributions to society" (Wessel, 2016). The depletable nature of natural resource deposits is a fact of nature. Deposits are limited in size. In addition to the limits on absolute deposit or occurrence size, various factors of geology, deposit delineation techniques, extraction and processing technologies, and extraction costs combine to prevent complete (100%) extraction of the contained valuable mineral(s) (the economically recoverable metal-bearing and other minerals) in a deposit. This is true regardless of whether the valuable resource comprises 100% of the core of a deposit, for example, a paper-grade marble or dimension stone granite, or a few parts per million (grams per tonne) in the case of gold and platinum group metal deposits. The mine life of a deposit depends on its size, the grade (i.e. the percentage of valuable mineral(s) in the deposit, the cut-off grade (the grade at which extraction becomes unprofitable), and the extraction rate. Some deposits are mined out within a few years while others may last decades.

Natural resource deposits are not uniformly distributed

Natural resource deposits are unevenly scattered around the world. Some areas are mineral rich, for example the southern part of the Katanga Province of the Democratic Republic of the Congo, which contains the majority of the world's cobalt

production and significant copper resources. The world's major platinum group metal deposits are in South Africa, Russia, and Zimbabwe with much smaller occurrences in the Stillwater Complex of southcentral Montana and various parts of Ontario and Quebec. The world's major iron deposits are in the older (~2+ billion-year-old) cratons of the globe. Major deposits of phosphates, a critical fertilizer (the P of N-K-P of fertilizer composition), occur in central Florida (increasingly depleted) and in a trend across northern Africa from Morocco to Saudi Arabia. The rare earth elements have traditionally come from either the Mountain Pass deposit in southern California or China. Rare earth element deposits are not so rare, but most are low grade and the most common rare earth element-containing mineral is monazite (Ce, La, Y, Th)(PO₄, SiO₄). Thorium (Th) is radioactive, creating an environmental hazard when processed for the rare earth elements. The La in monazite's formula stands for the lanthanide series rare-earth elements, which, except for cerium, are very difficult to chemically separate and which make individual rare earth element oxides expensive to recover. Natural resource deposits occur where they are and not necessarily in areas deemed less environmentally sensitive or in less socially desirable locations.

Balancing resource recovery with environmental and social impact mitigation

The extraction of a natural resource deposit produces one or more holes in the ground of widely varying size. The clay pits of Hopi and other Native American potters may be fairly small as were the somewhat larger Native American flint quarries. In sharp contrast are the giant iron mines of northern Minnesota and Michigan or the porphyry copper mines including such giants as the Bingham Canyon Mine west of Salt Lake City, UT or the Chuquibambilla Mine complex of northern Chile. In addition to the holes and piles of waste rock, mineral process-

ing techniques may add adverse environmental consequences, such as the use of mercury to recover gold by amalgamation, particularly by artisanal or small mining operations. The fact that many metal mines are within pyrite-rich rocks whose oxidation produces acid mine drainage is another variety of potentially adverse environmental consequence of mining. Small amounts of mercury-, arsenic-, and other toxic element-bearing minerals may be part of the suite of minerals comprising a particular deposit. These and other factors contribute to the potentially adverse environmental consequences from mining that should be addressed.

The social impacts resulting from the construction and operation of a mine can also be significant. Roads, public utilities, sewer and water lines, schools, town-size expansions or creation of new towns are examples. Frequently, the people already living near the mine site desire training that allows them to work at the mine. The social impacts vary considerably from project to project and must be dealt with on a project by project basis. As Bilham and Di Capua (2020) point out:

Living sustainably, prosperously and equitably on our crowded planet in the coming decades will depend on mining. However rapidly we increase recycling rates, improve resource efficiency and reduce demand for raw materials through new approaches to product design and use, we will continue to need to mine significant quantities of an ever-increasing range of elements. The mineral needs of the near future will be quite different from those of the recent past, given the urgent need to transition to low-carbon energy systems and to harness new, materially complex technologies to address a nexus of environmental, social and economic challenges, as articulated in the UN Sustainable Development Goals. Meeting these needs will mean mining in new places and communities—as well as in settings that bear the scars of unethical and unsustainable practices of the past—and will depend on the engagement and support of communities rightly seeking to assert their rights and defend their interests. It is therefore essential, from both a moral and practical standpoint, to mine responsibly, minimizing negative social and environmental impacts, maximizing benefits and legacies to

affected communities, and including them as partners in a shared societal enterprise.

Bilham and Di Capua's observations are from the Introduction to Jan Boon's *Relationships and the course of social events during mineral exploration: an applied sociology approach* (2020). Boon discusses the various relationships between an exploration company and the various people and groups that are encountered in the course an exploration project. The nature of the relationships between the exploration company and these people and groups will determine whether and with what ease, or lack thereof, the exploration project's technical aspects (geology, mine design, process testing, mineral resource and reserve delineation, etc.) can proceed to the development of an operating mine.

"Ore" is that part of a mineral deposit from which one or more valuable minerals can be legally extracted at a profit. That is, the revenues received from a mine's operation must exceed the costs of mining and processing the contained minerals for sale. On one hand, developing a long-term mineral supply would encourage maximum extraction of a deposit's valuable constituents by keeping the costs of production low thus allowing for a lower cutoff grade. But minimizing costs for things like environmental mitigation and social impact mitigation can result in unacceptable adverse impacts for those living near the deposit. The costs for environmental and social impact mitigation increase the cut-off grade, the minimum grade that allows for profitable extraction. A higher cut-off grade results in reducing the maximum recovery percentage of the valuable mineral(s) in a deposit. Mining industry mineral resource and mineral reserve classification systems such as the Society for Mining, Metallurgy, and Exploration's *SME Guide for Reporting Exploration Information, Mineral Resources, and Mineral Reserves* (2017) or the Australasian JORC Code (2012) define critical terms and provide detailed guidance about the information required in order to determine that a mineral reserve (the economically extractable part of a mineral deposit) exists. This includes addressing the environmental and social licensing aspects of the deposit. Figure 2 presents the need to balance maximum resource recovery with minimizing the adverse social and environmental impacts of mining.

Who decides what the balance will be? The IAPG's *White Paper on Responsible Mining* (Arvanitidis, et al., 2017) defines responsible mining: "Responsible mining demonstrably respects and protects the interests of all stakeholders, human health and the environment, and contributes discernibly and fairly to broad economic development of the producing country and to benefit local communities, while embracing best international practices and upholding the rule of law." Doyle's (2019) blog, "Responsible investing in natural resources" examines the environmental, social, and governance (ESG) issues for responsible mining investing. These papers imply the balancing summarized in Figure 2. The *White Paper* lists 15 best practices for responsible mining. These practices require identification of and dialog with relevant stakeholders including local and regional authorities, community members, employees, contractors, and non-government organizations. Dialog among the mining industry and these stakeholders is the key to finding the

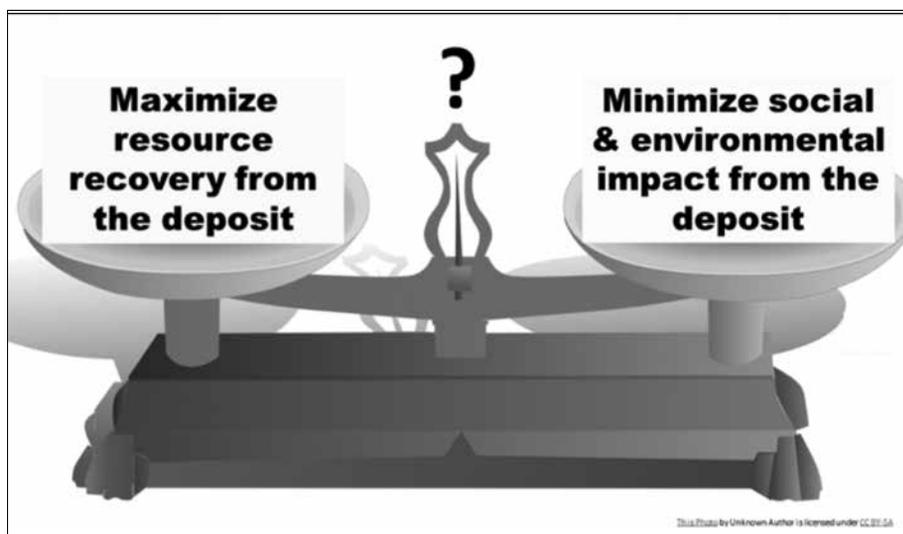


Figure 2 - Balancing resource recovery with social and environmental impact mitigation.

appropriate balance for each mineral deposit shown in Figure 2. However, the discussion among the various stakeholders about a particular deposit should also recognize society's need for mineral products including acceptance of some level of adverse impacts.

The alternative for reaching a balance between maximum extraction and minimized adverse resulting impacts is by regulation. Oreskes and Conway (2010) in their Chapter 3 on acid rain point out that had regulations on reducing acid-rain-causing emissions from coal-fired power plants been adopted sooner than they were, not only would mitigation have occurred sooner, the economic incentive to develop new, more efficient, and less costly mitigation technology would have occurred sooner as well. Enacting laws or regulations requires political power. Oreskes and Conway's review of the acid rain saga and the associated political aspects of the issue provide a good case history.

Finding new deposits to replace depleted ones

Because natural resource deposits are depletable, natural resource supplies can only be sustained by finding new deposits. Even when substitutes for the use of a particular mineral product are found, deposits of the substitute minerals must be found. Grennan and Clifford (2017) observe, "Fundamental to a sustainable supply of raw materials for manufacturing industry is a mining industry; fundamental to a sustainable mining industry is a vibrant exploration industry; fundamental to a vibrant minerals exploration industry is geology. The real problems of the technical and financial risk attaching to mineral exploration, and the importance of geology, are rarely discussed. Grennan and Clifford (2017) point out:

There are two principal reasons why exploration tends to be ignored in all of this debate. Firstly, the high risk of no success—exploration success in Ireland is around 5,000 to 1. Most people, especially those in government service or in academia, rarely understand why anyone would undertake such risks. This is why there is a special section within the Stock Exchanges for such high-risk companies. Secondly, having succeeded in finding a viable deposit, the extent of the regulatory obstacles put in the way of development is enormous, and costly. They can be ameliorated, but the environmental lobby has totally captured the administrative system.

Mineral exploration and the risks involved are also impacted by the fact that the easily found deposits that occur on or near the surface have pretty much been found. The remaining deposits are further below the surface and harder to find. Wood (2018) observed that while the amounts spent on exploration have climbed significantly, the number of discoveries has declined. Wood attributes this to the continued focus on exploring for open-pit mining targets and suggests that exploration should refocus on targets requiring underground mining methods. Wood and Hedenquist (2019) describe the needed changes in exploration strategy. Moving to underground mining methods can change the environmental impacts but underground mining costs more on a per tonne basis than open pit mining.

Although changed exploration strategy is needed, it may or may not significantly reduce exploration risk. Grennan and Clifford (2017) cogently observe:

It has been argued that the best, and most efficient, way to find a deposit is to allow small exploration

companies to flourish, whereby they can raise high risk finance and/or obtain exploration funding from major mining companies. Whilst it is undoubtedly true that exploration costs are rising, the real escalation in costs is in the post-discovery pre-development phase. Few geologists will argue against an increase in environmental and reporting standards, and inevitably the smaller company cannot sustain the costs and is typically taken over by the larger partner. The major company, through social and regulatory pressure accedes to the environmental/cultural/administrative lobby. This in turn leads to increased costs being imposed both directly and indirectly on the developer, which leads to lower profits, and thus lower tax payments, resulting in the self-fulfilling prophecy that such companies avoid paying tax. This does not have to be the case.

Alternatives to consider—substitutes and improved technologies

There are alternative routes to a sustainable supply of natural resources. Substitution of one mineral or metal for another is one alternative. Lead was formerly used as the primary white pigment in paint until this use was banned. TiO_2 , largely from the mineral ilmenite, FeTiO_3 , is the current most commonly used white pigment (reading ingredient labels reveals the widespread use of mineral products in a wide variety of products if you know chemical formulas of common minerals, for example, quartz, SiO_2). Construction studs are available in wood or steel versions and some substitution between the two stud types does occur. Laminated wood beams have been used as substitutes for steel beams in buildings. Such substitutions will continue as the installed price for a particular metal or mineral product increases relative to the installed cost of the alternative, assuming job specifications are met. The relative amounts of platinum and palladium in automobile catalytic converters changes with the relative prices of the two metals.

New or improved technologies can make a huge difference. Agricola (1556, p. 217) noted that the second principal cause for mine closures was the quantity of water that flows in [that is, the inability to pump the water out or drive drainage tunnels]. The development of steam-engine driven pumps in the 18th century allowed the rejuvenation of the tin mines of Cornwall that had earlier supported the Bronze Age. Major improvements in the efficiency of mining equipment and techniques in the 20th century made possible dramatic improvements in open pit mining, which evolved from rail-based haulage to truck haulage. Similar improvements occurred in underground mines. Currently, the development of remote control, autonomous vehicles, and robotics technologies for mining equipment is expected to make significant technological advances in the coming years (Burgess-Limerick, 2020).

The extent to which substitutions and improved technologies will impact future mining and the timing of their adoption is unknown but significant impacts are expected.

Post mining uses of lands

Increasing attention is being paid to the post-mining uses of mined lands as shown by the following examples:

- Former aggregate mine pits (sand and gravel and crushed stone quarries) are being used for water storage.
- The ponds formed by aggregate mines are valuable features of new real estate development.

- Former underground limestone and salt mines are being used for records and other types of storage facilities.
- A large area of former smelter tailings in Colorado Springs, Colorado is being covered by new homes.
- Part of a former coal mine in western Colorado is now a mushroom farm.
- Aspen Skiing Company and Holy Cross Energy recently developed a methane-powered electric generation plant to capture the released methane from nearby gassy coal mines (<https://www.aspentimes.com/news/how-aspen-skiing-co-became-a-power-company/>). Methane is a potent greenhouse gas and its conversion to water and CO₂ is an environmentally desirable outcome.

Conclusion

Providing a continued supply of the natural resources that society continues to need requires recognition that individual natural resource deposits are depletable and limited in extent. Determining the extractable dimensions of a particular deposit depends on balancing resource recovery with the various capital and operating costs of exploring for, finding, and then building the extractive operation. This includes the costs associated with reducing the environmental impacts and obtaining the required social license to operate. As Schendler (2009, p. 238-239) points out, “The bottom line is that this [sustainability] job isn’t about the beauty, it’s about the mess. It’s not about the glory, it’s about the dogged pursuit of an enormously challenging goal. This book [*Getting green done: hard truths from the front lines of the sustainability revolution*] is testimony to the fact that the sustainable business movement isn’t gliding along rails. We’re slogging through the mud, struggling with difficult problems that have complex answers. There’s contradiction in the very fact of our existence, and uncertainty as to the outcome of our work. I am constantly asked: ‘Climate change is big these days. But what’s next?’ My latest response has been, ‘Honesty.’ The point is that unless we own up to the realities, we’re deluding ourselves, we’ll never be able to get down to solving the real problems.”

The ninth geoethics value statement, *Ensuring sustainability of economic and social activities in order to assure future generations’ supply of energy and other natural resources*, should be changed to a more forthright and transparent statement. A suggested change is, *Assuring supplies of natural resources for future generations requires recognition that individual natural resources deposits are depletable and that their identification, delineation, extraction, and processing have social and environmental consequences whose mitigation must be balanced with maximizing the recovery of the valuable minerals needed by society from each deposit*. The term “energy” is deleted from the statement because oil and gas, coal, and uranium are adequately covered by “natural resources.”

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