Original research article

Green energy futures: Responsible mining on Minnesota’s Iron Range

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ABSTRACT

Controversial mining projects are being proposed across the U.S. in the quest for supplies of precious and rare earth elements to fuel green energy technologies, like wind turbines and electric vehicles. This new prospecting is, in part, the result of geopolitical tensions over China’s export limits. While the U.S. has ample resources of rare earths, the main challenge is a lengthy permitting process that pits environmental opponents, especially native tribes, against developers who claim a “responsible” mining agenda. The article examines these tensions through a case study of PolyMet’s proposal for an open pit mine along Lake Superior in Minnesota. Over 80,000 public comments were submitted for and against the project, making it the most contested project in state history. The research is based on interviews, field visits, media reports and participant observation at siting hearings. The article synthesizes two emerging areas of energy social theory, the geologic turn in geography/anthropology and STS interests in responsible innovation, to reveal the new vulnerabilities and opportunities that are being co-produced with the new energy economy. I examine how stakeholders are making sense of mining’s landscape and livelihood impacts, while addressing the need for just energy futures that balance short-term resource needs with long-term sustainability.

On a frigid night in January, when the air temperature measured −10 F (−23 C), more than 2000 people gathered at the River Center in Saint Paul, Minnesota for a public hearing on the state’s first proposed rare earth metals mine. PolyMet Mining Corporation’s proposal for a $650 million open pit mine in northern Minnesota has become a lightning rod of controversy. The hearing was aimed at gathering public input on the 2200-page environmental review, put together by the Minnesota Department of Natural Resources, U.S. Army Corps of Engineers and U.S. Forest Service. Nearly 80,000 public comments have already been submitted for and against the project, making it the most controversial project in state history.

Rare earth metals are vital for the clean energy revolution. The production of electric cars, LED lights, wind turbines and other “smart” technologies all depend on these metals [1]. The Polymet project is the first of many to be proposed in the state, as Minnesota is home to one of the world’s largest untouched deposits of copper, nickel and valuable rare earths. In fact, mines are being rapidly proposed and permitted throughout the U.S. in the quest for more “critical” and “strategic” rare earth elements to fuel clean energy production. Across the nation, proponents argue that new mines will bring jobs to struggling rural economies. In contrast, mining opponents express concerns about long-term water and air quality impacts. Mining companies respond that they can usher in a new era of “responsible” mining.

Using the above Minnesota case study, this article critically considers the future of new mining in the U.S. by asking three interdisciplinary questions of interest to readers of Energy Research & Social Science. First, what can recent mining controversies teach us about the trade-offs and tensions incumbent in negotiating what I call the “green energy bargain”? Second, how can analyzing the “responsible mining” discourse help us examine the role corporations are playing in ushering in energy transitions? And, finally, how is rule making across political scales, from bottom up to top down action, shifting how we justify who bears the economic and ecological burdens and benefits of clean energy development across social groups?

This Minnesota case study research is based on analysis of environmental impact documents, media reports, participant observation at public hearings, interviews with residents, activists, and project proponents. This article is part of a much larger social science study examining the future of rare earths mining in the U.S., and thus my observations on the Minnesota case are supplemented by my research on the potential of the international mining industry to usher in an era of safe, sustainable and responsible mining.

1 Rare earth metals include: rare earth elements—17 elements in the periodic table, the 15 lanthanides plus scandium and yttrium; six platinum group elements; and other byproduct metals that occur in copper, gold, uranium, phosphates, iron or zinc ores [1].

2 This research has been generously supported by the National Science Foundation (SES #1535169). I am also grateful to my student research assistants, Garrett Eichhorn and Kaitlyn Lindaman, for their help with this article.

Please cite this article as: Phadke, R., Energy Research & Social Science (2017), http://dx.doi.org/10.1016/j.erss.2017.10.036
The article begins by investigating the discourse around rare earths mining by reviewing mining literature and perspectives, drawing together diverse bodies of scholarship from geography, anthropology, and science and technology studies to think about energy justice and corporate social responsibility. In particular, I examine how the social construction of a “strategic materials crisis” is underpinning new mining development. The article then describes how residents, business interests, and state and national regulators have responded to the proposed PolyMet project in northern Minnesota. I am interested in the kinds of demands and concessions that are being made to gain a “social license to operate” in this region. I focus on how PolyMet aims to be responsible, as well as how and why communities are resisting this discourse. I conclude with some reflections on what we can learn from this case about the tensions and frictions involved in negotiating a clean energy future. In this spirit, I share many concerns with the authors of this special issue. In particular, I recognize how important it is that we continue to negotiate what justice, equity, fairness and democracy look like in the context of our societal energy transitions.

1. Rare earth elements explained

The unique magnetic, luminescent and catalytic properties of rare earth elements, like cesium, neodymium and yttrium, have led to their incorporation into most “smart” energy technologies. Rare earths are key for four clean energy applications: permanent magnets used in wind turbines and advanced electric vehicles, lithium-ion advanced batteries, photovoltaic systems using thin-film semiconductors, and rare earth phosphors used in high-efficiency fluorescent lighting systems [2]: 93). While rare earths are not rare in nature, they are very hard to find in heavy concentration, making their extraction both extremely expensive and environmentally dangerous. Rare earth elements are often found alongside deposits of other precious metals, like gold and copper, and radioactive materials, like uranium and thorium. Rare earth elements are also often found together in geologic deposits. Processing rare earths poses significant hazards to human health and the environment, such as the production of large amounts of acidic wastewater, radioactive waste residue, toxic gases, and dust.

Over the next decade, the demand for rare earths in the United States is expected to significantly increase in order to meet state and federal targets for widespread clean energy adoption in the U.S. [3]. The global demand for rare earth elements is expected to grow at an annual rate of 5% by 2020 [4]. While it is speculated that the demand will likely be met by mines in the developing world, including South Africa, Vietnam, Afghanistan and Laos, the World Bank notes the significant lack of robust data from which to map these deposits [5]: 26). World Bank analyses are drawn from the USGS [6] minerals commodity surveys. While these estimates are provided in Fig. 1, it is important to note how much data is listed as not available (NA). New rare earth mines are also proposed for Canada, Greenland, Australia and the U.S. While China is today the major exporter of rare earths, metals analysts project that China will be a net importer by 2025 as they outstrip their own supplies [7].

The U.S. was the center of rare earths mining for decades. Rare earth mining was first developed in southern California in the 1950s and continued for nearly forty years at the Molycorp Mountain Pass mine site. By 1984, Molycorp met all of the domestic demand for rare earth elements and one-third of the global demand. The Mountain Pass mine first closed in 2002 due to leaks in its wastewater and evaporation systems. A federal investigation found 60 spills—some unreported—occurred between 1984 and 1998. In all, about 600,000 gallons of wastewater flowed onto the Mojave desert. Molycorp was sued by the San Bernardino County district attorney and paid more than $1.4 million in fines and settlements [8]. A consortium, including Goldman Sachs and Pegasus Capital, bought Molycorp in 2008 as rare earths prices were tumbling [9]. The site was reopened for a brief period but eventually closed under bankruptcy in 2015. In June 2017, the site was purchased by MP Mine Operations LLC, a Chinese mining consortium for $20.5 million [10]. This purchase supports claims that China will be meeting its domestic shortfalls through foreign investment in mines [7]. Mining interests urge President Trump to nationalize Mountain Pass to block Chinese ownership [11].

The U.S. Geological Survey has outlined 23 “principal” domestic rare earths deposits, 19 of them in western states. The result has been a run on rare earths claims in Idaho, Alaska, California, Arizona, New Mexico, Colorado and Utah. Even if the Mountain Pass facility had produced at full capacity, experts claim that the U.S. needed at least seven mines the size of the Mountain Pass to meet the demand for magnets for wind turbines alone [3].

The USGS National Minerals Information Center reported that the nation was 100 percent import reliant on 20 mineral commodities in 2016, including rare earths designated as “critical” or “strategic” to the economy. Between 2012–2015, the U.S. imported 72% of its rare earths from China [12]: 134). Many argue that China’s market domination is due, at least in part, to lax health, safety and environmental controls [13]. However, over the last decade, China has become an unstable trade partner for the U.S. Geopolitical tensions arose in 2010 when China drastically cut 40 percent of global exports of rare earths. While the Chinese claimed their actions were based on the need to improve pollution and safety at mine sites, and conserve domestic supplies, many analysts believe the import restrictions were due to a maritime territorial dispute with Japan [14]. The U.S., E.U. and Japan sued China over its protectionist practices at the World Trade Organization (WTO). In a 2014 ruling, the WTO Court found in favor of the U.S., E.U. and Japan citing China’s use of export taxes, quotas, and bureaucratic delays to effectively create an artificial shortage. After losing its WTO appeal, China removed its export controls. Nevertheless, these geopolitical concerns led the U.S. Department of Defense and Department of Energy to reclassify rare earths as “critical” to economic growth and energy security and of “strategic” importance to national defense interests.

While the U.S. has ample domestic supply of rare earths, the main challenge to new exploration is the lengthy permitting process. It is anticipated that a new rare earth mine will take an average of 7–10 years to receive state and federal permits, and several additional years for site development before any production begins [15]. The instability of global supplies, coupled with its immense importance to the renewable energy industry and national security, led the 114th U.S. Congress (2015–16) to sponsor three different bills, including the National Strategic and Critical Minerals Production Act of 2015 (H.R. 1937). This bill aimed to more rapidly develop domestic rare earth elements of strategic importance to American economic and national security, and manufacturing competitiveness. Two of the bill’s key provisions caused great concern: a 30-month limit on the total review process for permitting and severe curtailment on citizen suit provisions. Since Trump’s election, additional federal bills have been proposed in both the House and Senate to address the gaps in rare earths infrastructure and technical expertise, including creating a rare earth research program and extending loan guarantees for mining and processing operations.

Rare earth prospecting has drawn the attention of local and national environmental organizations throughout the U.S. and Canada, particularly among native rights groups. Local host communities, concerned about groundwater, surface water, air and sediment pollution, have launched campaigns with international implications. For example, the “Tarnish Toyota” campaign led by the Algonquin tribe contested the acid mine drainage and public health impacts that would result from the opening of the Kipiwa mine in Quebec. Toyota had guaranteed purchase of 100 percent of rare earths extracted from this mine for the production of hybrid car batteries. I provide additional details about

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3 These estimates were sources from the USGS 2016 Mineral Commodities Summary. See section on rare earths (Pg. 134).
nate activism against mining in the Great Lakes region in the following sections.

In the U.S, because mine sites are often proposed near protected federal lands, citizen concerns include the loss of amenities like scenic views and noise impacts. This is part of a trend where mining sites, like solar and wind energy sites, are increasingly facing opposition in regions of the “New West” where recent migrants have embraced open space over resource extraction [16–18]. A similar phenomenon has occurred across northern Minnesota’s small towns, where North Woods residents began transforming their “landscape of production into one of consumption” in the 1920s interwar years [19]: xiii). The “watery wilderness” amenities of the region have continued to be a direct challenge to mining interests.

2. What is the green energy bargain?

Given the geopolitics of rare earth mining, and the current development imperative for new domestic sources, this is an important moment for policy makers and citizen groups to ask a range of descriptive and normative questions about how we carefully balance long term climate mitigation priorities with local community environmental justice concerns. The rapid development of rare earths mining capacity in the U.S. will require broad based public acceptance. I call this the “green energy bargain”. As new mining projects touch down in local communities, it is not clear that the willingness for such a bargain exists, particularly when these processes are led by state level agencies. The staunch opposition to rare earths mining has been driven by environmental justice activists who call out the unfair ecosystem and body burden that will be borne by those who live near mining sites, particularly native groups. While rare earths are essential for the development of clean energy technologies, the fast tracking of mining projects creates important implications for how local communities can resist the “responsible” mining discourse being asserted. It also further naturalizes the claim that climate change action rests on solving the “strategic materials crisis” so that we can make and consume more of the smarter, greener technologies we demand from raw materials. I return to this last point in the concluding section of this article.

In the case of Minnesota, I am interested in how this green bargain is being defined, negotiated and communicated. Some may argue that rare earth mining struggles are nothing new; that these are classic examples of “jobs versus the environment” rural-urban class conflicts over mining. Yet, unlike the development of mining infrastructure in the postwar period, the new energy economy presents administrative agencies with unprecedented challenges for engaging publics. Yet, there are three fundamental differences when we compare rare earth mining with conventional mining debates, such as mountain top coal or fracking for natural gas. I outline these aspects of the green bargain below.

Clean energy technologies have a high degree of dependency on rare earth elements. As Fig. 2 below shows, there are few reliable and accessible alternatives for many technological applications. Paradoxically, the green energy substitutes for coal and fractured gas, such as wind energy, also require rare earth elements. As a result, environmental activists are challenged to simply argue against new mining prima facie; they must concede that some rare earths mining is required either at home or abroad to achieve the desired rapid and deep decarbonization of the American economy. This is not lost on industry leaders, and their lobbyist associations, who aggressively claim that the clean energy future is being arrested by this materials crisis. They demand the federal government fast track strategic mineral discovery and processing. They have found support among politicians who endorse a free-market, supply side approach to both job creation and emissions reduction. (Fig. 2)

The second major challenge to the green bargain is the role of states and local bodies in approving projects. A new rare earths mine has not been permitted in the U.S since the 1950s, before the passage of the National Environmental Policy Act (NEPA). In addition to NEPA requirements for extensive review of biological, ecological and cultural impacts, any new rare earth mine will intersect with layers of local, state and tribal jurisdictions, each with different processes for public engagement. The Bear Lodge project in Wyoming is an unusual example of a rare earths mine having cleared a contested EIS process [20]. This project, however, seems to have stalled out due to a lack of financing

<table>
<thead>
<tr>
<th></th>
<th>Mine Production 2014</th>
<th>Mine Production 2015</th>
<th>Reserves</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>5,400</td>
<td>4,100</td>
<td>1,800,000</td>
</tr>
<tr>
<td>Australia</td>
<td>8,000</td>
<td>10,000</td>
<td>3,200,000</td>
</tr>
<tr>
<td>Brazil</td>
<td>-</td>
<td>-</td>
<td>22,000,000</td>
</tr>
<tr>
<td>China</td>
<td>105,000</td>
<td>105,000</td>
<td>55,000,000</td>
</tr>
<tr>
<td>India</td>
<td>NA</td>
<td>NA</td>
<td>3,100,000</td>
</tr>
<tr>
<td>Malaysia</td>
<td>240</td>
<td>200</td>
<td>30,000</td>
</tr>
<tr>
<td>Russia</td>
<td>2,500</td>
<td>2,500</td>
<td>NA</td>
</tr>
<tr>
<td>Thailand</td>
<td>2,100</td>
<td>2,000</td>
<td>NA</td>
</tr>
<tr>
<td>Other Countries</td>
<td>NA</td>
<td>NA</td>
<td>41,000,000</td>
</tr>
<tr>
<td>World Total</td>
<td>123,000</td>
<td>124,000</td>
<td>130,000,000</td>
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</tbody>
</table>

Fig. 1. Estimates of world production and reserves of rare earths.

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5 NEPA triggers environmental review for projects on federal lands, funded by federal funds, that impact air and water quality regulated by federal law, and impact species and habitats protected by federal law.
Table: Technology, RE Element(s) Used, Function of RE Element, Degree of Dependence on Rare Earths

<table>
<thead>
<tr>
<th>Technology</th>
<th>RE Element(s) Used</th>
<th>Function of RE Element</th>
<th>Degree of Dependence on Rare Earths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Vehicles</td>
<td>Lanthanum, neodymium, and dysprosium</td>
<td>Batteries and magnets in electric motors</td>
<td>Significant use of rare earths, however, potential substitutes for rare earths in electric motors are under development.</td>
</tr>
<tr>
<td>Wind Turbines</td>
<td>Neodymium and praseodymium</td>
<td>Permanent magnets for next generation wind turbines</td>
<td>There are no known substitutes for neodymium magnets.</td>
</tr>
<tr>
<td>Fuel Cells</td>
<td>Lanthanum and yttrium</td>
<td>Provides conductivity and used as a stabilizing dopant</td>
<td>Because recent technology advancements expect to reduce the need for rare earths in fuel cells, no significant rare earth supply issues may occur in this area.</td>
</tr>
<tr>
<td>Electric Lighting</td>
<td>Yttrium, europium, and terbium</td>
<td>Used in phosphor powders which allow compact fluorescent lights and LEDs to achieve high levels of efficiency</td>
<td>There are no known substitutes for yttrium. The demand for yttrium, europium, and terbium are expected to grow significantly.</td>
</tr>
</tbody>
</table>

Fig. 2. Dependency on rare earth elements.

[21]. Compared with conventional hard rock mining, Clagett [3] argues that permitting for rare earths is particularly challenging because there is “no set of instructive federal regulation or guidance to help mining companies or the public understand which permits are required to open a rare earth mine” (2013: 135).

Federal calls for the fast tracking of new rare earths mining will not circumvent local and state regulations, creating an opportunity for states to lead the charge on defining and resisting new mining. This was the case with Wisconsin’s landmark Mining Moratorium Law, also known as the “Prove it First” law, which halted new mining in the state. Under the law, prospective developers must first provide an example of where a similar mine in the U.S. or Canada has not polluted surface or groundwater during or after mining before the state can issue a permit for mining of sulfide ore bodies. The Sierra Club and native activists have heralded “Prove it First” as an exemplary law that needs to be replicated in other states and applied to rare earths debates. State governments are particularly challenged to promote rare earths projects in the Trump era, given the historic rollback of federal clean energy and climate policy and an aggressive federal pro-mining stance.

Lastly, one of the more paradoxical rationales for new rare earths mines in the U.S. is the environmental justice implications of re-domesticating a dangerous global industry. As this Minnesota case study will go on to show, rare earths mining proponents, particularly corporate leaders, claim that it is ethical to bring this industry home where strong American environmental laws can monitor development and protect people and places. Given the egregious human rights violations associated with rare earths mining in China in particular, this may be a compelling reason for activists to consider making concessions toward a U.S.-based rare earth mining industry [22]. On the other hand, this corporate speak is often interpreted as greenwashing by environmentalists who point out that the same multinational mining corporations developing U.S. sites are responsible for the human rights violations abroad.

3. The extractive turn in the social sciences

As Sovacool [23] describes in his inaugural article for this journal, scholars need to approach themes related to energy justice, scale, institutions and innovation with an interdisciplinary methodology (2014). The social science literature has already taken a critical look at the political economy of renewable energy, including examining the life cycle impacts of technologies and concerns about public attitudes and social acceptance [24–27]. My interest in this article is to connect the robust social science literature on energy transitions and energy justice, with decades of scholarship in geography and anthropology on the impacts of extractive mining on community well-being and ecosystem health. This kind of analysis helps us consider what it might take to achieve a “green energy bargain”.

For decades, anthropologists and geographers have been investigating mining’s impacts on communities and the explosion of resistance movements, particularly in the Global South.6 The more recent qualitative and applied literature in these fields has investigated how corporate social responsibility programs are emerging in response to both community critique and the need for public buy-in of mining operations [28–30]. The literature on sustainable mining, corporate social responsibility, and a corporation’s “social license to operate” provides insights into the material politics of project development [31,32]. According to the late ecologist Robert Goodland, who many considered the World Bank’s “social conscience,” mining is always an issue of social justice, because the impacts on agriculture and the environment are mostly borne by the poor. Goodland [33] argued that “responsible mining” is fundamentally about the design of operations to secure optimal net benefit for the citizens of the host country over the long term with the lowest social and environmental impact. Goodland claimed that obtaining a “social license” requires mining companies to gain the respect, trust, and collaboration of governments and local populations, especially indigenous communities (2012). Historically, social license in the U.S. was tied to “company towns” where mining companies provided the social and human services infrastructure, like hospitals, parks, and desirable housing for workers, required to settle the frontiers of capitalism [34]. In the heyday of mining, American company towns were often prosperous, cosmopolitan, culturally diverse, and bestowed with urban architectural gems like opera houses.

While there are no agreed-upon criteria that determine when or how a social license is to be granted, McAllister et al. [36] argue that it is a widely-accepted principle throughout the mining industry that companies have an obligation to maintain and promote the social and biophysical health of the region affected by their operations (2014). Yet, it is entirely unclear to whom the corporation is primarily responsible; is it to a federal agency, a state regulatory body, citizens groups, or corporate shareholders? When there is a lack of social resistance to a project, mining corporations assume that this signifies a “social license” to operate rather than a lack of routes for social response [37]. As Owen and Kemp argue, minimal community resistance is a poor measure of social license because it conflates available evidence of support with “actual” levels of support. While the notion of a social license has been used by industry to suggest its goodwill about the social dimensions of a project, it has rather operated as a way of limiting business risk.

The geologic turn in the social sciences draws readily from the work of STS-informed theorists, particularly surrounding the emergence of the Anthropocene [38,39]. There is a rich tradition in Science and Technology Studies (STS) of work on energy infrastructure [40–42], including more recent work from STS scholars appearing in Energy Research & Social Science [43,24,44]. There is also an emerging interest in the field of renewable energy ethics and policy, evidenced by the

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6 In parallel, environmental historians have also examined the impact of mining. See J. R. McNeill and G. Vratis’ 2017 book Mining North America: An Environmental History, 1522–2012.
June 2013 special volume on Energy Transitions in *Science as Culture*. Yet, there is a surprising lack of specific STS work on mining specifically, or extraction as a domain of research. The major exception is Gabrielle Hecht’s work on uranium mining. In her 2012 book *Being Nuclear*, Hecht details the geopolitical history of the African uranium trade, tracing both the flow of materials and how large mining companies and postcolonial powers downplayed the health risks connected with mining.

Given the importance of rare earths to the material realities of a post-carbon economy, this is clearly a ripe area for development within energy policy scholarship. As Raman [46] argues, “the socio-technical networks of renewables extend beyond the point of energy supply to include materials, institutions and publics involved in the production of these technologies”. She goes on to write that a “socio-technical perspective requires making visible the political economy of metals required for renewable energy technologies” (2013: 175). The emergence of “responsible innovation” in STS is a useful theoretical lens for considering the future of rare earths mining. It also extends the anthropological and geographical work on the “social license to mine” toward governance issues and the design of “just” energy infrastructures.

4. **Mining Minnesota**

Polymet’s mammoth northern Minnesota project, called Northmet, would create an open pit mine with adjacent temporary and permanent stockpiles. The company’s plan is to refurbish a portion of the former LTV Steel Mining Company (LTVSMC) processing plant and construct a new hydrometallurgical facility at the plant site. In addition, they will construct an upgraded tailings basin, waste water treatment facilities at both the mine site and plant site, and add to existing utility infrastructure and rail lines. The project requires the Forest Service to swap Superior National Forest Lands for five tracts of private lands within the Superior National Forest proclamation boundary. The Forest Service approved the land swap in 2016.

This $650 million project is located between the towns of Babbitt and Hoyt Lakes in northern Minnesota, in a region known as the Iron Range (see Fig. 1). The project area is within the headwaters of the St. Louis River, which flows into Lake Superior, considered to be the wildest and most pristine of the Great Lakes. According to the company, if permitted, the mine will annually extract 72 million pounds of copper, 15.4 million pound of nickel, and thousands of pounds of other metals including cobalt, platinum, palladium and gold from this site.

Polymet is new to the mining business. This junior mining company, headquartered in Vancouver, has never operated a mine before. Polymet is, however, backed financially by Glencore, the giant and controversial Anglo-Swiss multinational commodity trading and mining company. Glencore trades, manufactures, refines, ships, or stores at least ninety commodities in three dozen countries. Fortune Magazine’s article on Glencore described how “the commodities that Glencore mines and moves now touch virtually every facet of our hyperwired lives. Charge your cell phone, turn on your computer, flick the light switch, drive your car, ride a train, take a flight, eat a bowl of cereal or a plate of sushi, or drink some sugared coffee—Glencore could have had a hand in all of that” [47]. In 2015, with sales estimated at $170.5 billion, the company ranked 14th on the Global 500, above Boeing and General Electric. Glencore’s board of directors is currently chaired by former BP CEO Tony Hayward, who was at the helm of BP when the Deepwater Horizon disaster occurred. Glencore has an exclusive agreement with Polymet to sell the mined metals on the global commodities market. Glencore has underwritten the expensive and arduous process of gaining permits from various federal, state, and local agencies. Glencore’s experience, expertise, and capital are invaluable for linking this isolated region of Minnesota with the international market for precious metals.

4.1. **Current permitting status**

The permitting process for Polymet’s Northmet Mining Project began nearly ten years ago, and has already cost the company $200 million. In 2016, the Final Environmental Impact Statement (FEIS) for the project was approved by the Minnesota Department of Natural Resources (DNR), the U.S. Army Corps of Engineers, and the U.S. Forest Service (USFS). Polymet submitted its first set of permit applications in June 2016 following approval of the FEIS. PolyMet must now secure an additional 20 state and federal permits for the mine, including a permit to mine from the DNR. If and when the DNR approves a draft permit to mine, the permit will be subject to a 52-day public review period and a likely formal “contested case hearing” in front of an administrative law judge due to local opposition. In short, the project will remain in limbo for at least another year, and environmental groups are ready for the fight. One attorney from the organization WaterLegacy stated that “What was in the final environmental review was certainly not enough to protect Minnesota’s environment or Minnesota’s financial responsibility” [48].

This project has generated more public comments than any other in state history. The DNR reported that the draft EIS generated nearly 52,000 comments, of which 5000 were unique letters rather than form letters. The agency reported that they received an additional 30,539 submissions during the public comment period on the final EIS in 2016, of which about 800 were categorized as unique.9

The NorthMet open pit mine straddles the highly touted Superior National Forest, raising concerns over environmental compliance and harm to water quality. The project is also in close proximity to the Boundary Waters Canoe Area Wilderness, which ranks as the most visited wilderness area in the U.S. In addressing these concerns, Polymet declares on its project website they are devoted to “comply [ing] with all applicable state and federal standards designed to protect Minnesota’s water, air, and other natural resources”.

4.2. **Polymet’s support base**

Minnesota’s mining story began in the 1880s when iron ore was first extracted from open pits on the Iron Range. The Iron Range is a broad term used to describe nature and society in the northeastern corner of the state. The term marks the geological features of iron ore-rich mountain ranges, of which the Mesabi Range is furthest to the west. The Iron Range also refers to the political geography of an area composed of nine counties. Within these counties, many company towns that are now ghost towns, form a string-like pattern following the development of mining deposits. The population of the Iron Range is older and whiter than most of the rest of the state. While new immigrants flock to the urban regions of Minnesota, the Iron Range lacks economic and cultural diversity. The Star Tribune reported that in December 2016, Hibbing’s unemployment rate was double that of Minneapolis [49]. It is hard to get your bearings when traveling across the Iron Range. What seems like natural topography is most often the result of mining waste. The emerald green lakes that dot the Range, more reminiscent of Colorado than Minnesota, are in fact often a toxic soup of mining tailings. One unusual “scenic” overlook, visited by thousands annually, is the giant canyon called the Hull Rust Mahoning open pit mine outside

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7 The author co-led a NSF-funded 2017 workshop on the theme of “STS Underground” aimed to draw out and network scholars working on resource extraction (SES Grant #1632265).

8 In the language of mining finance, a “junior” company carries the risk of exploring a new prospect before it becomes a proven asset. The prospect is then sold to a “major” or “senior” mining company.

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9 I did not have access to all the public comments. These final numbers were reported by the DNR in its FEIS. Available at [http://files.dnr.state.mn.us/input/environmentalreview/polymet/polymet-eis-rod-030316-final.pdf](http://files.dnr.state.mn.us/input/environmentalreview/polymet/polymet-eis-rod-030316-final.pdf).
of Hibbing. This 4 mile-long, 600 foot deep, active open pit mine is emblematic of the how the landscape of northern Minnesota has been shaped by 130 years of industrial development (See Fig. 310). As Francaviglia describes in his book Hard Places, sites like this are an example of both “landscape by subtraction and landscape by addition” (137). Here, human-made mountains constructed of overburden lifted from the mine pits create a topographical effect that would take eons of geological time but in fact happen within an individual’s lifetime [35]: 142).

PolyMet’s proposed Northmet project is located on the Mesabi Range, one of the three ranges that make up the greater Iron Range, and is the largest deposit of iron in the U.S., spanning 120 miles. The sediment here is stable enough that miners can create ledges working their way down the pit since the iron-formation is close enough to the surface. As miners progressed deeper into the earth, they began to create a new landscape shaped mainly by the overburden pushed out of the pit. While the landscape has revegetated over time, the blood red sediment still peeks out in recently eroded places. Fig. 411 depicts a mine pit lake in the town of Virginia, which now provides the city’s water supply. There are hundreds of lakes like this across the region which are the result of old mining pits. There are also six active open pit taconite mines on the Mesabi Range today (Fig. 512).

As I mentioned, the Mesabi Range is characterized by ubiquitous tailings ponds. While the overburden was a place to accumulate soil, rock and other debris that was dug to create the open pit, the tailing ponds serve as another kind of dumping grounds. Engineered like a dam, mineral waste was deposited along with leftover processing chemicals. The main concern with tailing ponds in the current mine proposals is acid rock drainage, an issue limited to mining sulfuric rock. Acid rock drainage occurs when waste rock or tailings containing sulfide minerals are exposed to air and water. If the tailing ponds leak, this drainage could go on to contaminate other watersheds. Opponents argue that this water contamination could last hundreds of years.

Many trends that began in the 1970s changed the trajectory of Iron Range mining. First, the growth of the Chinese mining sector in 1980s deeply affected the economics of Minnesota mining by lower prices on global markets. Second, passage of the Boundary Waters Canoe Area Wilderness Act in 1978 limited industrial development and created a new regional recreational economy that gave rise to powerful, and often urban-based, wilderness advocates. Third, the passage of state and federal environmental regulations and permitting processes created new regulatory hurdles for mining companies, such as the federal 1972 Clean Water Act and the 1977 Surface Mining Control and Reclamation Act that addresses the reclamation of abandoned mines. In 1972, the U.S. Department of Justice filed a lawsuit against the Reserve Mining Company, on behalf of the newly constituted EPA, for its dumping of toxic tailings in Lake Superior. The appeals process dragged on for decades and severely impacted the taconite industry in the process.

Finally, native communities in the Great Lakes region have distinctly challenged development projects that pose threats to water quality in general, and indigenous wild rice production in particular. The Minnesota context is not unique. Gedicks [50] argues that transnational mining corporations are “disrupting and sometimes destroying the communal and subsistence cultures of both indigenous and non-indigenous communities in a process of capital accumulation and dispossession” across the globe (2015: 3). Grossman documented that with the defeat of the Crandon mine in Wisconsin nearly a decade ago, an alliance of Potawatomi, Menominee, Chippewa and Ojibwe activists asserted their political sovereignty in ways that sent strong signals to the global mining industry that they were interested in “environmental repossession” rather than dispossession (2017: 256).

Recent mining proposals face all the above pressures and new constraints. Given the realities of 21st century mining, including the need for precious and rare metals for consumer technologies and the deeply seated tensions around creating jobs and protecting the environment, it is unclear if mining will remain a part of the region’s identity. In the towns surrounding the Mesabi Range, residents seem
unsure what their future identity will be if not connected to mining. While some are quick to point out that mining has made their lives possible and is still “alive” on the Range, others look towards opportunities to “Change the Range” by attracting new kinds of residents and business opportunities. Yet, despite efforts to open new Makerspaces and revitalize downtowns with public arts, the western Mesabi is dominated by a nostalgic mining culture. In comparison, towns like Ely, along the eastern edge of the Iron Range, have been more successful at shaping a new economic and cultural identity. Here, many residents and local businesses are rebranding themselves as the “gateway to the wilderness” due to the proximity of the Boundary Waters Canoe Area Wilderness [19,51].

In many ways, Minnesota’s Iron Range has much in common with other post-industrial “rust belt” regions that ushered in President Trump’s victory. As environmental historian Jeff Manuel has noted, the Iron Range’s economic ties were historically to steel centers to the east like Chicago, Cleveland and Pittsburgh, rather than the local political capital of Saint Paul. While mine closures in 2015 and 2016 continued the job loss in the region, new tourism jobs simply haven’t made up the difference. In the 2016 Presidential election, many residents chose Trump as their candidate, in part as a response to the 360 mining jobs that hang in the balance over the Polymet project. Local reporter Aaron Brown argues that since the early 1980s economic and population decline have changed the demographics and culture of the region and impacted the Democrats historic hold. Brown cites that Trump carried the town of Hibbing, a place where a “Republican hasn’t won the presidential race since Hoover” [52].

A week before the 2016 Presidential election, PolyMet submitted its 427 page permit application to the state DNR, with 14,000 pages of appendices, asking to become Minnesota’s first nonferrous mine. Local politicians have touted the Polymet project as a savior for the region, and hope that the project will prevail in a Trump era. Proponents hope for the return to a kind of economic security the region enjoyed in the 1970s, when jobs were plentiful and high paying. Polymet claims it will generate community development, provide precious metals to buttress a national clean energy economy, and provide significant tax revenues to the state. In the summer of 2016, when much of the state’s attention was focused on police violence against people of color, the Mayor of
Babbitt, proposed home of the Polymet project, proclaimed at a public hearing that “mining lives matter” too.13

4.3. Polymet’s opposition

Polymet has been met with great resistance throughout the state of Minnesota. A coalition called “Mining Truth” was formed by the organizations Conservation Minnesota, Friends of the Boundary Waters Wilderness, and the Minnesota Center for Environmental Advocacy to combat the project. Their chief concerns are water quality, human and ecosystem health, clean up assurances, and the effects on the region’s robust tourism industry. Mining Truth has reported that their analysis showed that 98 percent of those who submitted comments on the EIS expressed opposition.14

Activists cite the fragility of the Lake Superior as one of their central concerns. With a residence time for pollutants in Lake Superior at close to 200 years, contaminants that enter the Lake are retained and become more concentrated with time [53]. Water outflows are also relatively small (less than 1 percent per year) in comparison with the total volume of water in the lake. To protect the water that eventually reaches Lake Superior, all the snow and rain that falls onto stockpiles and into the open mining pits will need to be contained and treated, along with any water that leaks from the tailings basins where leftover waste is deposited. This colossal engineering task has not dissuaded Polymet. Despite the inherent risks, Polymet CEO Jon Cherry stated this mine is a once-in-a-lifetime opportunity for both his company and the state of Minnesota. According to Cherry, “Part of what makes this exciting for me and for Polymet is to have the opportunity to be the first one in the state of Minnesota, and to do it in a way that sets the standard, the bar, for a lot of the other ones that will be developed” [54].

Three hundred years ago the Iron Range was all Dakota land. The Polymet project has met with vocal resistance from the local native community who depend on the waters for their wild rice cultivation. The Ojibwe bands (Fond du Lac, Bois Forte and Grand Portage), which retain hunting, fishing and gathering rights in the 1854 Treaty Ceded Territory, have been among the sharpest critics of the project. Sharon Day is a water activist, and Fort Bois Ojibwe elder. She has spent years walking the rivers of the state to draw attention to pollution. In response to claims of responsibility, she retorts that forty percent of the waters in Minnesota are impaired under the Clean Water Act, including the headwaters of the St. Louis River.15 In her opinion, there is no evidence that Minnesota does it right. Famed native activist Winona LaDuke has also gotten into the fight proclaiming that Polymet’s project is a form of “extreme extraction,” no different than the Dakota Access Pipeline.16

In the most recent chapter of the battle against Polymet, the Center for Biological Diversity and Earthworks are suing the U.S. Fish and Wildlife Service and U.S. Forest Service under the Endangered Species Act for their approval of the PolyMet EIS in the Superior National Forest. They claim the project will destroy important habitat for the gray wolf and Canada lynx, both listed as “threatened” under the Endangered Species Act. According to Lori Andresen of Earthworks, “the science shows that these sulfide mines always pollute the water – even the state of Minnesota has acknowledged pollution is inevitable. Great Lakes communities and endangered species don’t want and don’t deserve the fragmentation and toxic sulfide mine waste PolyMet’s mine will generate.” [55]. The state is home to about 250 lynx and about 2200 wolves.

4.4. Polymet’s responsible mining discourse

Mining companies aim to assuage community concerns, and gain a social license to operate, by claiming they will act “responsibly” in the region. Across the mining industry, the term “responsible mining” currently maneuvers with great interpretative flexibility, often privileging the role of corporations in shaping the discourse around project planning. Most of the responsible mining literatures emerge from transnational corporate coalitions, like the Mining Minerals Sustainable Development Project. Herein, “responsible mining” references the rectification of egregious environment and human rights conditions in far flung places, like regions of Indonesia, Papua New Guinea and southern Africa [56,57].

On the Iron Range, PolyMet interprets responsibility to mean complying with EPA and state standards, along with providing jobs and buttressing local economies. In 2017, PolyMet was honored by the American Exploration & Mining Association for its responsible development of the NorthMet Project. It received the Platinum Award for Corporate Excellence for its “outstanding commitment to environmental responsibility, community engagement and employee safety”. The press release goes on to state that Polymet is being recognized for “embodying the mining industry’s commitment to sustainable mining practices, environmental stewardship and commitment to the community.”17; PolyMet will need to raise more than half a billion dollars from investors and lenders to build out the mine, with financing likely to come after permits are approved. It is important it maintains a reputation of environmental and social responsibility to attract that financial capital.

Polymet’s media campaign has saturated the state. Corporate communicators defend their project, such as in a tweet stating “PolyMet will responsibly develop Minnesota’s copper-nickel resources while providing metals needed for everyday life and a green economy”. The project website cites PolyMet’s commitment to “responsibly develop our state’s natural resources to help manufacturers produce many of the things that make our lives safe, healthy, clean and comfortable. Things like solar, wind and other types of alternative energy, smartphones, high-tech medical devices, and hybrid cars”. PolyMet’s CEO, Jon Cherry, has argued that it is responsible to mine Minnesota by stating that the minerals for cell phones and other desired technologies “have to come from somewhere, why not get them here in our backyard with some of the most progressive and stringent environmental regulations on the books”.18 Extending this discourse, the Polymet website features the below image in Fig. 4 called “Metals We Depend On”.

Polymet’s allies in state government have also taken up its responsible mining discourse. At a 2014 public hearing for the Polymet project, State Representative Tom Rukavina scolded mining opponents to leave their cell phones and iPads at the door if they didn’t support Polymet. In a well-orchestrated action, miners wearing hardhats stood in the back of the hearing room holding up and shaking giant paper bags. “All these little gadgets that you have are made from minerals...You can export your pollution to China, or you can have slave labor in Africa, but right here you can have good union mining jobs in the state of Minnesota,” Rukavina told a boisterous crowd [58]. In a similar statement after the Trump election, Kelsey Johnson, President of the Iron Mining Association, stated that miners are good at what they do and have been doing good for over a century. “We have a duty because we have the history and we have the ability to be responsible,” she argued [59].

In 2017, the debate got even more vitriolic with accusations that miners are the “real environmentalists”. In her blog titled “The

14 Compared with public comments submissions, public polling results on Polymet has been highly controversial. The most respected poll is the one Mason-Dixon conducted throughout the state in 2014. They determined that 46% of respondents wanted approval, 21% rejected the project, and another 30% remained undecided.
16 October 13, 2016 “Stop Polymet” rally in Weida Park, St. Paul.
17 This statement was drawn from http://www.uppermichigansource.com/content/news/Mining-group-honors-Eagle-Mine-PolyMet-Mining-406932255.html.
Arrogance of Environmental Activists”, Cynthia Omerza Stene, Chief Operations Officer for Fight for Mining Minnesota, wrote

Activists clearly trade the infinitesimal potential of mining hazard here for the lives of tens of thousands of children all over the world, forced into servitude and subjected to all sorts of unsafe mining practices. Activists would rather the Rain Forest be bulldozed at mind-boggling rates than have our own U.S. environmental regulations ensure the preservation of our global ecology. By curtailing mining here, activists support the unsafe, unguarded mining practices of countless countries all over the world rather than championing the safe mining technologies here, at home.19

The above statement underscores that Polymet’s responsibility is about safe practices, ones that pose only an “infinitesimal” threat to people and place in Minnesota. Responsibility hinges on doing little environmental harm, while providing jobs. While Polymet’s proponents reference human rights violations abroad, and safe mining at home, the company makes no promise that local norms of engagement in any way impact global practices, especially given global demand for metals.

4.5. Polymet’s social license to operate

Polymet rests on a claim that it has support from the community, or a “social license to operate”. Mining scholars often use the term “social license” to describe how community buy-in is as important as regulatory approvals for determining the success of a project. The term is often attributed to mining executive Jim Cooney, who coined the term in the 1990s to refer to the on-going consultations between a mining company and the local communities that included a “precautionary approach” to regulatory compliance to deal with potentially high impact environmental disasters and an agreed on plan to optimize the economic benefits from a mine to local communities [60: 230]. Achieving a social license is also now a trademarked process that many consulting companies offer as a service to mining companies to help generate social capital.20 The “social license” theme is so important to mining in Minnesota that an entire stream of panels and presentations was devoted to the topic at the 2016 Society for Mining, Metallurgy & Exploration conference in Duluth (Fig. 61).

It is striking that those who support new mining on the Iron Range beckon to a 20th century version of the social license to operate. Historically, company towns were forced to do good by their workers as a result of active protest from progressive reformers who were concerned about the conditions in the mines and the need to retain wealth for their community. These struggles were led by unions, largely representing the new Swedish, Finnish and Italian immigrants to the region. The grandiose public buildings of the Iron Range, like Hibbing high school with its marble floors, frescoed ceilings and crystal lighting, are a reminder of the power that local politicians, like famed Hibbing mayor Victor Powers, wielded to force mining companies to help generate social capital.21 The “social license” theme is so important to mining in Minnesota that an entire stream of panels and presentations was devoted to the topic at the 2016 Society for Mining, Metallurgy & Exploration conference in Duluth (Fig. 61).

Today, Polymet’s responsible mining discourse, echoed by some local residents, industry proponents and politicians, references legal permitting expectations, as well as the extralegal need for community buy-in. Polymet suggests it has a social license to operate because local residents want mining. Writing in the local newspaper, Nancy Norr, Chair of the organization Jobs for Minnesotans, cites the importance of Polymet’s social license to operate, arguing “The project is a beacon of hope for the East Range communities that have waited patiently for the completion of the 10-year environmental review process” [61]. Those who stand in the way of mining are routinely referred to as NIMBY opponents, or worse, as urban tree huggers who do not live on the Range.

Yet, compared with the kinds of obligations a company felt toward its employees in the early days of Minnesota mining, today a social license to mine must go well beyond the borders of a mining town. Citizens and government officials are taking a much wider set of issues into consideration in determining assertions about future prosperity, mining heritage, and what responsible stewardship must look like. Owen and Kemp [37] go further in arguing that “Nothing short of a move away from social license at the project level is required to pave the way for a more proactive stance towards sustainable development” (2013: 34).

While the company and the media make a general claim about local support, there are many local residents who fear threats to watersheds in the region, and fear reprisal for going against Polymet. At a 2016 public hearing, one local resident stated to mining interests, “You owe us more than a Faustian choice between economic stagnation and a kind of pollution that lasts 500 years”.22 Local residents employed in non-mining sector jobs still fear social and economic reprisal if they speak out against Polymet. Others avoid speaking for or against the mines all together, and instead discuss the need to bolster economic diversification. These residents point out that healthcare not mining is the biggest employer on the Iron Range. In 1944, there were 94 mines open on the Iron Range, by 2011 it was down to seven (Manuel, 2015: xxvi). Compared to the peak of iron production in 1979, when mining employed 15,000 in the state, today 4500 people work in mining throughout Minnesota [62]. Mining constitutes only 3.6% employment locally on the Range, and a mere 1% statewide.23

5. Conclusion

While it will likely be years before we know the fate of the Polymet project, this case helps us think about the contradictions, trade-offs, and potential negotiations necessary to usher in the clean energy future. After Trump’s withdrawal from the Paris climate agreement, many state governors and hundreds of mayors committed to the “We Are Still In” campaign to enact the U.S. emission reduction goal in the absence of federal support. A bipartisan coalition of Minnesota legislators are supporting the Governor’s goal of increasing the state renewable energy standard to 50% renewable energy by 2030. This would be one of the most ambitious portfolio standards in the nation, comparable to New York and California. The standard would also require significant new investments in solar and wind facilities, all of which require rare earths metals for their manufacturing. How will state residents, politicians and business leaders balance the goal of clean energy futures, and the concomitant need for metals, with the state’s steadfast commitment to protecting water quality and wilderness? This is one of the central challenges we must resolve when we think about expanding the future of clean energy. With the Minnesota case study as backdrop, I end with three observations about the challenges inherent in defining and regulating responsible mining. Across these issues, I echo the concern shared by Giuro et al. [63] that a long term focus on sustainable development has been replaced by a short term focus on “responsible mining” (2014).

20 See the website for the consulting company On Common Ground Consultants at http://sociallicense.com/.
21 From http://www.polymetmining.com/northmet-project/importance-of-metals/.
23 Interview July 11, 2016.

24 Mr. Voitylla. Duluth public hearing, July 13, 2016.
25 Interview with Aaron Brown, July 11, 2016.
First, the national scope of the permitting process, and the global financial complexities of mine ownership, may mean that the terms “responsibility” and “social license to operate” are insufficient analytical categories to serve the interests of citizens and the state. Anthropologists studying corporate social responsibility have long argued that rather than altruism, mining companies see the responsibility discourse as a way of maintaining their agency and control [64]. Resolving tensions about the future of mining requires us to ask what kinds of regulations and public processes should ensure that extensive public engagement happens, especially given broad calls for fast-tracking projects in the name of clean energy development? In other words, who should control the political definition of responsible mining? Is it lawmakers, regulators and the public? Are EIS processes simply too antiquated to fully account for how and which short term benefits (jobs) are balanced along long term risks (climate change and water quality)?

A second, but related issue, is that “responsible” mining is not the same thing as “sustainable” mining, the later term evoking a greater focus on future generations, the global footprint of mining companies, and the need to “think globally but act locally”. Polymet’s proponents equate responsible mining with the re-domestication of mining efforts. Yet, it is not at all obvious that responsible mining in Minnesota mean less irresponsible mining in China or Chile. In the end, as the “junior” company, Polymet will likely sell its holding to a “senior” player, most probably Glencore. In comparison to Polymet, which has a presence in the state, what will it mean to hold Glencore responsible to the people of the Iron Range or citizens of Minnesota. Given that federal lands are being exchanged, the greater U.S. public also has a stake in this project. Examples from mining’s heyday on the Iron Range, when local politicians could exert potent power over mining companies, seems like a very distant reality in comparison to the highly globalized and vertical integration of a firm like Glencore.

Third, and perhaps most importantly, claims that we must choose between risky mining and the consumer demands of clean energy normalizes the discourse of a “critical” and “strategic” materials crisis. Essentially, by looking narrowly at only the corporation and the mine, we have naturalized the assumption that we need more and more raw metals to drive the production and consumption of clean energy technologies. Is there an alternative? A supply side focus on responsibility at the mine site entirely obfuscates policies or practices that might favor demand side solutions, including extended producer responsibility and economy wide materials recycling and recovery programs. Rare earths metals recovery in urban areas, where consumers routinely discard high-tech electronics, has the potential to meet some new demands. Yet, when politicians and industry boosters speak about meeting the rare earths challenge they focus on digging up the earth. While this last issue is beyond the scope of this article, it is a part of the broader social science project that I am investigating, and is central to the scope of this special issue of Energy Research & Social Science.

As the authors of the introductory essay in this special issue point out, issues of justice, equity, democracy and fairness are central to deliberating new energy futures. My article is sympathetic to many of the concerns expressed by the breadth of authors represented in this issue. For example, Lenferna [65] makes an important point in their piece that the U.S. and Canada have a crucial role to play in pursuing climate justice because of their “oversized” contribution to the problem (in press). Yet, at the same time, I am concerned that we notice the important social and economic dislocations that result within North American communities as we pursue a strident path toward decarbonization. Delina’s [66] article on sociotechnical imaginaries in Thailand reminds us of the tensions between “development first” and “climate first” narratives. I believe my look at northern Minnesota reveals that these narratives are also ever present in the U.S., especially in rural communities grappling with decades of economic stagnation. This Minnesota case study also urges us, as do many other authors in this special issue, to dive deep into the tensions between fair and fast, or equitable and efficient, energy transitions [67,65]. As Mey and Diesendorf [68] suggest in their article, we must also carefully consider “who owns an energy transition”, and I would add, who is left in its wake (in press).

In summary, just energy transitions require us to wrestle with what it means to mine responsibly in the future across the planet. The past mining experiences of places like the Iron Range are perhaps a poor model for guiding our future decision making. Terms like “responsible mining”, or even a “social license to operate”, may be too captured by industry to serve public agencies and citizen groups working beyond the borders of company towns. Creating a new architecture for decision making is a challenge that requires not only investigating the conditions when it may be appropriate to mine locally, and perhaps even in the name of re-domesticating extraction, but also when alternatives like urban metals recovery present a more sustainable long term option.

References


