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The Anthropology of Mining: The Social and Environmental Impacts of Resource Extraction in the Mineral Age

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Abstract

This article examines the social and environmental costs of living in the mineral age, wherein contemporary global livelihoods depend almost completely on the extraction of mineral resources. Owing to the logic of extractivism—the rapid and widespread removal of resources for exchange in global capitalist markets—both developed and developing countries are inextricably entangled in pursuing resource extraction as a means of sustaining current lifestyles as well as a key mechanism for promoting socioeconomic development. The past 15 years has seen a massive expansion of mineral resource extraction as many developing countries liberalized their mining sectors, allowing foreign capital and mining companies onto the lands of peasant farmers and indigenous people. This mining expansion has also facilitated the rise of artisanal and small-scale mining (ASM). Transformations in livelihoods and corporate practices as well as the environmental impacts and social conflicts wrought by mining are the central foci of this article.

And not only was the rich soil required to furnish corn and due sustenance,
but men even descended into the entrails of the earth,
and they dug up riches,
those incentives to vice,
which the earth had hidden and had removed to the Stygian shades.
Then destructive iron came forth, and gold, more destructive than iron;
then war came forth.

—Ovid, *Metamorphoses*, Book I, lines 137–143; cited in Agricola [2014 (1556), p. 7]

THE EXTRACTIVE IMPERATIVE AND THE EXPANSION OF MINING IN THE MINERAL AGE

Life in the first decades of the twenty-first century is now characterized as the Anthropocene (Steffen et al. 2007), a new geological epoch in which humans play a greater role in shaping earth systems than do natural processes. Although science is still unsettled on which date to assign to this transition, as the first-century Roman poet Ovid noted, we have had a long history of extracting the entrails of the earth and dealing with the vices and violence that are so often associated with mining, mineral resources, and wealth. Yet, since the late 1990s, novel processes have arisen globally in the extraction of resources. The production and consumption of mineral resources far exceed anything we have ever witnessed historically (Arsel et al. 2016). In fact, our entire livelihoods are utterly dependent on minerals. From the copper that lights our homes and workspaces (LeCain 2009), to the iron ores that shape our transportation systems, to the gold, silicon, lithium, and other various minerals of the “digital age” (Mantz 2008, Smith 2011) that comprise our phones and computers, all these mineral resources underpin the societies and economies of late capitalism in the twenty-first century.¹ While we may be living in the Anthropocene, there is certainly no doubt that we are also living in the mineral age.

In one of the founding ethnographies of mining, Nash [1993 (1979), p. 15] argued that “mines are a synecdoche for the modern age of industrialization” in that they represent the international expansion of capital, the rapacious absorption of natural resources, the acquisition of wealth to the few, and the exploitation of workers. In this vein, mineral extraction continues to illuminate important aspects of globalization in which greater numbers of people find their lives shaped by corporate practices and capitalist logics and evermore environments are exploited and degraded in the name of development. What makes resource extraction novel today is what many researchers are calling the “extractive imperative,” “extractivism,” and “neoextractivism” (Acosta 2013, Arsel et al. 2016). Extractivism is the 500-year history, associated with imperialism and colonialism, of a mode of accumulation whereby raw materials were removed from the Americas, Asia, and Africa to enrich the centers of the world economy. What makes extractivism new and imperative is that it is the primary means of socioeconomic development that developing countries themselves pursue, even in left-leaning nations in Latin America. Extractivism is the “ideological mindset” (Jalbert et al. 2017b) that underlies the rapid, large-scale removal of resources as a form of development that ultimately benefits the wealthy countries at the expense of poorer ones.

What is also new about resource extraction today is the role of international financial institutions (IFIs) and corporations promising moral and sustainable extraction. New resource frontiers are also being created in ever more marginal spaces globally (Childs 2016, Tsing 2005). Much of this

¹Of course, the energy minerals, oil, coal, uranium, and natural gas, do so as well; however, given length constraints I do not discuss these in this article.

resource extraction is occurring on the lands of peasant and indigenous groups, who are both engaging with resource extraction as artisanal miners or workers at large-scale mines and resisting these encroachments on their lands. The ethnographic research on mining serves to document and critically theorize the interplay of capital, corporations, states, and place-based livelihoods, and the impacts it has on the environment. To that end, I address four interrelated developments in the anthropology of mining: (a) livelihood transitions in the context of the expansion of the mining sectors globally, (b) transformations in corporate practices related to the social aspects of resource development, (c) environmental impacts and changing human-environment relations, and (d) the place of minerals and mineral-based livelihoods in creating and maintaining social conflict.

This review builds on two previous *Annual Review of Anthropology* articles on mining. Godoy (1985) summarized the economics of large-scale mines, as well as the social organization and ritual and ideology of mining communities. Ballard & Banks (2003) expanded on this founding work through “the triad stakeholder model” of the corporation, the state, and the community, especially examining how these intersect with and impact indigenous communities in the Asia-Pacific region, and the ethical role of anthropologists involved in mining research, consultation, and advocacy. As such, this review, while not a comprehensive summary of all the fascinating work that has been done in the last 15 years, is limited primarily to works published since 2003.

MINING SECTOR REFORMS AND THE NEW MINERAL RUSH

The last 15 years have seen a significant increase globally in large-scale mining as well as artisanal and small-scale mining (ASM). Prior to the 2000s, unattractive investment policies and political instability prohibited foreign mining firms from investing in mining in most developing countries (Asner et al. 2013; Banchirigah 2006; Fisher et al. 2009; Hentschel et al. 2002; Hilson 2005, 2009; Sinding 2005). However, with pressure from the IFIs, such as the World Bank and the International Monetary Fund, often imposed through structural adjustment programs, many countries liberalized their mining sectors through privatization and deregulation. By the mid-2000s, more than 90 countries, mostly developing, had rewritten their mineral codes and policies (Hilson & Yakovleva 2007). In Ghana, annual outputs in mineral production increased by 500% for gold and by 300% for diamonds between 1985 and 2005 (Hilson & Potter 2005). Mining concessions started covering vast areas of developing countries. In Peru, by 2011 there were 24 million ha, compared with 2.3 million ha of mining concessions in the 1990s (Acuña 2015). This liberalization of the mining sector helped also to drive up commodity prices. The price of gold, for example, went from under \$300 per ounce in 2001 to more than \$1,600 per ounce in 2012; this price increase fueled even greater expansions of both large-scale mining and ASM (Ferry 2016).

While the definition of what constitutes ASM varies by country and researcher, the World Bank (2009, p. 9) characterizes it as distinct from large-scale mining through “low investment, labor intensive local production, informality, as well as no or low levels of mechanization.” Recent estimates indicate that ASM provides direct income earning opportunities for 20–30 million people in more than 80 countries and as many as 100 million people indirectly (World Bank 2009), and yet ASM is often overlooked by international and national development agendas as a viable source of income and poverty alleviation (Hilson & McQuilken 2014). The same structural adjustment programs that facilitated large-scale mining expansion also created a process of “deagrarianization” (Bryceson & Jönsson 2010), particularly in sub-Saharan Africa, depressing commodity prices for crops to the point where many farmers turned to nonagricultural income pursuits. Other farmers in the same region have used ASM to diversify their incomes through a process of improvisation (Mantz 2008, Pijpers 2014). As Smith (2016) discusses for the Maasai in Tanzania, when the

tanzanite (a gemstone) industry was liberalized in the 1990s, it removed ASM workers from the core of the mining area, giving control to a foreign mining company. At the same time, however, this process opened up space for some Maasai to become lucrative middlemen traders, transforming notions of success in a pastoralist society. In other global regions, subsistence farmers are also using ASM to diversify incomes, such as in Indonesia (Peluso 2018, Soemarwoto & Ellen 2010), Mongolia (High 2013), Papua New Guinea (PNG) (Halvaksz 2008, Moretti 2006), and Latin America (Arsel et al. 2016, Cohen 2014, Veiga & Hinton 2002). ASM, as such, is a critical livelihood strategy undertaken by unemployed or underemployed people, and yet it is frequently critiqued by IFIs owing to its linkages with environmental degradation, prostitution and HIV/AIDS, and poor health and safety concerns (Banchirigah 2006).

MINING CORPORATIONS AND CORPORATE SOCIAL RESPONSIBILITY

Simultaneous with the expansion of large-scale mining companies into new global arenas of extraction was an ever-intensifying critique of their activities by international nongovernmental organizations (NGOs) and other activist groups (Rajak 2011a). The response by corporations was to engage in corporate social responsibility (CSR) through programs and other initiatives that benefitted the people who were being impacted by resource extraction. The rise in CSR can be traced to the poor state of the mining industry in the late 1990s, a time when commodity prices were depressed and public opinion of the industry at large was poor (Kirsch 2014). As a response to the poor public image of industrial mining, in 1998, Sir Robert Wilson, Executive Chairman of Rio Tinto, brought together CEOs and other leaders in the mining sector under the banner of the Global Mining Initiative in order to make mining more “sustainable” (Kirsch 2010). In a presentation at Davos in 2000 at the World Economic Forum, Sir Robert noted that “mining has fallen into increasing public disfavour” and that this “current set of preconceptions, if left unchecked, will have a direct effect on the fortunes of the industry. Moreover, they will drive legislation and distort markets in ways that will ultimately harm developing economies, and produce unintended environmental and social consequences” (Wilson 2000).

The outcome of the Global Mining Initiative was a two-year research group called the Mining, Minerals, and Sustainable Development (MMSD) project (see IIED & WBCSD 2002, Kirsch 2014) whose goal was to ensure that the phrase “sustainable mining” would be part of the Rio+10 Earth Summit in Johannesburg in 2002, technically known as the World Summit on Sustainable Development (Whitmore 2006). Out of the MMSD project, the International Council of Mining and Metals (ICMM) was formed in 2001. It was started by some of the largest mining companies in the world—Rio Tinto, Freeport-McMoRan, AngloGold Ashanti, Anglo American, BHP Billiton, Newmont—and today includes 25 mining and metals companies who claim to adhere to the ICMM 10 Principles, such as ethical corporate governance and transparency, sustainability, human rights, and so forth.² While mining corporations were attempting to align their philosophies and practices under the rubric of sustainability (Jenkins & Yakovleva 2006), governments and the United Nations (UN) were also getting involved. At the Rio+10 meetings in Johannesburg, UK Prime Minister Tony Blair announced the Extractive Industries Transparency Initiative³ (EITI), which proposed that governments should publish reports showing their income from resource

²The ICMM 10 Principles can be found at <http://www.icmm.com/en-gb/about-us/member-commitments/icmm-10-principles/the-principles>.

³As of November 2017, 51 countries are now implementing the EITI Standard of reporting; see <http://www.eiti.org>.

development and that companies should report all taxes and fees paid to governments. The key idea behind the EITI was to reduce “the corruption, conflict, and environmental degradation” inherent to the extractive industries sector while promoting “wise management” of the resources (Hauffer 2010, p. 54). Around this time, the UN Secretary-General, Kofi Annan, ushered in the UN Global Compact, which recognized the economic power of corporations and attempted to create a partnership of public–private governance between the UN and multinational corporations (Kuper 2004).

To make mining appear to be sustainable, companies had to transform “the bottom line”—profit—into “the triple bottom line”: profit, people, and the planet (Elkington 1998). In this new formulation, economic growth had to be balanced with an awareness of the environmental damages and social disruptions that mining often produced. In addition to the business of mining, corporations increasingly produced environmental impact assessments, published annual reports on sustainability, and undertook CSR projects (Jenkins & Yakovleva 2006; Li 2009, 2015). As Kapelus (2002) argues, the transnational expansion of mining in the early twenty-first century corresponded with the transnationalization of opposition to mining, especially in developing countries (see Kirsch 2007, 2014). Practices that were socially and environmentally disruptive revoked a mining company’s “social license to operate” (Prno & Slocombe 2012), requiring new sets of practices. As scholars (Hilson 2006b, Jenkins 2004, Sharp 2006) have noted, CSR itself is a form of liberalization by shifting the onus of development from the state to private entities. But as Sharp (2006, pp. 216–17) asks, what are the implications of shifting the state’s role in bettering the economic, social, and environmental lives of its citizens to that of the corporation attempting to do so to the limited set of “stakeholders” or “host communities” affected by its activities?

Within the past several years, anthropologists have addressed these implications through in-depth ethnographic research of CSR in mining contexts. In South Africa, Rajak (2011a) examined Anglo American’s CSR programs to understand how “power is accumulated and exercised through the practice of CSR” (p. 2), in that “CSR creates particular kinds of moral relations within the supposedly amoral realm of corporate capitalism” (p. 14). CSR enables corporations to exercise new forms of authority over their workers and affected communities and in their relations with the state. As a form of moral economy, according to Rajak, CSR appears to be the face of postneoliberal capitalism in its move away from disciplinarian and harsh austerity measures. However, as Rajak (2011a, p. 239) concludes, “The moral economy of CSR represents, not an opposition to corporate capitalism, nor a limit to it, but the very mechanism through which corporate power is replenished, extended and fortified.” One of the key arguments made by researchers of CSR in the mining industry (Benson & Kirsch 2010; Dolan & Rajak 2011; Kirsch 2014; Perreault 2015; Rajak 2011a,b; Welker 2009, 2014) is the need to understand how CSR is performed or enacted and ultimately recognized in what Rajak (2011b, p. 11) calls “ritualistic theatres of virtue,” whereby corporations receive awards for their CSR programs. The Batu Hijau mine in Indonesia, operated by the Newmont Mining Corporation, is the subject of Welker’s (2014) analysis of corporations and CSR projects. Welker (2014, p. 4) argues against the monolithic nature of corporations and seeks to show how an object of corporate analysis, like CSR, is “inherently unstable and indeterminate” and is understood best by how it is enacted by diverse people with diverging and sometimes conflicting ideas of rights, responsibilities, and boundaries.

Inherent to the discourse of CSR used by mining companies is that attending to social and environmental issues makes solid business sense from the standpoint of profitability. Yet a major question remains as to whether CSR is merely greenwashing or a smoke screen to pursue what is undeniably unsustainable resource extraction. Opinions among researchers are split; some argue for a more nuanced approach to the efficacy of CSR (Jenkins 2004, Rajak 2011a, Welker

2014), whereas others are highly critical (Gilberthorpe & Banks 2012, Hilson 2006b, Jacka 2015c, Sharp 2006). Assessing whether mining company CSR efforts are alleviating rural hardships in Ghana, Hilson (2006b, p. 43) is decidedly circumspect and asserts that his “analysis serves as a stark reminder that mining companies are not charities and engage with African countries strictly for commercial purposes.” Examining CSR efforts in PNG, Gilberthorpe & Banks (2012, p. 186) write that “there is little evidence of any real socio-economic development through benefit flows to all sectors of affected communities” (see also Gilberthorpe et al. 2016 for Zambia).

A significant shortcoming in CSR practices is that it is the companies themselves who undertake the programs, provide feedback about the “success” of a program, and determine whether to continue their practices. A case in point is the Porgera Gold Mine in PNG, where I have been working since 1998 (Jacka 2005, 2007, 2015a). In the case of Porgera, in the early 2000s in a show of corporate social performance, the mining company (initially Placer Dome, as of 2006 Barrick Gold) created an advisory committee, Porgera Environmental Advisory Komiti (PEAK), to evaluate both environmental and CSR projects. The committee was composed of mining employees, NGOs, church groups, and academics, and it met biannually. However, following a series of accusations of serial human rights abuses by the mining company, which started to come out in 2010 (Amnesty Int. 2010, Columbia Law School 2015, Hum. Rights Watch 2010), PEAK was unilaterally disbanded and CSR programs were severely curtailed. To date, Barrick has never discussed its actions, and the entire PEAK website disappeared from the Internet shortly after the group was disbanded. As such, it is important not to confuse the shareholders with the stakeholders (i.e., the “community”) in examining CSR practices, as it is to the former that mining companies are beholden.

MINING AND THE ENVIRONMENT

Mining at any scale impacts the land, water, and air in areas at and around where it occurs. Land degradation ranges from moon-like landscapes created by ASM (Aryee et al. 2003, Asner et al. 2013) to massive open pits filled with highly toxic waste water (Finn 1998) and vast tailings piles. Subsequent deforestation also accompanies ASM (Asner et al. 2013, Laurance 1998, Swenson et al. 2011) and large-scale mines (Jacka 2015a,b). Mining’s impacts also extend to water resources (Biersack 2006; Harper 2005; Jacka 2018; Kirsch 2006, 2014; Li 2015) and the atmosphere through the emission of toxic particulates (Hilson 2006a). Mercury pollution is especially prevalent in ASM, impacting land, water, and air, and has significant health impacts on ASM communities (Aspinall 2001, Gibb & O’Leary 2014, Hilson 2006a, Telmer & Veiga 2009, van Straaten 2000, Veiga & Hinton 2002). Finally, mining also has indirect effects through the ways that it reshapes human–environmental relations and ontological perspectives (de la Cadena 2010, 2015; Jacka 2015a; Kirsch 2006; Li 2015; Rumsey & Weiner 2004; West 2006).

Land cover disturbance resulting from mining is particularly problematic in ASM, as nearly all large-scale, corporate mining operations agree to rehabilitate former mines. In the Amazonian basin of Peru, Asner and colleagues (2013) found the rate of deforestation resulting from ASM to have tripled from 2,166 ha per year to 6,145 ha per year following the 2008 global recession. Many of these ASM areas, as mentioned, are pockmarked by craters and are prone to erosion from the removal of plants and trees. These actions, combined with the toxicity of leftover tailings, make land cover regeneration difficult (Rodrigues et al. 2004) or nonexistent in some areas. In Suriname, ASM was estimated to result in deforestation rates between 4800 and 9600 ha per year between 1980 and 2000, and the resulting regrowth of forest was lower in diversity and slow to recover (Peterson & Heemskerk 2001). As most of this land was adjacent to waterways, this slow regrowth of forest is of particular concern owing to sedimentation and other detrimental aspects of an impoverished riparian habitat.

Mining's impacts on water resources (waterways and groundwater) are especially prevalent at both large and small scales owing to acid mine drainage and the water used in processing ores (Long et al. 2013, Schwarzenbach et al. 2010). Acid mine drainage occurs when mining exposes rocks that are naturally abundant in sulfide minerals to air and water, which then produces sulfuric acid (Akcil & Koldas 2006). The low-pH water that pours out of mines in many cases flows across old tailings piles, which add heavy concentrations of toxic heavy metals to waterways. Acid mine drainage lasts for hundreds if not thousands of years, requiring mining companies to create "to perpetuity" abatement plans (Grubb 2016), which are highly unlikely to be carried out, given the life cycles of most mining companies. The processing of ore also impacts water resources owing to the large volumes of water needed and the resulting reincorporation of the water used back into the environment.

Mercury pollution and other toxic metal pollutants that artisanal miners produce, and are exposed to, have received substantial attention in the last decade from social scientists and development studies researchers (Calain 2012). Globally, since 1998, ASM has been responsible for one-third of all mercury released into the environment (Swenson et al. 2011). Peru alone imported 130 metric tons of mercury in 2009, 95% of which was used in ASM (Swenson et al. 2011). Mercury is used in the final stages of ASM processing by binding the gold flakes and miniscule pieces of gold into larger chunks of mercury-gold amalgamate. This amalgamate is then heated to burn off the mercury—frequently this is done indoors without protective equipment, exposing miners to mercury vapors—a powerful neurotoxin. To this point, Hilson (2006a) argues that the priority of mercury in ASM research should be focused on the anthropological component: understanding levels of awareness and promoting mercury abatement technologies. Of concern from a health perspective are the atmospheric emissions of mercury that end up in soils and waterways (van Straaten 2000) and that, through bacterial interactions, catalyze into highly toxic methylmercury. Methylmercury bioaccumulates and biomagnifies up the food chain so that top predators (such as humans and piscivorous fish) end up with high levels of mercury in their bodies (Tschirhart et al. 2012). However, these impacts are not uniform. In a river basin-wide study in a Bolivian ASM area, Tschirhart and colleagues (2012) found that communities that incorporated fishing into their livelihoods had much greater concentrations of mercury than did farming communities.

The greatest attention that anthropologists have given to environmental issues in mining is through exploring the changing human-environmental relations brought by mining development. In PNG, Kirsch (2006) uses indigenous modes of analysis, such as animism, totemism, sorcery practices, and attachment to place, to examine how people living downstream of the Ok Tedi mine responded to the devastation of their homelands by riverine tailings disposal. By interpreting the destructive excesses of capitalist resource extraction through indigenous forms, the Yonggom were able to foster a political protest movement against the mine, resulting in one of the largest out-of-court settlements related to mining-related degradation of the environment (Kirsch 2014). In a parallel vein, de la Cadena (2010) documents the resurgence of "earth beings" into Andean political practices by Andean indigenists. At a countermining demonstration with her friend, Nazario, de la Cadena remarks on the supposed shared interests they had in preventing a mine from being located on a nearby mountain. Whereas de la Cadena opposed the mine for its destruction of pastures, Nazario feared the spiritual wrath that a neighboring mountain would have that could potentially result in people being killed from rock falls and landslides (see Jacka 2001 for a similar situation in Papua New Guinea). Nazario's motivations for protesting were thus to prevent a mountain's ire over a proposed mine. In northern Peru, Li (2015) discusses concerns over the Yanacocha mine, which was being proposed on the sacred, sentient Cerro Quilish. Li's friend, Herlinda, claimed that the mountain would have to "give its consent" before mining could take place, as it was a "fierce" mountain that had already killed mine workers during the exploratory

phase (pp. 107–8). Around the Porgera gold mine in PNG, several researchers (Biersack 1999, Golub 2014, Jacka 2015a, Wardlow 2004) have described ancestral python spirits that live at the base of mountains, cause earthquakes, and are thought to account for the source of gold deposits in the region. Of deep consternation to the people I work with in the eastern Porgera valley was what would happen when mining geologists captured the “diamond python”—the source of all the minerals and petroleum in the PNG highlands—and what new forms of resource dispossession would result now that foreign, corporate powers held the true source of mineral wealth. Similar concerns about the development of a copper mine in Ecuador (Davidov 2014) shaped emergent resource regimes in which certain natural resources (land, copper, biodiversity) were strategically emphasized by diverse political actors such as the state, mining corporations, and local activists. These examples demonstrate the rich potential for further research on “ontological politics” (de la Cadena 2010) and the implications of the transformation of “agentive landscapes” (Li 2015) in the anthropology of mining.

MINING CONFLICTS

A significant contribution to the anthropology of mining in the last decade and a half has examined social conflicts related to mining and its impacts. This issue is certainly not recent, though, as humans have a long, complicated history with minerals. Book one of Agricola’s [2014 (1556)] sixteenth-century treatise on mining and metallurgy traces the—at that time—2000-year-old debate that ancient and medieval scholars were having over the effects of mining and mineral wealth on human welfare, values, and the environment. Contemporary research takes a more nuanced approach as to whether mining is “good” or “bad” and focuses primarily on the processes shaping life in the mineral age: local opposition to mining (Davidov 2013, Kirsch 2008, Shade 2015, Wooden 2017), conflicts between large-scale and small-scale miners (Côte & Korf 2018, Luning 2014, Marshall & Veiga 2017), the role of mineral resources in contributing to social conflicts (Jacka 2016, Le Billon 2012, Welker 2009), and conflicts over the uneven distribution of resource rents (Pijpers 2014).

The relationships that indigenous and local people have with mining is far more complex than an *Avatar* story that pits rapacious mining companies against nature-worshipping natives. In a comparison of four case studies from the United States and Canada, Ali (2003) argues that sovereignty issues factor into indigenous resistance to mining projects more than do anticipated environmental damages. This is not to say that the environment is not a concern, but that it may not be the primary point of contention around the impacts of mining. Some of the opposition that locals have to mining operations is that mining activity, especially in Latin America, is moving into areas occupied by indigenous groups with little to no previous experience with mineral resource extraction (Bebbington et al. 2008). In the Peruvian Amazon, Acuña (2015) documents resistance to mineral and oil development by the Awajun people, who had ceded traditional land that was to become a national park. But in this new era of extractivism, the park’s boundaries were greatly reduced, and mining concessions were created in the freed land. The resulting protest in June 2009 resulted in hundreds of injured people and the deaths of 10 civilians and 24 police officers (Taylor 2011).

Concerns about water have also focused resistance to mining in Latin America (Bebbington & Bury 2013, Li 2016). As Sosa et al. (2017) highlight for communities around the Las Bambas copper mining project in Peru, the need for water resources for the open pit mining reshaped existing and customary water rights in the community, which had always been negotiable and flexible. In this case, the mining company filed formal documents to access water resources, which gave them rights over and above customary uses. In subsequent actions pursued by the communities, the

state recognized the mining company's formal rights, thereby erasing "not just...existing rights and systems...but also...shared community histories and vernacular knowledges" about water resources (Sosa et al. 2017, p. 223). A central commonality in these struggles is addressed by Li (2015), who draws on Fortun's (2001) concept of enunciatory communities that emerge in response to livelihood threats. In the case of the Yanacocha mine in Peru, resistance mobilized around water, but not in terms of scarcity, as the water would be used for processing ore, then treated, and returned to the local waterways. Rather, because the water came from a sacred mountain, the mountain needed to be protected. By framing the opposition to mining around the purposes for which water from a sacred mountain would be used, a much larger set of activists who were neither "environmentalists" nor "antimining" worked to oppose the mine (Li 2015, p. 136). Babidge (2013) presents a more complex and subtle set of conflicts between communities and lithium mining companies in the Atacama Desert in Chile. Here, mining is not a novel situation, but the unevenness of relationships between the companies and the communities is a source of discontent for the latter. In this case, communities sell precious water resources to the companies but do so in the context of relying on the companies to provide information on the environmental impacts of extracting subterranean water resources (see also Carrasco 2016). The conflicts between neoliberal agency—selling resources—and peasant moral responsibility—long-term patron—client partnerships with the mining companies—foster disappointment in peoples' relationships with the companies.

Conflicts between large-scale and small-scale miners are receiving increased attention by social scientists. From the perspective of large-scale miners, the activities of ASM workers are often characterized as "illegal" (Hentschel et al. 2002). The notion of illegality stems from the informal nature of ASM and the rare instances in which artisanal miners have legal claims to mine. In many cases, mining companies are granted concessions by the state to mine, but these are also the lands of local people who may or may not have been artisanal mining. Initially, locals enter the concessions and mine "illegally" but over time are joined by outsiders from the larger region. In Ghana, for instance, as of 2006, more than 13% of the land was under mining concessions; one mine project alone displaced 9,500 subsistence farmers (Banchirigah 2008). As a result, illegal ASM activities in Ghana expanded from 30,000 people in 1995 to 1 million in 2006 (Banchirigah 2008). Ghana has a long history of ASM; artisanal mining operations have been ongoing in some areas since the late 1880s, "long before Western involvement in the country's mining sector" (Hilson & Yakovleva 2007, p. 100). The concessions granted to the large-scale miners are a major source of conflict between large-scale and small-scale miners. In southwest Ghana in 2004, for example, one Canadian mining company was granted a 145-km² concession, in addition to surface mining rights on an adjacent 129-km² property, plus additional smaller concessions in the area (Hilson & Yakovleva 2007). Companies frequently mine on only a small percentage of their concession, and when ASM takes place elsewhere in the concession, states and mining companies declare it "illegal," such as is happening in the Ghana case.

Over the past couple of decades, researchers have sought to understand whether resources in themselves help to fuel conflicts. Le Billon (2012) discusses the varied approaches along three lines: the resource curse literature, resource conflicts, and conflict resources. The concept of the "resource curse" has been extensively covered elsewhere (Bebbington et al. 2008, Gilberthorpe & Papyrakis 2015, Le Billon 2012); in essence, it argues that resource-rich countries are "cursed" by poor economic performance and weak institutions of governance compared with countries with similar levels of income per capita. At macro levels, there is strong support for this argument, but much more work is needed at regional and local scales (Gilberthorpe & Papyrakis 2015). Resource conflicts center around the contestation over territories where scarce resources are located. Conflict resources have garnered the most attention in anthropology through the exploration of blood diamonds and conflict minerals.

While the terms “blood diamonds” and “conflict minerals” are used in the media and by NGOs to focus attention on the role of consumer choices—jewelry and mobile phones—in providing funding for conflicts in developing countries, the results from social science research on whether certain resources help to fuel conflicts are less clear. As Le Billon (2012) highlights for diamonds, the way that the resource is distributed is a critical factor. Diamonds occur both concentrated in kimberlite volcanic deposits and widespread in alluvial deposits from eroded kimberlite sites. Comparing Sierra Leone and Botswana, the alluvial nature of diamonds in Sierra Leone helped to fuel civil war there when it did break out (Maconachie & Binns 2007), whereas the concentrated nature of diamonds in Botswana requires large-scale mining for extraction, limiting the ability of diamonds to be used to prolong conflicts. The role of coltan as a conflict mineral is also contested. Ethnographic research in the Democratic Republic of the Congo (DRC) (Mantz 2008; Smith 2011, 2015) highlights the violence that Congolese warlords inflict on the local population over coltan production and control. By comparison, other researchers (Bleischwitz et al. 2012, HCSS 2013) examine the global production statistics around coltan to demonstrate that the DRC is but one of many coltan producers, and arguing that coltan itself is a conflict mineral is problematic. Nevertheless, certification schemes are now in place in an attempt to legitimize the international trade in conflict resources. In the case of diamonds, the Kimberley process (Bieri 2016) and Fair Trade schemes (Le Billon 2012; see also Hilson 2014 for Fair Trade rubies) are being used, whereas Section 1502 of the US Dodd–Frank Act was passed to certify coltan (Smith 2015).

The uneven distribution of resource rents is also a source of conflict in mining. In PNG, these conflicts have run the gamut from a secessionist civil war, such as the case with Bougainville (Filer 1990), to the hoarding of royalty checks by male heads of household (Golub 2014). Banks (2008) argues that resource conflicts in PNG are less about resources than they are about how individuals and social groups are attempting to shape and further particular social and political agendas. Ninety-seven percent of PNG is held by customary groups who are entitled to share in the benefits of resource development on their lands under national law. As such, being demarcated an official “landowner” associated with a project is of great concern in the country; however, given the dense and overlapping kin ties that shape Melanesian sociality, this process is not straightforward (Jorgensen 2004, Macintyre & Foale 2007). Living in the shadow of a development project, but not being an official landowner has serious consequences. At the Porgera mine, for example, dissatisfied young men turned to what they called “working in the life market”—engaging in interclan warfare with groups who had received money from the mining project to try and extort money from them, or at least die trying, knowing that their lives would then have to be compensated by the group they attacked (Jacka 2015a). The PNG case demonstrates that resources are construed very differently and understood through diverse social knowledges by many non-Western people. As Acuña (2015, p. 86) argues more generally, many socioenvironmental conflicts related to resource extraction derive from different political ontologies in which many indigenous peoples make claims to territory that are alternative to Western political ontologies where the environment is “appropriated and exploited through proprietary entitlements and modern technologies.”

FUTURE DIRECTIONS IN THE ANTHROPOLOGY OF MINING

I conclude with a discussion of three areas for future research—materiality, gender, and “remote” mining. Over 40 years ago, the geographer Harvey (1974) argued for a consideration of the social nature of “natural” resources. More recently, geographers (Bakker & Bridge 2006) have used Harvey’s concept to explore the “materiality” of resources, and this topic has quite recently become potent for exploration in anthropology (e.g., Davidov 2014, High 2013, Smith 2011). In this line of thinking, Richardson & Weszkalnys (2014) ask what the processes are through which

resources come into being and how best to study these ethnographically. A fine example of this is High's (2013) analysis of "polluted money," bank notes that come from money earned from gold mining, where the negative aspects of mining gold transform the materiality of money into wealth that should be used only in conspicuous consumption, not toward socially valued items. Along with studies of materiality, the anthropology of mining would benefit greatly from science and technology studies approaches, which to date have largely ignored the mining process (but see Graeter 2017, Velásquez 2012).

Gender is another area that is understudied in mining (but see Heemskerk 2003, Lahiri-Dutt & Macintyre 2006, Moretti 2006, Rolston 2014). However, recent work that examines women's direct and indirect involvement in mining (Bryceson & Jönsson 2010; Lahiri-Dutt 2012, 2015; Werthmann 2009; Yakovleva 2007) and constructions of sexuality and masculinity in mining sites (Bryceson et al. 2013, 2014; Cohen 2014; Cuvelier 2016; Rolston 2013) are exciting areas for future research endeavors. For example, in his description of Amparo, a single mother of six who takes up artisanal gold mining, Cohen (2014) highlights the opportunities that ASM offers, such as life outside of a domestic sphere and autonomy in a male-dominated world, while also depicting the gender-based violence of ASM camps.

The anthropology of remote mining, or the mining of deep-sea nodules and deep-space asteroids, points to exciting new arenas for future field research. Whereas some countries, such as Namibia, have issued moratoriums on deep-sea mining (Childs 2016), others, such as PNG, are actively pursuing it. In 2011, the PNG government issued the world's first deep-sea mining license for an area rich in marine biodiversity, but the company, Nautilus Minerals (<http://www.nautilusminerals.com>), has thus far failed to garner enough investor funding to begin the controversial project, prompting the CEO to resign at the end of 2017. And finally, anthropology is poised to go to outer space (Valentine 2012), as ethnographers study the mining of asteroids. In 2020, the space mining company Planetary Resources (<http://www.planetaryresources.com>) plans to deploy multiple spacecraft that will explore several near-Earth asteroids to answer the question, "Where will we establish the first mine in space?"

Life in the mineral age has serious consequences for most of humanity and much of our global environment. The anthropology of mining, as such, provides a critical perspective of the destructive processes and effects of resource extraction in which we, as consumers, are all complicit. The importance of this topic is sure to amplify as we expand ever farther in our quest for mineral resources.

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Contents

Perspectives

- Others' Words, Others' Voices: The Making of a Linguistic
Anthropologist
Richard Bauman 1

Archaeology

- Development and Disciplinary Complicity: Contract Archaeology in
South America Under the Critical Gaze
Cristóbal Gnecco 279
- Ethics of Archaeology
Alfredo González-Ruibal 345
- An Emerging Archaeology of the Nazi Era
Reinhard Bernbeck 361
- Bayesian Statistics in Archaeology
Erik Otárola-Castillo and Melissa G. Torquato 435
- Looting, the Antiquities Trade, and Competing Valuations of the Past
Alex W. Barker 455
- Developments in American Archaeology: Fifty Years of the National
Historic Preservation Act
Francis P. McManamon 553

Biological Anthropology

- Ethics in Human Biology: A Historical Perspective on Present
Challenges
Joanna Radin 263
- The Bioarchaeology of Health Crisis: Infectious Disease in the Past
Clark Spencer Larsen 295
- Crop Foraging, Crop Losses, and Crop Raiding
Catherine M. Hill 377

Emerging and Enduring Issues in Primate Conservation Genetics <i>Richard R. Lawler</i>	395
Effects of Environmental Stress on Primate Populations <i>Jason M. Kamilar and Lydia Beaudrot</i>	417
Ethics of Primate Fieldwork: Toward an Ethically Engaged Primateology <i>Erin P. Riley and Michelle Bezanson</i>	493
Hunter-Gatherers and Human Evolution: New Light on Old Debates <i>Richard B. Lee</i>	513
Female Power in Primates and the Phenomenon of Female Dominance <i>Rebecca J. Lewis</i>	533
Anthropology of Language and Communicative Practices	
Food and Language: Production, Consumption, and Circulation of Meaning and Value <i>Martha Sif Karrebæk, Kathleen C. Riley, and Jillian R. Cavanaugh</i>	17
Language of Kin Relations and Relationlessness <i>Christopher Ball</i>	47
The Ethics and Aesthetics of Care <i>Steven P. Black</i>	79
The Language of Evangelism: Christian Cultures of Circulation Beyond the Missionary Prologue <i>Courtney Handman</i>	149
Children as Interactional Brokers of Care <i>Inmaculada M. García-Sánchez</i>	167
Political Parody and the Politics of Ambivalence <i>Tanja Petrović</i>	201
Word for Word: Verbatim as Political Technologies <i>Miyako Inoue</i>	217
Sociocultural Anthropology	
Literature and Reading <i>Adam Reed</i>	33
The Anthropology of Mining: The Social and Environmental Impacts of Resource Extraction in the Mineral Age <i>Jerry K. Jacka</i>	61

Science/Art/Culture Through an Oceanic Lens <i>Stefan Helmreich and Caroline A. Jones</i>	97
Consumerism <i>Anne Meneley</i>	117
Police and Policing <i>Jeffrey T. Martin</i>	133
Industrial Meat Production <i>Alex Blanchette</i>	185
Interspecies Relations and Agrarian Worlds <i>Shaila Seshia Galvin</i>	233
Hybrid Peace: Ethnographies of War <i>Nikolai Ssorin-Chaikov</i>	251
The Gender of the War on Drugs <i>Shaylib Muehlmann</i>	315
Precarity, Precariousness, and Vulnerability <i>Clara Han</i>	331
The Anthropology of Ethics and Morality <i>Cheryl Mattingly and Jason Troop</i>	475
 Theme I: Ethics	
The Ethics and Aesthetics of Care <i>Steven P. Black</i>	79
Police and Policing <i>Jeffrey T. Martin</i>	133
Children as Interactional Brokers of Care <i>Inmaculada M. García-Sánchez</i>	167
Ethics in Human Biology: A Historical Perspective on Present Challenges <i>Joanna Radin</i>	263
Development and Disciplinary Complicity: Contract Archaeology in South America Under the Critical Gaze <i>Cristóbal Gnecco</i>	279
The Gender of the War on Drugs <i>Shaylib Muehlmann</i>	315
Precarity, Precariousness, and Vulnerability <i>Clara Han</i>	331

Ethics of Archaeology <i>Alfredo González-Ruibal</i>	345
An Emerging Archaeology of the Nazi Era <i>Reinhard Bernbeck</i>	361
Looting, the Antiquities Trade, and Competing Valuations of the Past <i>Alex W. Barker</i>	455
The Anthropology of Ethics and Morality <i>Cheryl Mattingly and Jason Throop</i>	475
Ethics of Primate Fieldwork: Toward an Ethically Engaged Primateology <i>Erin P. Riley and Michelle Bezanson</i>	493

Theme II: Food

Food and Language: Production, Consumption, and Circulation of Meaning and Value <i>Martha Sif Karrebæk, Kathleen C. Riley, and Jillian R. Cavanaugh</i>	17
Consumerism <i>Anne Meneley</i>	117
Industrial Meat Production <i>Alex Blanchette</i>	185
Interspecies Relations and Agrarian Worlds <i>Shaila Seshia Galvin</i>	233
Crop Foraging, Crop Losses, and Crop Raiding <i>Catherine M. Hill</i>	377

Indexes

Cumulative Index of Contributing Authors, Volumes 38–47	575
Cumulative Index of Article Titles, Volumes 38–47	579

Errata

An online log of corrections to *Annual Review of Anthropology* articles may be found at <http://www.annualreviews.org/errata/anthro>