

Eco-anxiety and solastalgia in lived territories: sacrifice zones and mining environmental liabilities in Atacama, Chile

**Ecoansiedad y solastalgia en los territorios
vivos:** zonas de sacrificio y pasivos ambientales
mineros en Atacama-Chile

**Eco-ansiedade e solastalgia nos territórios
vivos:** zonas de sacrifício e passivos ambientais
da mineração no Atacama-Chile

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Abstract: In 2015 and 2017, two flow events occurred in the Atacama region of Chile. The region hosts several intensive mining projects and faces associated pollution problems. This article examines these disasters within the broader framework of climate change, sustainability, and socio-environmental conflicts. Drawing on qualitative content analysis and taking the flow events as an analytical axis, we explore how these issues are framed in the press and in corporate sustainability reports. The results reflect a historiographical operation that separates the impacts of the mining industry from socio-environmental disasters.

Keywords: mining megaprojects; global climate change; socio-environmental conflict; sustainable development; eco-anxiety; solastalgia.

Resumen: En 2015 y 2017 se registraron dos aluviones en la región de Atacama, Chile. Se trata de una zona minera donde se alojan distintos proyectos de extracción intensiva, con los problemas de contaminación que suponen. Este artículo aborda estos desastres desde el marco más amplio del cambio climático, la sostenibilidad y los conflictos socioambientales. A la luz de un análisis de contenido cualitativo, tomando como vector a los aluviones, exploramos cómo son enunciadas estas problemáticas desde la prensa e informes de sostenibilidad empresarial. Los resultados expresan una operación historiográfica que escinde los impactos de la industria minera de los desastres socioambientales.

Palabras claves: megaminería; cambio climático; conflictos socioambientales; desarrollo sostenible; ecoansiedad; solastalgia.

Resumo: Em 2015 e 2017, foram registrados dois aluviões na região de Atacama, no Chile. Esta é uma zona mineira onde se localizam vários projetos de extração intensiva, com os problemas de poluição associados. Este artigo aborda estes desastres no quadro mais abrangente das alterações climáticas, da sustentabilidade e dos conflitos socioambientais. À luz de uma análise de conteúdo qualitativa, analisamos, tendo os deslizamentos de terra como vetor, a forma como estas questões são descritas na imprensa e nos relatórios de sustentabilidade. Os resultados expressam uma operação historiográfica que separa os impactos da indústria mineira dos desastres socioambientais.

Palavras-chave: megaprojetos de mineração; mudança climática global; conflito socioambiental; desenvolvimento sustentável; eco-ansiedade; solastalgia.

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1. Introduction

The well-documented social disintegration associated with mining activities (Rodríguez & Medina, 2012; Santa Cruz, 2018) and the progressive weakening of the state have restricted the forms of public expression available to the local population. While sustainable development considers the social component as one of its pillars for building trust, it does so from a vertical perspective, in which highly institutionalized actors make unilateral decisions affecting communities. In these cases, corporations speak from a position of power, controlling and framing what is said through a variety of strategies and media.

At the same time, there is also a marginal position of enunciation. With some exceptions (Palma & Alcaíno, 2020), inhabitants are often not heard, and their voices are rarely represented. Organizations such as NGOs or the media sometimes take into account what local residents think or believe, especially when strikes or protests are at the forefront. But when such organizations do not exist or when they have conflicting interests, the voices and perceptions of the people living in the territories become invisible.

In 2015 and 2017, two flow events occurred in the Atacama region of Chile, bringing visibility, in the context of emergency, to communities in areas where intensive copper extraction has been the main economic activity for decades. These were catastrophic events in environmentally saturated localities inhabited by large transient populations under outsourced and subcontracted labor arrangements. These disasters brought mining territories into the news spotlight due to the consequences of their impacts: large volumes of water, mud, stones, and waste flowed down from the mountain through dry riverbeds, creating a socio-environmental disaster among local communities. Numerous residents died, and others disappeared and were never found; a significant portion of the population had to leave their homes, while the state, with the collaboration of mining companies and their machinery, took charge of physical reconstruction.

The record of climatic events that occurred in the Third Region of Atacama dates back to 1655 (Griem, 2017). The chronology shows that flows were recorded only infrequently until 1972. Between 1972 and 2017, five events were recorded as flows, which are technically mass movements that carry everything in their path (Easton-Vargas et al., 2018). This increase in the frequency of rainy events in the high mountains, characterized as catastrophic, coincides with population growth in the region (from 42,500 inhabitants in Copiapó in 1970 to 290,581 inhabitants in 2012; a growth rate of 0.8% during the 2002-2017 census period¹). It also coincides with mining activity associated with large and medium-sized mining projects. Risk increases as the exposed population grows, and in the context of flows, this risk increases in association with climate change.

1 <http://www.ineatacama.cl/noticia.aspx?opc=ShowNew&id=521>

This article first addresses how mining production is associated with socio-environmental conflict, but from the perspective of how mining companies encode the alterations caused by this activity. Secondly, we argue that there is a historiographical operation (Certeau, 1993) that shifts attention away from the impacts of mining and toward corporate social responsibility, translated as sustainability, understood mainly in terms of reducing greenhouse gas emissions, rather than addressing the risks posed by large-scale mining operations, including waste storage facilities.

2. Theoretical framework

2.1. Mining: extraction and sacrifice zones

Chile is widely defined as a mining country and is likely to remain so (Rodríguez et al., 2022). Antofagasta and Atacama are widely recognized as mining regions, which means that, in relation to commodities, there are several overlapping discursive strata. These strata are cultural, social, labor-related, migratory, scientific, technological, economic, infrastructural, communicational, environmental, and legal, and they evolve in relation to one another (Santos, 2000).

Mining is characterized by cyclical processes and high-impact operations involving millions of dollars. Producing and less developed countries generally export unprocessed concentrates, limiting their opportunities and the development of their own industries. When these countries are single-commodity producers, they are vulnerable to fluctuations in global prices, which are volatile and follow cycles of boom and bust. This generates social, environmental, and territorial impacts that are disproportionately borne by the most vulnerable populations, hindering the transformation of their living conditions and the transition to higher levels of well-being (Dunbar, 2016; Leuenberger et al., 2021; Hodge et al., 2022).

From the perspective of social analysis concerning communities, what is important is what is at stake beyond currency and its impact on fiscal revenues with the development of mining. A set of problems arises that leads to social mobilization with demands for protection, economic, social, and environmental justice, public health, civil rights, and human rights.

It is in this context that the issue of so-called extractivism becomes relevant: a type of “removal of natural resources” that can be observed in mining, agriculture, forestry, and oil extraction (Gudynas, 2014, p. 12). These processes involve high-impact interventions, generally leading to the disintegration of social fabrics and socio-environmental deterioration (Gago, 2015; Svampa & Viale, 2014). As Latin America primarily focuses on the export of natural resources, the region consolidates itself as a supplier of raw materials to core countries, positioning its resources and economy within the global geopolitical sphere of dominance and subalternity (Göbel,

2013). The strong impetus following the structural reforms of the 1980s, in what is called the commodities consensus (Svampa, 2013), and a state that primarily facilitates investments and the repatriation of profits (Portillo, 2014), lead to intensive exploitation and significant territorial transformations (Gudynas, 2009, 2014; Paz, 2014). This impetus tests community resilience, understood as the capacity of social systems and institutions to organize and confront adversities (Magrin, 2015) and to develop lessons and capacities to face them (Uriarte Arciniega, 2013).

From the perspective of the landscape, the identification of some of the various categories previously mentioned as produced space (Santos, 2000) defines the mining landscape. The burden of extensive activities and operations remains as empirical evidence, simultaneously evaluated as both liabilities (i.e., inactive operations) and assets (i.e., work culture). Substantively, the presence of large accumulations of material called “Environmental Mining Liabilities” (EML), products of mining extraction that are not part of an active operation, is perceived through sight, sound, and smell.

Environmental mining liabilities have become a pressing concern for local populations. Nine years of fieldwork in the Atacama region (Broitman & Ortiz, 2018; Broitman, 2019; Broitman, 2023) and some publications (Rodríguez et al., 2021; Rodríguez et al., 2022) allow us to affirm that there is a widespread suspicion among the inhabitants that the localities are contaminated by heavy metals (i.e., mercury, lead, cobalt). Even when these are found naturally, the suspicion is that there may be significant concentrations in the air, soil, and water that exceed current environmental regulations, due to the removal of material inherent in the intensive extraction of minerals.

Now, when observing the territory from the perspective of investments and conflicts, a burden of contamination and risk appears that is distributed unevenly in territorial and social terms. The most exposed populations end up being categorized as “disposable” or “subclasses” due to the limited recognition of their rights. Viewed in terms of experiences, a relationship was established in the 1960s between these harmful environmental burdens, inherent in the historical conceptualization of development, and racial and class conditions, as well as place of residence. That is to say: not all neighborhoods, cities, and regions are affected and contaminated in the same way (Lerner, 2010).

From this perspective of justice and injustice, Canadian environmentalist Naomi Klein (2014) argues that an economy based on energy sources that release poisons as an inevitable part of their extraction and refining has always required sacrifice zones. Entire groups of people are considered part of productive operations, which means that their poisoning in the name of progress becomes, in some way, acceptable.

An extreme condition of environmental injustice would be the so-called

“environmental sacrifice zones”, among which are some mining areas. A “national sacrifice zone” is defined as an area so contaminated or depleted of its resources as to have little or no future use (National Institute of Human Rights [INDH], 2018).

Sacrifice zones involve not only environmental damage but are characterized by the presence of poor populations, who typically lack visibility in the media and do not possess the tools to negotiate politically with authorities and transnational companies.

In these territories, environmental damage has meant a situation of vulnerability and increased impoverishment for communities. In this sense, current instruments regarding territorial planning and strategic environmental assessment [in Chile] do not allow the concentration of business projects in these territories to be considered, nor do they account for their cumulative consequences (INDH, 2011, p. 254).

The externalities of extractivism are a problem of distribution of the burdens of development, as the costs and benefits are beyond individual and collective consent. However, there is a relative tension regarding sacrifice zones: while the industry will avoid such designation due to the social burden it entails, the inhabitants may want to mobilize it as a strategy to generate political pressure in search of various benefits, even at the cost of the stigma it brings. However, the mere insinuation or public idea of a sacrifice zone devalues the territory, urban complexes, the value of housing, and the production, collection, or capture of local resources, because it defines an undesirable place to live (Rozo Castillo, 2021; Bravo Ferretti et al., 2022).

Although the National Institute of Human Rights in Chile has designated only four sacrifice zones in Chile (INDH, 2018), many other locations could be considered as such by relaxing the methodologies. For example, in 2021, the Decree No. 15 (Ministry of Environment, 2021) established Copiapó and Tierra Amarilla, locations included in this study, as “saturated in MP10 or respirable particulate matter”. Likewise, in 2024, the National Mining Company (ENAMI) declared the closure of the Hernán Videla Lira smelter (on the outskirts of Copiapó). This plant exceeded the emission standards for air quality by 500% (Verdejo, 2022).

2.2. Sustainable development in mining

The conceptual framework of sustainable development framed a significant part of the reactions from the mining world regarding the aforementioned disasters. As a result of the Brundtland Report (World Commission on Environment and Development, 1987), which established sustainable development as a guiding principle in the business world, linking environmental protection and economic growth, companies worldwide adopted this approach as a solution to poverty and environmental issues (Pal & Jenkins, 2014). Consequently, it influences public discourse on how we understand environmental issues (Livesey, 2002). In this sense, under-

standing the meaning of sustainability will always be a challenging task, because social, economic, and ecological factors are part of life on Earth (Cantrill, 2012).

However, it lacks the epistemological density required to operate as an imperative. The notion cannot explicitly distinguish between strong and weak sustainable development (O'Connor, 1998). The strong position is based on the idea that economic development and environmental preservation are contradictory, because economic activities have negative consequences for the natural environment, assuming that there are processes of irreversibility and uncertainty associated with the evolution of ecosystems. The weak position holds that damage to natural capital is not irreversible, because adverse effects can always be recovered through investment, emphasizing the substitutability of natural capital with manufactured capital. The depletion of natural resources could then be compensated for through technological changes or the implementation of other resources. In this sense, O'Connor's proposal recognizes that well-being does not regularly depend on a specific type of capital (such as natural capital), but rather that the important factor is the conservation of the global capital stock (O'Connor, 1998).

The way companies act in response to pollution -and climate change- is also part of the development of sustainability as a problem, establishing a rhetoric of "doing something" (Ihlen, 2009). Actions such as implementing a sustainability strategy, with internal departments, communication, corporate social responsibility (CSR), and fieldwork, among others, can be understood by inhabitants in very diverse ways. This shows how the territory is not just a material space but also a rhetorical space in which national and transnational corporations, the state, interest groups, and individuals seeking to "do something" participate as a manifestation of socio-environmental concern.

2.3. Understanding the problem from a sensitive perspective

The mining industry, in turn, has concrete impacts on these territories. While some are more difficult -or impossible- to perceive (water, soil, and air pollution), there are measurable effects in daily life (dust, blasts, allergies) and in the landscape (tailings, EML, truck traffic). These impacts lead to changes in routines, customs, and daily life that can shape perceptions and affect those who live in mining territories, as they witness the destruction of their environment and ecosystems, especially under conditions of greater vulnerability (Cordella, 2021).

The anguish of observing the disintegration of their living space (such as their territory) and its possible disappearance, along with the grief that this entails, is termed solastalgia² (Uhl & Niemeyer, 2023). Originally

2 From the Latin *soluacium* (comfort, welcome) and *algia* (pain, suffering, grief).

coined to understand mental health disorders linked to pollution, climate disasters, and territories (such as mining extraction or droughts), and understood as somaterratic disorders³ (Albrecht, 2007), solastalgia has evolved into a broader notion. It can also be understood through the lens of displacement, albeit without physical relocation, since the territory itself is transformed or displaced. It is a situated life experience (Galway et al., 2019).

Moreover, the extractive industry and the transformation of territories have also affected the mental health of individuals. Evidence also suggests that individuals can develop various climate-related emotional states (anxiety, depression, anger), particularly in the changing and abrupt contexts of climate change (Arcanjo, 2019; Léger-Goodes et al., 2022; Agoston et al., 2022).

For decades, research has focused on defining and limiting eco-emotions (eco-guilt, eco-grief, eco-anger), facing ethical dilemmas, such as protests or environmentalist movements (Kurth & Pihkala, 2022), as well as media saturation regarding the potential risks of the planetary climate crisis (Pihkala, 2020). In 2017, the American Psychological Association (APA) defined eco-anxiety as “a chronic fear of environmental doom” (Clayton et al., 2017, p. 69), placing the diagnosis within a landscape of clinical recognition. And while eco-anxiety is primarily used to refer to impacts related to climate change, it can also refer to ecological disasters in general (Kurth & Pihkala, 2022).

Consequently, the conceptual framework of eco-emotions is an appropriate theoretical framework for problematizing the ongoing perception of uncertainty (Agoston et al., 2022) observed in the empirical work conducted, as the lack of certainty is also an expression of anxiety. Additionally, flooding phenomena have also been studied within this theoretical framework (Jackson & Devadason, 2019; Cianconi et al., 2020).

3. Problematization

The two flow events discussed above form a chronological framework for analyzing the positions of enunciation from which the relationship among mining activities, climate change, and communities is understood. This relationship is articulated through the conjuncture (the flows in the media) and from academia and related institutions. It is also articulated in timeless, abstract spaces (sustainability reports from mining companies), which recognize flows as part of climate change, but not in terms of increased risk due to their own operations.

We propose that behind the urgency attributed to “climate change” by the media lies a historiographical operation (Certeau, 1993). The historio-

3 From the Latin soma (body) and terratic (related to the earth).

graphical aspect refers to a place where information is produced, which establishes power through position, resources, and the human and material capital that participate; an institution is a political place, as it always mediates the real, because its nature allows for a singular type of narrative production that stimulates some discourses and omits others, while concealing the position from which it speaks. In historiographical operations, the “I as author” is eliminated because the subject of enunciation is separated from the enunciated object, thereby inscribing a desire in an autonomous linguistic artifact such as documents.

In this way, the focus of responsibility shifts regarding the extractive process of companies (scientific, technical, economic), as well as the responsibility of the state (protection and construction of the life project). Mining companies address climate change as a general “external” dimension that needs to be “paid attention to”, mitigating it by reducing greenhouse gas emissions, but not in relation to the territorial location where operations are carried out. Thus, “socio-environmental disasters” become “environmental disasters”, and the increase in risk is attributed solely to climate change, not to mining operations and their present and past practices.

4. Method

We address the problem through a qualitative-interpretive approach to documents, with the aim of understanding and coding meanings and comparing them with one another (Flick, 2010). While some approaches prioritize experimentation and the meaning that individuals attribute to their lived experiences through interviews (Smith et al., 2021), others work on the analysis and interpretation of documents to make visible the meanings that embody certain topics or discursive constructions (Bowen, 2009). Because previous studies (Rodríguez et al., 2021; Rodríguez et al., 2022) had already addressed residents’ perceptions, drawing on a sample of 40 interviews with members of neighborhood councils, individuals, local authorities, unionists, company representatives, politicians, and human rights groups, this article addresses the problem from other sites of enunciation, strongly coded and endowed with institutional and corporate legitimacy: media and documents from mining companies.

4.1. Technique

With this objective, we conducted a content analysis (Krippendorff, 2018), as a technique aimed at constructing valid inferences from documents within the framework of the flows, but across different temporalities, since media and corporate documents are published at different times and in different contexts. Following the proposal of reflexive thematic analysis by Braun and Clarke (2006, 2021) and Byrne (2021), we implemented an analysis procedure for the selected documentation, consisting of familiarization

with the data, code naming, linking themes, associating themes with the coding scheme, and selecting references.

In this coding work, systematically carried out using ©Atlas.ti, we identified 87 codes. Subsequently, we identified relationships among these codes to systematize their interactions and uses. The coded issues relevant to our research were: flows, crisis, disaster, climate change, risk, strategy, sustainability, and sustainable development, as well as their relevance, arrangement, and meanings.

4.2. Sample

4.2.1. Local press documents

We reviewed two local media outlets, “El Chañarcillo” and “El Diario de Atacama”, yielding a sample of $N = 384$ items. The former was founded in 1991, does not belong to any large media conglomerate, is based in Copiapó (the capital of the Atacama region), and describes itself as “the only authentically regional newspaper”. During the analyzed period, it had a section dedicated exclusively to mining. Along with this section, ongoing news coverage and advertising about mining reflect the media outlet’s closeness to that economic sector. As mining is the main regional economic activity, *El Chañarcillo* represents the interests of the local economic elite. The second newspaper analyzed, “Diario de Atacama” from Copiapó, has a century-old tradition in the region and has been part of the El Mercurio SAP group since 2004, the main conglomerate of print media in Chile. Closely linked to the political right and conservative social groups in Chile, and pro-business, several scholars have discussed the historical ties between *El Mercurio* (the main newspaper of the group in the capital, Santiago) and the main Chilean capitalists, including those in mining (Sunkel & Geoffroy, 2001; Monckeberg, 2009). Both publications have the highest circulation in the region and are therefore among the journalistic products with the greatest impact on the construction of public opinion (Valenzuela & Arriagada, 2011).

Considering the aforementioned background, we analyzed these newspapers from March 24 to 27, 2015, and from May 13 to 17, 2017. These time frames correspond to the days of greatest intensity of the flows studied. We analyzed only these two weeks because the selected regional media outlets channel legitimate voices (Broitman, 2017) in the context of the situation (the flows). Consequently, we moved away from quantitative analysis given the nature of our object of study. The short duration of the flows is difficult to reconcile with long-term studies on climate change (Dotson et al., 2016) or mining. The few elements available to us regarding these components cannot be categorized or classified, for example, in any conflict or episodic frame.

4.2.2. Sustainability reports from mining companies

Due to the limited evidence available in the media and to provide a necessary counterpoint to enrich our analysis, we integrated a second approach into our methodological framework to address another collection of documents directly from the mining industry. The prevailing coded issues were strategy, sustainability, risk, and sustainable development.

Using the two flow events mentioned above as a basis, we established a time frame from May 2015 to July 2017 for data collection. To question how mining corporations understand risks in terms of environmental impacts, we investigated how these corporations communicate about sustainable development.

To reach these companies, we downloaded data on all mining tailings in the Atacama Region (743) from the National Geological and Mining Service (SERNAGEOMIN) website. As our interest was related to communication, we filtered the information, excluding all EML. The result was 30 active mining tailings deposits. We then conducted a microscopic examination of the data (Strauss & Corbin, 2002), identifying only four companies in the region that communicate their sustainable development strategy. In this way, our *corpus* consists of twelve reports (four companies, three per year), which, although not explicitly stated, are primarily directed at investors, economic actors, and government officials. The documents are drafted and published based on the companies' expectations, organizational culture, and a neutral discourse on sustainable development. In these reports, which highlight the three pillars of CSR, criticism is excluded, and the facts are presented in a way that supports the continuation of resource extraction.

Of the four companies involved in this study, two are public: ENAMI (National Mining Company) and CODELCO (Copper Corporation); and two are private: CAP (Pacific Steel Company) and Lundin Mining, which operates the Candelaria copper mine. This information is crucial for understanding how these corporations view sustainable development, as transparency and accountability requirements differ between the public and private sectors.

5. Results

5.1. Press Analysis

This content analysis exclusively examined news related to flows as the first filter, systematically excluding all news outside this topic from our *corpus*, such as police or political news. It is worth noting that, in presenting the results below, we trace a conceptual journey through two climatic phenomena (the 2015 and 2017 flows). It is worth noting that the 2015 flow

caused far more severe damage due to its greater magnitude and the lack of sufficient, suitable infrastructure to withstand it.

5.1.1. What flows carry away: fundamentally natural risks

Risk was one of the themes with the greatest presence in our *corpus*. The *corpus* reveals an intense debate regarding possible solutions to mitigate the impact of flows on society, such as increasing mitigation works or re-locating the population. Another ongoing aspect is the attribution of responsibilities. On the one hand, the state's duty to invest in oversight and in updating regulatory plans is emphasized. By contrast, it is considered that government authorities hold residents responsible for living in high-risk areas, whether in informal settlements or by insisting on rebuilding in the same areas affected by the 2015 flow.

Copiapó is also included, characterized as one of the municipalities in the country with the highest proportion of informal settlements, many of which are located in ravines with flood risk. Indeed, there are many northern coastal settlements that find themselves in a situation similar to that of Chañaral. Undoubtedly, the catastrophe should prompt a review of urban settlements and their conditions. This is a genuinely effective long-term preventive measure (El Diario de Atacama, 2015, p. 12).

At the same time, the risk of contamination associated with flows is systematically denied by both extractive industries and the government. Thus, while the executive president of CODELCO, Nelson Pizarro, categorically denied that there are risk factors in the Pampa Austral tailings dam, as has been discussed in some media (Vásquez, 2015, p. 2), the undersecretary of public health, Jaime Burrows, argued that massive contamination from heavy metals coming from tailings in the disaster-affected area is unlikely (El Chañarillo, 2015a, p. 5).

Although the *corpus* contains publications suggesting a link between flows and mining contamination, they are never supported by documentation. They are instead associated with uncertain testimonies related to the crisis. However, even when this possibility is raised, it is dismissed through evidence or authoritative discourse.

One of the points that most concerns the community is the content of the mud, (...) which may pose a risk to the population. To address this, a specialized team from the Ministry of Health will arrive in the region (...).

There is an understandable concern about contamination with heavy metals that may come from the tailings (...) The risk is lower because it would be diluted with normal mud. If there is any concentration of a heavy metal, it would be low due to that dilution. We will not know that until we have a thorough study of this material that is arriving in the city (El Diario de Atacama, 2015, p. 16).

5.1.2. Repairing disasters from sustainability

During both periods, local media largely omitted perspectives on solutions to the issue; this absence contributes to a representation of events as an “inevitable catastrophe”. During the 2017 flow, the debate over solutions began to emerge on the media agenda, primarily involving the government and mining companies.

Among the solutions, reactive measures are proposed, such as: providing water trucks, heavy machinery, and chemicals for cleaning or clearing, air and ground transport for rescues, setting up shelters, distributing vouchers and loans, and distributing blankets, nylon, sandbags, emergency housing, food, and water. It is worth noting that prevention prevails in the texts corresponding to the second stage.

The publications bring together a wide range of actions, which are published, in part, from a critical perspective, but mainly from an informative one, in a context where the public communication of government decisions related to crises was inherent to the mission of the media.

The Minister of Public Works, Alberto Undurraga, stated that

The mitigation works carried out by the Ministry of Public Works in these two years in the Atacama region saved lives (...) Now, after the emergency and cleanup phase, we will need to undertake more works and additional pools to further reduce the impact of the flows (Núñez, 2017, p. 3).

However, when discussing resources and construction projects, private companies are incorporated, particularly within the framework of social responsibility. The collaboration of the mining industry was mentioned not only in long-term preventive measures but also in reactive measures, maintaining a persistent and stable level of exposure throughout the media coverage. In a crisis context, companies deploy resources and initiatives that strengthen their commitment to inhabitants through various actions:

Large and medium-sized mining companies, as well as mining suppliers, have been collaborating with planes for the transport of support personnel, machinery for clearing roads, helicopters for rescue, as well as food and water, among other things (El Chañarcillo, 2015b, p. 5).

In turn, the proactive support agenda of mining companies, which simultaneously adheres to the axes of social sustainability and strategic communication, is not limited to material collaborations but also actively participates in the construction and implementation of public decisions in the context of the crisis.

Gastón Burgos, president of Coresemin Atacama, expressed

I would highlight the joint work. The truth is that the authority requests that all of us in the mining sector join a joint effort to develop stronger controls in the future for these flood situations. We will collaborate technically, through a public-private

working group that allows us to work and interact with our technical professionals so that each of the projects that the Government has been developing aligns and thus ensures greater effectiveness in mitigation and relief measures (El Chañarillo, 2017a, p. 3).

5.1.3. A phantom climate change

In our entire *corpus*, we find only two direct references to climate change and one indirect reference (from 2017). Two were on the same day. The first was an editorial from the “Diario de Atacama” titled “Construction, Plans, and Climate Change”. From its own platform, the media proposes an explicit link with the flows: Climate change is not an invention, as some claim, and it has been felt in the region (El Diario de Atacama, 2017, p. 8). The second reference, made on the same day but in the other analyzed media, corresponds to a statement by the then-President of Chile, Michelle Bachelet (El Chañarillo, 2017b). We also detected an indirect reference to meteorological phenomena in an opinion column published by the “Diario de Atacama”, which stated: climatic behavior will intensify in the coming years, and this is just the beginning (Céspedes, 2017, p. 8). Since we can only record these three elements detected in the *corpus*, neither local authorities nor mining companies refer to climate change in these media during the mentioned periods.

In this way, the analyzed editions fundamentally addressed the flows from the social perspective that socio-environmental disasters provoke: material damage, humanitarian crisis, repair work, etc. The lack of mention and connection with climate change and mining not only shows a certain disconnection between what mining companies wanted to communicate and local emergencies, but it also refers to how mining companies organize the limits of their activities.

Another relevant aspect to note is that we found only one concrete mention (not conditional) throughout the *corpus* regarding the possible impact of mining activity on the affected populations. This refers to the responsibility of Codelco, Chile’s most important public mining company and one of the largest state-owned companies in the world, regarding the pollution of Chañaral Bay over the last 20 years. The request was made by a regional deputy (El Diario de Atacama, 2015). Even though neither the flows nor climate change are mentioned in the article, it seems to us that the political logic behind the event in the context of the flows is not trivial (Chateauraynaud, 2011).

5.2. Analysis of mining documents: strategy, risk, and sustainability

Although strategy, risk, and sustainability may seem obvious categories, they allow us to establish certain guidelines to explain why and how the

studied corporations understand and construct risk through sustainability reports.

i. *The ubiquity of strategy*

The keyword “strategy” is observed throughout our *corpus*, and for this reason, it served as the starting point for our open coding. Linked to environmental, social, and R&D issues, its omnipresence shows us how the analyzed sustainability reports frame business practice.

In the opening of CODELCO’s Sustainability Report (2015), its General Manager, Nelson Pizarro Contador, explains to the readers:

2015 was a very complex year for CODELCO, with significant management adjustments, in an international scenario marked by falling commodity prices. However, this complex scenario did not prevent us from embarking on the development of our corporate sustainability with the same determination, seeking better performance and awareness of its value as a strategic axis of our business (CODELCO, 2015, p. 3).

Although the omnipresence of strategy is observable throughout the *corpus*, the data also show that Lundin Mining gives it the greatest emphasis, at least in quantitative terms. The way it understands strategy through a social prism is especially revealing. Its approach to corporate social responsibility, in this sense, functions as a strategy.

LMC promotes long-term benefits for local communities by supporting self-sustaining programs and other social initiatives that improve quality of life in the areas where we operate. We recognize that our operations can have significant economic and social impacts on local communities if they are not properly managed throughout the life cycle of our mining projects (Lundin Mining, 2015, p. 43).

ii. *Risk is not the main focus*

Risk was not an important part of the agenda of any of these companies. CODELCO was the only one that introduced the concept during the three years analyzed. It did so as an environmental, social, and even R&D concern, arguing, for example, that *sustainability and institutional relations have specific methodologies to identify and manage risks and impacts related to environmental and social impacts* (CODELCO, 2016, p. 29). On the other hand, CAP only mentioned risk once (Muñoz & Barros, 2017). That same year, Lundin Mining spoke about environmental risks, recognizing, from a global perspective, how mineral waste stored in tailings facilities can pose a risk to the environment.

iii. *Sustainability addressed from different perspectives*

As we have worked with sustainability reports, it is pointless to search for “sustainability” as a keyword: it is everywhere. Nevertheless, it remains relevant to understand how companies mobilize this concept. Eleven of the twelve reports associate sustainability with the environment and social is-

sues. And although the four companies also published the keywords linked to R&D, there are differences among them, particularly in how Lundin Mining understands it, as it reveals implications of sustainability as an economic factor. CODELCO is, by far, the company that most frequently associates sustainability with the environment.

iv. Sustainable development as a neutralizer

Sustainable development is understood from the perspective of environmental management (Pal & Jenkins, 2014) by all the analyzed corporations. The environmental impacts of mining are seen as macro-problems that require macro-solutions, and (over)consumption is not viewed as part of the problem. Sustainable development as a strategy should then neutralize the damages caused by corporate activities.

As we pointed out, the social and R&D dimensions are also part of the analyzed sustainability reports. The strategic configuration of these three dimensions (environmental, social, and R&D) underscores the importance of a sustainable shift in the mining industry. By taking concrete, measurable actions in that direction, companies can demonstrate that they care about the environment, residents, and innovation. For example, an ENAMI Sustainability Report states:

To strengthen ties with stakeholders in the areas of influence and build a relationship of trust, ENAMI created the “SOMOS... Comunidad” program as a basic and essential framework for engaging with its publics. The program is intended to proactively address the needs of its surrounding environment, building trust through spaces for education, information, and awareness-raising on issues related to the company (ENAMI, 2016, p. 98).

Infrastructure, benefits, funds, donations, and innovation are just a few examples of how companies channel sustainable development. CODELCO allocates the most energy to empowering the residents:

Investment priorities include projects related to sustainability, infrastructure, productive development, and education. Each of these axes has as its main objective the development of projects that seek to address the socio-environmental impacts generated by our operations, promote citizen participation, and improve the quality of life for individuals (CODELCO, 2017, p. 41).

By measuring and controlling impacts on the one hand, and by listening, sharing, and providing tools to residents on the other, sustainable development becomes operational for companies to neutralize perceptions of risk. Psychological risks must be partially controlled, especially with regard to compensation: from the company's perspective, if residents can be convinced that damage is reparable, risk becomes more manageable.

5.3. Emerging results

5.3.1. Climate change dissociated from territories

First, it is pertinent to note that climate change does not appear to be a significant concern for CAP or ENAMI. The former barely mentions it as a strategic concern. For example, in a section titled “Energy and Climate Change”, it states: climate change and social transformations have exacerbated in our country an energy context that was already complex (CAP Minería, 2015, p. 22). ENAMI’s Sustainability Reports do not mention climate change at all. This can be explained by the nature of the corporation: because it works with medium- and small-scale mining, a global concern like climate change does not seem to be a priority.

The reports by Lundin Mining and CODELCO, both large-scale copper-mining companies, understand climate change from a global perspective. The Canadian company has integrated climate change into all its reports as a subcategory, in the central section “Environmental Management”. Climate change is managed and measured with concrete indicators and is regulated by recognized international standards.

In our calculations, we used the most recent global warming potentials provided in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), as recommended by the Greenhouse Gas Protocol and the CDP. Our greenhouse gas emission calculations include carbon dioxide, methane, and nitrous oxide, expressed in carbon dioxide equivalents (CO₂e). When available, emission factors for each fuel type have been obtained from national publications; otherwise, default fuel emission factors from the 2006 IPCC Guidelines for national greenhouse gas inventories have been used (Lundin Mining, 2015, p. 95).

Although CODELCO is a public company, its understanding of climate change is not really different from that of Lundin Mining. It consists of measurable indicators, including energy, environmental management, water management, and greenhouse gas emissions. CODELCO adopts the IPCC (Intergovernmental Panel on Climate Change) guidelines and the principles for addressing climate change, and applies the guidelines of the International Council on Mining and Metals (ICMM).

At the corporate level, we have Energy and Water Resource Management. Its main responsibility is to comply with the sustainable development policy, promote the efficient use of energy and water resources, and contribute to reducing greenhouse gas emissions and their impacts. This is part of our commitment to and alignment with the ICMM Principles and Position Statements (Principles 2 and 6 and Position Statements on Climate Change). (CODELCO, 2015, p. 71).

5.3.2. Flows are treated only as a social problem

Flows are barely mentioned in our analyzed *corpus*, and when they are, it is in relation to the report's social section or from a social viewpoint. Erick Weber, CEO of CAP, states in an editorial: "The ties between the company and the community were significantly strengthened due to the extreme situations experienced in the Copiapó area by the flows". (CAP Minería, 2015, p. 2). A section titled "Natural Disasters", it is noted that immediate actions were taken to support those affected and to normalize the functioning of the city (CAP Minería, 2015, p. 38). CAP does not mention flows in its 2016 or 2017 reports.

On the other hand, in ENAMI's sustainability report, a special section titled "ENAMI in the climate emergency of March 25, 2015" was dedicated to the work related to the flows. Details are provided about the measurable and material aid given to the community. The section is divided into subcategories such as "Support for the affected community", "Actions of the ENAMI board", "Support measures for small mining", and "ENAMI moves for ENAMI" (in which corporate workers helped each other). The focus is always social, providing material support, in human and financial resources. ENAMI's sustainability reports for 2016 and 2017 did not address the flows.

CODELCO and Lundin Mining, which are larger corporations with operations worldwide, also refer to the flows from a social perspective. CODELCO makes a single mention of the 2015 event: "We highlight the investments made to remediate the effects of the flow that affected the region in March 2015" (CODELCO, 2015, p. 28). There was no mention in the 2016 and 2017 sustainability reports.

Lundin Mining highlights the Copiapó flow in 2015 through the "President's Message" by Paul Conibear, which reflects the assistance-based approach that aligns with the understanding of the disaster:

In the first months after Lundin Mining acquired Candelaria, the Copiapó area suffered a severe natural disaster: the flood of the Copiapó River valley, which devastated communities, businesses, and farms along more than 100 km of the river's course. Although the flow resulted in tragic human losses, the communities, mining companies, and local government quickly united to manage the disaster, and Lundin Mining played a significant leadership role, first in relief efforts and then in supporting reconstruction, which continues to this day (Lundin Mining, 2015, p. 2).

The flows are always addressed in the report from the perspective of "social responsibility". In 2016, the company announced its investments related to the disaster in question: *funds expended in 2015 under a multi-year community investment agreement with the Municipality of Tierra Amarilla to assist the community* (Lundin Mining, 2016, p. 27). The flow events were never linked to risk, the environment, climate change, tailings deposits, or the EML.

5.3.3. The controlled representation of tailings deposits

Finally, it is also revealing to understand how companies discuss tailings deposits and their potential infrastructure risks. For CAP, there is no associated risk. The tailings from CAP Mining's iron ore production processes are inert and harmless (Muñoz & Barros, 2017, p. 3).

Tailings deposits are common elements in the description of mining activities. Mine closures, accumulated material, or even expansions are common contexts in which they are mentioned. However, in ENAMI's sustainability reports, they are not associated with risk, at least not directly. Nevertheless, some indirect associations can be found. At each of the company's operational plants, there is an Environmental Contingency Plan that outlines how to respond in the event of an environmental emergency. Additionally, emergency drills are conducted to train workers to respond to them. (ENAMI, 2016, p. 135).

Lundin Mining systematically integrates tailings deposits into its environmental assessments, measuring them and taking steps to control their risks.

In 2015, Lundin Mining developed a Tailings Management Standard (TMS) to ensure that all Tailings Management Facilities (TMFs), including the main water-retention dams, are designed, constructed, operated, decommissioned, and closed in such a way that all structures remain stable and all aspects comply with regulatory requirements, company standards, accepted international practices, and commitments to local stakeholders (Lundin Mining, 2015, p. 68).

However, this representation of a planned control cannot, under any circumstances, include the possibility of an external -and unpredictable- risk, such as a flow. Since certain environmental risks cannot be easily quantified by corporations, they tend not to be included in sustainability reports. In these cases, companies prefer to speak of adaptation to climate change.

The risks and opportunities associated with climate change in our operations have been considered in accordance with the 2000 Special Report on Emissions Scenarios (SRES) of the Intergovernmental Panel on Climate Change (IPCC), which considers a balance among all sources of climate change (Lundin Mining, 2015, p. 86).

CODELCO, as a large mining company, has also integrated the risk associated with tailings deposits in all its reports. For example: *in 2016 we initiated the first studies aimed at identifying new risks arising from climate change, particularly the improvement and modification of facility designs in light of new weather scenarios* (CODELCO, 2016, p. 58).

6. Final reflections

6.1. The historiographical operation as an image of transparency in extractive companies

The analysis of sustainability report records and press archives suggests that we are facing a historiographical operation in Michel de Certeau's sense (1993).

In this sense, the real, materialized in our empirical work, constitutes an operation that determines the objects and objectives, distributing them according to the hierarchy of existing models (political, economic, environmental, social, scientific). Therefore, the writing of a news article related to the flows affecting the Atacama region in local (and also national) newspapers corresponds to a controlled discourse. It condenses (hidden) ideas to induce effects of meaning, by producing and mobilizing stories that construct the real or the plausible.

Thus, the analysis of the body of documents reveals the historiographical operation by showing how "truth" is produced when climate change is described and referenced as a phenomenon in its own right. It appears, on the one hand, as an unpredictable effect and, on the other, as a concern for companies and authorities. As places of enunciation and production of the real, companies respond to climate change as an external imperative and mobilize around the objective of mitigating global warming and reducing greenhouse gas emissions. However, this production of the real eludes and omits any reference to the fact that the expansion of mining activity increases socio-environmental risks, as its production, distributed territorially, exacerbates the vulnerability of human and non-human populations and their ecosystems. In this way, the "true" content is housed in the text (press and institutional documents) as a measure of mitigation, not as the risk associated with the activity. Thus, the institutional and press narrative naturalizes exogenous factors, placing the catastrophes outside the productive sphere.

6.2. The anxiety of denial

In this way, the construction of "the real" in documents endowed with significant symbolic capital and legitimacy only accentuates an explanatory void for a problem that seems unreachable, inexplicable, and ineffable. There do not seem to be reassuring answers from the media's own stated commitment to truth (Page, 1996), or from social responsibility, an integral part of sustainable mining.

And while there seems to be a widespread suspicion (Rodríguez et al., 2021; Rodríguez et al., 2022) regarding the degree of responsibility for the contamination of territories, the legitimate places of enunciation that could connect natural events with anthropogenic action do not speak to this is-

sue. Thus, the suspicion remains confined to illegitimate, alternative, or occasional sources (blogs, social networks, neighborhood meetings, etc.).

Thus, the force of the two flows may bring with it eco-emotions due to the traumas they may have left behind, along with the persistent threat they posed. Fear, worry, anxiety disorders, and depression have been identified in critical situations such as those studied in this work (Pihkala, 2020; Cianconi, 2020).

Additionally, and even when its diagnosis entails recognized difficulties (Arcanjo, 2019), the lack of explanations can be interpreted from the framework of meaning and psychosocial dynamics. And while eco-anxiety sometimes prompts environmentalist action, it also leads to paralysis in the face of the enormity of the problem (Léger-Goodes, 2022). This ecological paralysis, closely linked to solastalgia, is characterized by the inability to respond meaningfully to climate challenges (Agoston et al., 2022).

6.3. The unequal effects of pollution

A central impact of socioeconomic inequality in Chile and Latin America is that it also shapes inequality in social rights and in variable, differentiated exposure to environmental risks.

Environmental inequality corresponds to inequitable exposure to environmental risks, which situates the issue within debates on justice. Its specific form is driven by political and social factors, in which the weakest and most vulnerable individuals suffer the consequences of decisions made by others regarding land-use planning. Rights such as the right to live in a pollution-free environment, health, physical and mental integrity, life, the full development of children, work, education, adequate housing, water, and sanitation are violated (Instituto Nacional de Derechos Humanos [INDH], 2015). That is to say, those affected are those who lack public visibility and influence over what permanently affects their lives. Perhaps, then, this very condition may trigger a constant search for vectors through which discomfort can be channeled, with flows serving as the tip of the iceberg of a much deeper phenomenon.

One of the expressions of the extractivist model is subalternity among racialized, ethnic, and disadvantaged communities. Considering the above, it is possible to situate its horizon of meaning in the field of human rights and territorial justice. Many communities, then, are part of the so-called “areas or zones of environmental sacrifice”, as a manifestation of the unequal distribution of negative externalities. The more precarious an area becomes, the more likely it is to turn into a genuine repository of waste. Social and economic precariousness, along with structural vulnerability, weakens the community in the face of decision-making that affects their territories. Thus, the “sacrifice zones”, whether acknowledged or denied, are conditioned by the arbitrariness of decisions.

Considering the above, one must ask how mining has integrated hu-

man rights policies into its corporate social responsibility policies. Are there instances of human rights violations and environmental contamination connected to the activity? If so, what initiatives have been taken to seek mitigation and compensation in response to these situations?

If the understanding of future projections and impacts of climate change is limited, what is the true comprehension of the nature of climate change risks in mining?

7. Conclusions

Some territories in the Atacama region affected by the studied flows meet the criteria to be declared sacrifice zones, but they have not been. There is evidence that climate change exacerbates certain climatic phenomena, such as flows. However, that link is not established in the analyzed documents, which reflect the legitimate voices in the context of the crisis under examination. This reflects a long-standing historiographical operation centered on a web of power relations, labor, and infrastructure. The crisis can be interpreted as an environmental disaster. But it could also be approached as a socio-environmental disaster. This creates a scenario of significant uncertainty, closely linked to eco-emotions such as eco-anxiety and solastalgia.

A scenario of greater informational transparency is needed, involving increased discussion, greater corporate receptiveness to the public, and the dissemination of technical arguments. It also requires well-founded responses to observations made by communities and interest groups (communities, environmentalists, academics). From this, it follows:

- a) working from the perspective of territorial dialogue and with transparency regarding the scope of projects, as well as the level of burden that a region or territory can bear.
- b) incorporating the participation of academia and other actors to strengthen, mediate, evaluate, endorse, or arbitrate issues and the relationship between companies, communities, and the state.

This relationship is important for companies and their projects over the long term. It is also important for the state in relation to project evaluation and public policy on mining investment. An efficient policy requires clarity regarding the limits of what is possible and desirable. The above demands flexibility from the business world and the strengthening of an environmental institutional framework that is more technical than political.

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