Transversal Harm and Zemiology: Reconsidering Green Criminology and Mineral Extractivism in Cerro de Pasco, Peru

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Abstract

Green criminology has been advancing a focus on environmental crimes and harms. Extending this inquiry into avoidable and avertable environmental harms is a key function of both green criminology and zemiology. However, while the former seeks to expand regulatory frameworks, the latter contains within it the potential for a more holistic reimagining of the social world. Based on a methodology that combines qualitative methods (key informant interviews), a zemiological analysis, and the political ecology of Felix Guattari, we present a reconceptualization of harm inflicted by mineral extractivism in Peru's Cerro de Pasco. The analysis utilizes the concept of transversal harm, which allows us to move beyond the criminal and civil damage of corporate crime and negligence and to capture the collective and continuous impact of mineral extractivism. A discussion of transversal harm as a potential new avenue for expanding the conceptual boundaries of studying environmental harm concludes the article.

Keywords: Green Criminology, Extractivism, Zemiology, Transversal Harm, Peru, Mining.

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1. Harm at Peru's "Mining Capital"

At the historic city of Cerro de Pasco, located high in the Andes at approximately 4,300m above sea level, 174 km northeast of the capital, Lima, the impact of mineral extractivism is rendered both stunningly visible and inescapably visceral. The landscape is dominated by a substantive open pit mine, described as "consuming the city" (Dajer 2015). The overgrowing and overdeveloped mining industry, unaccustomed to the imposition of controls and regulation, not only transforms the geographies of land tenure and livelihoods (see e.g. Bury 2005), but also the actual physical geography of this place. The "city built around a mine" or the "mining capital" of Peru (Martinez 2018a) has been a mining "focal point", with a distinct mining history extending across pre-colonial, colonial, and post-colonial eras (Arellano Yanguas 2010; Deustua 1994).

Mineral extraction in Peru has been a key labor sector and an important factor in economic development. After an initial period of disorganization and change in the post-independence period, the mining sector re-established its pre-eminence in the Peruvian economy in the late 1800s, as new international demand for industrial metals contributed to a surge in copper, silver, and gold production (Bury 2005: 224; Helfgott 2013). To date, Peru possesses some of the world's richest mineral deposits, generates almost half of its income through exports from this sector, and accounts for a substantial portion of global mineral production (Bury 2005: 224; Cederstav and Barandiarán 2002; Damonte 2016).

The city's central open pit mine has long been identified as a source of pollution and the root cause for the city's gradual degradation and ultimate destruction, with studies tracing pollutants from the mine being released into the atmosphere as early as 1400 years ago (van Geen *et al.* 2012; Helfgott 2013). In 1999, the Volcan company bought the Cerro de Pasco mine and privatized the old state company (Volcan 2018). Volcan engaged in a general policy of expansion, with the aim of expanding the open pit mine and the tailings deposit, leading to a series of disputes with the community about access to and use of the land. Furthermore, Volcan spearheaded the establishment of a new cyanide leaching (lixiviation) plant, which introduced a new and highly toxic element into the area – cyanide (Helfgott 2013; Arellano Yanguas 2010).

Available data on mining-related environmental contamination in the lakes, river, and soil of the surrounding area as well as contamination of human and animal tissue present an alarming picture (van Geen *et al.* 2012; Source International 2020). Particularly, vast quantities of waste rock and tailings, contaminated with heavy metals and other pollutants, have been accumulating all around the city and over an area of 10 km^2 to the south-west of the main pit (van Geen *et al.* 2012). Residents have been diagnosed with severe health issues, specifically heavy metal poisoning

involving metals that are "neurotoxic, carcinogenic, teratogenic and toxic for the human body" (Source International n.d.). The community in Cerro de Pasco continues to be heavily affected by poverty, despite the multi-generational wealth generated by the mine and its various owners. As with other mining and industrial locations worldwide, the poverty rate is more than double compared to the rest of the country (Bianchini 2022; Cabral and Garro 2020; Loayza and Rigolini 2016a; Jamasmie 2015).

Historically, the Peruvian economy has experienced several cycles of export-led growth and ambitious state reforms, in which mining continued to occupy a crucial role (Thorp and Bertram 1978; Thorp *et al*. 2000). This remained the case even after 1968, when foreign-led extractive operations came to an abrupt halt with the nationalizations of the "Peruvian experiment" of General Velasco, and later with the 1985 "unorthodox adjustment" of President Alan Garcia Perez (Bury 2005: 222; Pieck 2015; Hays-Mitchell 2002). The latter meant "unorthodox" macroeconomic policies, which were undertaken by the Peruvian government between 1985-86 and 1990, in an effort to avoid structural adjustment (Glewwe and Hall 1994).

Since the 1990s, "structural adjustments", initially as part of Alberto Fujimori's programme of rapid neoliberalization dubbed "Fujishock", minimized the state's role in mineral extraction. The National Mining Bank was dissolved in 1992, sharply affecting many small-scale miners across Peru. State mining and oil companies were privatized, and tax exemption was granted to private companies undertaking large extractive operations, as efforts were heightened to attract foreign investment (Damonte 2016). This generated "a new cycle of extractive expansion" (Damonte 2016: 961), intensifying extractivism through neoliberal economic reforms and integration into global markets, and through the attraction of foreign investment flows in the 1990s (Bury 2005; Hirsch 2017; Killick 2019). Peru, hence, adopted an export-oriented, extraction-based development model (Bury 2005; Damonte 2016; Helfgott 2013).

When assessed in macro-economic terms, Fujimori's policies were considered "a success within international financial policy circles" (Bury 2015; Hays-Mitchell 2002: 73; Pieck 2015). However, these reforms tapped into the long-standing extractivist impulse within Latin America and exacerbated existing inequalities and conflicts within Peruvian society (Li 2015; Van Teijlingen 2016). Indicatively, by 1990, when the third phase of Fujimori-led structural adjustment commenced, "Peru had experienced one of the most rapid and severe peace-time deteriorations of living standards ever recorded" (Glewwe and Hall 1992: 7 in Hays-Mitchell 2002: 72). By 1993, "more than 27,000 lives had been lost" due to these socio-economic reforms, and by 1994, "59% of the population was living in poverty" (Hays-Mitchell 2002: 73).

How can such complex, intersecting and intergenerational harms, with Cerro de Pasco's open pit mine as the focal point, be thoroughly defined and carefully addressed? The current literature highlights a long history of legal reforms aimed at addressing the side-effects of mining, since the introduction of the first mandate for compensation payments for damages suffered at work in 1911 with Law 1378, the *Ley de Accidentes de Trabajo* (Work Accident Law) (Helfgott 2013: 101). However, despite the introduction of successive laws, the legal framework has widely been criticized due to the persistent obstacles in its implementation and overall effectiveness (Helfgott 2013; Drinot 2011; Blanchard 1982).

Criminologists have been grappling with the question of harm for over two decades in the field of green criminology. This green addition to criminology is concerned with "the greatest threats to environmental rights, ecological justice and nonhuman animal wellbeing" (White and Heckenberg 2011: 96). With a particular focus on the exploitation of "humans, nonhuman animals and natural resources", green criminologists interrogate how structures that privilege powerful groups and institutions are "precisely tied to the exploitation of nature and humans" (White 2008: 170; 2002). Primarily preoccupied with crimes against the environment, the emergence of a broader consideration of environmental harm within green criminological literature has been considered as an intrinsically contestable issue "at the level of definition and discourse, and in terms of visions of what is required for desired social and ecological change" (White and Heckenberg 2011: 98). Within the remit of these investigations, legal structures are often deemed intertwined with the interests of powerful groups, and thus attention is directed towards the correct expansion of regulatory frameworks, including the creation of new corporate and/or environmental crimes.

Green criminology has been seen to fall short of provoking deeper consideration of the complexity of environmental harm, its "underlying structural features and how these can be effectively responded to" (Woodward 2021: 2). To address this shortfall, zemiology introduces a more holistic reimagining of the social world, moving beyond the question of whether certain acts are or should be illegal, extending the conceptual elements of harm to problem framing involving everyday activities, structures, and ideas (Copson 2016; Boukli and Copson 2019; Copson and Boukli 2020; Kotsakis and Boukli 2023). Applied to mining, zemiology focuses on the underlying extractivist imperative, which enables the perpetuation of socio-environmental harm.

This zemiological approach is adopted and expanded in order to define and address the pervasive impact of extractivism. What characterizes the following investigation of harm at Peru's mining capital, and distinguishes it from other mining studies, is the emphasis on how diverse types of harm become proliferated by socially injurious institutions, practices and discourses, drawing on the political ecology of Felix Guattari, and in particular his concept

of transversality as employed in his framework of the "three ecologies" (Guattari [1989] 2008). This form of political ecology draws on the tradition of non-centred ecological thought and problematizes nature and humanity reciprocally, by seeing nature "as multiform and as inextricably confounded with humanity's projects and self-understandings" (Whiteside 2002: 3). The link between zemiology and transversality has been used in the context of oil extraction and has produced the concept of transversal harm (Kotsakis and Boukli 2023), which we will be deploying here in the context of mineral extractivism.

The article proceeds as follows. Section 2 presents the theoretical context of our investigation and situates the boundaries between green criminology and zemiology. Section 3 proceeds to present a zemiological analysis of mineral extractivism in Cerro de Pasco. In section 4, the analysis introduces the concept of transversal harm, to capture the structural causes and continuous impact of extractivism. A discussion of transversal harm as a potential new avenue for expanding the conceptual boundaries of socio-environmental harm concludes the article.

2. From Green criminology to Zemiology

Nigel South (1998) refers to green criminology as the "green perspective" encompassing a wide range of different theoretical positions. Several contributions within this perspective offer an interdisciplinary approach to "analysing harms to the environment" (Tourangeau 2015: 530). Scholars have focused on actions that violate existing laws, known as the crime approach, often aiming to address "*institutional-level* offenders" such as states and corporations, and less so "*individual-level* offenders" (Brisman and South 2018: 204; Brisman 2010). Others have pursued a wider approach that accounts for both environmental crimes and harms (South *et al.* 2013; Brisman and South 2018). The latter aims to encapsulate both acts and omissions that are legally regulated as well as harmful actions, decisions, and omissions that fall outside the strict confines of regulation. Green criminology has, therefore, sought to expand the orbit of criminological inquiry, and in doing so, has arguably aimed to bridge the gap between crime and harm.

Since the instigation of the green perspective, partly, through the work of Michael Lynch (1990), several authors have established a platform for new and important explorations on green crime and harm. Notably, Rob White's (2013) Environmental Harm: an eco-justice perspective, Reece Walters' (2011) Eco crime and genetically modified food, Nigel South and Avi Brisman's (2020) Routledge International Handbook of Green Criminology, Angus Nurse and Tanya Wyatt's (2021) Wildlife Criminology, to name a few, demonstrate a range of recent developments in the field. While this growing engagement with environmental crime and harm contributes important understandings of how environmental harm is intertwined with corporate production, less attention has been paid to

environmental harm as the effect of preventable social processes and cultures (White 2013; Halsey 2004a, 1997; Tourangeau 2015: 531).

Further challenging the strict confines of crime and criminology, the introduction of zemiology in the late 1990s, signified a turning point. Zemia (*ζημία*) or social harm was placed at the epicentre of the newly founded discipline, which sought to "challenge the discursive power" of the concepts of crime, criminal, and criminal justice, along with the "disciplinary agendas" set by them (Hillyard and Tombs 2017: 285, 288). Contributions within this field have reflected on the tension (and potential contradiction) between crime and harm, and have utilized social harm to denote uncriminalized harms (e.g., Hillyard and Tombs 2004), but also criminalized harms (e.g., Paoli and Greenfield 2018), and the harms perpetuated by criminalization and the criminal justice system (e.g., Presser 2013). Gradually, the various attempts to operationalize a zemiological analysis prompted the development of constellations of – 'physical, financial, psychological, and cultural/environmental' – harm and challenged the confines of crime and criminalization (see Hillyard and Tombs 2017: 289; Tombs 2020; Canning and Tombs 2021). A social harm perspective in particular, which incorporates environmental harms at its core, allows us to incorporate a wider framework of:

> "omissions, decision and non-decisions taken, policies developed, defended and implemented, and practices and cultures established, over long periods of time – so that we can then think of these in combination in terms of conditions, states of affairs, incubating phenomena and triggering events, and chains of processes" (Tombs 2020: 62).

It is in this framework that one has to make sense of the zemiological shift away from crime and criminalization, both in political rhetoric and in legislation.

A direct engagement with environmental harm, through the zemiological prism, is confronted with the already established evolution of green criminological thought (Brisman and South 2018). In an effort to explore the blurring of boundaries between the two, green criminology has been seen to move away from an emphasis on individual-level crimes, and instead, "looks at the political and social dynamics which create environmental harm" (Woodward 2021: 4; Stretesky, Long and Lynch 2014; White 2013). For instance, the treadmill of production scholarship has focused on "how green crime takes place as a result of a specific colonial, capitalist, and racialised developmental configuration" (South and Brisman 2013; Lynch *et al.* 2018 in Atiles and Rojas-Páez 2022: 1292). Equally, scholarship on natural resource extraction has highlighted the infliction of "continual and multitudinous environmental harms" (DeKeseredy and Donnermeyer 2022: 5). In effect, green criminology, similarly to zemiology, has been recognizing the structural factors that fuel harm production. Yet, prior to discarding zemiology as obsolete,

it is worth asking whether there is a risk to lose something crucial for critical thought and for our understanding of relations of domination that could emerge from a zemiological investigation in this area.

For the proponents of this exploration, zemiology (unlike green criminology) is free from the confines of criminal, civil, and regulatory systems. The importance of this is twofold. On the one hand, zemiology may be a more suitable candidate for critiquing systemic asymmetries of power, particularly those connected to extractivist cultures (Kotsakis and Boukli 2023). On the other, zemiology may hold the potential to assist in a more radical reimagining of justice processes, as it does not seek to conform to criminal justice agendas (see Copson 2016). In this sense, zemiology's contribution to the study of environmental harm can be seen to reflect Mark Halsey's critique of green criminology's inadequate engagement with the "mobility of environmental problems" (Halsey 2004a: 846). Namely, the process by which nature, the infliction of environmental harm, and the development of systems of environmental regulation are always "discursively produced and contested" (Halsey 2004a: 846). This approach invites us to conceive the world as *flow*, beyond attempts "to classify, manage and contain" (Halsey 2004a: 846).

3. Extractivism in Cerro de Pasco: inflicting social harm from the cradle to the grave

The zemiological approach forms the basis for a move away from crime and criminal justice responses and towards social harm and social justice alternatives. Such an analysis focuses on all the different types of harm, "which people experience from the cradle to the grave" (Hillyard *et al.* 2004: 1). This section applies this approach to mining extractivism, by presenting the main analysis of our interviews. We propose a conception of environmental harm as a flow and a process, within a field of struggle and contestation, rather than a singular event. Zemiology helps disentangle the interconnected "physical, financial, psychological, and cultural/environmental" harms (Hillyard and Tombs 2017: 289). To these, we add a fifth element, transversal harm, to describe the collective and continuous impact of mineral extractivism (see Kotsakis and Boukli 2023; Spencer and Fitzgerald 2013; Halsey 2004b). Transversal harm, we argue, lies in the mechanisms that enable the perpetuation of environmental harm under an extractivist imperative. This is because the concept points directly to a form of on-going and multiplicitous harm that passes through the three registers of the environment, society, and subjectivity under neoliberal conditions. Rendering such transversal harm visible allows for new analytical connections to be made between these three registers, in turn revealing the structural entanglements, transdisciplinary potentialities, and stakes of knowledge and action in the face of global extractivism.

Research for our findings involved methods consistent with primary data (i.e. key informant interviewing) (Patton, 2002). One of the authors (Boukli) travelled to Cerro de Pasco in 2019, along with a team of documentary producers, for the purpose of conducting in-depth interviews in relation to environmental harm. From the initial corpus (n= 16), the present investigation is based on a selection of interviews (n= 9), involving residents and stakeholders who were directly or indirectly affected by mining operations, such as government officials, civil society members, community leaders, and representatives of the mining industry (see Appendix 1). These interviews do not claim to be representative of all issues related to mining in Cerro de Pasco but supplement the current literature, by offering testimonies of social harm from those directly affected by it (Döringer 2020; Saenz 2018; Yin 2003).

For the analysis, we undertook a two-stage content analysis of the interview transcripts (n= 9) using a process of selective coding (Neuendorf 2017). The first stage involved a manually coded analysis of the corpus of the 'manifest content' i.e., the countable references to "harm" embedded in the transcripts (Gray and Densten 1998: 420 in Neuendorf 2017: 57). The second stage utilized computer-aided analysis (NVivo 12 Plus) to count key words and phrases (linked to harm, e.g., death, cancer, pollution) and it involved automated tabulation of variables for target content.[1]

3.1 Physical harm

The pollution stemming from mining operations is complex and multifaceted, directly linked to fatalities and irreversible environmental harm (Bech *et al.* 1998). The impact on the natural environment and people is inseparable. Contamination caused by mining has proven to increase the release of heavy metals in the atmosphere (water, air, and soil), leading to elevated levels of pollution, the contamination of food chains, the degradation of wildlife as well as "irreversible climate change" and death (Piñeiro *et al.* 2021). The physical harms associated with mining are inflicted upon human and non-human animals. Lead in samples of animal tissue from llamas corroborate findings of high concentration of lead in grasslands between the different mining tailings dams (Source International 2020; van Geen *et al.* 2012). Metals such as cadmium, lead and arsenic have been found in river water samples from Cerro de Pasco "in concentrations higher than … national and international quality standards" (Source International 2020: 1). Arsenic compounds have been proven to cause both acute and chronic effects, in individuals and other organisms in the environment. Depending on the specific species and length of exposure, the effects may vary from death to inhibition of growth, reproductive problems, and behavioural effects (WHO 2001).

Medical tests on local residents have shown that the average concentrations of lead in 2018 were "46 times higher than the Maximum Acceptable Level … while arsenic was twice as high" (Source International 2020: 4). Prolonged exposure to heavy metals has been seen to contribute to the development of a variety of fatal conditions, such as "kidney failure, different types of cancer, and neuronal damage" (Piñeiro *et al.* 2021). For our interviewees, these conditions are all too familiar. A teenager and her mother described the gradual progression of adverse effects from lead:

> 'I started being symptomatic since I was nine years old. It started by nosebleeds, so we had tests performed to measure lead in my blood …The results showed high levels of lead in my blood. But a few years later, I had another test. In the meantime, I had nosebleeds and frequent headaches. The new test showed that the levels of lead in my blood were much higher now' (CdP8).

Hair samples collected from children living in the Paragsha region of Cerro de Pasco, which is exposed to the open pit mine, showed high concentration of "aluminium, antimony, arsenic, cadmium, chromium, iron, lead, tin and thallium" (Piñeiro *et al.* 2021). Samples collected from the same children in two separate occasions over a period of three years, also, showed that the chronic exposure to heavy metals resulted in progressively increasing contamination. The physical symptoms associated with heavy metals include nosebleeds, chronic colic, dermatological alterations, mood swings, reduced visual camp, to name just a few (see Piñeiro *et al.* 2021).

Given the pervasive effects of widespread and progressive physical harm, one of our interviewees described mining contamination as a form of genocide:

> "Social leaders have betrayed the people knowingly that we are dying progressively. Here with my people there is a *genocide* in place. Because here we have several deaths and never have them recognised that it is due to mining. And never the Peruvian state has said that it is due to mining […] For 400 years my city has been exploited … Here we have several children with no future, the medical doctor has said that the harm in these children is irreversible. There is no cure." (CdP1, emphasis added).

Indeed, the described idea of progressive death, caused by arsenic exposure due to mining, may also encompass physical harms to reproductive health and infant mortality. The risks associated with these comprise a variety of conditions, such as: congenital malformations, which include a wide variety of conditions developed prenatally and may be identified before or at birth or even later in life; pre-eclampsia, which affects pregnancies and it is thought to occur when there is a problem with the placenta; high placental concentrations of arsenic; high risk of stillbirths; and high fetal, neonatal, and postnatal mortality rates (WHO 2001).

Physical harms become exacerbated by the lack of health services. For instance, a prominent community leader affiliated with a grassroots organisation in Cerro de Pasco recollects how marches such as the "marchas de

sacrificio" of 1969-1971 (Dewind 1975: 44), and more recently, the 2015 March of Sacrifice, reflect the politicized nature of (absent) healthcare provision and the attendant amplified physical harms. For instance, the 2015 March of Sacrifice started with over 50 demonstrators marching from Cerro de Pasco's Simon Bolivar district to Peru's capital, Lima (Post 2015a). The march took thirteen days and it was a protest against mining pollution, contamination, and the exacerbated harms inflicted by the absence of adequate health services. As one of our interviewees, who was among the protesters, explains:

> "We undertook the march to Lima in September 2015 from 17 September to October 1st … we arrived to sign documents with the *compromises* and promises to address the issues of environmental pollution, and mainly the issues relating to the harms in the health of our children … Nevertheless, we do not have satisfactory results on any of the cases … The law states that the mining company in co-ordination with the Health Ministry and with regional health direction can put in place medical services backed by the company to address any health issues … but the enterprise, they just don't care" (CdP2, emphasis added).

For other community leaders, physical harms are further exacerbated by deregulation and by what they describe as the lack of "responsible" mining practices:

> "I have heard, and I know, that in other parts of the world there is a different mining, more responsible with excellency … But here take for instance the case of Quiulacocha here, nearby in this town were 50% of the children have lead in their blood. The name Quiulacocha meant the Lake of Seagulls. Nowadays, it is all mineralised and dead" (CdP4).

Environmental challenges stemming from mining operations can therefore be seen to be increasingly capital-centred, wealth-generating, and physically manifested. Against the background of racism and colonialism, mineral extractivism has been systematically accruing wealth for a small minority of the world's population, often based in the Global North and away from locations that are used for mining (Buu-Sao 2021). In the Pasco region, the juxtaposition between responsible mining "in other parts of the world" versus irresponsible mining in the site of Quiulacocha, is not an abstract slogan but it is rather a crucial stake of political action and an issue of global inequalities.

Violently suppressed protests over environmental degradation and inequitable distribution of benefits from mining in Peru is a well-documented issue (Amnesty International 2015). For instance, in June 2011 at least five people were shot dead and more than 30 were injured in clashes between police and protesters. The demonstrations were ignited by a new mineral mining contract given to a Canadian corporation, which sparked fears that it would increase pollution, while bringing few benefits to the local population (BBC 2011). Again, in September 2015, three people were killed and 23 injured in a clash between police and local residents protesting against a copper mining project owned by a consortium, led by a Chinese state-owned corporation (BBC 2015; Post 2015b).

For the years between 2000-2007, available data suggest that 433 fatal incidents were officially recorded in the Peruvian mining industry (Iramina *et al.* 2014). While in 2001 a new health and safety framework was introduced, the morality rates remained high. Even after the introduction of the 2001 framework, reports suggest that an accurate identification of causes of deaths in the mining sector has been absent. Further, between 2010-2021, a total of 490 people died as a result of mining accidents in Peru (Statista 2022). Fatalities of mining workers as well as dangerous conditions and injuries are deeply entrenched within the industry to the extent that certain mines carry a "killing and maiming" reputation (see, e.g., the mine of death - *mina de la muerte* - in Huancavelica, central Andes in Brown 2001: 467). For 2021 alone, 50 people died as a result of mining, while another 1,190 people were badly injured or sustained incapacitating injuries (Statista 2022).

These figures exclude long-term respiratory diseases and the effects of arduous labor at high altitude that many workers may develop over time (see e.g., Mori Mojalott and Alarcón-Novoa 2017). As testimonies suggest mine workers and their families are confronted with the inevitability of physical harm: "if [workers] don't die in an accident … they die from disease caused by the mines" (POTP 2003). Indicatively, the mining industry in Peru employed approximately 228,000 workers in 2021 (Statista 2022).

3.2 Economic harm

It is widely accepted that the economic benefits of mining have not been spread equitably across countries, nor within countries between Indigenous and non-Indigenous groups (Dewind 1975; Helwege 2015; White 2017; Bedford *et al.* 2022). Rather, impoverished and underrepresented communities are the ones mostly impacted by mining operations (LAOEC 2007). Regional inequalities become manifested in failed redistribution attempts of mineral revenues from central to regional and local governments. Simultaneously, local communities in heavily mineralized regions end up suffering financial harm as the result of mining, compounded by the lack of alternative employment opportunities and extensive sector deregulation for the purpose of attracting foreign investment (Helwege 2015; Li 2009).

In effect, the mining industry has brought positive average effects on the national economy, however, it has negative distributional effects on Peru's districts. This dual effect of mining has been attributed to "educated immigrants required and attracted by mining activity" as well as less profitable jobs that some community natives obtain in mining-related industries and services (Loayza and Rigolini 2016b: 219-220). This applies to both mining

companies and community enterprises, further described below. Therefore, despite its enormous revenues, the inequalizing impact of mining has been causing social discontent (Loayza and Rigolini 2016a; Martinez 2018b).

Our interviewees also suggested that the lack of compensation is a detrimental source of financial harm inflicted upon individuals and the wider community by both companies and the state. Compensation, as money owed to the wider community and/or individual community members is seen in cases of either land annexations by the state in order to facilitate extractivist interests *or* the effects of pollution on land and communities alike *or* compensation for mining accidents and occupational health problems. These three sources of financial harm linked to compensation often appear interconnected (see POTP 2003). For instance, in the words of a prominent community organiser:

> "When the Chinese company bought Las Bambas [copper mine, bought in 2014] they didn't have any reason to continue with the project of creating a pipeline and compensating communities through the compensation package agreed by the previous owner of the mine. Therefore, they [the Chinese company] changed the transportation of copper to the Pacific Ocean, not through a pipeline but through road transport. This generated terrible problems because it was not consulted with local peoples and the whole narrative of the environmental impact disappeared. The Ministry of Energy and Mines also approved the modification without any consultation [with local communities]. This generated a very dramatic response by the community. Not only because of the environmental impact but because the new roads where to be created [through community land] without any compensation" [CdP9].

The lack of compensation by mining companies has raised questions regarding accountability, regulation, and mining operations. A lawyer and community leader maintained that compensation is an intrinsic part of the corporate social responsibility of mining operations: "The law states that the mining company in co-ordination with the Health Ministry and with regional health services should put in place medical services backed by the money of the company to address any health issues arising from mining … that's the social responsibility of the enterprise" (CdP2).

Further, extensive research has been conducted on the Janus-faced role of the emergence of the "community enterprise", which largely reflects the complex contours of struggles between the centralized state and localities – both representing characteristics of neoliberal regionalization and also resistance to it (Vincent 2012). In other words, the emergence of community enterprises has been considered a source of local mutual support, while also a direct vehicle for both domestic and international financial harm. For example, the community enterprise in San Antonio, Rancas, was set up on 2nd August 1991 "under a permanent struggle between the community and the mining company Centromín-Peru" (CdP5). The state mining company Centromín, which had taken over from the Cerro de Pasco Corporation in the nationalization of 1974, "began depositing increasing amounts of waste materials on the west and north sides of the open pit" (Helfgott 2013: 377). This expansion of the mine encroached upon community land. In 1983, the government issued an order appropriating 540 hectares of land from the Rancas community, with only a

minimal payment to the community in return. In response, the community refused to hand over the land. Subsequently, a seven-year conflict between the community and the state-owned company ensued (Helfgott 2013).

In 1990, the community signed an initial agreement with Centromín "granting the mining company a lease on part of their territory for a period of 20 years. In exchange, the community received USD 2.5 million, which it invested in setting up a peasant cooperative and a community company" (Arellano Yanguas 2010: 130), eventually becoming a community enterprise of "multiple services under the name Ecoserm-Rancas" in the "mining industry and the oil industry" (CdP5). The compensation money was invested in buying heavy equipment, and the community company "essentially became a contractor for the mines" (Helfgott 2013: 378). The outcome was thus a composite of sorts, part community and part enterprise, with a relation to both the Rancas community and the mining company.

This specific community enterprise became the model for other community enterprises across the region, "thus inaugurating a new type of company-community" relationship (Chacón 2009 in Helfgott 2013: 378). While useful, as a means of creating jobs for community members, our interviews attest to widespread financial harm resulting from this new company-community relationship. For instance, a community enterprise representative highlighted that the community enterprise may often have different targets from the community itself: "The community keeps the struggle [in relation to] the integrity of their lands, and the struggle for their rights" (CdP5). However, the aim of the community enterprise is tied to entrepreneurial leadership: "not only [are we] a leader among the communal enterprises but I see ourselves competing with the big private enterprises … and other big enterprises in this country" (CdP5). We thus observe a dividing line between the community and the community enterprise due to their different relationships to the mining sector. A good synopsis of this suggests that "the community enterprise cultivates a strictly entrepreneurial relationship with the mining company" (CdP5). In doing so, it looks into "the projects as providers of competitive services and prices, and on this basis make ourselves worthy of getting new projects … nowadays we think more as an enterprise than as a community" (CdP5). Indeed, similarly to mining companies, community enterprises often do not employ workers from local communities: "we have to hire workers from other places in order to fulfil these jobs, these tasks that … as an enterprise we need to perform" (CdP5).

The infliction of financial harm can also be traced to the local population's historic dependence on mining and mining-related economic activity (Helfgott 2013). As examined earlier, the current legitimization and operational logic of the open pit mine are linked to the 18th century and the mine's colonial past. As one of our interviewees put it, "Cerro de Pasco is a colonial mine, established by the Spanish Empire, after the collapse of the production of Potosí in what is nowadays Bolivia" (CdP9). These close links between the mine and the colonial economy can be seen as the prolonged temporality of the "colonial matrix of power" (i.e., coloniality, see Quijano 1992). In Quijano's work

the colonial matrix of power includes the control of the economy (e.g., land appropriation, exploitation of labor, control of natural resources) (Mignolo 2007: 156). In this sense, the intensification of extraction following the neoliberal economic reforms of the 1990s, while seeking to stimulate foreign private investment, have prolonged unequal relationships, and can be read as a new form of corporate imperialism perpetuating coloniality through the control of the economy (e.g., Li 2009; Nugent 1997). Ultimately, the combined effect of the above have gradually been impoverishing local communities. Therefore, environmental, social, and financial *zemia* is perpetuated:

> "Environmentally they [mining companies] do not comply with the regulations ... Socially they do not work on projects that can push forward the development of the communities, the society around their exploitations. And on the entrepreneurial level, they do not hire workforce from the region, from our city; they do not generate jobs here" (CdP2).

3.3 Psychological harm

Studies have been carried out in adults showing that exposure to low lead levels are associated with higher odds of "major depression and panic disorder" as well as "cognitive and neuromotor" conditions (Bouchard *et al.* 2009). In young adults the risks for "major depressive disorder and panic disorder" increased with higher blood lead levels (Bouchard *et al.* 2009). Among the children that were exposed to Cerro de Pasco's mining pollution and experienced the physical harms mentioned earlier, most of them also experienced altered mood in the form of irritability or depression, to the extent that the chances of having an altered mood is "seven times higher in children exposed to the mine than in unexposed children" (Piñeiro *et al.* 2021). Parents of contaminated children have also been affected, with reports describing cases of parents feeling helpless and suicidal (Cabral and Garro 2020).

In July and August 2021, an investigation carried out by Source International involving a local team of psychologists, "Superdotados Perú", found evidence of what they described as the "psychosomatic effects" of the exposure to heavy metals, which contributes to the development of mental health conditions as well as physical conditions such as "cancer, respiratory, and kidney diseases, and eventually drives to death" (Source International 2022). According to this latest report, the detrimental impacts on neurological development extend to "verbal comprehension, working memory, perceptual analysis, and information processing" functions (Source International 2022: 5). The report concluded that "neurotoxic substances such as arsenic, cadmium, mercury, manganese and lead" negatively impact the areas of the brain associated with "language, memory and executive function, and psychosocial behaviour" (Source International 2022: 7). These findings are consistent with previous studies that have reported an association between blood lead levels and "reduced intellectual functioning" (Source International 2022: 7).

During the COVID-19 pandemic, high levels of anxiety to adult residents manifested in symptoms such as "dry mouth, lack of energy, chest tightness and difficulty breathing, tremors, muscle aches, palpitations, and tiredness" (Fhon *et al.* 2022). As for symptoms of depression, these were associated with "cold sweats and chills, dry mouth, lack of energy, chest tightness, and difficulty breathing" as well as a wide variety of sleeping problems (Fhon *et al.* 2022). The above can only be seen to be exacerbated by poverty. As noted by Ann Helwege (2015: 74), "where the impact is on disenfranchised poor people who lack access to healthcare, claims of long-term health effects are easily dismissed as unrelated to mining". A statement echoed by one of our interviewees, "I have children with cancer, leukaemia, osteoporosis, mental health problems, children that have abandoned school. I have two children who died since 2015 … the national and regional government have never recognised that it is due to mining" (CdP1).

3.4 Cultural and environmental harm

One may initially consider cultural harm to be a nebulous concept. However, this section maintains that the process of forcing communities off their land and having their "ways of living" disrupted or removed is a material one (Tombs 2020: 72). Best perceived as the murderous disruption of native institutions, whose traditions and ways of being have been decimated (see Chernomas and Hudson 2007), the context that gives rise to cultural harm is the following. Reports from the early 2000s have presented an environmental disaster taking place that violates the residents' right to life (CNDDHH 2017). In May 2012, the government of Peru declared a health state of emergency in 12 districts of Pasco, because "dangerously high levels of lead, arsenic, aluminium, and manganese were found in local water … and lead arsenic and mercury were also present in the soil (BHRRC 2018). By late 2018 several cases of children contaminated with lead were emerging.

A research by Ojo Público (Cabral and Garro 2020) gathered testimonies by several families in various districts of Cerro de Pasco. The stories have striking similarities. The children have "almost three times the maximum levels of lead permitted" and display very similar symptoms, including learning and developmental problems, deficiencies in short-term memory and speech, and nose bleeding. Due to the lack of adequate medical infrastructure, children are often transferred to hospitals in Lima. The parents accompany them and leave behind their other children, relatives, community, and home. The children who stay in Pasco are then forced to leave school and accept precarious employment conditions to pay for immediate expenses (Cabral and Garro 2020). In a chain reaction, deregulation of corporate activity, the removal of state assistance, and environmental destruction are having grave effects on the living conditions of communities.

By cultural harm, one may include the neoliberal economic reforms of the early 1990s, which gave rise to the mining conflicts (*conflictos mineros),* mentioned earlier. These reforms sought to stimulate foreign capital investments in mining and other sectors, and through the introduction of new technologies, they "led to an expansion of extractive activity into areas formerly used for agriculture and farming" (Li 2009: 219). These techno-economic and environmental changes, altering the landscape and forcing communities off their agricultural land and into the wage labor force, paint a shifting identify narrative. In the words of one of our respondents: "We have changed from being a people that farm lamas, alpacas and vicunas, we have been changed by mining because mining forced us, sometimes subtly and sometimes with violence, to go to work in mines. And sadly, that meant that many people had shorter lives and died because of the contamination of mining work" (CdP4).

The running battle between the survival prospects of the community and the environment, against the extractivist projects of mining operations, has been whittling away at the ways of living, including the ancestral culture, the symbiotic culture of environment-community, and the native language. For our interviewees, "our language disappeared. The Quechua language was replaced by Spanish. Our ways of life also disappeared … all the reciprocity rituals we had with Mother Earth …[disappeared]" (CdP4). Simultaneously, new forms of cultural and environmental destruction emerge. For instance, starting in the early 1900s, the corporate proposal of physical relocation was introduced.

Initially, relocation was introduced by the American mining company *Cerro de Pasco Investment Company*, which, upon realizing that the city "was totally mineralised they told the population and the authorities 'we are going to build you a new city somewhere else because this is mineralized and you are going to have problems'" (CdP6). Relocation was then re-introduced in 1915 by *Cerro de Pasco Copper Corporation* (Kincheloe 1937: 443-444), a company that kept growing its operations until 1956, "the year in which the Cerro de Pasco Copper Corporation tells again the authorities and the population 'we are going to build for you a new city because we want to keep exploiting this area here. But not with [the existing] mine anymore, but with an open pit'" (CdP6). Following this, in 1968 during Velasco's "Peruvian experiment", the *Cerro de Pasco Copper Corporation* was replaced by the state-owned company Centromín. For the third time, "Centromín-Peru in order to keep exploiting also tells the population and the authorities, 'we are going to build you a new city. Please choose where.' And the authorities of Pasco and its population reply, 'we do not want it. We don't want a new city. This is our city'" (CdP6).

When the relocation plan was rejected for the third time, "General Velasco issued Law 18863 that stated … remodel the city, not rebuild, not move, not displace the city, remodel the city, but in the district of Yanacacha, where

it is actually now" (CdP6). In the intervening years, additional legal proposals emerged for the relocation and "remodelling of the city". Specifically, as an interviewee recalls, "in the year 2008 a new law was issued, Law 29193", this "law declared that out of public necessity and national interests, the urban development should be taken forward in a sustainable concerted fashion and the relocation of Cerro de Pasco" should proceed (CdP6). Unlike previous efforts, where companies themselves instigated the relocation plans "as a condition for beginning or expanding operations, in this instance the company was opposed to the new relocation law" (Helfgott 2013: 502). However, more recently, further relocation plans were made:

> "[i]n 2009 through an urgency decree no. 103/2009 the Peruvian state put in place five million Sol to take forward the studies for this new development for the city. And studies to relocate the city in the future. In 2010 the regulation for this … was put in place. It is a decree 018/2010 by the Presidency of the Council of Ministers […] So, there are three laws that allow to think … the development of Cerro de Pasco and also to relocate the city in a new space" (CdP6).

This plan then proceeded even further:

> "[t]here was national and international competition called and the entity that won this contest has already issued their study naming three different possible locations for the relocation of the city Cerro de Pasco. And also, to work on this present city, … [but some politicians and groups] of citizens" (CdP6) opposed this plan.

This is considered the fourth time that opposition emerged against relocation. The material effect of this is evident. In the Ayapoto district, "a dog resting on the ground covered with weeds" surrounded by abandoned houses and shops with broken windows, on the sides of empty streets "dusty and abandoned tricycles and toys, as well as remains of appliances such as televisions all scattered" (Cabral and Garro 2020). A member of the last family to remain in the district explains: "I am a true Ayapotino,[1] and I am not leaving … my father, my mother, my grandparents and my great-grandparents are Ayapotinos …" (Cabral and Garro 2020).

Lastly, social harm denial is also part of a culture that perpetuates harm. Multiple sources attest to a form of state-corporate gaslighting taking place, by which authorities and company representatives denied the existence of mining pollution and its deleterious effects on humans, non-human animals, and the environment. For instance, the chief executive of a mining company asserted that "no contamination is coming" the operations of the specific mining company (BHRRC 2018). Central government officials also describe that their activities "promote private investments in our mining sector. We are promoting sustainable mining that means mining that is responsible with the environmental aspect" (CdP3). Other members of parliament also often defend mining operations: "it is not true that

[1] "Aya" means dead in Quechua, and "proto" means coffin (Cabral and Garro 2020).

in all cases contaminated water comes from mining waste" (Livingstone 2018). In effect, Indigenous communities are forced to gradually abandon traditional protections and demands, and instead often prioritise the symbolic recognition that social harm has indeed taken place:

> "[…] it's quite difficult first of all to allocate responsibilities because you have a wide variety of actors. Both from the private companies, the government and even previous operators [of the mine] … Maybe it will be an idea to have a truth commission in terms of human rights and generate a social and political agreement in order to assess decades of violations. And at least symbolically, recognise the violation rather than being able to monetarily compensate" (CdP9).

To conclude this section, one may observe that the generation of interconnected colonial, environmental, physical, psychological, financial, and cultural harms are intertwined with efforts to resist the generation of these harms through judicial means. Most strikingly, the ongoing efforts to mobilize the judicial system against social harm have resulted in judicialization – i.e. attempts to introduce successive legal reforms. The ever-accelerating reliance on "courts and judicial means" has effectively rendered the combined corporate and state (including judicial) powers ineffective of resolving "core moral predicaments, public policy questions, and political controversies" (Hirschl 2006: 721; 2011). The introduction of strategies such as the community enterprise, the plan for relocation, and the seductive (yet futile) idea of responsible mining, have merely perpetuated harm.

4. Transversal harm at the 'extractive frontier'

To the initial fourfold social harm typology of physical, financial, psychological, and cultural/environmental harms (Hillyard and Tombs 2017), we contend that a fifth category needs to be added that takes into account and frames the overall, cumulative effect across and intersecting all "ecological registers" – namely, the environment, social relations, and human subjectivity (Guattari [1989] 2008: 28). This fifth category is transversal harm and possesses a deleterious role in sustaining and perpetuating other kinds of harm. The concept of transversal harm, as developed in recent scholarship (Spencer and Fitzgerald 2013; Kotsakis and Boukli 2023), draws on the work of Felix Guattari, anchored in the commitment to expand the understanding of harm, beyond environmental and legal conceptions of the term, in what is called a "non-centred" way, without being bound to the partitions and compartmentalizations of legal or environmental thought (Whiteside 2002: 3).

In *The Three Ecologies,* Guattari places the environmental crisis within a wider context of deterioration and implosion, not just of the natural environment, but across the three ecological registers (Kotsakis and Boukli 2023). In this conception, environmental problems, such as in this case of mineral extractivism, are to be placed in an

intersectional continuum, along with poverty, inequality, competitive individualism, consumptive lifestyle, and a wide chain of social issues that relate to the "compromised and imploding relationship between subjectivity and its exteriority (whether it is social, animal, vegetable or Cosmic)" (Guattari [1989] 2008: 19).

Following this conception, the dichotomy between anthropocentrism versus ecocentrism perpetuates alienating modes and functions. Anticipating more recent developments, such as the new logic of accumulation described as "surveillance capitalism" (Zuboff 2019: 22), the accelerated invention of new products and the "machinization" of time, for Guattari, has led to "new modalities of subjectification" (Guattari [1989] 2008: 62). Cultural harm can be used to highlight a culture of corporate anthropocentrism, which manifests against ecocentrist moves. It has been argued, for instance, that the cost of banning mineral extraction would translate into a loss of jobs and income for families, and also a loss of competitiveness for the region. Animated by contemporary politized conflicts evaluations of harm – that is, the harm of corporate anthropocentrism set against the harm of ecocentrism – reduce complex issues to mere antagonisms (Kotsakis and Boukli 2023). So, the transition from identifying harm to finding a solution to harm is not assisted by the classical division between anthropocentrism and ecocentrism.

Indeed, Guattari has argued for the apparent similarities between two seemingly separate phenomena, namely the presence of toxic algae in the Venice lagoon and the 1980s gentrification in New York. Gentrification pushes families and local residents out of New York, as it suffocates residents, who eventually become "like the fish affected by toxic algae growth" (Guattari [1989] 2008 :43). At the intersection of multiple harms, gentrification stands as a form of toxic pollution with tangible, measurable, and avoidable environmental, social, and psychological harms. Both those that can relocate and those that cannot experience a type of transversal harm, cross-cutting at the intersection of multiple registers of harmful effects.

While the analysis has contributed to an understanding of the multiplicity of harm, our study also demonstrates that certain dynamics, which have been ongoing for centuries "have sedimented institutions and structures that drown and silence" a "wider spectrum of voices" (Goyes 2018 in de Carvalho, Goyes, and Vegh Weis 2021: 264). Specifically, we contend, our interviewees' voices themselves attest to power asymmetries. Unveiling the heterogeneity of these voices and affirming the legitimate difference both from each other and from a notional "we" is crucial in making a "pragmatic intervention" in order to "escape the dominant capitalistic subjectivity" (Guattari [1989] 2008: 9). Indeed, the various attempts that our interviewees make to define the problem of harm and its corresponding solutions may seem singular and finite. However, it is the unveiling of "non-dimensioned, non-

coordinated, trans-sensible and infinite" possibilities that become erased at this point in time of possible responses to harm (Guattari [1989] 2008: 75).

Further, it is the compartmentalization of laws that remain disconnected from the voices of our interviewees in Cerro de Pasco, and the ordering of local, national, and global hierarchies that allow to perpetuate the collective subjectification of these voices. It is across these three registers that a response to the ecological crisis should be given on a global scale, by "reshaping the objectives of the production of both material and immaterial assets" (Guattari [1989] 2008: 28). Production of new ways of being and development of specific practices that will modify and reinvent the ways in which we live, on a microsocial level and on a larger institutional scale, are needed for reconstructing the modalities of "group being" (Guattari [1989] 2008: 34). In this sense, the perpetual mobilization of regulation and of judicialization that trickles down in univocal ways, driven by the profit economy and by power relations, would only lead to "dramatic dead-ends" as seen in Section 3 (Guattari [1989] 2008: 28). It is therefore a matter of comprehending interactions between ecosystems, rather than separating the social from nature – "nature cannot be separated from culture" (Guattari [1989] 2008: 43).

Transversal harm is therefore embedded in the separation of (class, gender, race) struggles. It lies in all these harmful effects described previously that come to pass as the "normal", "business as usual" operation of mineral extraction "at the extractive frontier", taking advantage of lower cost-production regions within globalized markets (Andreucci and Kallis 2017). By shifting the lens on structures, the upshot is to reveal an even wider and ongoing harm, the transversal harm of extractivism (see Spencer and Fitzgerald 2013; Mondaca 2017; Melón 2022; Kotsakis and Boukli 2023). As the mining projects continue to expand and more industrial production is added (chemical plant), human and non-human communities suffer from this transversal harm. Transversal harm captures therefore the harm of separatist extractivist logics, which infiltrates and saturates the life of human and non-human beings across the world.

This questioning that the Guattarian thought promotes is, to a certain extent structural, and directed towards what he called "integrated world capitalism", of which mineral extractivism and the expanding capitalist market for minerals to sustain techno-corporate giants, form a part (Guattari [1989] 2008: 47). The term refers to a late stage of post-industrial capitalism, where its rationality moves away from the production of goods and services "towards structures producing signs, syntax and … subjectivity" (Guattari [1989] 2008: 32). Capitalism and the economy more generally have been a perennial target of environmental thought and discourse, connecting the production of environmental harm to both criminalized and un-criminalized corporate activities. Equally, concerns pile up regarding

surveillance, discrimination, racism, sexism, wealth inequalities, and human rights abuses both at the outsourced fringes of the system and the hegemonic centres of it.

However, Guattari takes this critique even further to the third register, i.e. the formation of human subjectivity. Capitalism "seizes individuals from the inside" and subjugates them by "overcoding" human activities, thoughts and emotions (Guattari 2009: 244). The persistence of environmental problems, such as mineral extraction reliance, is ascribed to the fundamental problem of the social reproduction of forms of behaviour that act as constant sources of problems, not merely environmental, in consumer societies under late capitalist conditions. It is no longer that mineral extraction itself is regarded as the problem. For instance, the destruction of the local communities is described as a social problem; the blood poisoning as a health emergency; the lack of compensation as an economic redistribution problem; while the operational decisions of mining companies are understood as corporate problem. That is, the compartmentalized legal framework is reflected and reproduced through the conceptual separation of what the actual problem is and how *the* solution to this problem can be most effective, while accepting the ongoing operation of mineral extraction.

Consequently, environmental problems coexist with a dangerous homogenization of behaviour and conduct and "can be traced to a more general crisis of the social, political and existential" (Guattari [1992] 1995: 119). Indeed, we see this in the ongoing insistence of "we are not anti-mining", as it gives rise to the demand for "responsible mining" (CdP1-CdP9).[2] We also see this in the colonialist perception of the problem as disconnected from what one may perceive as global problems (e.g., Wright 2023). Instead it features as a localized problem, high in the Andes, contaminating a contained locale and adjacent communities. Through this prism, the harms of mining contamination in Cerro de Pasco, and elsewhere, could have been prevented, and further harms can be mitigated, but the logic of perpetual growth and the absolute reliance on overexploitation of natural resources obscure radical changes to global economic, political, and social arrangements.

This type of non-centred approach leads to a non-centred conception of the acute, catastrophic manifestation of a broader system of imbrication between minerals and society. This entanglement between the two is, in fact, what we come to describe as transversal harm. We can move beyond the harm inflicted in Cerro de Pasco and merge it with a long-standing social harm that, along with the rest of the mineral industry, shape human society. This is not to say

[2] Across the diverse voices and subject positions, the demand for "responsible mining" and the statement "we are not anti-mining" were repeated.

that studying how social harm operates within certain locales is redundant, but to connect the local manifestations of social harm with borderless, placeless globality of the galloping climate emergency. The immediate implication of this is to resist the global/local colonialist dichotomy that transnational extractivist corporations and their complicit technological giants inflict upon our modes of life as part of a system of immaterial production that has evolved beyond the production of goods and services, and their mineral externalities. Transversal harm signifies the multiple damage caused to the three ecological registers and offers a more nuanced understanding of how environmental harm is no longer contained in previously perceived neat conceptualizations.

5. Conclusion

As with most open pit mines, the overall harm seems obvious; even more so, when faced with the stark images of Cerro de Pasco being devoured by the mine as the overall surrounding landscape has been exploited across centuries. It is a toxic environmental problem of heavy metals and pollution, of deteriorating living conditions, and of years of unrestrained state and corporate extractivist activity that has inflicted immutable and irreversible harm. Formal legal mechanisms have been ineffective in keeping corporations accountable and in even acknowledging the multiple harms being perpetually inflicted upon local communities. Successive legal reforms and plans to mitigate the harms have also failed to implement a compensation mechanism and to bring a resolution. Simultaneously, corporate extractivist operations seem not only to be surviving but thriving, while technological giants have a constant thirst for mineral consumption. In effect the mineral industry is disguised as the necessary evil of technological advancement.

Driven by extractivism and economic reliance on mineral extraction, the perpetuation of coloniality through capitalist structures causes significant harm to communities and ecosystems. Dramatic pictures of red translucent lakes, lamas grazing next to mining dumps, fish dying within seconds of being exposed to polluted water make for powerful visual representations of the environmental harm inflicted. As chronicled in news media reports and documentaries, the locality of such a disaster is hard to be confined. Yet, prolonged ambiguity and uncertainty as well as the resulting doubt are strategies promoted by corporations to avoid having to implement actual reforms in the present (Benson and Kirsch 2010).

It is therefore not due to the lack of evidence that contamination ensues, but despite accumulating evidence. For instance, according to the WHO report (van Geen *et al.* 2012) examined earlier, Peru had not implemented standards for all harmful elements that may cause soil contamination (e.g., lead). Subsequent studies conducted in Cerro de Pasco, such as the 2016 study by Source International, suggested that lakes in proximity to the mine "were

turned into waste disposals", meaning that river basins and tap water were contaminated. The pH of these lakes has been highly acidic, far beyond legal levels, the iron concentration has been 6,000 times over the national limit, and manganese concentration 2,200 times more than Peruvian law allows (Source International n.d.). Specifically, the Quiulacocha mine tailing (mentioned above by our interviewee CdP4) was found to be high in manganese, zinc, and iron and it contained more than 275 times the level of cadmium, 63 times the level of arsenic, and 34 times the level of mercury established in the ECA (the Peruvian Environmental Quality Standard) for the conservation of the aquatic environment in lakes (Source International 2020: 9).

As a result, environmental regulatory strategies in practice offer poor regulatory standards, which are not applied to protect health "but to allow for slow and gradual environmental regulation" at the expense of both the environment and its inhabitants (Cederstav and Barandiarán 2002: 11; Bayene and Berhe 2015). For instance, the regulatory framework of mining pollution, such as the WHO Maximum Permissible Limits, which is a set of international quality standards utilized to set maximum allowable metal concentrations on metalliferous mining sites or as a result of mining activities, while useful for producing comparative data and for making recommendations on regulation and standard setting, it has limited practical enforceability (e.g. WHO 2001).

Against the backdrop of this regulatory paralysis, we proposed a conception of mining contamination as flow and a process, rather than as a singular event, through the lens of the Guattarian thought. In doing so, we conducted a zemiological analysis of the harms inflicted due to mineral extraction and made a case for the introduction of transversal harm. The upshot has been to introduce a non-centred approach leading to a non-centred conception of the acute, catastrophic manifestation of a broader system of imbrication between minerals and society. This entanglement between the two, we argued, moves beyond the harm inflicted in Cerro de Pasco and merges with a long-standing social harm that, along with the rest of the mineral industry, shape human society. The immediate call stemming from this analysis is to resist the global/local colonialist dichotomy that transnational oil corporations and their complicit technological giants inflict upon our modes of life, as part of a system of immaterial production that has evolved beyond the production of goods and services, and their mineral externalities, and infiltrates and saturates the life of human and non-human beings across the world.

[1] Participants agreed to the use of these transcripts for research purposes and for the publicly available documentary, titled "OU DD311 Peru Cerro De Pasco", which can be found here: [https://www.youtube.com/watch?v=QcX_K_lp_lc].

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Appendix 1

Interview coding

In-text code	Description/Demographics
CdP1	Resident of Cerro de Pasco, community leader, worker in the hospitality sector in Cerro de Pasco, female.
CdP2	Resident of Cerro de Pasco and local government representative, male.
CdP3	Resident of Lima, central government representative, minister, male.
CdP4	Resident of Cerro de Pasco and community leader, male.
CdP5	Resident of Cerro de Pasco, worker in the mining sector, and community enterprise representative, male.
CdP6	Resident of Cerro de Pasco, lawyer and civil advocate, male.
CdP7	Resident of Cerro de Pasco, worker in the hospitality sector, female.
CdP8	Resident of Cerro de Pasco, high school student and daughter of CdP 7, female.
CdP9	Resident of Lima, researcher for a non-profit research centre, male.