

Mercurial Worlds: Producing Toxicity, Risk, and Precarity in Kenya's 'Artisanal' Gold Mining Communities

by

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Dedication

This dissertation is dedicated to Soon Ok and Philip.

For making the investments.

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Abstract

Artisanal and small-scale gold mining is currently practiced in over 70 countries worldwide. It is recognized as an important livelihood activity for the 15 million individuals who participate in it (4-5 million of whom are women and children), despite its association with large-scale environmental pollution, including that from mercury. Mercury is a potent neurotoxin that has long been used in mining because of its abilities to bind to other metals and create an amalgam. However, it is also a global environmental pollutant that can persist in the environment, enter food chains, and flow far from its initial site of release. Decades of failed mercury abatement programs have relied on a mix of policy and programmatic interventions, including: education outreach, the introduction of improved technologies, domestic and international bans on the trade and use of mercury, and formalization policies designed to reorganize the ASGM sector and bring it under formal recognition, regulation, and monitoring. When these programs and policies fail, artisanal and small-scale gold miners are often blamed and characterized as being too poor, too ignorant, or too unconcerned about their environment and health.

This dissertation draws on 22 months of ethnographic field work conducted with western Kenya's ASGM communities between 2013 and 2017. It explores how gold miners make sense of, relate to, and make decisions about mercury—a chemical that they have used for decades and have been habituated to see as harmless—as new but partial information about its risks are becoming available to miners. Paradoxically, increased information about mercury's potential

risks begins to increase the precarity of women as they are burdened with both the responsibility to prevent, as well as the blame that results from, mercury exposure.

It examines how miners understand mercury as both a toxic substance *as well as* one that is necessary for survival, and how those understandings have implications for their practices and management of it. This study demonstrates how understandings about what mercury is and how it affects people and the environment shape how miners perceive its risks, make decisions about it, and (re)produce existing socio-political dynamics. Information is far from apolitical and can be used to further disadvantage already marginalized members of a community, while making miners feel as though they have to choose between being poisoned or being poor.

My last paper examines how precarity is produced or maintained on Rosterman, the largest informal mining camp in Kakamega that regularly attracts thousands of miners from throughout East Africa. This paper traces how obligations of care are drawn upon, invoked, or engaged to strategically gain access, withhold, or unevenly distribute resources necessary for the maintenance and bolstering of life for miners.

Introduction:

Producing Toxicity, Risk, and Precarity in Kenya's 'Artisanal' Gold Mines

Ezekiel and I are driving a motorcycle through the throngs of people streaming out of the shops, bars, and restaurants that line the streets of downtown Kakamega. Everyone is shouting, dancing to music. Young *boda boda*, or motorcycle taxi drivers are swerving their bikes in the road out of drunken excitement. It is September 1, 2017 and the Kenyan Supreme Court just announced it was cancelling the results of the presidential election following a series of interferences, voter irregularities, and the brutal slaying of an election official and his mistress in Nairobi. Western Kenya is a region where the opposition candidate, Raila Odinga, affectionately referred to as *Baba*, or father, has his strongest supporters. Western Kenya is also home to the second largest ethnic group in Kenya—the Luyia—who have never held the presidency despite their large numbers and who, together with their neighbors, the Luo, often feel marginalized in national politics and national development schemes. The Supreme Court decision gave hope to his supporters who felt that finally Kenya was ready to fulfill the promises of a democracy and that maybe this time around, it would be with a son of western Kenya at the helm.

The Supreme Court's announcement shocked the nation. Despite questions of irregularities, external election monitors had declared the election fair, so the country had just assumed that the results would be maintained, that corruption would prevail, and that life would continue as it always had—grinding under the weight and pressure of various states of

abandonment. Ezekiel, who was driving the motorcycle, turned around as we stopped to let the foot traffic move around us, and exclaimed:

You know, Jessica, we are educated now. No longer can a sitting president hope to steal an election. That's what the Supreme Court proved today. We are celebrating because finally, there is one part of the government that is working for the people—for us!—to safeguard our interests.

He could not stop beaming. Upon returning to my host family's home and relaying the news of the Supreme Court decision, which they had expressly avoided assuming the worst, my host father broke out into a large smile. "Are you serious, Jessica?" He immediately went to turn on the radio and we sat for hours listening to the news, soaking it all in. "I never thought I would see the day that the Court would stand up to the president, that we wouldn't be told that we have to accept corruption....And maybe this time, we can pick our real president—*Baba* [former Prime Minister of Kenya and leader of the opposition party, Raila Odinga]—hah!"

This election year laid bare the animating political economic structures that shape the everyday experiences of Kenyans, especially for the many artisanal gold miners I lived and worked with in rural Kenya, in a way that I could never capture in interviews held prior to 2017. Accustomed to being ignored, neglected, and forgotten about, left to struggle without a safety net, and to make do with what little they could get, this election was a visceral manifestation of Kenyans' overwhelming dissatisfaction with the country's political processes and their increasing economic and political marginalization. Discontent seeped into every conversation I had that year. In every interview, every debate, every discussion I had with my main interlocutors and interviewees, my host family, *boda boda* (Kiswahili for motorcycle) drivers,

and fellow bus passengers, there was an underlying anger that laced our discussions, turning every topic—the increased prices in staples like sugar and maize, the prolonged drought, the state of the roads, labor conditions, domestic conflicts, hospital visits, and school fees—into explicit expressions of political dissatisfaction. My interviews from 2017 chronicled judgements about a government that sought to reap as much as it could from its citizens without offering much in the way of social services and much needed infrastructure.

This was especially true among *jua kali* (literally translated as “hot sun” in Kiswahili; used to denote informal or casual labor) laborers. Earlier that year, the World Bank (2017) had released a report that claimed Kenya’s GDP had increased by five-percent and lauded the country for its potential to enter the category of “middle income” countries. But few in Kenya’s rural townships and cities outside of specific concentrations of wealth in Nairobi experienced or enjoyed the benefits of a growing economy. The majority of the Kenyan labor force is employed in the informal sector. A 2017 economic survey conducted by the Kenya National Bureau of Statistics showed that 83.1% (an increase of 6% from 2012 (IEA 2012)) of the country’s total labor force, approximately 13.3 million people, is employed by the informal sector (KNBS 2017).

Among the everyday struggles that interviewees experienced, questions about mercury’s potential, invisible, and latent impacts on their health and environment seemed small in comparison. Indeed, mercury often faded from view until I explicitly brought it up and asked them to re-center it, to dwell for a quick minute on its risks and its potential dangers. Often, this re-centering was met with bemusement as miners who had come to know me over the years humored me. After years of being subject to the perceived negligence, corruption, and incompetence of a government designed to extract as many resources from its people, of the

disconnect between Kenya's new classification as a "middle-income country" whose GDP had grown five-percent over the last year, and the difficulties of their daily lives, and of a confluence of environmental changes that brought a prolonged drought to the country causing widespread water shortages, rationing, and the failure of essential crops like maize and sugar, the miners barely noticed or paid attention to mercury's latent and, oftentimes, invisible risks until they had to confront them.

My incessant questions, the increasing presence of development workers and consultants in the mines planning interventions and policy reports for their head offices, news articles and broadcasts about mercury poisoning in the mines, tour groups gawking at female miners processing gold with mercury, increased government monitoring and regulation that disrupted the well-established patterns of their work on the mines, and eventually, miners' own fears as they began to connect mercury to potential symptoms rendered mercury into a potentially dangerous substance. Little things began to gnaw at them. When they would get a headache or start feeling a tingling sensation in their arms was it mercury poisoning, was it malaria, or was it that they had been working for hours in the hot sun? Questions: *Whether or not? Could it be? And if so, then what do I do?* began to appear in my field notes. As they read and heard more about mercury over the years, their bodily symptoms became fodder for debates, questions, and contestations about whether to believe the government, scientific experts, or the Chinese-*mzungu* about the potential risks, about whether mercury was the cause of disease, and about whether the focus on mercury, like everything else in their lives, was part of a broader politics that was meant in some part to rob them of one of the most lucrative livelihood activities in the area. This dissertation describes these conversations, debates, questions, and critiques, following miners into their everyday lives as mercury simultaneously existed as a life-saving and necessary

substance for securing their economic livelihoods, as well as one full of potential risks and dangers.

In the villages of western Kenya, much like the rest of rural Kenya, the lack of basic infrastructure—water sanitation, roads and transport, education, and medical facilities—shaped everyday life, and stood as reminders of other daily struggles to procure basic necessities. The average wage for a *jua kali* [casual] laborer is the equivalent of USD \$1.50. And everyone is subject to the vagaries of social, political, economic, and ecological systems that make life inherently precarious (Butler 2004; Tsing 2015)—conditions where indeterminacy, uncertainty, and instability become the norm. It often felt trivial to bring up questions about mercury’s risks given this context. Later, it felt as though I was adding to their concerns, simultaneously opening up a space where those fears could be voiced but where there were no easy solutions. When speaking with government officials from the National Environmental Management Authority and consultants with the United Nations Environment Programme, the best solution they offered was to get people to stop using mercury. As I demonstrate in Chapter 1, in the absence of viable, available, effective, *and* affordable alternatives to mercury, miners were convinced that mercury was the only way that they could continue to mine, and therefore, the only way that they could continue securing their livelihoods and quality of life.

Drawing inspiration from Auyero and Swistun’s (2009) ethnographic work in the Argentinean shantytown, Flammable, that was widely contaminated by an oil refinery, I demonstrate that miners’ experiences and understandings of mercury are “anchored” (9, 66) by both the physical and intangible properties of mercury, circulating information about its risks, their own experiences with the chemical, and a prevailing context that made it logical, easy, and at times, *necessary* to dismiss mercury’s potential risks. This dissertation engages political

ecology and science studies to frame and analyze fundamental questions about how we come to know our environment, how we come to understand that something we have taken for granted as safe has been harming us all along, and how, once armed with that knowledge, we grapple with this newfound information and make decisions about how to live in an increasingly precarious world. The central organizing questions that motivate the first two papers of this dissertation, are: *When and under what circumstances did mercury's harmful effects become visible to the miners with whom I worked? How did miners relate to and come to understand mercury as a substance capable of harm and providing value? How did miners discuss it among themselves? How did they seek to contain its dangerous properties? And to what effect?*

It is within this space and context that I argue mercury and its risks need to be understood. The literary scholar, Rob Nixon (2011), notes that “violence” wrought on bodies and places over long periods of time can often go ignored when their effects are slow to manifest (Adam 1998; Nixon 2011). This temporal pattern also resists easy storytelling and the attention of the media because, unlike displays of spectacular and sudden forms of violence, “slow violence” is difficult to capture, largely uncertain, and has long periods of latency (Nixon 2011; Adams 1998). The increasing focus on time as a means of shaping how violence is understood, experienced, and reported on contributes to a growing body of social science literature that seeks to understand the nature and experience of violence (e.g., Farmer 1996; Farmer et al. 2004; Watts 1983; Peluso and Watts 2001; Das 2007; Das et al. 2001; Kleinman et al. 1997; Kirsch 2002; Kirsch 2010), especially those forms that remain unnoticed within societies. These less visible forms of violence are often described as “structural” (see: Farmer 1996; Farmer et al. 2004) or “silent,” (Watts 1983) because they are so widely distributed and embedded within the movements and rhythms of everyday life that we come to accept, maintain, or fail to see their

harmful effects. We become unable to connect them to broader patterns that maintain conditions of marginality and vulnerability for society's weakest and invisible members.

This dissertation demonstrates how silence, invisibility, uncertainty, and temporality come together to make mercury exposure and poisoning, like that of other forms of toxic exposure, inherently difficult to discern. Other uncertainties: is mercury a hazard or a risk in these communities? Do elevated hair and urine levels (and at which threshold) mean that harm is happening? To what extent? How far does mercury emitted into the environment move from these communities? What environmental compartments and which organisms are impacted by mercury's movements through the environment? How do we balance the potential and actual harm caused from mercury use with the benefits brought from mining? And what are possible effective strategies to reduce exposure? Given the large uncertainties, unknowns, and information asymmetries that exist among miners—and that exist for toxic exposure, in general—this work pays attention to the kinds of uncertainties miners considered, their (mis)understandings of the heavy metal, and their practices with it as miners made sense of mercury in their lives and reworked their understandings of it over time. While these (mis)understandings are commonly conceived as the products, as well as a reflection of, miners' ignorance or irrationality, serve as important “epistemic vehicles” by which to examine how miners view and understand their worlds.

Part of this evolving project, however, has been a move away from mercury for methodological and theoretical reasons. I often listened to the concerns of artisanal gold miners, watched as they worked and interacted with one another, noted how resources changed hands in Rosterman mining camp, the largest mining community in Kakamega, participated in their work, and began to wonder how miners forged a life for themselves on the mines. Mercury was, for a

lot of the miners I spoke with, far from their list of immediate concerns. Most of the interviews I conducted did however focus on the role of social networks either for getting started on the mines or maintaining their work and depending on others for (access to) resources and for the enforcement of rules and regulations. But accessing care in the mines came with it relational obligations that could produce their forms of precarity and risk in the mines. By proxy, it also meant that when social networks broke down, or when individuals were left without access to resources, their security in the mines was also put at risk. Research focused on understanding the unique but often invisible roles that women occupy in informal or artisanal mining communities has suggested that an attention to “labor dynamics” might allow for better programming that enhances gender equity in informal extractive industries(Hinton et al. 2003; Hinton 2011). While this research calls much needed attention to issues related to gender equity in mining communities, by producing functionalist accounts that highlight the jobs women occupy on the mines, it misses the fact that while gender is an important factor that shapes resource access, gendered communities—like all communities—are far from heterogenous and fails to account for intersecting subject positions, such as age and race. By throwing relief on relationality and care relations, Chapter 3 demonstrates how individuals in an informal mining community distribute resources and extend care, but how those extensions of resources and care can also produce forms of precarity and risk, act as a disciplinary measure, *and* provide economic security.

I argue that paying attention to relations of care allows us to gain a better understanding of how labor in mining communities operate as well as a more nuanced understanding of relationships, decision-making power, and access to resources. The third paper in this dissertation therefore examines questions about the practice and politics of care by asking: *How*

*do relations of care shape and produce social relations on the mines? How do miners strategically invoke, engage in, withhold, or maintain care in order to access resources? While “care” is often understood according to a romantic or aspirational context (Martin, Myers, and Viseu 2015; Bartos 2018), I also paid attention to how expressions of care were withheld, acted to maintain separations, and were otherwise unevenly distributed, distinguishing between those who “mattered” enough to be cared for, while excluding others, following an injunction from Michelle Murphy’s (2015) call to “unsettle” care and move towards one of *critical care* (Martin, Myers, and Viseu 2015).*

Mercury, Artisanal Gold Mining, and Kenya in Context:



Figure 1: A group of school children watch an artisanal miner process gold with mercury. Source: Author.

In 2013, Kenya became a signatory to the Minamata Convention on Mercury, an international treaty designed to protect human health and work towards the reduction and eventual elimination of anthropogenic emissions of mercury into the environment (Minamata Convention 2019). It is one of a handful of international environmental instruments that seeks to

regulate the release of harmful chemicals into the environment (Gorman, Gagnon, and Norman 2016). The Minamata Convention on Mercury recognizes the fact that artisanal gold mining communities contribute the largest share of anthropogenic releases of mercury into the environment each year, and Article 7 lays out specific considerations for working with countries with significant ASGM activities to work towards reducing or eliminating mercury use in their ASGM communities. In August 2017, the Minamata Convention entered into force. With its estimated 250,000 artisanal gold miners (UNDP 2017), and because of its commitments to the Minamata Convention, Kenya is currently in the process of drafting its National Action Plan to work towards the eventual elimination of mercury in its artisanal and small-scale gold mining communities. It has yet to ratify the treaty, though it has signaled that it intends to do so.

Elemental mercury has long been used by miners to process auriferous mineral ore because of its unique ability to bind to metals and quickly vaporize. Once mixed with the crushed, mineral ore, mercury forms an alloy, which is then burned. Mercury vaporizes, leaving behind the precious metal. But mercury is a complex heavy metal that can exist in multiple states—elemental, inorganic, and organic—that shape both its risk, as well as its ability to move through bodies (both human and nonhuman) and various environmental compartments. While all forms of mercury are considered toxic to human and environmental health, elemental mercury is considered least harmful to human health, although it can be absorbed through the skin (Clarkson 1992). Vaporized mercury, on the other hand, is usually breathed in when miners handle elemental mercury or burn the mercury-gold amalgam. Once inhaled, it readily disperses through the body via the bloodstream and concentrates in the brain, then the kidneys, affecting the central nervous system, the immune system, and the digestive system. Once released into the environment, mercury can travel through surface waters and the atmosphere to areas far from its

initial site of release. The Arctic, for example, has become one of the largest repositories of mercury despite its remote location and the lack of mercury emitting activities in the region.

Both elemental mercury and inorganic, vaporized mercury can be converted by soil microbes to mercury's organic form through the addition of a methyl-group (CH₃).

Methylmercury is the most toxic form of mercury because it is biologically-available and can enter food chains. Once in food chains, it bioaccumulates in the tissues of organisms and biomagnifies in concentration as it moves up trophic levels. Mining populations can be doubly-exposed if they also consume fish who have methylated mercury in their bodies. While risk assessments in or near ASGM communities have begun to measure mercury levels in fish tissues (for two recent examples, see: Bastos et al. 2015; Niane et al. 2014), few have measured mercury levels in fish important for human consumption in the immediate or surrounding areas (c.f., Langeland, Hardin, and Neitzel 2017) leaving a large gap in our understanding of how mining activities are affecting local ecosystems that humans depend on for their daily consumption. It is far from surprising, then, that mercury has emerged as an issue of concern both for those who study global environmental change, as well as for those who work on issues of risk in ASGM communities. Since at least the 1980s, mercury abatement programs have been implemented in ASGM communities worldwide (Hilson 2006). The persistence of mercury use in artisanal and small-scale gold mining communities despite decades of mercury abatement programs has often been explained as the result of a mix of interacting factors, including: poverty that makes communities unable or unwilling to care about their health and environment; a lack of education about mercury's risks that leaves miners skeptical of expert and technoscientific knowledge; and a lack of access to capital and improved technologies that can make mercury obsolete (G. Hilson 2006a; Hinton, J.J., Veiga, M.M., Veiga 2003; Heemskerk 2003); as well as

prevailing social, economic and cultural factors (Heemskerk 2003). Such explanations, and the resulting policies and programs, rely on the logics of ecological modernization that assume economic efficiency and technological improvements will solve complex environmental problems despite the fact that these approaches have largely failed to bring about their stated outcomes (Robbins 2012).

Further, current research on artisanal mining often divorces the activity from a longer history rooted in imperial policies that were designed to prevent African miners from fully participating in the mining sector. In other words, the illegal miner emerged, like many other informal or illegal forms of labor in colonial Kenya (White 1990) through the development of colonial laws that established categories of legitimate and illegitimate forms of labor. This process turned, as anthropologist Robyn D'avignon elegantly describes, “African hunters into poachers and healers into witches” (D'avignon 2016, p.26). Contemporary research on artisanal miners continues this tradition by presenting artisanal miners as “illegal”, characterized by poverty, “ignorance,” and a “lack in technologies and skill” and often associated with vulnerability, risk, labor abuses, and large-scale environmental degradation (Smith et al. 2017; M. M. Veiga and Hinton 2002; Siegel and Veiga 2009; Telmer and Veiga 2009; Hilson 2009a). This dissertation acknowledges this history and is sensitive to and careful not to engage in this broader historical process that assumes the illegitimacy of artisanal and small-scale gold mining simply because of its seeming deficits, location in the informal sector, and pervasive social and environmental impacts. Miners’ current lack of access to technology and capital—two features which development practitioners and researchers posit as the main drivers of the environmental degradation that results from informal mining (e.g., Smith et al. 2017; Hinton, Veiga, and Veiga 2003; Sinding 2005; Jønsson and Fold 2011; Geenen 2012)—stems from their illegal status and

inability to secure capital (Smith et al. 2017). The extractive industries, as a whole, are often connected to large-scale detrimental environmental and social impacts, often operate without attention to existing rules and regulations (and may even seek out spaces with poorly written or poorly enforced regulations), regardless of their size or formal status (Kirsch 2014).

Artisanal Mining, Technical Fixes, and the Production of “Communities of Concern”:

When did artisanal gold mining become a marginal, informal, or even, illegal activity? When was it deemed obsolete and rudimentary, marked by a lack of technology, skill, and knowledge? Gold mining in Western Kenya began in the 1930s when the geologist, Sir Albert Kitson, described the Kakamega gold fields in his reports. The publication of his findings sparked what came to be known as the Kakamega Gold Rush (Shilaro 2007), a mining fever that at its height attracted tens of thousands of white settlers from throughout the United States and the British Empire. Kenya colony had been established as a settler colony with an economy dependent on plantation agriculture. By the end of the 1920s, the colonial administration was desperate for a new stream of revenue to bolster its weakened economy in the wake of the Great Depression, low prices for agricultural commodities on the world market, and years of devastating crop failures caused by locusts and droughts (Shilaro 2007). The decision to allow mining in western Kenya, however, sparked conflicts between miners and natives in western Kenya, as prospectors and miners sank shafts and pits on native lands, family compounds, and agricultural fields. It also invited critiques from British citizens concerned about the effects mining would have on native Kenyans, while threatening their land security (Shilaro 2007). Moreover, mineral rights were only provided to white settlers; black Kenyans were prevented from acquiring permits and licenses to prospect and mine based on the assumption that mineral

wealth would destroy the moral constitution of miners and that natives would waste the gold (Shilaro 2007). Thus, mineral rights were distributed along racial lines, with black miners relegated to positions as laborers in the mines.

When the gold mining industry collapsed by the early-1950s, western Kenyans continued to mine their lands for the precious metal while the newly independent Kenyan state turned a blind eye to their activities. Miners today often state that they learned how to mine from their grandparents who had been employed by the mining companies or by prospectors in the area, and that the use of mercury was part of their initial training. Mercury was not always necessary for processing mineral ore, however. As the deposits have been exhausted, miners have increasingly relied on mercury to capture the minute particles of gold (often referred to as “floured gold” by gold miners). They also depend on mercury to process the tailings from the first “wash,” reprocessing the waste at least two to three times to capture the remaining gold particles (field notes). Mine tailings, then, undergo their own economic cycle and are an important way for women to gain mineral access rights, as explained in Chapter Three.

Policy interventions, then, focus on formalizing the sector and implementing supply-side policies designed to drastically reduce mercury supplies on either the international and/or domestic markets. The argument plays out along the following lines: Formalization will lead to the legal recognition of the activity, allowing the government both to better monitor and regulate their activities because it removes the stigma of an informal or illegal activity. At the same time, formalization will then allow miners to access loans via microfinance or other financial institutions, therefore allowing them to access newer, more advanced technologies that will have a smaller ecological footprint, including reducing their reliance on mercury. Supply-side policies argue that decreased supplies of mercury in the markets will lead to a spike in prices as demand

increases in relation to the availability of mercury, thus pricing miners out of the market and reducing the use of mercury overall.

Both types of policies have failed wherever they have been implemented, however. Formalization has been fraught with tensions. There is very little economic incentive to participate when miners are now having to pay the fees necessary to acquire licenses and permits, in addition to taxes—all of which they never had to do before. Banks are still reluctant to offer loans to mining ventures because of the risky nature of the business, and microfinance offers loans at too high of an interest rate to make them feasible for the everyday miner. Supply-side policies have had the opposite effect, leading to an increase in mercury supplies, as informal communities in countries like Indonesia and Mexico have reopened former mercury mines (UNEP 2017; Spiegel et al. 2018) in order to maintain their supplies.

Programmatic interventions involve the introduction of new mining technologies designed to reduce or eliminate the use of mercury in mining, while others have utilized education outreach to circulate knowledge about mercury's risks (e.g., (Hinton, Veiga, and Veiga 2003; Basu, Renne, and Long 2015; M. Veiga et al. 2006; Spiegel and Veiga 2005). Such approaches have also run into problems because improved technologies have often failed to be tailored to the local geologies, cultures, and economic realities of particular places. Mercury retorts, for example, are designed to capture mercury emissions from the burning of mercury-gold amalgams. Those that were introduced in Ghana were too expensive for miners to access (Hinton, J.J., Veiga, M.M., Veiga 2003; G. Hilson 2006a); others increased the risk of dangerous exposures to mercury vapors when utilized without proper training (Hinton et al. 2003). Borax, a chemical that is being promoted to replace mercury during processing (Appel and Jønsson 2010) is effective for specific geological properties such as the absence of sulfides and for processing

small amounts of gold (Zolnikov and Ramirez Ortiz 2018). While experimental introductions have been made in the Philippines and Tanzania, there is concern that miners do not believe borax is more effective than mercury at processing gold. There are also concerns about the cost of the tools needed to adopt borax as a chemical and its availability (Zolnikov and Ramirez Ortiz 2018). Shaker tables have been introduced to mining communities in Kenya but are cumbersome to operate, break down frequently, require a connection to the electric grid, and are expensive to maintain and repair. When these programs and policies fail, practitioners and researchers often characterize artisanal gold miners as too poor, too skeptical, too ignorant, or too unconcerned to care about their environment and health (Hilson 2006).

Such characterizations are part of a broader historical process of intervention and development in Africa and the so-called Global South that “de-politicize” questions of resource allocation and use (Ferguson 1994). Rather than question how imperial classifications of native miners as “illegal” have contributed to their contemporary present, the socio-ecological problems associated with artisanal mining are blamed on a lack of government oversight, poverty, and other deficits on the part of miners, such as a lack of knowledge or access to technical skills. Africans and other Third World land managers have long been characterized as lacking in technological skill and knowledge (Ferguson 2006; Hecht 2012; Mavhunga 2014); a characterization which makes technology and knowledge appear as exogenous factors that must be imported in order to “solve” African problems and to save them from themselves (Hecht 2012).

Indeed, research on artisanal mining in the 1980s was characterized by attempts to define the category of “artisanal mining” in relation to its seemingly self-evident other, large-scale (corporate) mining (Hilson 2009a). But fitting the activities that were “known” to comprise

artisanal mining—with its diversity of practices, technologies, capital, work force, efficiency, and mineral ore recovery rates—proved to be harder than policy analysts anticipated. Confusion continues about the appropriate delineations of the boundaries of “artisanal mining” but that confusion is often collapsed by references to miners’ utilization of “rudimentary tools,” dependence on manual techniques to recover mineral ore, poverty, lack of technological investment, and lack of technical, geological knowledge (e.g., Hinton, Veiga, and Veiga 2003; Hilson 2009a) . If categories index existing social and moral orders (Bowker and Star 2000), then the inability to classify, like Mary Douglas’ dirt and pollution, represents things, people, and practices that are “out of place”; in need of reform, policing, and regulation (Douglas 1966; Bowker and Star 2000). Such characterizations were supported by early reports of rampant forms of labor abuse, including child labor, environmental degradation, and other social ills that became associated with artisanal mining communities, producing what Huggins, Buss, and Rutherford (2017) term a “cartography of concern,” in which artisanal mining sites that have long been associated with informal or illegal markets need increased monitoring and regulation.

This dissertation takes this history seriously. When I focus on the rumors, narratives, (mis)understandings, practices, and experiences with mercury, it is not to fall into the trap of presenting miners as superstitious, ignorant, or irrational actors. Rather, it is a move towards taking miners seriously as rational actors, to center the fact that all of us operate under conditions of uncertainty and imperfect knowledge, and to argue that how we make sense of our environment under such conditions matter for how we navigate our world, a finding demonstrated by decades of political ecological research (e.g., Robbins 2012; Sultana 2011, 2009; Parr 2010). For miners whose dependence on mercury rests on their ability to produce a semblance of economic security and dignity—a life worth living—their worlds are marked both

by pervasive forms of precarity *as well as* the production of a seemingly more stable world that is silently being undermined by their close contact with this hazardous heavy metal; its insidious effects remaining invisible until they emerge in the form of tingling skin, tremors, coughing, headaches while slowly wreaking havoc on their internal systems. This is an attempt to describe their *mercurial worlds*.

Rather than discard my interlocuters' uncertainties, fears, misunderstandings, experiences, and rumors, these become the core of my evidence. Too often, ethnographic accounts focus solely on what is known by our interlocuters (Auyero and Swistun 2009). This approach makes sense. After all, it is difficult to know what *is* known, harder yet perhaps to discern what isn't. But by displacing these unknowns and "unknown unknowns," we background an important aspect of how we all come to make sense of our worlds. By centering these unknowns, I produce an account of the processes of knowledge production, circulation, and application that often remain invisible in examinations of knowledge transfer and extend the analyses to examine how miners are making sense of the knowledge that they are receiving in a piecemeal fashion through the news, friends, rumors, and increasingly, government officials, nongovernmental agencies, and development practitioners.

Unearthing Mercurial Worlds: methodological approaches:



Figure 2: Map of Research Sites in Western Kenya.

This project draws on a combined total of 22 months of grounded ethnographic field work in western Kenya’s artisanal gold mining communities conducted between 2013 and 2017. Because artisanal gold mining was considered illegal when I first started conducting field work, I employed snowball approaches to recruit and enroll my initial sample of 25 artisanal miners in mining villages located in Kakamega County. Snowball approaches are usually deployed to reach vulnerable, marginalized, or otherwise invisible populations who either do not want to be found or are difficult to access. While it is a useful tool for enrolling vulnerable members, its dependence on social networks as a means to recruit individuals to a study often suffers from bias, since initial contacts are more likely to recommend other individuals who share similar views or are from a similar background. To counteract this effect, I also walked around mining villages with a trusted member of the mining community, knocking on the doors of randomly

selected households that showed evidence of mining activities in their compounds to recruit individuals for interviews. I also frequented rivers and large ditches where large pools of water existed and where men and women who did not have access to their own mineshaft would often process mineral ore. Mining villages in Kakamega were chosen based on convenience of access by motorcycle, foot, or public transport, as well as reported or rumored mining activities.

Over these four years, I interviewed 252 artisanal gold miners in Kakamega and Migori Counties, as well as government officials with Kakamega County's branches of the National Environmental Management Authority (NEMA), Ministry of Mines, and members of a grassroots, civil society organization called Groots Kenya that focuses on development initiatives to bolster the economic security of rural, Kenyan women and is an operational partner with a regional civil society group called *Haki Madini*, which focuses on mining issues in East Africa. From the large sample size, I created a smaller sample of 37 individuals from both Kakamega and Migori Counties, with five individuals from Migori County and 32 from Kakamega, my main field site. This smaller subset of individuals comprised both male and female miners, predominantly from the Luhya and Luo ethnic groups who are the dominant ethnic groups in Kakamega and Migori Counties, respectively. I worked with these 37 individuals to learn how they operated machinery, dug mine shafts and read the geology to find and exploit gold veins, and processed auriferous ore either manually by pounding it into smaller, gravel-sized pieces or by using mercury. The majority of these interviews were conducted in English and Kiswahili, languages which are widely spoken in western Kenya. I depended on three research assistants for interviews conducted in Baluhya, Baluo, or Kiswahili, transcribing the interviews in real time on a field laptop, in notebooks, or on a Neo2 AlphaSmart. I did not use recording equipment because it made interviewees uncomfortable, especially as Kenya was in the process of rewriting

its mining laws, and miners often feared that photographic, video, or recorded interviews could be used against them by law enforcement officers, who would appear at the main mining camps to regulate and monitor the daily activities of miners whose activities were still considered illegal.

I spent the first month with each of my research assistants training them on the objectives of this study, interviewing techniques, and ethical conduct of human subjects research. By the end of our research study, my research assistants were experts at conducting interviews, either using a standard questionnaire which I provided and/or conducting unscripted, informal interviews on a list of topics of interest. This proved helpful because my identity as an Asian-American, female researcher often made many potential interviewees suspicious that I was working for the government or that I was a Chinese miner who was looking to invest in mining. As I found out during my field work in Migori County, Chinese and Eastern European investors and mine operators often called themselves researchers or students when they were scoping out potential mining sites. Being able to depend on my research assistants to independently conduct interviews and touch on a broad swath of topics proved invaluable for the completion of this field work.

Having two groups of interviewees—my main interlocuters and a more general group—afforded me a unique perspective to test different interviewing strategies. With my more general sample, I often attempted to ask open-ended, “value-free” (insofar as I could tell, though it is possible and quite likely that my biases and assumptions did work their way into the questions) questions to prompt longer responses that allowed me to delve more deeply with focused, clarifying questions. With my main group of interlocuters, however, I was able to ask more pointed questions, and I often made statements or comment on a news report or incident that had

happened recently to gauge their response. While survey methodologists might be wary of such an approach for fear of affecting the interviewee's response or producing a form of bias, my main interlocutors knew me well enough not only to disagree with me but to also bluntly tell me when I was incorrect or had completely misunderstood an event. I relied on these responses to help provide a gauge for the kinds of topics, ideas, and opinions that mattered to them. Rather than deploy a standard questionnaire to examine general trends—as a fellow surveyor in the field once suggested insistently so to save myself time and deploy Likert scales—I was interested in the kinds of contestations, debates, concerns, and questions that arose in response to ideas and things. Deploying a Likert scale to answer questions about how miners experience mercury was inappropriate, as would a standard, coded questionnaire that could be deployed for quantitative analysis after the fact. From the outset, I accepted that many of the responses I received would be biased, as would any response that depended on subjective experiences of one's environment. Where I could, I attempted to remove bias that I might introduce as an interviewer and was aware of the inherent power imbalance within the interview space. As I took field notes and transcribed interviews, I also noted when a particular question would make an interviewee appear uncomfortable. I incorporated my interpretations of an interviewee's response to a question to serve as part of my data set.

Because of the suspicions that surrounded my field work, I also have very few photos of mining sites and miners themselves. Part of this decision was also an ethical one. Photographs allow for the easy identification of miners, many of whom did not feel comfortable with the possibility that their personal information might be found by a government official or law enforcement officer. They also seem to negate the idea of removing identifying information for our interviewees. From a more practical standpoint, photographs also changed the tenor of the

interview space. If I were photographing a miner and his or her family members, colleagues, or friends, there was always the need for the photograph to be staged and miners rarely felt comfortable with candid shots. Miners often felt the need to “show me” processes or practices that they might not normally engage in so that I could photograph them. One such example happened while I was visiting a miner during the rainy season. After our interview, he insisted that I go with him to his store room so that he could show me how he processed gold and I could then take a photograph. When I asked if he normally processed gold using mercury indoors, he said no. While the indoor processing of gold does happen in Kenya, especially during the rainy season, I feared the kinds of incentives or practices having a camera in the field would produce, and so most of the time, I left my camera in my field bag unless I was with one of my main interlocutors.

While most of my field work took place over shorter visits over the first four years, between 1-3 months, followed by my final nine-month long field trip, they provided the unique opportunity to trace how ideas of mercury and risk were changing over time. For the four years that I spent shuttling between Michigan and Kenya, I traced changing patterns in their narratives and practices, focusing on the kinds of risks they spoke freely about and the conditions under which mercury and its potential harms arose naturally in conversation, and when it was forced. It also allowed me the time to spend immersed in the worlds of my interviewees. We spent hours walking around their villages completing errands and household chores, going to the market, church, church meetings and conferences, schools, self-help groups, and cooperative meetings. We ate meals together and shared recipes. I learned about how individuals shared resources and made demands on their social networks. And as I learned about the risk-laden and precarious lives that many of the miners I met navigated on a daily basis, I also learned about how they

coped, how they cared for one another, and why that might matter more for “making do” in their worlds.

Kenya was the ideal country to conduct this field work. While it is rarely associated with artisanal gold mining—Tanzania, Ghana, and Senegal, for example, tend to attract more development aid and academic research—it has a significant population of approximately 250,000 gold miners. From 2012, as Kenya began the process of reforming its mining laws and began to adopt international policies to reduce and eventually work towards the elimination of mercury in its ASGM communities, I was able to follow changes in ideas about mercury under conditions of varying levels of information gaps. Migori County, for example, attracts most of the development assistance and academic research on ASGM, improved technologies, fair trade gold, and mercury in mining, whereas Kakamega County had until 2017 been largely ignored because of its lack of a large mining camp. But by 2017, Rosterman mining camp had been established in Kakamega. This set up an interesting set of spaces within which to observe changes in how miners spoke about mining, mercury, and risks, and provided a point of comparison between miners located over a more dispersed area who were not yet being reached by external researchers and practitioners and miners in a more concentrated location (Rosterman) where development initiatives were just starting.

Chapter Outline:

The three papers that comprise this dissertation ask the following questions: 1) What is the effect of increased information about mercury exposure in Kenya’s artisanal and small-scale gold mining communities?; 2) How do miners make sense of, relate to, and make decisions about

mercury in their everyday lives?; and 3) How do miners navigate the precarious conditions of their everyday lives? How is care extended, withheld, negotiated, and to what effect?

In the first paper (Chapter 2), I describe shifts in narratives about mercury's risks among western Kenya's artisanal and small-scale gold miners. I examine how they incorporate partial and imperfect information with their everyday experiences of risk and mercury as they negotiate two very opposing ideas about what mercury does—provide life sustaining benefits or act as a poison.

In the second paper (Chapter 3), I examine the myriad ways that miners understand mercury's risks and enroll these understandings into daily practice. I examine how fears over mercury as a “poison” shape miners' understandings both about the nature of mercury's risks—that it is most dangerous when ingested—and operates to produce precarity for women as it designates responsibility for the protection of life and blame when mercury is thought to cause harm.

My third paper examines the concept of care as it is invoked and engaged by miners at Rosterman mining camp, Kakamega's largest and only operating artisanal mining camp. It seeks to ‘unsettle’ care (Murphy 1995) by tracing the concept as individuals strategically deploy expectations and obligations of care to access, withhold from others, or unevenly distribute necessary resources. I develop the term “care distributions” to explore how these distributions both allow individuals to maintain life or prosper, producing precarious lives for some while bolstering the lives of others.

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Chapter 1:

Making Sense of Mercury: Toxic risk or lifesaving substance?



Figure 3: Mercury-Gold Amalgams. Source: Author

Ruth bends over the fire holding a black *karai* (blackened, metallic gold pan) that contains a small ball of mercury-gold amalgam. As the fire heats the metallic bowl, the mercury in the amalgam vaporizes and a plume of smoke envelopes Ruth and her daughter before billowing out over their family's clothesline to dissipate over their maize field. Her daughter coughs. My eyes water. I hold my breath and close my eyes as the back of my tongue is flooded with a distinct, metallic taste. The palms of my hands begin to sweat as I anxiously wonder how much mercury we're being exposed to. Ruth looks up and flashes me a knowing smile. She gestures impatiently, bringing the four fingers of her right hand to her palm. As I inch closer, I can see the grey, mercury-gold amalgam slowly turning yellow. Then, the smoke clears, leaving behind a ball of golden dust. Ruth smiles, transfixed by her yellow treasure nestled in the curvature of the black, metallic bowl. After a bit, I ask Ruth about the risks associated with

mercury. She pauses and looks at me for a second. Instead of answering, she gestures towards the bowl. “Look at this. How could I ever stop? It’s too addicting.” The gold left in the bowl is worth \$25 USD—slightly less than Ruth would make in a month of hard, casual labor anywhere else.

I begin this article with Ruth, because she is one of an estimated 250,000 artisanal and small-scale gold miners (ASGM) operating in Kenya who depends on mercury to process gold and because she represents how Kenya’s miners make sense of mercury, its potential risks, and its benefits. The recent literature on ASGM underscores the sector’s importance in sustaining the economic security of the approximately 15 million individuals who participate in the activity worldwide (Telmer and Veiga 2009). This literature tends to argue in favor of safeguarding artisanal gold mining even as it acknowledges the widespread problem of mercury use, exposure, and pollution prevalent in the majority of ASGM communities (Tschakert 2009a, 2009b; Tschakert and Singha 2007; G. Hilson 2009b; G. Hilson and Murck 2000; G. Hilson 2008; Hinton, Veiga, and Veiga 2003; Hinton, Veiga, and Beinhoff 2003). Research on the persistence of mercury in ASGM often characterizes it as a problem of poverty, a lack of education, lack of improved technologies and capital investments, and a lack of government regulation and monitoring because of their often illegal or informal status (Smith et al. 2017).

The social sciences have long examined questions of risk mitigation especially in the context of natural hazards and environmental change, highlighting the roles that personal beliefs, experiences, trust in authority figures, and personal and contextual factors play in shaping risk perception and risk mitigation (Paul Slovic 1993; P Slovic 1987; Wachinger et al. 2013). Sociological inquiry into this question has deployed the notion of what Auyero and Swistun (2009) writing in the polluted community of Flammable in Argentina, call the “relational

anchoring of risk perceptions” (9, 66) to describe processes in which every day routines and interactions work as “blindings” to environmental hazards that allow individuals to misunderstand, maintain uncertainty, or ignore risks. Moreover, critical geographers writing in the political ecology tradition have a long history of demonstrating how one’s experience of their environment shapes decision-making with recent literature paying attention to the gendered nature of resource access, control, and ownership over resources (Sultana 2008, 2009, 2011; Rocheleau et al. 1996). Drawing on work in emotional and affective geographies, Farhana Sultana (2011) describes how emotions and meanings attach to everyday processes of resource access, use, and control to underscore the emotive realities of critical resource management and to examine how the emotions of Bangladeshi men and women shape their decision-making when choosing to access arsenic-laced or arsenic-free water.

Even in the event that one is able to fully grasp the extent of potential risks, however, social scientists have described a curious paradox of risk perception: that higher risk perception is not always correlated with preparedness and mitigation (Wachinger et al. 2013; Siegrist and Gutscher 2006). Explanations offered for this paradox, include the ideas that 1) individuals choose the positive benefits over potential negative (and future) impacts (Hung et al. 2007); 2) individuals do not feel empowered to make changes (Terpstra 2009); and 3) individuals understand the risks but have too few resources to make changes (Wachinger et al. 2013).

Over a decade ago, Gavin Hilson (2006), a leading scholar of artisanal gold mining published a scathing review of existing mercury abatement programs in ASGM which depended on a mix of introducing improved technologies and education outreach. He found that these programs had failed to reduce mercury use among miners because the technologies were often “inappropriate” for the context, either because they were too expensive, too difficult to repair or

maintain, or required specialized knowledge or skills to operate. Further, education outreach often failed to consider existing social, cultural, and political dynamics that shape the adoption of risk mitigation (Hilson 2006). While urging for more research into the cultural, social, economic and political dynamics shaping risk perception, however, he largely adhered to the assumptions underlying these programs and policies, suggesting a lack of research into the kinds of incentives or risk narratives that would prove more effective at producing better risk reduction outcomes. In other words, while these programs and policies were critiqued for failing in their “fit” in artisanal gold mining communities, the model and underlying assumptions remained intact.

Almost a decade later, miners are still being presented with many of the same technologies and policies that Hilson critiqued in 2006. More recent literature has continued with critiques of failed policies and programs, with some describing the often unintended consequences of supply-side policies that rely on bans to reduce existing supplies of mercury on either international or domestic markets. These studies note a paradoxical increase in mercury supplies (UNEP 2017; Spiegel et al. 2018), due to the informal reopening of closed mercury mines in places like Indonesia and Mexico as a result of national or international bans on mercury (UNEP 2017; Spiegel et al. 2018). Further, these bans risk pushing miners deeper into illicit markets that can make it more difficult to access, monitor, or regulate their activities. Mercury abatement policies and programs demonstrated a taken-for-granted understanding within the social sciences and humanities that improved technologies and economic policies often fail to address environmental problems. One of the main reasons being that these approaches tend to ignore the underlying political economic structures that shape and produce poor environmental outcomes, while also assuming that technology and education are value-free and apolitical.

At the same time, risk mitigation strategies adopted for mercury reduction in ASGM continue to operate under the assumptions of a linear model of knowledge transfer, in which access to information and technology (in these cases) flows from experts to target communities who are then expected to adopt improved practices, which Cash et al. (2006) refer to as a “loading dock” model. This model has been widely critiqued by social scientists (Lemos et al. 2019; Cash et al. 2006), especially in the context of environmental governance and change (e.g., Cash et al. 2006). The risk with this assumption is that when communities fail to change or to adapt, they are often blamed, producing what anthropologist, James Ferguson (1994), refers to as an “antipolitics machine”. As Hilson (2006) demonstrates, when mercury abatement programs fail, ASGM communities are then characterized as being too impoverished, or simply, too unconcerned about their health or environment, as well as too skeptical and uncertain to accept expert knowledge about mercury and its risks. Further, science studies scholars, anthropologists, and geographers have demonstrated that these “technical fixes” operate as part of a broader historical process that delegitimizes the skill, labor, and knowledge of largely third world land managers and externalizes technology and knowledge that then needs to be imported to solve the problems created by these “other” communities (Hecht 2012). These characterizations of “Third World” land managers coupled with these broader historical processes of de-legitimization allow for these programs and policies to be replicated and reproduced elsewhere, despite their failures to produce the intended outcomes (Ferguson 1994).

While this model has been critiqued and largely dispensed with among social scientists and humanities scholars, it continues to prevail in development assistance, despite the rise of alternative models that reframe these social-ecological systems as “complex” opening up a space for more nuanced research (e.g., Berkes et al. 2003), or those that treat community members

and/or those traditionally targeted as the “drivers” of environmental change and degradation as stakeholders whose participation in the “co-production” of policies and programmatic interventions is necessary for solving complex environmental problems (e.g., Lemos and Morehouse 2005).

One arena that has remained under-investigated, however, is how communities begin to make sense of environmental contaminants under conditions in which they 1) have been habituated to think of a substance as harmless and even perhaps, necessary for the daily maintenance of their lives, while 2) having little access to technoscientific instruments and expertise about potential risks and dangers. In this study, I am concerned with how individuals are able to presence and absence mercury’s potential risks, as they make decisions about whether and how to navigate using a substance that is increasingly connected to danger, even as they acknowledge and understand that it is one that they depend upon not just for economic security but also for the *quality* of life that it allows. Geographers especially have paid close attention to how knowledge about our environment and what counts as valid understandings of the environment, shape our experiences, conflicts, decision-making, and management of resources (e.g., Sultana 2009; Goldman, Turner, and Nadasty 2011; Robbins 2012). My objective is to expand theorizations about the nature of knowledge circulation, critical resource management, and risk perception and mitigation in the everyday in two essential ways: 1) drawing inspiration from Luise White (1993, 2009), I ask how partial information, (mis)understandings, (mis)characterizations, and past experiences emerge as “epistemic vehicles” through which we can examine how individuals come to know and understand their environment and potential harms, highlighting 2) the need to take seriously these forms of (mis)information *as much as* we might “real” knowledge about things. In so doing, I provide one more argument against applying

eco-modernization and “loading dock” approaches for solving complex environmental problems that acknowledges that knowledge transfer is often patchy, uneven, partial, and uncoordinated. Further, it speaks to the forms of vulnerability and precarity that practitioners and researchers can produce if information is not tied to resources and support, and how miners themselves may misinterpret their options and continue engaging in practices that endanger their long-term health and environment.

Toxic chemicals like mercury are objectively difficult to understand. Long latent periods between exposure and the manifestation of symptoms, for example, make it difficult to connect symptomology to exposure. Many of the initial symptoms of mercury poisoning, such as the initial numbness or tingling that one can feel in their extremities (Clarkson 1992) can easily be confused with benign conditions, or with different conditions or exposures altogether. In cases of chemical exposure studied worldwide, invisible exposures are rendered visible and given substance through a process of technoscientific instruments that measure the amount of a toxin in one’s body or environment and correlates those elevated levels to altered bodily states in a process of risk assessment (Hecht 2012; Tousignant 2018; Murphy 2006). While mercury risk assessments have been conducted in ASGM sites worldwide, including a recent study in Kenya (CEJAD 2017), most of the exposure of Kenyan artisanal gold miners remains invisible, especially among certain subpopulations (i.e., children, gold buyers, male miners). Further, there are lingering questions about how chronic exposure to low-doses of mercury shape clinical manifestations of mercury exposure (Clarkson 1992), especially for populations that are exposed to a number of different environmental exposures, including: high disease burdens, nutritional deficits, and other chemicals (Nriagu and Skaar 2015).

The research for this article draws on over 22 months of ethnographic field work between May 2013 and October 2017. During this time, I conducted informal and semi-formal interviews with artisanal and small-scale gold mining communities in western Kenya, where miners use mercury to process gold. Spending four years in the field with the same groups of miners allowed me to observe changes in their understandings and practices with mercury as more information began circulating in the local press and through development and government officers conducting education outreach and programming with ASGM communities. I also worked as an apprentice to female gold processors which provided a unique vantage point to understand how narratives and practices with mercury were shifting over time, and whether narratives were corresponding with practice on an everyday level. Because women are predominantly occupied as gold processors in both mining villages and mining camps, most of my interviews focus on their experiences working with, containing, and understanding mercury. I attempted to expand my subject pool to include elderly and disabled members, who also seek work in ASGM but are harder to access because of large language barriers and because they are often less willing and able to speak with foreign researchers.

Kenya is the ideal place for such a study. It has a large population of approximately 250,000 artisanal gold miners who use mercury to process gold. Further, very few mercury abatement programs and policies had been implemented by the time the research period for this project began, thus allowing me to track how perceptions of mercury were shifting over a four year period as miners were increasingly exposed to more information, but also very partial information. For a study that grapples with how miners articulate their sense-making of a chemical seen largely as essential for the maintenance of an important and lucrative livelihood activity, it provides an inroad into the nuance both for understanding the complexity of building

knowledge while providing a cautionary tale for research and programmatic conduct when establishing development initiatives.

Through a series of case studies, this paper examines how mercury and its potential effects—both positive and negative—were made visible for Kenya’s artisanal miners in the absence of technoscientific instruments designed to document exposures and correlate them with detrimental health and environmental outcomes. On the other hand, it also examines instances in which uncertainties around mercury’s risks were drawn on by miners in order to background and invisibilize their risks. Therefore, it follows miners as they operate under conditions of extreme uncertainty, where increased awareness of mercury’s dangers as a “poison” are confronting long-held ideas of mercury as a safe substance necessary for maintaining one’s economic security and quality of life.. I spend a great deal of time discussing the animating political economic structures of everyday life, the materiality of mercury, miners’ experiences with the chemical, and their affective experiences with it as a necessary part of mining, as well as an emerging and potentially very dangerous substance, shape their understandings both of what mercury *is* and why it *matters*, while also leading miners to conclude that the options available to them present an impossible choice between being poisoned or being poor.

Anchoring risk perceptions: the production of mercurial worlds:

The context within which individuals experience risk matter for how they perceive, understand, and make decisions about risk. For many artisanal and small-scale gold miners, mercury’s potential to cause harm to their bodies, to the bodies of their children, and to their environments remained invisible because of their inability to perceive a direct impact and connection between their use of mercury and the stated risks that they had begun to learn about

from government officials and development practitioners, news broadcasts, and circulating information (including, misinformation) and rumors. Further, the symptoms of chronic mercury exposure are indeterminate; they can be confused for a number of different, benign conditions, or caused by a number of different exposures in one's environment (Nriagu et al. ; Clarkson).

For example, Ruth began to mine when she moved to her husband's village shortly after marrying about 15 years ago. Her husband taught her how to process gold using mercury and when she had children, she taught them. No one she knew had ever suffered from any negative side effects from using mercury. Her family began to dig a shaft a few years ago when the surface deposits were exhausted and they had accumulated enough capital to start digging, convinced that the soils beneath their feet contained riches they could only imagine. Their dreams of riches were spurred on by the simple fact that their town had once been the site of a large mining company prior to Independence in 1963, but their initial efforts at building a shaft failed because the tunnels kept collapsing. They had finally managed to start digging another and to support the cost, Ruth was purchasing tailings and mineral ore from a neighbor. Ruth, like other miners in Kenya, attributed her ability to access gold in part to mercury. "The first wash, we can usually get gold without mercury, but we use it because it makes it easy. Mercury allows us to wash the waste again and again, and it's necessary for that. We always get more gold each time, so the waste is always valuable."

When she asked me what the common symptoms of mercury poisoning might be, I told her. She responded by pausing and giving me a long look. "Who doesn't get headaches?! Who doesn't lose their temper? Who doesn't forget things from time to time or have numbing feelings [in their extremities]? As for everything else...." She trails off in reference to damage caused to the kidneys, digestive, immune, and central nervous systems. She shrugs. Like many of the

individuals who started mining and processing ore with mercury, Ruth had very little reason to believe that mercury was dangerous. No one she had ever met had been harmed by it. Her children were fine. They excelled in school and were well-behaved, and the money the children made from processing was used to pay for their everyday fees, either from school, the occasional afterschool sweet, or more expensive costs like new clothing for celebrations or funerals. Ruth also suggested that if something should ever happen to her or her family, the children had a way to take care of themselves.

What Ruth knows and acknowledges is that mining has allowed her family to “develop” and that mercury allows her to process gold. It helped fund the expansion of their farming and livestock. Instead of having the usual chickens, they had managed to purchase two pigs, some goats, and now they were saving up for a cow. Ruth has also been able to send her children to school without the anxiety that they wouldn’t be able to afford the school fees. Her mining income allows her to buy meat once a week for her family and to provide a small donation at church and at celebrations. Perhaps, most importantly, when the children are sick, Ruth said she liked that she no longer had to wait, spending several days wondering if they had malaria or something more serious. She had more options and could choose to go and see a doctor rather than relying on friends or the local pharmacist. “I can take them to hospital. Not just any hospital. I can go to the government hospital, but if they are busy, I can also go to a private hospital like the one your [host] father operates.” She continues: “Farming might fail one year, but with mining, you always have a way to gain. It doesn’t get ruined by *wadudu* [pests/insects]. It’s just there. If we work hard, we can get it.”

In 2013, Kenya, a recognized hub for the illicit trade in mercury in Sub-Saharan Africa (UNEP 2013) signed the Minamata Convention on Mercury, one of a handful of international

treaties that regulate chemicals in the environment and that specifically attempts to protect human health from anthropogenic emissions of mercury into the environment. Kenya's membership to the Minamata Convention signaled its increasing commitment to protecting the environment. Because the approximately 15 million ASGM workers worldwide are responsible for the largest anthropogenic emissions of mercury into the environment (), the Minamata Convention requires its signatories with significant communities of ASGM to develop National Action Plans (NAPs) to work towards the reduction and eventual elimination of mercury in ASGM. Since then, news articles, radio and television broadcasts, and the increased number of development workers present in Kenya's main ASGM communities in Migori and Kakamega Counties have circulated information about the risks associated with mercury use in Kenya's ASGM communities, specifically highlighting the risks for women of child-bearing age and infants. In 2018, Kenya announced it would be banning all mercury use in ASGM.

But miners had worked with mercury for decades before information about mercury's risks had been released. When I asked if they knew of anyone who had been harmed by mercury, like Ruth, the miners I met in 2013 told me without hesitation that they had never met anyone who had been harmed by it. As my main interlocuter in Kenya repeatedly told me, "We learned from our parents, and our parents learned from theirs. We taught our children from when they were young. If there were any issues with it, wouldn't we know by now? If we thought there were issues, would we have taught our children?"

Ruth's perceptions of the risks associated with mercury use and exposure, like that of the other miners interviewed for this study, are anchored by her experiences of having used the chemical for well over a decade, her and others' lack of symptoms, as well as a potential symptomology that, when compared to other illnesses she could suffer from, doesn't appear that

serious. While it might be fair to assume that miners and their families are experiencing symptoms of mercury poisoning given their prolonged, chronic exposure, what those symptoms are and the severity of those symptoms is unclear. The expected symptomology that we associate with mercury poisoning is derived from instances of acute mercury poisoning, such as that from Minamata, Japan, one of the world's worst industrial disasters that discharged large amounts of mercury into the Minamata Bay, effectively poisoning those living in Minamata. This is not to deny the existence of *real* threats, or to say that she is unconcerned about these risks, It is to say that the dosage, timing, and routes of exposure matter in shaping risk outcomes, as well as her experiences with mercury, the experiences of others around her, and the conditions under which she operates. For Ruth and other miners in her village, no one had ever suffered from noticeable health effects related to mercury use, and it is that fact that allows her to continue to ignore its risks.

Recent scholarship in anthropology, geography, history, and allied fields have demonstrated how the physical properties of objects can shape social and political life (Lemke 2018; Bakker and Bridge 2006) and has attempted to discern how things come to “matter” (Miller 2002) in both the colloquial use of the term (i.e., becomes significant or important) *as well as* in the production of individual and collective subjectivities in relation to an object. But sensing an object's material characteristics can also be misleading, as geographer Joy Parr (2010) demonstrates in a collection of case studies on Canadian communities who were forced to cope with large-scale environmental changes in their home and work environments. These changes altered how individuals came to know their environment, as well as their abilities to judge their sense of safety and danger. Often, their past experiences and knowledge of the environment,

coupled with their sensorial experiences of environmental change, were insufficient for assessing their present danger.

As a woman in Kakamega County, where the average household income is still less than \$2/day, where the burden of household and family care rests on her, and where she is fully aware that one misstep could cause her and her family to lose what economic security they have, mining is crucial. Despite the nearly five percent increase in Kenya's GDP in 2017 (World Bank 2017), most families in rural Kenya continue to struggle to meet basic needs. Moreover, Ruth is exposed to several different things a day, which she says, affect her health in more direct ways. For example, she often cites the lack of clean drinking water in her village. "They put a pipe in, so now we don't just get it from the river like we used to. It comes from the spring. But we still get sick from the water on occasion." Recently, officials from the public health department installed a chlorine station so that women could disinfect their water right at the pipe. "The container on the pump was stolen almost right away, probably by someone who used it to wash clothes. It's a good way to get rid of stains."

When it comes to illnesses, Ruth says that they're normal. Typhoid, malaria, diarrhea, and the common cold seem to be the most common illnesses in her household. Despite her family's relative comfort, there is a noticeable absence of a protected latrine. When I asked to use the restroom, she paused for a second before bringing me to a small shelter that looked unstable. It had a wooden grate covering the floor that would let liquid through but probably nothing else. The stench and flies were overwhelming. It was the only shelter like it on the compound for three families. From then on, I made it a habit to use the bathroom every time I was at an interviewee's home so that I could take note of their bathroom facilities. Most of the homes had facilities like Ruth's. Some lacked the structure on their compound altogether. Open

defecation and lack of access to improved sanitation is a prevalent problem in rural Kenya leaving most of its population at risk for waterborne diseases. Only 30% of Kenya's population has access to improved sanitation; 30 million individuals out of an estimated 49.7 million lack sanitary toilets (World Bank 2018). As Kenya's economy has grown over the past decade, its access rate to improved sanitation has stagnated. Between 1990 and 2015, it increased by only five percent (World Bank 2018).

Walking with Ruth around her town, we're constantly covered in clouds of dust and diesel exhaust as motor vehicles pass us on the long, dusty road that leads to the main, paved road. When we walk it together, I often cough and cover my face whenever the wind picks up or the vehicles kick up dust and leave us in a trail of their exhaust, but Ruth continues as though she doesn't even notice. She walks for hours every day on this road, hauling heavy loads each time: water from the river to her home; bags of dried and broken down ore to the machine where it will be pulverized into a flour-like dust; the pulverized dust back to her home so she can process it; maize to be ground into meal to make *ugali* for the evening; her market goods. Life is difficult and it is full of hard, manual labor. She says life in the town has gotten better over the years. The graded road we walk on used to be "difficult, always full of holes and there was never any transport. Now, the *matatus* (informal minibuses that provide shared, public transport) and *boda bodas* (motorcycle taxis) come through and are opening more services to the villages and towns."

With everything that Ruth encounters in her everyday life, mercury hardly ever comes to the fore as a concern. "Unless you're asking about it, I don't really think about it." Even as Ruth admits that she has heard mercury called a "poison" and in some cases, refers to it as such, Ruth's practices with mercury suggest that she believes its dangerous properties can be

contained. “We always keep it in a special container—a strong, plastic bottle—and lock it in a place where the small children won’t get into it.” When asked about why she’s concerned about her youngest children accessing the mercury when her oldest daughters use it regularly, she responds, “It would be dangerous for them if they ate the mercury. They’re kids. We don’t want them playing with it and accidentally doing something like that.” For Ruth, mercury has the potential to cause great harm, especially if ingested, but the danger it presents can be prevented so long as it’s not ingested and it remains in its container.

Risk and Materiality: How does mercury come to “matter” for Kenya’s ASGM communities?:

By 2014, the connection between mercury and “poison” was a common refrain throughout Kakamega County’s mining villages with more miners noting that they were always careful to keep it away from their small children. As I describe in Chapter 2, rumors about children and old men who had died after ingesting mercury were beginning to emerge and parents were afraid that their children’s lives were at risk. These rumors were indicative of a local, geography of blame that emerged in relation to a growing awareness of mercury’s potential toxic effects for human health but were shaped by misunderstandings, uncertainties, and fears about the potential risks of mercury exposure. These rumors increasingly placed the responsibility and blame for mercury and its toxic effects on women. Like Ruth, they continued to keep it contained in a small, plastic bottle in a location where their small children could not easily access it.

While miners could not describe expected symptoms from long-term mercury exposure, the idea that mercury causes harm through ingestion was firmly rooted in the communities I

worked with through 2015, with some noting that the phrase “mercury poisoning” led them to believe that the problems people faced with mercury were the result of ingesting it, rather than its general use in the mines or through other possible routes of exposure. Indeed, as news about mercury became more common in the media, anxieties about the possibilities for accidental ingestion became widespread, with a group of male miners explaining to me that if their wives were to be caught processing gold or using mercury in dishes or cookware intended for serving or preparing food, it could be grounds for “beating, or even, a divorce.” Ironically, ingestion of elemental mercury is the least toxic route of exposure because it is poorly absorbed through the gastrointestinal tract (Clarkson 1992); in the past, elemental mercury was often used as a laxative and there are rare examples of individuals who have suffered from mercury poisoning or death from ingesting elemental mercury (Clarkson 1992). Mercury, then, became a substance of concern through its linkage with a poison. While its effects were still invisible in the sense that it was not being monitored through technoscientific instrumentation and experts, its dangers took on a tangibility: through accidental ingestion, it could harm or even kill the most vulnerable members of a household—unsuspecting young children and old men.

As information about the risks associated with mercury exposure increased in domestic media accounts, miners began to connect mercury’s physical properties to potential risks. Melissa, an elderly woman who had mined the soils in Kakamega with her husband for most of her married life, explained (as translated):

“There are times when the cups rust if we leave the mercury in them overnight.

That there are times when, if you leave mercury in a cup overnight and come back, there is a hole in the cup.”

...

“Sometimes, she worries. If it burns a hole through a metal cup, what is it doing to her?”

Melissa was concerned that mercury’s ability to corrode something as durable as metal might also be affecting her body in ways she couldn’t discern until it had already done the damage. Mercury’s unique electron configuration allows it to form bonds with other metals, creating the mercury-gold amalgam that miners depend upon to process gold, which I described in the opening to this article. But this same property also means that when it comes into contact with metals like aluminum, it can display corrosive properties. Thus, for miners like Melissa, the very same properties that allowed her to access gold, might also be wreaking havoc on her body, slowly, invisibly, and silently causing damage without her awareness until it was too late.

Others, however, noted how burning mercury could cause their,

“Chest to tighten, eyes water, and bad coughs. I heard that it can make your hands tremble, that it can make you blind. I cough a lot and my vision can blur. I used to drink milk to stop the coughs and that worked for awhile. But then....”
He shrugs as his voice trails off and he laughs nervously. “It stopped working. I heard mercury can affect your eyes, that it can make you blind and that it makes your hands shake.”

Silas is a man in his late-60s who started mining when he was young. The lands in the area were always rich with gold, he tells me. “You didn’t need mercury then. [The gold] was so pure you could just separate it out by hand. But now the deposits are exhausted.” Silas is convinced that there is more gold underground, especially at Michael’s homestead, where they

are currently digging. At the top of the hill rests the collapsed entrance to the mine shaft that was dug by the Kimingini Mining Company, Ltd. during the 1940s. The landscape of Masiyenze is punctuated by old mining claims, prospecting sites, and collapsed adits that lead into the main mine, popping up unexpectedly in the middle of a maize field, along the walls of a river bank, or along a random road.

His father used to mine with the Kimingini Mining Company, Ltd. during the colonial era. When the company shut down and the *wazungu* left, his father continued to mine the lands in the area. Like Ruth, Silas mines to ensure that his present (and that of his family) is buffered from the uncertainties and near constant, potential poverty of the present. Like Ruth, Silas acknowledges that life in the village has been hard. “When the crops fail, as they did this year, we struggle. We have to depend on the government to help us. But sometimes, it can be hard to get help. Or the help is not enough. The government,” he confides, “is unreliable.” This is the closest he has ever come to voicing his dissatisfaction to me about a government that, in 2017, would be viewed by western Kenyans as grossly corrupt, ineffective, and in need of change.

Silas works as part of an eight-member crew digging a shaft on my main interlocuter’s family compound. As the oldest member in the group, Silas acts as the group’s foreman, making sure that the members abide by rules and regulations that he established to govern their behavior inside of the mines. These rules exist, he explains, to reduce the risk from tunnel collapses:

“ Sometimes, when you have young men come to the mines, they will arrive drunk or they won’t be ready to work. Before you go down, we need to make sure that you’re able to do the work and won’t cause trouble. If you’re drunk, how can you work or not cause trouble? You might hit the rock in the wrong

place. If something goes wrong, you won't be able to stay calm. We never allow drunk men into the mine."

Sensing the potential for danger, Silas acts immediately to ensure that there is a system in place that governs everyone's safety in the mines. One drunk man at the bottom of a shaft could cause the whole operation to collapse, literally, and would present a danger to the group if something were to go wrong. As the group's foreman, as well as its eldest member, Silas also tests the "samples" that are dug and brought to the surface. These samples guide the miners in their digging and indicates the presence of gold particles. If gold is found, they will continue to dig until they hopefully find a vein. If not, they might switch directions, following the curve of the hillside where water is most likely to move. One day, after demonstrating how sampling works, including the burning of a mercury-gold amalgam, I ask:

"Aside from the coughing, have you experienced other symptoms?"

"I don't know. Sometimes I feel like my vision might be going. But I am old and that's what happens when you get old. So I don't know if it's the mercury."

"Do you ever get worried about using mercury?"

He pauses for a second. "What am I supposed to do?" he asks, "I am an old man," he responds. "If I lose my sight, if my hands shake, if I cough... what difference does it make? I have to eat now. Going blind now? Having my hands shake? Maybe if I were young like that one there," he gestures towards Michael who is seated beside us. "But I am an old man."

Like Bridget, Silas contextualizes the potential risks from mercury exposure against a backdrop of experiences of what it means to grow old and to slowly lose command of one's senses. He expects that by his age, he should start to experience certain symptoms: poor eyesight, trembling hands. But he also questions whether any potential risks from mercury are great enough to stop him from mining. After all, he hasn't experienced anything serious aside from the coughing and burning chest, and as he ages, mercury's potential risks seem less and less of a concern.

In other contexts, Silas insists that mercury is necessary for mining now, and he implies that mining is necessary for his and his family's comfort and life. Silas often invited me to his home, situated on a backroad in Masiyenze located near his church, the Pentecostal Assemblies of God, where he worshipped every Sunday. He lives on his family's compound with his wife, two of his sons, and their families. They keep a mix of healthy livestock, from chickens and ducks and a pig. It was a well-manicured compound with the grass freshly cut and the dirt around the homes neatly swept. His wife grew flowers. Every inch of the compound was cared for. It was a home to be proud of. Decorated, but not flashy. A place you could invite guests into that would demonstrate that you had worked hard your whole life and that God had rewarded you kindly but not extravagantly. It was the kind of home that demonstrated that his family was far from being "idle," as Silas explained to me after I exclaimed in delight that one of my favorite plants from home was growing in his compound.

All of this, I got from mining, from mercury," He tells me. "Mercury allows me to give all of this to my family. Not just in small ways. I built us this permanent house. I can give a little at church services every Sunday. I can take

care of my grandchildren and give them small gifts now and then. Mercury allows me to have a lot.

He later reflected that using mercury was necessary because of its ability to allow him to pursue a life of quality, a life worth living. He used the adjective *tamu*, the Kiswahili word for sweet to indicate such a quality to life. “Like tea,” he said, emphasizing his meaning by nodding to the cup in my hand. “It’s not worth drinking unless there’s sugar in it.”

During another visit, I asked Silas about mining and why he participates in an activity that seems so uncertain and full of risks, both from mercury but also in terms of large losses in money and possibly, of life.

“With mining, you control when you mine, how hard and for how long. You can save rocks to process later when you need it, and you are your own boss.

You don’t have to work for someone else.”

For Silas, mining allowed for a large amount of control over the conditions of his labor. But it also expanded his ability to control the conditions of his own life. Silas’ sentiments were echoed by other male miners whose comments indicated that mining wasn’t about a lack of alternative livelihood sources—there actually are a number of ways that men can make money in Kenya, from farming to fishing from deliveries to rock crushing or construction—and their use of mercury wasn’t about a fundamental misunderstanding of mercury’s toxic effects; rather, it was about choosing the resource that met their requirements and allowed them to retain a semblance of control over their working conditions and the lifestyles that they had established. And mercury was essential to that lifestyle.

On the other hand, for gold processors like Bridget, a Luo woman from Migori County who came to Kakamega to work at Rosterman, mercury's properties reaffirm her work and keeps her fascinated with the metal. Like Ruth at the beginning of this paper, Bridget has spoken repeatedly about how mercury is "addictive." One day while showing me how to wash mineral ore with mercury, she delightedly exclaimed, holding up the black *karai*:

"Look. You can tell there is a lot of gold here." She says.

"How? What tells you there's a lot of gold?"

"It turns grey and then it takes on a different appearance. Look, you can see it. Normally, it looks shiny, the surface is smooth," she says indicating the ball of elemental mercury, "But now the surface, it looks like there is dust. The more dusty, the more gold it contains."

When asked about the risks associated with mercury use, she shrugs and says, "There are risks with everything that we do. When we leave our homes and come here, there are risks. Walking the roads at night, there are risks. But gold lets us be free." For Bridget, mercury's potential risks had to be measured against a context which she suggested was inherently risky, in which immediate harms could be experienced at any possible moment, walking the roads or leaving their homes.

By 2017, miners increasingly began to connect altered bodily conditions (i.e., tremors, headaches, blurred vision) to their use of mercury, the idea that they should stop using it was rarely ever considered. Rosterman mining camp had received multiple visits by consultants and development officers associated with the United Nations Environment Programme. By August,

outside traffic into Rosterman consisting of tour groups, school field trips, and government officials had been increasing as word about Rosterman's operations began to spread and individuals curious about this seemingly "obsolete" and "backwards" practice (as a male school teacher leading his pupils on a tour of the mines opined to me). "It's hard to believe that this kind of thing still happens in a country like Kenya!" The group had been watching as a female processor quickly worked her way through a sack of pulverized ore. "Look at how she uses mercury. No gloves, no masks, no protection at all," he indicates to the school children as they crowd around her. Even when miners were concerned that they might be experiencing symptoms of mercury exposure, they could find some way to assuage their fears because the cause of their symptoms was always uncertain. Was it from the mercury, or was it from working 12 hours in the cold water? Were these headaches because I was burning mercury, or was it from being outside all day in the hot sun without any water to drink?

Evelynne, for example, is a young female miner I met at a mining camp who worked primarily as a gold processor. She used to chide me for the attention I paid to mercury in the mines. After a few months of working with her, however, she approached me after a long work day. She looked scared. "What are some of the issues with using mercury?" she asked. I looked at her for a second before answering. "Why do you ask?"

The other women told me I should ask you because of my arm. I woke up this morning and it was feeling numb. There's a sharp pain in my arm. I thought it was from working but I've never experienced it like this before. Someone said it could be from working in the cold water all day. But someone else said it could be the mercury.

Evelynne's comments surprised me because she had always been adamant about the safety of mercury prior to this conversation, laughing at me indignantly when I would ask her if she had listened to a recent broadcast linking mercury exposure with human health impacts. Like Silas, miners appeared to be debating whether mercury was really causing the symptoms they were experiencing and whether the effects of mercury exposure were really that bad. As the traffic increased at Rosterman, with development consultants inquiring into miners' understandings of and practices with mercury, miners increasingly began to openly wonder about the risks associated with mercury use, linking it to abnormal bodily conditions much like Evelynne had in our conversation. No longer could miners expect that the dangers of prolonged mercury use could be contained within the limits of a small, plastic bottle.

Perhaps more importantly, as they weighed the costs and benefits of mercury use, they also realized that the only potential choices being presented to them was to either continue using mercury to mine, or to stop altogether. Michael often explained it like this:

If I give up mining [to stop being exposed to mercury], I'll be nothing. I've done everything right my whole life. Went to school, got top grades, finished college. I'm one of a handful of men who have finished school and moved to Nairobi. I had a nice job at a bank. But then I left after years of putting in work because I was always being asked to train the new employees who would get promoted above me. They had the right qualifications, went to the best schools. So I came back home. Took over my father's farm. I was doing well until last year when I got into an accident on the boda boda I was leasing. Had to pay for the bike even though it was old and always breaking down. Last year, my wife had twins. So now there are four [kids]. Then this year, the weather changed.

We're in a drought. Now we don't have maize, so we can't make ugali. And the cost for sugar—it is too high! But mining has always worked for me. It is always there. When times get hard, I process the stores of [ore] that I keep in the supply room while I look for more gold. And now they're saying that mercury can harm you. But there is nothing we can do about it. Do we stop using mercury? What am I supposed to do?

Despite an acknowledgement of the risks that mercury could pose to them, their family members, and their environment, the question remains: what kind of mercury was produced? In the absence of technoscientific measurements, experts, and “official” information, I argue that while some of mercury's risks were rendered visible—its abilities to cause headaches, tremors, to effect one's eyes and lungs—its more insidious abilities to cause harm to one's central nervous system, digestive and immune systems, however, remained invisible. Further, even when its risks were acknowledged, miners could not shed disentangle its potential negative impacts from the benefits they derived from using it. To accept mercury as a necessary substance in their lives then, often meant accepting its risks.

Conclusion:

My goal in this article was to expand the boundaries of theorizations in critical resource management and risk perception and mitigation to provide a missing emphasis on how “everyday forms of lay knowledge” (i.e., the (mis)understandings, rumors, materiality, partial technoscientific information, and experiential and emotive connections) shape how individuals experience and consider potential decisions about their environments and health. This analysis

will better elucidate nature-society relations and why they play out in the manner in which they do, rather than relying on a priori assumptions about the motivations and characteristics of target populations that shape the outcomes of risk mitigation, and in this case, mercury abatement programs.

This article describes how artisanal and small-scale gold miners, who had been habituated to the use of mercury in their everyday lives make sense of a chemical that was, between 2013 and 2017, increasingly acknowledged as a dangerous substance, but that also provided them with immediate, economic—and in some cases, lifesaving—benefits. Artisanal gold miners drew on the perceived physical properties of mercury, their lived experiences with the chemical and its importance for mining, as well as their own affective connections to mercury to understand both its risks and benefits. I argue that these experiences allowed miners to perceive mercury as both a dangerous substance *as well as* one necessary for the maintenance of their daily lives. Yet, even when miners acknowledged the risks of mercury use, exposure, and pollution, they also often described solutions as a necessary choice between mining or not mining, choosing to use mercury in mining or foregoing mercury and therefore, foregoing mining. How miners understand the possibilities for risk management and reduction matters for whether and how they will engage with programs and policies. Miners feel they are being forced into choosing between one or the other, of being poisoned or being poor, which is not a choice at all.

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Chapter 2:

Producing Precarity: Rumors of toxicity and geographies of blame

What kind of meaning can be derived from stories and narratives that appear to be steeped in superstition or a lack of techno-scientific information? This question has been a central concern of anthropologists who study the occult. E. Evans-Pritchard's (1937) groundbreaking work on the Azande, demonstrated that their belief in witches is demonstrative of how the Azande make sense of uncertain and unfortunate events in their daily lives. In addition to serving as an explanation for misfortune, witchcraft accusations are often the result of conflictual personal relations, as well as a means by which individuals can designate moral behavior. Evans-Pritchard was careful to underscore the fact that Azande witchcraft beliefs are not peculiar to this subset of West-Central Africa, or even to those people who today would be located in the "developing world." Rather, elements of the occult can be found throughout the world, including within Euro-American societies (Pritchard, 1937).

In the extractive industries, research on the occult began with Michael Taussig's classic 1980 Marxian study of the story of the devil in the plantations and mines of South America, as well as June Nash's 1979 work on the spirit, "El Tio" in the Bolivian tin mines. In both instances, occult stories emerge in response to rapid, social transformation and represent the violence of encounter between pre-capitalist and capitalist societies. Jean and John Comaroff (1999), working in South Africa, locate the cause of the ubiquitous emergence of the occult economy in a "doubling" in which individuals both witness the vast amounts of wealth that are accruing to a

few, while at the same time, are left out of the promises of economic development and prosperity (see, Ferguson, 1999 for a similar process on the Zambian Copperbelt).

Caught in the violence of capitalist and neoliberal societies, rumors and myths function to provide a “vehicle” through which individuals are able to give voice to their everyday experiences within a broader political economy that leaves them disenfranchised, impoverished, materially deprived, and in a state of suffering (White, 1993; Comaroff and Comaroff, 1999). As anthropologist, Stuart Kirsch (2002) notes, following Veena Das (1997), rumors of violence in West Papua indicate local concerns that transform “...what is always present, although often unseen, into tangible form through language. Through rumour, people both concretely *experience* the threat of violence and *express* their concerns about it.” Rumors and narratives, then, present an “epistemological category” (White, 1993) through which we can examine how individuals express their concerns about their lived experiences.

As stated in Chapter 1, geographers have paid close attention to how knowledge about our environment and what counts as valid understandings of the environment, shape our experiences, conflicts, decision-making, and management of resources (e.g., Sultana 2008, 2011; Goldman & Turner 2011; Robbins 2012). This study contributes to this rich literature by examining how these “epistemic vehicles” (White 1993) function to communicate fears related to the risks of mining, including those associated with the use of mercury. But rumors, as Kirsch (2002) astutely points out, also become productive of violence. Thus, this study also examines the gendered “geographies of blame” (Farmer 2006) that these rumors enable, burdening women in particular with the responsibilities for protecting the most vulnerable from harm while holding them accountable when things go wrong. This paper demonstrates an accepted truth of political

ecology and science studies: Knowledge, once made to circulate, is far from apolitical, and it participates in, while (re)producing social and political life, with material effect.

Mercury Abatement Programs in ASGM communities and Kenya:

Worldwide, artisanal and small-scale gold mining (ASGM) is an important livelihood activity for more than an estimated 15 million individuals (UNEP 2008); however, a lack of government support, monitoring, and regulation, the activity's largely informal status, and the utilization of outdated or improvised technologies (Smith et al. 2017; Spiegel & Veiga 2005; Hilson & Potter 2003; Tschakert 2009) to access and process gold are recognized as important factors that have led to the activity's detrimental health and environmental impacts both on its immediate members, as well as individuals in surrounding communities (Smith et al. 2018). For ASGM, the use of mercury to separate gold particles from crushed mineral ore in a process called amalgamation has been a serious concern because mercury is a potent neurotoxin that can easily disperse into the environment (Hilson 2006; Hilson and Van Der Vorst 2002; Hilson and Pardie 2006). Under the right conditions, it can be converted into a biologically-available form (methyl-mercury) that can enter food chains. In its methylated, or organic form, mercury is in its most toxic state. When it is ingested by organisms, it accumulates in bodily tissues and magnifies in concentration as it moves up trophic levels, causing motor deficits, declines in intelligence and memory, while affecting the kidneys and the digestive and immune systems (Clarkson 1992).

On August 16, 2017, the Minamata Convention on Mercury, an international treaty designed to protect human health and reduce anthropogenic emissions of mercury into the environment, entered into force. The Minamata Convention recognizes that ASGM communities worldwide are the largest anthropogenic contributors to global mercury pollution (Telmer and

Veiga 2009). As a result, it requires each of its member states with significant ASGM communities to design and implement National Action Plans to work towards the elimination of mercury in their ASGM communities. In 2013, Kenya—an East African country that has an estimated 250,000 artisanal gold miners and is recognized as one of two major hubs in the illicit mercury trade in sub-Saharan Africa (UNEP)—became a signatory to the Minamata Convention.

As part of its National Action Plan, Kenya announced in November 2018 that it would ban mercury in its ASGM communities as part of a larger, multi-country pilot program run in partnership with the Global Environment Facility (GEF) and the United Nations Environment Programme (UNEP) (Muchira 2018) following the publication of a multi-country study that demonstrated elevated mercury levels in the hair and urine of eighty female miners in Kenya (IPEN 2017). This study was widely reported on by the international and domestic press, leading to the production of several prominent articles and radio and television broadcasts in Kenya on the working conditions experienced by Kenya’s artisanal gold miners, including their exposure to mercury. Some of these news articles and television and radio broadcasts became the topic of conversation during informal interviews conducted with miners in western Kenya (author’s field notes, July-October 2017).

In 2018, Kenya announced a ban on mercury in ASGM, presenting a familiar approach to mercury abatement. In addition to the ban, Kenya promised to work with the Global Environment Facility to introduce improved technologies, including possibly borax, education outreach, and policies designed to reorganize and formalize the ASGM sector, bringing ASGM communities under tighter monitoring and regulations (Muchira 2018). Attempts to curb mercury use in ASGM worldwide by introducing improved mining technologies and education outreach, implementing supply-side policies that attempt to push miners out of the mercury market, and

formalization policies, however, have a long history, beginning at least in the 1980s (Hilson 2006b). Despite their best efforts, these approaches to mercury abatement have largely proven unsuccessful (Hilson 2006b; Zolnikov and Ramirez Ortiz 2018); other technologies proved inappropriate for the local geology in which it was introduced, or too expensive or cumbersome to repair or replace (Hilson 2006b; Hinton, J.J., Veiga, M.M., Veiga 2003; Zolnikov and Ramirez Ortiz 2018). More recently, the United Nations (2017) reported that mercury mining has been increasing over the past five years despite bans on the international trade in mercury. Perhaps unsurprisingly, restrictions on mercury supplies have led to the re-opening of formerly closed mines in Mexico and Indonesia (Spiegel et al. 2018; UNEP 2017).

Despite these policy and programmatic failures, however, it is often the miners themselves who are blamed for being too skeptical, too ignorant, and too poverty-driven to make sound decisions over their health and environments. This study engages with miners as rational actors, and it takes as its object of concerns rumors that began circulating in the mining villages and Rosterman mining camp between 2013 and 2017 as more information about the risks of mercury and mining began to circulate. I discuss two kinds of rumors. The first involves rumors about the “cursed” bodies of women and the risks one might encounter if a woman is allowed near the entrance of a mineshaft. The second involves rumors that recount the death of a child or an elderly man following the accidental ingestion of mercury. I argue that both rumors acknowledge the risks associated with mining and mercury and express the fears and anxieties that miners have when it comes to mining and mercury. I also demonstrate that these rumors also become productive of new forms of violence that disproportionately act to exclude women from engaging in full participation within the minerals sector while elevating them as the guardians of

household safety and care, producing a gendered “geography of blame” that places the burden of responsibility for harm on women and women alone.

Methods and Structure of the Argument:

The research for this article is part of a long-term, multi-year project that began in May 2013 and continued through October 2017. It draws on ethnographic work conducted primarily in Rosterman, Kakamega County’s largest mining camp, as well as in villages located in three of Kakamega’s sub-counties (Shinyalu, Ikolomani, and Lurambi) where significant mining activities take place. Until the end of this project in October 2017, development assistance in Kakamega’s mining communities was rare to nonexistent (personal communication 2017). Most miners received information about mercury through the media and geologists with the Ministry of Mines during on-site inspections, but there were no existing programs or outreach programs specifically related to mercury (personal communication 2017). Ongoing regulatory measures to fine miners for poor health and environmental conditions were enforced regularly, however (personal communication 2017). I also conducted semi-structured interviews with miners in Migori County’s mining camps at Osiri and Masara for comparison. Migori County is located along Kenya’s southwestern border with Tanzania and regularly attracts miners from Tanzania, as well as development workers and civil society groups who promote and introduce improved technologies for processing mineral ore and gender equity in mining. See Figure 1: “Map of research field sites,” for the locations of these sites.

I conducted semi-structured and open-ended interviews with 43 households and 12 focus groups (both jointly and gender-segregated), as well as one-on-one interviews for a total of 252 individuals. I remained in frequent contact with a smaller subset of individuals in Kakamega and

Migori throughout the course of this project. In both Kakamega and Migori, local language speakers were employed to conduct interviews with participants in either Ba-luhya or Ba-Luo (the dominant, local languages in the two regions), respectively, or in Kiswahili (the national language). I trained both translators in research methodology and research ethics. Interviewees were offered a small gift of tea and sugar for their participation in the study.

A portion of the interviews focused on miners' experiences with mercury (e.g., how they used and stored it; how they accessed it; what they understood about its risks; how they learned about mercury's risks; whether they knew of anyone affected by mercury; whether they had any concerns about using mercury and what, if anything, they had heard about mercury), their demographic background, as well as their labor history on the mines and their ability to access mineral ore. I coupled these interviews with participant observation in which miners would teach me how to dig for, process, and sell gold. This perspective allowed me to observe how individual miners think about, discuss, and use mercury on an everyday basis. As I conducted interviews, I began to notice rumors and stories that were being in response to questions about the risks of mercury use, and that these rumors and stories became more frequent as miners began to hear and learn more about the risks associated with mercury. Some of these stories are incorporated into the analysis below. Rumors and stories, even if they appear apocryphal in nature, can serve as important epistemic vehicles for understanding how individuals experience their everyday, lived experiences (White 1993). Here, they are treated as evidence both for what they tell us about miners' growing concerns about the risks associated with mining and mercury use, as well as who is responsible for ensuring that mercury is used appropriately—and perhaps, more importantly, who is to blame when someone is affected by mercury.

Kenya is the ideal location for this study because of its significant ASGM community and because it is considered a hub of the mercury trade in Sub-Saharan Africa (CEJAD 2018).

Kakamega and Migori Counties provided ideal locations from which to understand how miners exposed to varying degrees of development assistance (in the form of improved technologies and education outreach on mercury) understood, related to, and put into practice information about mercury and its risks. It also provided a comparison for examining how mercury exposure was distributed along axes of class, race, gender, and age.

In the upcoming sections, I will first provide some context on the intersections between gender inequality, mineral access rights, and mercury use and exposure before detailing ethnographic work on mercury knowledge and practices, as well as how emerging knowledge about mercury's risks is increasing the already precarious positions of women in artisanal mining communities in western and southwestern Kenya.

Producing Exposures: Mineral Access, Gender Inequality, and Mercury:



Figure 4: Women washers processing pulverized ore with a sluice box, Source: Author.



Figure 5: Women emptying a washing pit, Source: Author.

Female artisanal gold miners in Kenya are primarily responsible for processing mineral ore as manual crushers (who use makeshift hammers to break down the ore into gravel-sized pieces), haulers (who dry and then move the gravel-sized pieces to mechanical machines that grind the pieces down into a flour-like dust), and/or “washers” (who use mercury to amalgamate gold). Often, these positions are combined. Their access to mineral ore is usually dependent on men, who either sell them whole ore or tailings that were “washed” once with mercury or hire them to process their ore. In mining camps, like Rosterman, after women are hired to process a male miner’s ore, the tailings become her possession, and she will then reprocess the tailings up to three times to extract the remaining gold particles.

I worked with a three-member team of middle-aged women who shared the costs of leasing a pit from a landowner so that they could be hired to wash the ore of male miners at the main mineshaft at Rosterman. Each male “customer” offered the women 150 KSH (USD 1.50) per sack of ore to be washed with mercury. The work was often backbreaking, a monotonous

routine of hauling buckets of water from another pit to the top of their makeshift sluice box—being careful not to slip on the mud--where another woman would dump the freshly, floured ore while the third woman would watch to make sure that the material ran over the jute carpets laid down on the trough to collect gold (See: Figure 4: “Women washers processing pulverized ore with a sluice box”).

Despite the difficult labor involved, the women insisted that it was worth it:

On a farm, you make 150 KSH for a whole day of work. From morning until evening. You might get some ugali for lunch, more likely githeri [a local dish made of maize and beans], but the work—eh! It’s better to be here. Here, you can be free. You can work when you want, how you want. You can make much more.

While the work was profitable, with each woman easily making at least twice that amount from customers in addition to what they would make after they processed their combined tailings, it also meant that they were in close contact with mercury, as well as particulate matter that can cause serious respiratory illnesses. To process the ore, the women used mercury. To collect the tailings, the women had to drain the pit into another one, climb down and scoop the mercury-laden tailings—bucket by bucket—and lay it out to dry on a plastic tarp, occasionally sifting through it--with its vaporizing mercury--with their bare hands to ensure maximum dehydration. Then, they would start the process over again. Haul a bucket of water from the pit they had just filled while another woman would dump the dried tailings into the top of the sluice, both closing their eyes and holding their breath as the dust flew up, enveloping them. Then, the water was added, massaging the tailings through the holes with their bare hands. Collection of the carpets,

washing them to collect the gold particles, and separation with mercury. Repeat. The tailings, or “waste” from the initial wash is important because it passes mineral rights onto women allowing them to gain from the sale of recovered gold particles from subsequent washes that could provide up to an additional 1500 KSH (\$15 USD) to their wages.

Women in mining villages often gained access to mineral ore, or more likely, tailings by purchasing it from a neighbor’s mineshaft if her own family did not have one of their own. She might also invest in the development of a neighbor’s shaft by making a small, monthly payment so that she gets a guaranteed share of the ore when the mine produces, or her husband or other male family member might work in a mine. Here, too, she is responsible for the processing of mineral ore with mercury. While female miners in mining camps like Rosterman take the mercury-gold amalgam directly to a gold buyer so that the mercury can be burned off, a woman in a mining village is more likely to burn it herself. During the rainy season, which is long and extended in Kakamega, it also means that if a woman is burning the mercury-gold amalgam, she is doing so in her kitchen.



Figure 6: Male miners working a pulley to lower a miner into the mineshaft, Source: Author.

The lack of mineral rights that most female miners experience is maintained through stigmas attached to women and enforced by maintaining the spatial separation from the mineshaft. Before entering a new mining area, I always had to seek permission from the mining foreman. Every time I asked permission, I was supplied with a variation of the following:

We think that it is not appropriate for a woman to be near the mines. For example, if a woman is wearing a skirt and is standing at the entrance, it would be inappropriate.

To which I would usually gesture towards my trousers.

Also, we believe that a woman might cause an accident to happen. The tunnels might collapse. Or the gold might disappear.

While some men, such as my main interlocuter, Michael, would laugh at such stories, referring to them as the “superstitions” of their fathers and grandfathers, many did in practice attempt to restrict women from entering the area directly surrounding a mineshaft. Even Michael’s wife kept her distance from the mineshafts, sending her son to carry the crew’s lunch and tea to them daily. Mineshafts, seen as both a corrupting space for women, as well as spaces that can be corrupted by women, needed to be separated from the female body. And it was a strict separation. Women who were employed by the mines to provide water or cook lunch for the men would deliver the water or meals at a point that was located just outside of the shelter covering the mineshaft. Lucy, a female miner in the village of Lirhembe, concurred:

Even when we are working together, the men refuse to let us near the mine.

They make us stand just there, she says, indicating the far edge of the opening of the clearing. We cannot see what they bring up from over there. How do we know if we are getting our fair share? We give money to help run the mine, we should be getting equal shares. But the men, they control how much we get.

They keep us from seeing the ore because they say, we are cursed.

In the past few years, a few women have become mine owners. While their numbers are still small and restricted to women who come from wealthy families, have relatively high-paying jobs (two of the women I met began to mine after conducting fieldwork for a Swiss development organization), or are able to attract sponsorship from civil society organizations, they often discussed the tensions that resulted from having to depend on their male mine workers to access mineral ore. As Rose, a woman who had recently invested in a mineshaft at Rosterman told me:

Sometimes, the men [workers] will attack me. They'll tell me to go away when we are producing, because a woman cannot come near the mine. They say it's because they fear [I will cause] the tunnel [to] collapse or the gold will disappear. They refuse to keep digging if I stay....there's nothing I can do. I have to pay for the upkeep of the mine, and I can't do that if we don't produce....What can I do?

Another woman, Mary, who leads a mining cooperative with both male and female members made similar observations:

We depend on the men to get the gold. They insist that we [women] stay away from the mines because bad things will happen, because they think we are cursed. But if we are forced to stay away, how can we know how much ore the men are bringing up? It causes trouble. But we manage.

The expressed frustration of female mine owners and partial investors indicates both a mistrust of male workers in the mines and a sense that despite gains made towards accessing mineral rights, men will actively draw on circulating ideas about a woman's "cursed" body to maintain a physical separation between women and mineral ore, effectively restricting women's abilities to access mineral ore while monopolizing the valuable resource. Women who have managed to become investors in mines, who effectively make all of the capital and technological investments and risks of running a mining operation and who control the mineral ore are subject to these stigmas, which are deployed against them by their male laborers. Such processes have been noted elsewhere in the literature on women and mining (Jenkins 2014). Yet, while these rumors

may function to exclude women from accessing mineral ore, they also strongly communicate the fears that male miners have when entering into the mineshaft. By deploying the notion of a “cursed” female body that makes gold disappear or causes the mines to collapse, men acknowledge the inherently risky nature of mining, which they would almost never admit to when asked directly. As a Tanzanian miner working at Rosterman once pointed out when asked if he was ever afraid of working in the mines, “You cannot fear. If you do, you’ll never make it out alive....But look at the mineshaft. Look at the opening. It’s almost like a grave, even in the way it is shaped. They even lower us in on ropes like we’re going to our death.” Or, as another claimed, “Why do you think the men here drink so much? The money helps, but it’s the rest of it, too. It’s the work itself. I don’t know how I’d get through it if I didn’t drink.”

For women who depend entirely on men to access mineral ore, their positions are tenuous. Unlike female mine owners or investors, their only access to mineral ore is through processing or purchasing ore and that access is always dependent on men (Jenkins 2014). As gold prices have spiked over the last few years and more women have moved to the mining camps, competition for access has increased. Further, at Rosterman, as well as in the mining villages in Kakamega where I worked, men insisted that women’s labor in the mines was the direct result of their generosity and not necessary to produce gold. As Mike, the foreman at the main shaft at Rosterman said:

We try to give them something...kidogo [small], you know. It won’t make them rich but it will put food on the table for the day. These mamas they don’t have much. So we let them work here.

Indeed, this characterization of “charity” and “generosity” when it came to women’s work in the mines was a repeated refrain from male miners, is the subject of Chapter 3. It is also a characteristic which is common among men in ASGM communities on the African continent (Jenkins 2014). When asked about the risks associated with mercury, and whether they have spoken to the women they hire to process their ore about mercury and its risks, the men would also frame their unwillingness to speak with the female processors about mercury and its risks as a form of protection, of shielding women from the risks associated with their labor:

How could I tell this mama here that there’s an issue with mercury? She comes in everyday to work, she makes a good amount of money, and now I’m supposed to tell her that she’s working with a poison? Eh.

Men are generally the recipients of information entering the mines about risks, technologies, and new knowledge. They tend to be better educated than women, thus allowing them to communicate in Kiswahili and English. Thus, even as men grew increasingly aware of mercury’s potentially detrimental impacts on their health, learning new information about mercury through government officials, development consultants, and external researchers such as myself, they kept that information from their female laborers, who often avoided, or deferred to male miners when development consultants from the United Nations Environment Programme and partnered organizations when they began to visit Rosterman in late-2017 to observe mercury use in Kakamega’s ASGM communities.

These are processes, however, that are not confined to Kenya. Across Sub-Saharan African ASGM communities, where women’s involvement in gold mining can be as high as 70-80% (Jenkins 2014), access to auriferous ore is often dependent on men (Jenkins 2014, 2015;

Lahiri-Dutt 2006, 2012, 2008; Hinton et al. 2003). They are paid significantly less and are less upwardly mobile than men since their wages provide them with just enough to subsist. When they do gain access to mineral ore, it is ore that bears trace amounts of gold because it more likely than not has already gone through a round of processing. In mining villages, however, women might have direct access to mineral ore if their family owns the mineshaft or if they purchase the ore from a neighbor. If not, a woman in a mining village might also process mine tailings. Therefore, as Parker Shipton (1994) succinctly summarizes, women workers operate “under rights deemed dependent on or ancillary to those of males.” And like land rights, mineral rights are also always political. The material manifestation, in this particular case, being that women are relegated towards processing mineral ore, which places them at greater risk for respiratory diseases, such as silicosis from breathing in the flour-like dust while crushing or washing or suffering from higher rates of mercury exposure.

Men, on the other hand, usually have direct access to mineral ore and are paid in mineral ore (rather than in daily wages); a situation they prefer because of the potential for enormous returns from mineral ore. While this might mean that there are long periods of time when they are going without pay, when the mines begin to produce, they are able to accumulate economic wealth to a greater degree and at a faster rate than their female counterparts (Jenkins 2014). They are more able and likely to delegate processing tasks to women as competition for processing jobs among women has increased in recent months and as men are encouraged to hire women out of charity. Despite women’s involvement in mining communities, they have until recently commanded very little attention as mine workers (Lahiri-Dutt 2006, 2012; Jenkins 2014; Hinton et al. 2003; Price 2019; Rolston 2014), with most research concentrating on their work as sex workers (Fisher 2007; Bryceson, Jønsson, and Verbrugge 2013, 2014) and hence, their

vulnerability to sexually transmitted diseases, such as HIV/AIDs. Efforts have increased over the years to recognize the roles they play in mining communities (Hinton et al. 2003; Eftimie et al., n.d.; Hinton 2011). Development initiatives have also increasingly targeted women (Groots Kenya), and some state policies are also requiring that large-scale mining companies maintain a percentage of their workforce for female employees (Lahiri-Dutt 2006).

Mercury Poisoning and Local Geographies of Blame:

Prior to 2017, risk assessments were unavailable in Kenya's ASGM communities. However, miners had begun to associate mercury as a "poison" by 2013. In the absence of expert knowledge, technoscientific measurements, or programmed education outreach conducted by government officials or development practitioners, miners had begun to give substance to mercury's potential risks by drawing on common references to "mercury poisoning." Thus, mercury's invisible exposure and risks were materialized as a poison that, when ingested, would cause death. By 2014, references to mercury as a "poison" had increased in frequency. When pressed further, many would respond that they had to take special care to ensure that they locked it away so that their young children would not accidentally find it, play with it, or worse, consume it. That elemental mercury is a liquid at room temperature also fed into these prevailing ideas, with miners fearing that mercury could be confused with other liquids if one were not careful and mistakenly ingested. Ironically, elemental mercury is poorly absorbed by the gastrointestinal tract (Clarkson 1992) and there are few examples of individuals who have died after ingesting it. In fact, mercury was historically used in medicine as a laxative (Clarkson 1992).

Despite the understanding of mercury as a poison, however, most miners did not express any other risks associated with mercury use and they had no reason to believe that it couldn't be handled safely. Like other "poisons" in their lives, such as chemical pesticides, miners believed that mercury's dangerous effects could be contained if handled properly. Most claimed to have special locations in their homes where they would hide their mercury stores, as well as plastic bottles that ensured that mercury's risks could be contained. Otherwise, they did not utilize any other precautions.

When asked about whether they used gloves or masks when handling mercury, miners often explained that even though they knew about gloves and masks and where they could be purchased, they often complained that they were cumbersome to use, uncomfortable in the afternoon heat, and made it difficult to keep track of the ball of mercury when processing. The ability to feel the bead of mercury as they washed was important for miners, especially for those who were first starting to learn how to process and feared that they would accidentally "lose" the mercury as they removed water from their processing bowl. Further, miners could not explain why one would need to use either gloves or masks for protection when using mercury. Given that mercury's risks had strong associations with ingestion, its other exposure pathways were rendered invisible. The idea that mercury could vaporize from its metallic form on its own and without burning or be absorbed through the skin were remained invisible as potential routes of exposure for Kenya's ASGM.

By 2015, however, two years after Kenya had signed the Minamata Convention and news stories about ASGM and mercury began to appear more frequently, the narratives I heard from miners in Kakamega in response to questions about mercury's risks began to shift. As I described in Chapter 1, during one particularly telling interview in a mining village on the outskirts of

Kakamega Town commonly frequented by non-governmental organizations, development researchers and project managers, Michael introduced me to Linus and his wife Melissa, both of whom had been mining in the village for over a decade (though Linus had recently decided to stop mining because of his age). When asked about mercury's risks, Melissa cleared her throat and said something in Luhya—the dominant language among the Abaluyia in western Kenya. Michael translated:

“She says, there are times when the cups rust if we leave the mercury in them overnight. That there are times when, if you leave mercury in a cup overnight and come back, there is a hole in the cup.”

I nodded in acknowledgement of the statement and looked at Melissa to encourage her to speak. She continued. Hesitating again, Michael translated:

“She says that sometimes, she worries. If it burns a hole through a metal cup, what is it doing to her? She says there's an mzee¹ from over there,” he translates, gesturing towards a hill in the distance. “He died from mercury.”

“Died? How?”

“He was out late one night, drinking changa'a. Do you know changa'a? It's local alcohol. Very strong. He was out drinking and he came home and [continued to drink]. But he accidentally drank a cup of mercury that had been left out on the table thinking it was changa'a and then he died.”

“Who is the mzee?”

¹ *Mzee* is Kiswahili for “old man,” or “male elder”

“She doesn’t know the name, just that he came from far. Beyond that hill there.”

“Has this happened before?” I ask Michael.

“There are times when children will drink mercury and die. That’s why we make sure to keep them away and make sure the children can’t get to them.”

Stories about the deaths of individuals following the ingestion of mercury were in wider circulation by the time I returned for more in-depth research in 2017. By then, both men and women told stories about individuals who had died from mercury ingestion, with men often positing that the victim was a child, who had ingested mercury because his or her mother failed to adequately secure it in a safe place.

During one particular focus group, all 14 men claimed that the mother of the child was to blame for the death. After all, the reasoning went, she was supposed to be watching her child and making sure the child was safe. In other versions of the story, like that told to me by Melissa, it is an old man who dies after a heavy night of drinking. Usually, he stumbles home and mistakes a cup containing mercury for his liquor, drinks it, and subsequently, dies. Again, it is the woman’s fault for not putting away the cup, or, for storing mercury in a cup used for drinking. As a male miner explained to me, “If a woman is caught using dishes or cooking ware for mercury, she can be beaten, or worse, divorced!” The men in his mining group nodded in agreement.

These stories appear apocryphal in nature because ingestion of elemental mercury is rarely a cause of death since it is poorly absorbed through the gastrointestinal tract. Further, the victims of mercury ingestion always remained nameless and from some distant village, “just over there.” Despite their wide circulation, no one had met a family member whose relative had ever

died after drinking mercury. These rumors of mercury ingestion and death, however, acknowledge that mercury can cause serious harm to one's body and perhaps, even, an acknowledgement that its dangers might affect them even if they may not understand how or what it is doing to their bodies. Whether these stories are "true" or not is inconsequential; what matters is how they are told, understood, and put into practice. Like the characterizations of women's bodies as "cursed," rumors about literal mercury poisoning suggest that miners are aware that they are participating in activities that put them at serious risk.

At the same time, however, both rumors serve to delineate both the appropriate social role of individuals, as well as a failure of individuals to behave according to their prescribed role. Women, as domestic caretakers, are responsible for both the preparation of food and drink, as well as vulnerable members of the family, such as small children and old men. It is a woman's responsibility to ensure that mercury is contained and stored in the designated safe place. The function of these stories is to produce what medical anthropologist, Paul Farmer describes as a "local geography of blame," in which women bear the brunt of the responsibility for the harm that results from using mercury. This blame is compounded by the fact that they are also held responsible for protecting vulnerable members even when they themselves are rarely granted access to current, technoscientific information about mercury's risks that might be circulating among male miners because of their easy access to development practitioners, government officials, and external researchers.

Conclusions:

The objective of this study was to expand the boundaries of what "counts" both in terms of our evidence as ethnographers, but also how rumors, partial information, and

(mis)understandings allow for certain risks to be perceived, while maintaining the invisibility of others. For Kenya's ASGM communities, mercury's physical properties, coupled with ideas about mercury as a "poison" come together to shape how miners understand dangerous exposure pathways but fail to grasp the possibility for other, more invisible, pathways like breathing in mercury vapor, or consuming organic mercury through their diet.

These conditions are not confined to Kenya. Rather, as we are learning from newly emerging information about the prevalence of persistent and dangerous chemicals in our environments, drinking water, and food supplies, forms of imperfect information, rumors, and misinformation shape the landscape of toxic knowledge. For toxic exposures that exist under conditions in which technoscientific instruments, scientific expertise, and risk assessments are lacking or occur unevenly, understanding how communities make sense of those exposures matter for risk mitigation strategies.

Further, how individuals understand a dangerous substance, which of its properties can be contained, and who is most vulnerable also matters for who is designated responsible for ensuring everyone's safety, and therefore, who is to blame when things go wrong. In this case, women bore the responsibility both for the protection of the most vulnerable, while also bearing the blame when deaths occurred, even as they were also least likely to hear information about mercury. Information, then, is far from apolitical, and the potential threat of danger and knowledge about that danger, can produce forms of precarity that get distributed unevenly along axes of class, race, and gender to fall hardest on those who are already most marginalized.

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Chapter 3:

The Politics of 'Care Distributions' in Kenya's ASGM Communities



Figure 7: A female crusher manually pounding stones to the size of gravel, Source: Author

Introduction: Extending Care to the Mines:

I am walking arm in arm with Timothy, the chairman of the Kakamega Mineral Mining Group, during one of my first visits to Rosterman mining camp. The group was started a few years back by 65 local miners to raise funds for mining ventures in Rosterman, to advocate for artisanal mining rights at national fora, and, as the group grew in size and membership, to establish and set rules and regulations for the behavior of miners at Rosterman and settle conflicts. As we meander through the muddy footpaths that snake throughout Rosterman mining camp, we pass the main mineshaft on our left which gives life to the entire venture and allows

others to sink their own pits. The silent and largely absent investor of the main mine shaft is a Luo man from Migori County who provides the capital for the large pumps and motors that simultaneously oxygenate the snaking tunnels below while drawing out massive amounts of groundwater through a pipe that fills the nearby processing pits and empties into the nearby river after irrigating several small maize fields. The pumps that attend to the main mineshaft draw out so much water that some mineshafts only require a small pump to draw out the remainders.

“Before the investor came in, this,” he moves his left arm in a sweeping motion indicating all of the smaller, vertical mineshafts that dot the outskirts of the mining camp, “would not have been possible. We tried for so long but there was just too much water. Every time we tried, we would be flooded. If we went in by the Rehabilitation Center [the former entrance to the Rosterman Gold Mining Company, Ltd.], we’d be crushed. The problem in this place is the water. It causes flooding and makes the walls weak. But the gold here is so rich and pure, that’s why it goes for 3,5[00 KSH] per gram. In Sigalagala, it’s closer to 2,7[00 KSH]. It allows us to give jobs for all of these mamas here,” he says, indicating the throngs of women hammering away at large chunks of ore, breaking them down manually to the size of gravel, while others haul large sacks of ore to the steel-ball crushers that will pulverize the ore to a fine dust, and other women—mostly Luo—work on washing the dust with water and mercury.

“Now, we have thousands of workers from Nyanza and Kakamega. But there are also those Kikuyu there, some Tanzanians, and others over there who are from the same place as your research assistant. All over.”

Timothy is proud of the accomplishments made by his mining group, which he refers to as a cooperative. He claims that they opened up opportunities for the local community, especially the women.

“Anyone who comes here looking for a job, we provide it. We understand how hard life can be, so we want to make sure that everyone benefits....Life here in Kakamega, it can be hard, you know? So we give people jobs, something kidogo [or, small] that helps them.”

Timothy frames these jobs as the result of charity, of looking out for one’s fellow community members, and to a larger ethos that the minerals of the county should directly support the economic development of that county. But he also gestures towards a sense of shared protection and community-building, one that emerges out of relations of care:

“We care for one another; we look out for each other. Look at that babe there. She can wander and play while her mother works all day, and the mother doesn’t fear. Someone will come along and pick her up and play with her. Everyone knows the child belongs to that woman there. We protect each other and make sure that everyone has what they need. That’s what mining should do.”

Care, care ethics, and the politics of care are generally examined in their more traditional sites, such as medical facilities and domestic spaces (Livingstone 2012; Bartos 2018; Martin, Myers, and Viseu 2015). But Timothy’s insistence that the Rosterman mining camp is

fundamentally a place where individuals can access care, protection, and economic security, suggests that it too can be a space where relations and politics of care come to matter for how individuals are able to access resources. For the miners who live and eke out a living within the Rosterman mining camp, who experience forms of precarity in their daily lives, relations of care allow them to exist, cope, or even thrive. To deploy care as an analytic is to shed light on how these relations not only come to matter for how individuals can access resources, but also how relationalities structure society (Bartos 2018; Robinson 2011). Drawing on injunctions by feminist science studies scholars and critical geographers to “unsettle” or to “trouble” care in its various manifestations (Murphy 2015; Bartos 2018) and to avoid falling into the trap of upholding romantic notions of what it means to care, unsettling care allows us to examine the darker side of care—of those excluded from care, deemed undeserving of care—as well as the politics that are involved in what I call “care distributions.” Care distributions denote resource distributions that are the direct manifestation of care. Just as care can be extended, it can also be withheld, applied unevenly, or deployed to produce relations of obligation (Martin, Myers, and Viseu 2015; Murphy 2015). Thus, care is inherently political (Tronto 1993; Robinson 2011; Murphy 2015; Martin et al. 2015), and as I demonstrate, it can return as profit for those who extend or receive it.

In this article, I examine case studies where care is used to draw the lines of what counts as appropriate behavior or legitimate bodies within Rosterman mines, designating who is, therefore, deserving of care. By following instances in which care is withheld or restricted to particular groups producing uneven distributions in access to mineral resources, and hence, economic security, these case studies underscore the material, affective, and political ramifications of these relationalities of care. Care distributions matter for the gold miners at

Rosterman camp, and they define who *deserves* particular kinds of care, who can access it, and under which conditions. But care distributions are also active. Rather than argue that relations of care are necessary for the maintenance, continuation and repair of miners' worlds (Bartos 2018), I depart from this tradition to examine how care is strategically deployed, invoked, and engaged to maintain or gain access to mineral rights.

The other way in which I seek to unsettle care is to expand the possibilities for who can participate in relations of care. Traditional studies of care, building off of Fisher and Tronto's often cited definition of care as "*a species activity that includes everything we do to maintain, continue and repair our 'world' so that we can live in it as well as possible*" (1990: 40; emphasis added) restrict analyses of care to the realm of the living with a strong anthropocentric bias. But the "material turn" in geography, anthropology, and allied social science fields have illuminated how things come to matter in shaping social and political life (Lemke 2018). In the Rosterman mining camp, where machine breakdowns, tunnel collapses, water intrusion, and fuel shortages occurred with regularity, activity in the mines were strongly dependent on these things running smoothly. Thus, my research attempts to expand the kinds of spaces where care relations could be analyzed, while broadening the scope of actors who matter in how these relationships play out.

To conduct my analysis, I draw on nine months of ethnographic field work conducted in Rosterman mining camp, an informal gold camp that attracts several thousands of miners—men and women—predominantly from Kakamega and Migori Counties, but also from Tanzania. Rosterman mining camp is located at the site of the former Rosterman Mining Company, which closed its doors in 1952. During this time, I worked with miners in the various jobs available at the mine camp, from digging (in my case, observing) for gold in the smaller, vertical shafts on

the periphery of the camp, manually breaking down mineral ore, washing pulverized ore with mercury, and the sale of gold. In these encounters with miners, many of whom I remained in contact with throughout the entire nine months that I was in Kenya in 2017, I conducted semi-structured and informal interviews, observed their practices and relations with other miners, and learned about how miners navigate social relations at Rosterman.

Through three case studies, I examine how care is deployed to maintain, establish, or gain access to mineral rights. These case studies allow us to think critically about the relationship between care and critical resource management, the ways in which care is extended, invoked, withheld and to what extent, while keeping hold of the material, social, and political ramifications of those actions. I present the ethnographic text and field notes in almost complete form so that the stakes of resource access are contextualized within the minespace to move analytically towards a form of *critical care* (Puig de la Bellacasa 2011, 2015; Martin, Myers, and Viseu 2015).

Case Study 1: The stakes and ramifications of care given and care withheld:

Hilda is an elderly, Luhya woman who manually crushes mineral ore with a makeshift hammer. Every morning, she awakes by 5 A.M., builds a fire and puts the kettle on for *chai*, and proceeds to sweep the floors of the one-bedroom hut she shares with her husband. Hilda confides to me that her husband generally spends his days either finding casual work on their neighbors' farms or as a mason's assistant. He spends his earnings at the neighborhood *changaa*² hut, a single mud hut constructed in one of their neighbor's compounds where men, usually fresh off a casual job will gather—sometimes as early as 9am—and stay until they have spent their new

² Illegal liquor brewed in many Kenyan villages. It was recently outlawed by the government because of a rash of deaths that occurred from poorly brewed batches.

earnings. On this morning, her husband had stumbled home around 11 the evening before and he had slept in until around 8. She always waited until he woke up, setting out fresh *mandazi* (fried bread) (5 KSH), and hot *chai* with sugar (~30 KSH) for him before setting off on the 10-kilometer trek to the Rosterman Gold Mines.

Hilda began working the soils at Rosterman in 1996. She claims that mining accidents were common and she had to stop working there when the government intervened and shut down the mining operations. About a year ago, just around six months after the large shaft had opened, she decided to start again. At first, she was reluctant to go and find work there. She was older now and she wasn't sure what kind of work she would find. But another woman in her village started working in the mines, and when Hilda approached her to learn more about the work, she convinced Hilda to come with her. "She was only a few years younger than me and she told me she made a lot more money working on the mines than from doing anything else. I didn't want to be idle anymore, so I followed her."

Work on the mines was difficult. She didn't know what was expected of her, when to show up, who to work for. The first few days, she didn't even have her own hammer and she showed up after all the work was taken, so she went home empty-handed. Finally, her friend helped her, lending her a hammer and training her with the jobs that she received from her regular "customers," and giving her a small portion of the earnings. After a few days, she was on her own. There weren't that many women yet willing to pound [the ore], and she could usually find a miner to hire her. She charged 150KSH to crush a 25-kilogram sack. If she was able to get through it quickly, she could generally do three to five sacks a day. At the end of the first day that she crushed, her entire body ached. Her wrist felt like it was "on fire. I couldn't keep it still, my whole arm was shaking. It felt weird. Numb but like it had needles." But she kept coming

back to the mines because it was the most money she had been able to make for a single day's worth of work. Now, she claims with pride, her body still aches, but it isn't the same kind of pain she experienced those first few days. She is stronger now and her body is able to take the pain of the repetitive task. Besides, over time, she has learned how to strike the rocks in just the right way to reduce the impact on her arms and lessen the amount of energy she has to exert.

By the time I met Hilda, Rosterman was attracting thousands of workers to the mines everyday. The line of women waiting outside of the main mineshaft had tripled in size since Hilda first started, and Hilda worried all the time. "Every day that I come to the mines, there are new women there waiting for jobs to crush," she says, staring at them warily. "One of them will replace me one day, probably soon. I'm getting too slow. I can only do two to three bags of ore a day. My usual customers are making excuses now. Ah, *mama!* Not today! I promised Faith or Nancy. I decided to keep my ore today instead of processing." She says, sighing. That day, Hilda sat on the periphery of the semi-circle of women that had formed outside of the main mineshaft, waiting for hours, trying to catch the attention of some of her most loyal customers, the ones she can usually convince to continue giving her work. "I remind them of their own mothers. Sometimes, I ask how they would respond if I were their mother. How would they feel if a person refused their mothers work, refused to help her eat." But sometimes, even that's not enough: "Sometimes, I have to beg," she whispers, looking down at her hands.

"I'm too old. These young girls, they come here and they are stronger, faster than me. They are attractive and the young miners, they like that. [The men] want to please [the new girls]. Now when I crush, I always look for a new girl who can help me. That way, at least, we can move through the work faster. If

she is attractive, it's even better because then the men want to please her, want to hire her.”

Male miners acknowledged that hiring a woman to crush or to wash their ore was a generous act, one of “charity” that allowed women to survive. Mike, the foreman of the main shaft often said it was necessary for the men to give the *mamas* something “*kidogo* (or, small) so that they can eat and fill the bellies of their babies. It is our duty to provide that.” Mike and the other male miners considered the act of providing work to women as part of a moral obligation that allowed women to gain access to necessary and life-sustaining funds. Hilda invoked those obligatory expectations and relations when she called on her usual customers and reminded them of their mother, imagining them in her position at risk without work. And she used whatever means were at her disposal to gain access to that work, including capitalizing on the ability to attract work by partnering with a young, attractive girl.

On days when she can't find a young girl to help her crush and finding work is difficult, she is forced to work for customers she knows are unreliable because they are known to refuse to pay after the work is completed. Despite having administrative officers who are available to handle these kinds of conflicts, they are rarely resolved and the women are told to leave it alone. “Sometimes, if a woman complains too much, she will be [verbally] attacked by the man who has refused to pay her. He'll say, ‘why are you causing so much trouble? Why do you accuse me?’ And then the other miners will refuse to hire her because she has insulted the man and because she might cause trouble for the other men.” Thus, just as care can be extended, it can easily be withheld from people who are seen to transgress the appropriate social codes expected of their gender. Withholding ore, then, can be a disciplinary measure designed to let a woman

know when she has overstepped her boundaries, while withholding enforcement allows for abuses to fester in the mines, especially among the very women who are supposed to be there for much needed assistance and work.

One of the young girls who Hilda had trained was a woman named Nancy, who had started at the mines a few months ago. Nancy never had trouble finding work, despite the intense competition at the mines. She explained it to me like this:

“The men in the mines, they like me and always want to do things for me. Sometimes, I’ll date one of them. I tell them we’re not in a relationship because I’m in love with someone else who lives in Nairobi. But while we’re together in the mines, my boyfriend will make sure that I always have work and I can also make sure that Faith [Nancy’s close friend] also has work.”

Nancy was careful to stress that the relationships she had with men at the mines *were* relationships and *not* prostitution; a framing that has been observed in mining locations in Tanzania among female bar workers engaging in sexual relationships with men (Bryceson). She makes this distinction because in a relationship, “the man has to provide you with certain things. He has to take care of you. That’s why I can get work for Faith, because he will always tell his friends to give her work when I ask him. But a prostitute, it’s just an exchange of money. Once it’s done, it’s done.” Nancy strategically positions herself to gain access to mineral ore for both her and her best friend by establishing relationships with men in the mines, benefitting from the interactions with the young men, while extending her relations of care to include Faith.

At the same time, her relationships also put her at increased risk for acquiring sexually transmitted diseases, especially HIV/AIDs which is prevalent in western Kenya. Nancy mentions

that she is able to access contraception “most of the time. I go to the clinic and get a shot and it lasts. It protects me.” But when it comes to condoms, she says, “I try to convince [my partners] that we should use condoms. Sometimes, they are willing, but usually, no.” When asked about whether she had access to testing centers and resources about sexual health, she stated:

“There are NGOs that come here sometimes, other times, health workers from clinics or hospitals will come. They tell us about HIV/AIDs and other diseases. But we can’t go to the clinics to get checked. If we did, and someone found out why we were there, eh...! I’d never be able to be in a relationship.

Other women in the mines concurred with Nancy’s assessment. The possible stigma that could attach to a woman because of the possibility that she might have HIV/AIDs was enough to prevent most women from accessing medical care, highlighting how care distributions can entrench existing gender and economic inequalities, strengthening the boundaries around acceptable and unacceptable behavior, and putting women at risk. Care relations, counterintuitively, can act to produce and maintain forms of “structural violence,” as described by Farmer (1994) in his work on HIV/AIDs in Haiti.

Cast Study 2:

While the previous case describes a situation in which care distribution occur along lines of economic and gender inequalities, with women strategically deploying strategies to invoke and gain access to resources, this case examines how care distributions are also highly racialized. Rosterman’s main mineshaft, and indeed, many of the mineshafts in the area are owned, operated, and staffed by Luo men. Luo men and women are characterized as expert miners

because of the existence of large mining camps in Migori and their relative proximity to Tanzania, which allows them access to better and more economically viable (i.e. less expensive) mining technologies and knowledge. It is no surprise, then, that because Luo men control access rights and the means of production that they, along with Luo women not only have access to the best jobs, but they are also granted better access to mineral rights. When Luhya men complain that their Luo colleagues are being given more ore than they are, even when they are digging the same amount of ore or more, the technological skill and expertise of Luo miners is often invoked in order to justify the higher payment. Markers of skill, technological ability, and access to capital shape ideas of “legitimate” miners who then designate a category of miners who *deserve* better access to mineral ore according to race.

Male miners are not paid a daily wage; rather, they get a share of the mineral ore that is dug out of a mine. Men prefer this system because it means that when they’ve hit a productive vein, they can be handsomely rewarded and can accumulate wealth faster than if they were paid a daily wage. While women generally lack access to mineral rights because they do not work in the mines themselves, they are able to gain access via one of two main routes: they can purchase mineral ore from a male miner, or they can work as a “washer” to process pulverized ore with mercury. After the first wash, the tailings, and whatever gold is leftover, become their property. Unlike their Luhya counterparts, like Hilda, who are generally employed as crushers earning a wage per sack of ore broken down, Luo women enjoy both the gains from the wages they receive for processing ore as well as whatever gold they can capture from mine tailings. Luo women will often pool their resources to dig or rent a pit so that they can share their tailings with one another. Doing so helps to smooth the risk and ensure that all women are gaining the benefits of gold. And because Luo men tend to work in mineshafts with the highest quality of ore because of their

perceived expertise and skill in mining, and they are more likely to hire a Luo woman to wash their ore, Luo men and women gain the most from this system.

Overall, the people who benefit the least from this system are Luhya women. While they can get jobs as washers, and thus, gain access to mineral ore, language barriers and relations of care that exist between Luo men and women tend to exclude them from the highest quality ore because Luhya men tend to get paid less than their Luo counterparts, and are less likely to acquire jobs in the main mineshaft. Thus, while Timothy, who we met at the beginning of this piece theorizes a concept of economic, social, and moral responsibility that the mines have towards the economic development of Luhya communities; in practice, Luo miners tend to enjoy the majority of the benefits from mining in Kakamega with very little cost.

Case Study 3: Non-human actors and the politics of care:

On multiple occasions, miners often told me that the problem of Rosterman “was the water.” Western Kenya, and Kakamega County in particular is home to some of the lushest and agriculturally-rich, though vastly underutilized, lands in the country. It rains regularly, even during parts of the dry season. As a result, the water table which Rosterman is built on, has a large water table that is located close to the subsurface. Prior to the construction of the main mineshaft, artisanal gold miners in Kakamega often tried to access the deep network of underground tunnels that had been dug by the Rosterman Mining Company, a company that had been in operation in the area until 1952. Most were flooded out. If they managed to make it into the tunnels, the tunnels often collapsed, weakened after years of being inundated by water. Accidents were common and as my interlocuters often repeated, “many people died.” On my first visit to Rosterman in 2013, all of the mining was restricted to alluvial mining. But in 2016,

the main mineshaft at Rosterman was opened, backed by a Luo investor, who provided the capital, large pump, motors to pump the large volume of groundwater out at a fast enough rate to allow miners to access the tunnels, and the main staff to operate the mineshaft.

Rosterman's current status as a mining camp that is capable of supporting thousands of miners is a testament to the capital and technological investments made in the main mineshaft. The entire system is dependent on its proper and regular functioning. The opening of the main mineshaft allowed other miners to sink their own shafts because the networks of pumps and pipes at the main mine drew out large volumes of water, at a fast enough rate, sucking out the water from the periphery of the water table like a giant straw, and reducing the operating costs for the smaller mining investors who have since sunk their own mineshafts. Rather than needing a big pump like the one at the main mineshaft, investors can run their operations with a much smaller, less expensive, and more widely available pump and motor.

But the problem with the water is that, while the water pumped from underground was often utilized to support mining operations, including the processing of mineral ore, it also fed into and irrigated nearby agricultural crops, while the rest of it was dumped directly into the small stream at the base of a hill. This small stream was located at the base of a hill that served as the main drinking source for nearby villagers. The additional water would often flood the stream with the brown, opaque water from the depths of the tunnels, flooding the stream bank. Women in the villages also used the refrain, "the problem in this place is the water," but rather than referencing the abundance of water and the need to remove it, they were lamenting the *lack* of clean water and their newly polluted water supplies. Thus, the costs borne by individuals in the surrounding villages—individuals which Timothy and the operators of the main mineshaft purported to help and support—lost access to their main drinking water supplies and were forced

into daily decisions about whether to access their water from the polluted stream below, or to scale back their use of water.

Throughout the nine months that I conducted field research on Rosterman, the main mineshaft would be forced to stop production on occasion because of equipment failures or tunnel collapses. When this happened, all of the mineshafts had to shut down production. Their small pumps couldn't pump the water out fast enough. If the shutdown lasted several days, the mineshafts resembled a series of wells pockmarking the landscape and mining investors feared that the flooding would cause the walls of their mines to weaken, putting them at heightened risk for tunnel collapses. Women from the nearby villages could often be seen drawing their household water from the mineshafts now turned into wells, drawing on their clearer appearance to assume that these newfound water sources were safer than what they could get in the stream.

When the main mineshaft at Rosterman stopped, almost all of the economic activities at Rosterman came to a standstill, its labor force drastically reduced as Luo miners and washers disappeared and service providers, from clothing vendors, restaurants, and mobile banking kiosks remained closed. Female Luhya laborers, however, still reported to work, looking for the rare miner who had saved some of his rocks and was looking for someone to help him crush or wash them. Rosterman's closures brought to the fore how uneven care distributions played out for the miners at Rosterman. Those who could afford to leave and take the few days off—mostly Luo workers and many of the male Luhya miners—left the mines; those who couldn't—especially the Luhya women who were paid laborers—remained, desperately seeking out work.

In the weeks preceding and following the first of two presidential elections of 2017, Rosterman shut down. During this month-long period, Luhya miners with whom I had interacted with for the last seven months were left to remain “idle” at home. They dipped into what they

were able to save from working in the mines and depended on their self-help groups to get them through these difficult and uncertain times. Most of the Luhya female miners I knew at Rosterman belonged to at least one group. Self-help groups in Kenya help individuals save informally, that depend on each individual member contributing to a communal pool of money that is then distributed to members based on rules that they created. Most of the women I met, including Hilda, credited mining with allowing her to join a self-help group which provided her with both a social group, as well as some measure of economic security. When women belonged to self help groups that attracted women from a diversity of economic activities, they were able to make it through the mine closures fairly well, since their groups could adjust their distribution rules and accommodate the woman in her time of need. But when all of the members were miners, as many of the groups that formed

These work stoppages also laid bare some of the contradictions embedded in Timothy's romanticized idea about the obligations of care and economic development that Rosterman represented and provided to the local, Luhya communities of Kakamega County. That, at the end of the day, Rosterman operated like any other extractive company once its mineral deposits have been exhausted. It leaves, taking with it its laborers, minerals, and equipment without regard to the long-lasting, silent and detrimental impacts on the environment, local hydrogeology, and economic security of those who depended on it for their economic security.

Thus, machines, water tables, electricity, and even political events shaped whether the mines were operating or not on any given day. They produced polluted waters for surrounding communities. In their breakdown, inabilities to be restrained or procured, "things" also shaped whether there were resources to distribute while compounding the precarity of those for whom care distributions were withheld or limited.

Conclusions: Care Distributions and Research Practice:

This paper seeks to “unsettle” care by examining how it is invoked, how its distributions shape and produce social and political outcomes with material effects. By paying attention to how miners, especially Luhya women, invoke obligations of care, as well as how resources were distributed according to feelings of social obligations, this paper also illuminates how resources withheld, extended, or unevenly distributed act to define appropriate behavior, legitimacy, and social codes on Rosterman.

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Conclusions:

This dissertation examined how miners make sense of mercury. For artisanal and small-scale gold mining communities, who depend on the use of mercury to process auriferous mineral ore, the use of mercury is considered essential and is associated with securing, maintaining, and bolstering miners' economic livelihoods. For western Kenya's artisanal and small-scale gold miners, many of whom had grown up mining, had parents and grandparents who mined using mercury, and who didn't know anyone who had been negatively affected by its use, mercury potential risks often escaped comprehension, with reason. Toxic exposure and toxicity are very difficult to observe on a daily basis. Given the long latency periods between exposure and symptomology, the complexities of multiple and possibly synergistic exposures, the uncertainties around whether the symptoms one is experiencing *are* the result of mercury exposure or something else in the environment, and mercury's complex physical properties and abilities to form compounds that change the nature of its risk, it is inherently difficult to know and to give substance to mercury's dangers.

This dissertation grappled with these large uncertainties as it followed artisanal and small-scale gold miners under conditions where they are receiving information about mercury but in an uncoordinated and piece-meal fashion. Their sources of information included: passing government officials during inspections or health regulation enforcement, in workshops run by NGOs as part of a larger campaign to reform mining laws and regulations, through the news, through development workers and external researchers, and through friends, family members,

and colleagues. My first two papers described how miners make sense of mercury under these conditions. Which characteristics, which stories, which practices come into focus and highlight mercury's dangers? Which characteristics matter for obscuring its risks? How do miners seize on the physical properties of mercury and enroll existing ideas about mercury into producing meaning about what it is and what it does to their bodies? I argue that paying attention to these uncertainties, rumors, narratives, and (mis)understandings about mercury matters for how miners form an idea of risk and decide whether it is possible to make changes. For the majority of miners for whom mercury's risks are made visible, the only possible option is to accept being poisoned. These studies underscore the ethical implications of research and practice to those who are targeted for assistance. Information released takes on a life of its own. Information in the absence of viable, available, and affordable solutions leads to a resignation and acceptance of risk. Information released without context and specificity produces precarity for those already marginalized in society.

This study also examined how miners at Kakamega's largest informal mining camp accessed resources. By operationalizing contemporary theories of "care," I sought to extend the focus of spaces within which we imagine care to take place. I also sought to trace how obligations and relations of care are strategically deployed by miners to gain access to resources. In so doing, I also demonstrated how the extension and withholding of resources also define who is deserving of resources and under which circumstances. Uneven 'care distributions' also fall along lines of perceived legitimacy. In Kenya's artisanal gold mines, where Luo men and women are considered the most skilled, able, and technologically sophisticated miners, they are prized and awarded better access to quality ore with cascading, downstream effects that detrimentally

shape the abilities of Luhya women to access life-saving and life-sustaining resources, including mineral ore, water, and health care.

This study underscores the need to proceed cautiously when thinking about care when providing assistance. All of the development projects and policy reforms aimed at attempting to reduce mercury use and exposure in artisanal and small-scale gold mining communities rest on an ethics of care. But treated in a romanticized, idealized manner in which one is acting to help or to save or to protect can lead to the production of increased precarity in artisanal and small-scale gold mining communities. Without an appropriate attention to how resources are distributed, to who benefits and who loses, to who sets the rules about when resources are distributed and under which circumstances, we risk compounding existing socio-political dynamics that make life easier for some at the expense of others. Timothy's idealized notions about the meaning of Rosterman and about its responsibilities to the Luhya community are belied by the practices and distributions of care and resources. But as someone who has benefitted enormously from the recent investments in Rosterman, he is also particularly blind to the plight that Luhya women are encountering on the mines often seeing their existence as the result of charity rather than economic justice, contingent rather than necessary and sustaining.