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Don't wake up the dragon! Monstrous geontologies in a mining waste impoundment

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Abstract
This paper is an invitation to view tailings – the most prominent byproduct generated by mining activity – as more than their usual incarnation as waste, object of governance by waste management programs. In doing so, it applies Elizabeth Povinelli's notions about geontopower/geontologies to analyze the practices devoted to managing the tailings produced by Mina El Teniente, a large copper mine located in central Chile. From this framework, the mine's tailings impoundment are enacted as both a "dragon" and a "trickster", entities endowed with a monstrous vitality that openly challenges the mining industry's usual geontologies, which are based on understanding impoundments as docile nonliving deserts very much open to capitalist exploitation/forgetting. On the contrary, the dragon/trickster enacts a geontology in which human beings appear as ultimately unable to truly control nonliving entities, and depend only on their goodwill to avoid environmental disaster. The acceptance of such a geontology, as will be explored in the conclusions, challenges us to develop a *geo-teratology*, or a set of alternative political and ethical commitments we should devise in order to start better living with the monstrous geontologies of mining waste.

Keywords
Mining waste, waste management, geontologies, dragons, trickster, geo-teratology

Finding a dragon at Carén

We were at the beginning of our first proper interview with Raul Cuevas in August 2014, the head of the tailings unit at Mina El Teniente, when he introduced us to the dragon.

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> Cuevas: ... the [tailings] impoundment, for me, is a dragon, that is there, quiet, and that you should leave quiet, nothing more.
>
> Flores: That doesn't wake up...
>
> Cuevas: That doesn't wake up, it's the same as in The Hobbit movie, the same theory, you can do a lot of things, but you mustn't wake him up, I don't want to cause a [massive spill like the one in] 2006, something that is quite easy, quite easy, if you don't take [the dragon] into consideration and then, ... when the dragon is fully awake, you have no option beyond entrusting yourself [to the saints], nothing more, and you can't do that, as simple as this...

This turn was utterly disconcerting for us.

For the two previous years, we have been studying the governance of mining waste in Chile, mainly through the ethnographic study of the complexities involved in the daily management of tailings, the most prominent kind of waste produced by mines. In doing so, our conceptual framework has been the emerging field of waste/discard studies, especially those inspired by developments in science and technology studies (STS). From this perspective, we have thus far viewed tailings as nodes of intersection between an ample variety of elements including chemical components, modes of production, regulations, human agencies, judgments, climates, etc.

It was from this approach that we initially undertook the interview with Cuevas. We were there to speak about waste management (WM) at the mine, especially the rationalization program he has lead since 2006, but instead ended up talking about a fictional monster. And it wasn't just passing commentary. While the word "waste" or "discard" was never mentioned in our three-hour conversation, the word "dragon" appeared over and over again, almost every time Cuevas mentioned Carén, the gigantic current waste impoundment of the mine. In Carén, instead of tailings or waste we ended up finding Smaug, the fictional dragon created by JRR Tolkien in his novel The Hobbit (1936), later turned into a movie trilogy.

After our initial shock had receded somewhat, we started to attribute more and more significance to this surprising encounter. A dragon at Carén wasn't just a curiosity, or simply a metaphor, but it embodied a growing sensation that had accompanied our fieldwork, the recognition that in mines such as El Teniente tailings are much more than waste. Obviously, the quality of being discards of particular production processes always remains at the very center, but it is usually joined (and even replaced in several cases) by multiple other enactments of tailings. In their daily interchange with multiple human and nonhuman entities tailings are many things: large infrastructures, ruins of a cherished past, economic devices, causes of disasters, landscapes and even "natural" entities. In several of these incarnations, and contrary to the traditional negative connotations of waste, tailings become also embodiments of attachment, memory and affections (Ureta, 2016). Through the recollection of these multiple ontologies, we concluded that seeing tailings solely as waste "forecloses the possibility of creating better ways of living with [a] thing that we reject as both different and redundant to our lives" (Hawkins, 2006: 11).

As a consequence, in this paper, we have decided to follow the dragon into Carén; to start exploring ways to think about tailings that go beyond their existence as waste. In particular, we are interested in analyzing tailings as entities embedded with a certain *monstrous* capacity, or an inner capability to affect massively and in strange ways other entities, close and far, among them human beings. Remaining faithful to our initial interest in the governance of mining waste, we will analyze such vitalities mainly from the standpoint of the kinds of politics to which they give rise, the different kinds of knowledge and technologies of power

developed by human beings to deal with such unruly entities. In doing so, we will use the recent body of work developed by Elizabeth Povinelli (2014, 2015, 2016, 2017) around the concept of geontologies and geontopower, seeing it as a key approach to understanding the kinds of politics emerging from our daily encounters with these anthropogenic monstrosities.

Aiming to contribute to the further development of this framework, we will propose the joint figure of the dragon/trickster as a particular geontology emerging in places such as Carén, a strategy of power based, quite paradoxically, on the recognition of our utter powerlessness when facing entities such as El Teniente's tailings.[1] The final aim of this exercise is not only descriptive or analytical, but also ethico-political. As will become clear in the conclusions, we are interested not only in conceptualizing tailings differently, but in the new kinds of politics we should devise in order to start living with entities like tailings in a better way.

Mining geontologies

In technical terms, tailings are described as "mixtures of crushed rock and processing fluids from mills, washeries or concentrators that remain after the extraction of economic metals, minerals, mineral fuels or coal from the mine resource" (Kossoff et al., 2014: 230). Besides gangues, tailings include several chemical additives, mostly "organic chemicals, cyanide, sulfuric acid, and other reagents used to achieve mineral recovery" (Lottermoser, 2007: 154), several of which could be potentially toxic to entities living in the mines' vicinity.

What makes the issue of tailings' environmental impact pressing is that even midsize mines produce several hundred thousand tons of tailings *per day*, in all reaching a "global quantity of approximately 18 billion m^3 per year ... [that could be located] in the same order of magnitude as the actual sediment discharge to the oceans" (Förstner, 1999: 1). As could be expected, the impoundments where tailings are accumulated usually become enormous, extending for hundreds of square kilometers and reaching depths of several hundred meters. Thus it is not so strange that a survey on the topic called tailings impoundments "probably the largest man-made structures on Earth" (ICOLD, 2001: 15). Given this scale, the whole process of producing and accumulating tailings (along with other mining discards) not only "comprise[s] the world's largest industrial waste stream" (Hayes et al., 2014: 240), but also is starting to be seen as "of the same order of magnitude as that of fundamental Earth-shaping geological processes" (Kossoff et al., 2014: 230).

Dealing with such amount of waste is made more complex by the fact that tailings are seldom inert. As recognized by most of the technical research on the subject (for an overview, see Lottermoser, 2007), tailings are quite chemically and biologically active entities. As a consequence, the impoundments usually become spaces of multiple encounters, where tailings continually mutate into different states (Smuda et al., 2008). In this context, "the mineral assemblage in the tailings can undergo geochemical oxidative processes, which can lead to the release of metals, toxic compounds, and acid" (Dold, 2014: 626).

As noted by Clark (2011), large and complex entities such as tailings "have dynamics of their own, and this often includes absorbing pressures or changes of input up to a point then lurching, quickly and unstoppably, into a new state" (p. xi). Beyond human expectations, they "combine and return, often amplified in ways we never would have expected" (Gabrys, 2009: 677). And, crucially, such changes happen "in circumstances when the majority of Others are not species and when this Other majority meets without human recognition or involvement" (Hird, 2010: 36). In this sense, tailings' capacities are fuzzy and hybrid, scaling up and down in ways that are utterly indifferent to any human thought about them. And as

they do this, tailings act on a truly geological scale, creating and transforming landscapes and strata. Thus, tailings materialize one of biggest paradoxes of the Anthropocene: a geological imprint caused by human agency that is largely indifferent to the humans that have created it, and which affects them in multiple unexpected ways.

This utterly beyond-the-human scale, however, does not mean that tailings are ungovernable – at least not from the perspective of actors such as Cuevas and other managers of large mining waste depositories like Carén. As seen in a previous publication on the topic (Ureta, 2016), tailings are traditionally dealt with through the design and application of different kinds of WM programs. In parallel with its technical components, WM programs are also, and above all, projects of power: projects of discipline and ultimate dominance of the waste being managed. For this last reason, WM programs fall quite neatly into Elizabeth Povinelli's notion of geontopower.

Superposing on Foucault's notion of biopower (as the ability to rule over life and death), Povinelli (2015, 2016, 2017) proposes the concept of geontopower to designate "a set of discourses, affects, and tactics used in late liberalism to maintain or shape the coming relationship of the distinction between Life and Nonlife" (2016: 17). In particular, late liberal geontopower could be defined as,

> ... A social project whose purpose is to keep an arrangement of accumulation in place through the specific governance of difference and markets that stretches across human and nonhuman forms of existence. Late liberal geontopower is an activity of fixing and co-substantiating phenomena, aggregating and assembling disparate elements into a common form and purpose. It is a set of dominant patterns, constantly tinkered with and revised according to local materials and conditions, according to which Life is fabricated and Nonlife is used. (2016: 249)

Then, the traditional resistance to grant life to nonorganic entities is not casual, but a mode of power. To declare some entities as non-living has been a central strategy of capitalism to make them available to human appropriation, transformation and, quite frequently, destruction. For this reason, "nonlife has remained fairly firmly sealed in its opposition to Life within extractive capital and its state allies" (Povinelli, 2016: 56). Geontopower, and its associated geontologies, should be seen, above all, as a historically specific mode of governance developed in late liberalism to rule through the distinction (and the policing) between living beings, entities to be governed, and non-living objects, entities to be appropriated, used and discarded. Although it is a global phenomenon, it reaches its most dramatic effects in the most vulnerable and faraway locations of global capitalism, where usually acts with exceptional force, displacing alternative notions on the ontological status of the non-living, such as indigenous cosmopolitics.

From her work among indigenous communities in northern Australia, Povinelli (2016) identifies three particularly salient figures of geontology: the desert, the animist and the virus. The desert "stands for all things perceived and conceived as denuded of life – and, by implication, all things that could, with the correct deployment of technological expertise or proper stewardship, be (re)made hospitable to life" (p. 33). The desert always exists in the tension of, on the one side, identifying a place/entity/phenomena as denuded of life while, on the other side, identifying its potential for animation through the deployment of the right extractive practices, knowledge and devices. In contrast, the animist "insists that the difference between Life and Nonlife is not a problem because all forms of existence have within them a vital animating, affecting force" (p. 34-35), although such force is accepted only when it contributes to the workings of late liberal governance, when is docile and malleable to the projects of capital. Finally, the virus looks to disrupt this arrangement by continually

muddling the distinction between life and non-life, moving from one side of the distinction to the other. In doing so, it "confuses and levels the difference between Life and Nonlife, while carefully taking advantage of the minutest aspects of their differentiation" (p. 37). Such an ambiguous character, however, does not mean that the virus is an escape from geontopower. As Povinelli recognizes, "to be the Virus is to be subject to intense abjection and attacks, and to live in the vicinity of the Virus is to dwell in an existential crisis" (p. 38). For late liberal governance viruses are dangerous, and for this reason they are policed with special rigor.

As could be expected, the mining industry has an intimate relationship with late liberal geontopower. As a key materialization of contemporary global capitalism, the mining industry tends to see the widest array possible of locations and minerals as "having the potential to create profit; that is, nothing is inherently inert, everything is vital from the point of view of capitalization, and anything can become something more with the right innovative angle" (2016: 38). Whether via novel practices such as urban, underwater, or subpolar extraction and/or processing, nowadays any tract of earth appears to mining companies as a "desert" waiting to be animated.

> Mining industries can claim a new magical capacity to acknowledge the endless vitality of all substances – even waste if viewed from the perspective of desire can become value—and to find the technical capacities to release this value as a market. But capital also—and the mining industry exemplifies this – depends on sequestering certain forms of existents into the pure object realm. Capital is … the Desert in Animist clothing. (2016: 170-171)

Especially when acting in the so-called global south, mining appears as one of the most prominent forms of contemporary late liberal geontopower: it arrives in "remote" places and installs technologies of extraction through the application of a particular geontological disposition, based on the notion that this is a desert that they are going to turn into profit, negating the existence of any other kind of sovereign being, usually acting against local cosmopolitics.

This process is especially poignant regarding tailings. The process through which a "desert" is enacted with respect to certain land/mineral deposits not only involves freely mining the ore, but also, once the valuable component/s has been extracted, leaving the remainder right there, for eternity. Tailings and other kinds of waste are the desert left by mining operation, the field of nonlife emerging out of the life of extracted value. True to their capitalist framing, and beyond their material components, what characterizes tailings is then their lack of market value, which is why in the technical literature they are simply defined as "non-economic sulphide" (Dold, 2014).

However, as Povinelli also notes, this "mode of late liberal governance … [is nowadays] trembling" (2016: 32), especially in the context of the Anthropocene. Against the neat geontopower proposed by WM, in practice the success of its accompanying sets of practices and technologies to properly govern tailings is, at best, precarious. The vast depositories accommodating tailings have a long history of accidents and massive leaks, heavily polluting the surrounding environment (ICOLD, 2001). A recent worldwide report on the issue by Newland Bowker and Chambers (2015) states not only that such spills are quite "normal accidents" (Perrow, 1999) for the mining industry, but also identifies the existence of "an emerging and pronounced trend since 1960 toward a higher incidence of … [large scale] failures" (p. 1), mainly derived from the need of contemporary mines to have ever larger impoundments to maintain their profitability. In this context, traditional mining geontologies are starting to be accompanied by new figures, emergent geontological arrangements

whose aim is to devise a new kind of governance that tries to take into account the tremors traditional WM programs are experiencing. In this paper, we are interested in exploring one of these emergent figures: the dragon/trickster.

Extractivism with a human face

The Corporación Nacional del Cobre (CODELCO) practices a strange kind of extractivism. Derived from the nationalization of Chilean copper mining industry in 1971, CODELCO was created as a public-owned company in charge of the management of several of the country's largest copper mines, becoming as a result the biggest copper mining corporation on the world. In achieving such position, its operation has been repeatedly associated with most of the conventional negative side effects derived from large-scale industrial mining, especially in the global south: environmental degradation, violence against local communities, especially indigenous people, destruction of cultural heritage, and so on.

However, in parallel, CODELCO do several things that are much less usual for large mining corporations. First, and foremost, being a public-owned company its revenues do not go to some group of wealthy individuals located on a faraway country. On the contrary, its profits go directly to the Chilean state, becoming as a result its prime source of revenues. In parallel, CODELCO is expected to act on a stately manner, considering the public well-being along with the mere search for profits. Even before the current furor about corporate social responsibility, CODELCO had been for years focused on achieving higher standards on social and environmental issues than other, privately owned, mining corporations operating in Chile. Although this second set of demands commonly don't go beyond being a discourse, they raise no little amount of points of friction and controversy on the corporation's daily functioning. Several of these constraints are very much present on the case of Mina El Teniente, CODELCO's biggest mine.

Mina El Teniente is located 100 kilometers south of Chile's capital city Santiago, in the Andes Mountains. Having more than 3000 km of tunnels, it is usually considered the largest subterranean mine in the world, and produces mostly refined copper (475,000 metric tons in 2016). Being by far the largest employer on the region, and in line with most mining geontologies, since its very beginnings El Teniente focus has not been only on the production of copper, but also on the management of the local population. Such aim was firstly directed towards turning them into trustable and loyal workers, developing a "style of management that combined rigorous control of everyday life with an extensive social welfare apparatus" (Klubock, 1998: 13), something that continues until today. As critical voices started to rise against the mine's environmental impact since the 1990s, such a program was progressively enlarged to include the population living on the mine's vicinity, establishing clientelistic patterns of relations (usually based on the provision of different goods and services) that look to difficult enacting social opposition.

After being produced at the mine, tailings are transported through a canal to the El Teniente's current tailings dam, known as the Carén impoundment. Carén is located in a valley in the Altos de Cantillana mountain range, around 85 km west of the mine. Its current infrastructure consists mainly of a dam made from waste rock in the shape of a downstream valley-fill impoundment (see Figure 1; the dam is located at the top left of the image). By 2007, "the impoundment occupied an 8.5 km-long and up to 2.5 km-wide area of the valley ... With an average deposition of ca. 200,000 t/d tailings (...), the total volume of the Carén impoundment was estimated at 7.6 Mm^3 with a total surface of 22 km^2" (Smuda et al., 2008: 63). It is expected that the impoundment will be operational until 2064, when the wall will

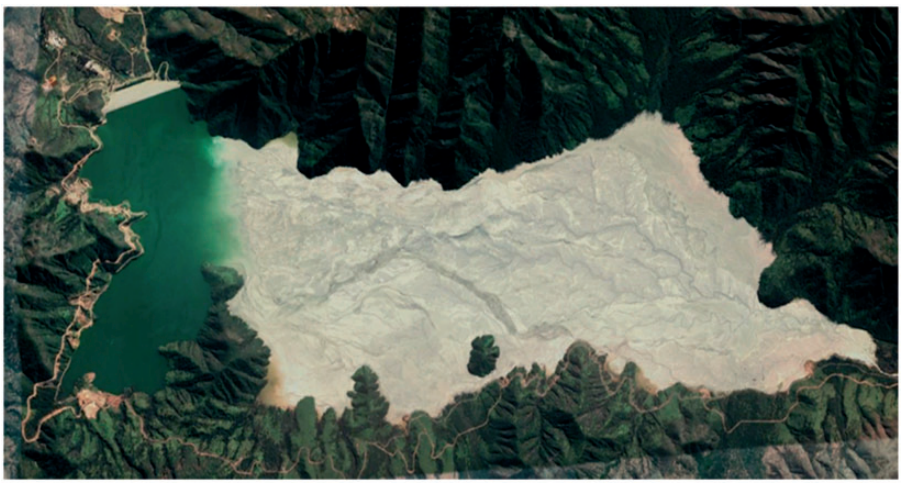

Figure 1. Satellite view of the Carén tailings impoundment.
Source: Google Earth.

reach a height of 135 meters (from its current 70 meters), filling the entire length of the valley with tailings.

After arriving at the impoundment, fresh tailings experiment a decantation process forming two new entities, sedimented tailings and tailings water. Sedimented tailings, on the one hand, are formed by the coarser fraction of fresh tailings and occupy the lower strata of the deposit (the gray area in Figure 1). Tailings water, on the other hand, is formed by the water added during the leaching process plus several chemicals and minerals and occupies the superficial layer of the impoundment, locally called "the lagoon." This water is continually extracted, treated and then released in the Carén River. This extraction occurs through a discharge tower whose entry point is located inside the lagoon, as can be seen in Figure 2.

The population living downstream from Carén is formed mostly by low-income farmers who make a living by cultivating small pieces of land.[2] Previous fieldwork among them by the authors (Flores, 2017), has shown that after years of coexistence with the impoundment and its personnel they have developed the usual pattern of clientelistic relations mentioned above. First, and foremost, they are conscious that most of the content of the narrow Carén River, the main source of irrigation for their crops, comes from cleaned-up tailings water. Given that this is a semi-arid region that receives very little rainfall annually, if it weren't for the impoundment the stream would have no water most of the year. In second place, CODELCO has strong bonds on the area, from being the basis of an informal service economy to regularly providing jobs to neighbors. Finally, the mine's traditional welfare apparatus has been partially enlarged to include this population, mostly taking the form of a series of goods and services, whose provision is usually accompanied by discourses about the uttermost security and environmental friendliness of the tailings' management. As a result, until recently such measures have decanted on (from the point of view of CODELCO) an ideal arrangement on which most of the local population reported having no issue with the company and the millions tons of tailings siting upstream from their houses, even some of them considering them a local asset.

This arrangement, carefully tailored for years, almost collapsed one Saturday night in April 2006. Around midnight a massive spill of tailings started, heavily polluting 17 kilometers of the river basin downstream. Suddenly, from the neighbor's perspective,

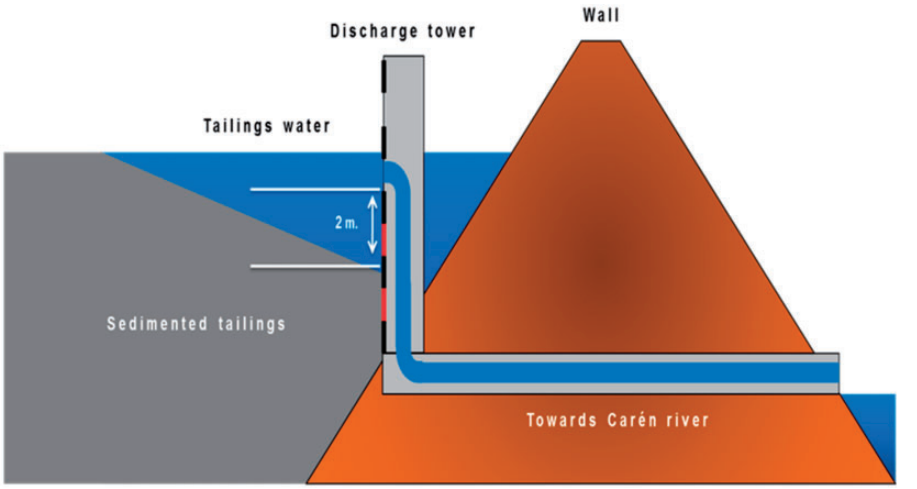

Figure 2. Carén's water discharge system.
Source: prepared by the authors based on material provided by El Teniente personnel.

the management of tailings was not as safe as expected. This wasn't merely an inert "desert" perfectly controlled by CODELCO personnel, as it has been claimed for years, but was something more akin to a virus that could heavily pollute their water and lands, even drown them, in a matter of minutes. Suddenly, tailings became a matter of local concern, including public demonstrations by residents, and CODELCO was forced to act urgently to reassert their damaged geontopower. After spending millions in clean up and compensations, they were able to (partially) do it. But the episode left a permanent crack on the local mining geontologies, the extended suspicion among the neighbors that this could happen again, with even worst consequences. Given this, a new motto was adopted by the mine personnel: "ni una gota" (not a single drop). The only way to fully reassert their geontological ordering on the Carén area was by making sure that not a single drop of tailings goes beyond the dam. Most of their efforts started to be ruled by this aim, as we will see in the rest of the paper.

A sleeping dragon

From our previous fieldwork at El Teniente's WM area, we were familiar with the many complexities involved in dealing with such an enormous and ever flowing amount of tailings. However, and based on what the employees of the area had told us, we thought that most of this complexity derived from the challenge of mobilizing El Teniente's tailings over more than 80 kilometers of a highly uneven and densely populated terrain from the mine to Carén. After that, it was only a matter of storing the tailings for eternity, based on the "ultimate sink" (Tarr, 1996) principle at play in most modern landfills.

Cuevas' words were a radical departure from this narrative. Seated in his office in El Teniente headquarters, located in the city of Rancagua (some 50 kilometers from the impoundment), we started to envision Carén as a truly different kind of entity, not merely as the final resting place of tailings. The Carén enacted by Cuevas that day was not at all an amorphous desert, but something strikingly different: a dragon, a kind of monster like those that traditionally "appear … as embodiments of death and damnation, and their appearance is calculated to terrify" (Lippincott, 1981: 20).

The emergence of the dragon was especially surprising to us given who was making such comments. Cuevas was a civil engineer who has arrived to the WM unit of El Teniente on the wake of the 2006 spill. As part of a radical modernizing program carried out by CODELCO since early 2000s (Soto, 2006), his main task had been to completely transform the unit in line with the most up-to-date WM technologies available. Besides bringing all kinds of new technical devices and expert personnel, this program has been especially focused on trying to erase the traditional ways of understanding and handling tailings, especially by the longtime employees of the unit, colloquially known as "*viejitos*" (old guys), and the local community.

The *viejitos* are the most vivid materialization of El Teniente's disciplinary but welfarist style of internal management (Klubock, 1998). Most of them have been with the corporation their entire working lives, even some of them being born inside its premises. More than in high-end educational credentials their competence is mostly based on what Frodeman (2003) calls "professional judgment" or "judgment calls made on the basis of one's education, partial data, and years in the field" (p. 34). Under the modernizing program at play in CODELCO since 2006, this kind of judgment has started to be seen as increasingly risky; hence, a main focus was on replacing it by a handling based on up-to-date WM technologies, standards and indicators. Through such "modernization", amply publicized on multiple PR initiatives, a parallel aim was to make the impoundment disappear as a matter of concern to the community, so the usual arrangement on which only CODELCO personnel have a say on the tailings at Carén would be restored. From a geontological perspective, Cuevas program could be seen as an attempt to turn Carén into a proper high-tech desert, even for long term employees of the corporation, after being affected the virus of the spill and its derived social unrest.

The dragon cannot be farthest from such a reform program. Against the modernizing notions championed by Cuevas, it could be seen as a direct heir of traditional notions of the monstrous emerging in mining areas in Latin American, as noted by Taussig (2010) and Nash (1993); frightening figures associated with "images, memories or recollections directly linked with destruction, violence or violation" (Gudynas, 2016: 146). In a similar way than traditional notions of the mine and mineral resources as "the devil" (for an overview see Gudynas, 2016), tailings at Carén are "spoken of as alive, resplendent with movement, color, and sound" (Taussig, 2010: 147). Tailings possessed a certain inner capacity, an untamed quality that clearly signals the limits of rationalizing programs such as the one headed by Cuevas.

This dragon is truly gigantic and growing every day, due to the never-ending flow of tailings coming from the mine. Besides its sheer scale, this monster is also not inert, forever waiting for human beings to be reanimated in just another turn of further capital creation. The impoundment, Cuevas told us, is alive. The fact that the dragon is sleeping did not mean that it is immobile. On the contrary, the dragon is constantly "*acomodando*" (adjusting), in unexpected ways.

> ... Every day we put tailings in Carén, ... every day 150,000 metric tons arrive ... then there is a movement in the tailings, an *acomodación* [adjustment], despite how big it is, it adjusts, it adjusts, it's like playing with a sand castle, you pile on [a certain quantity of] sand and then it adjusts, this adjustment is almost continual, but suddenly it stops, but at some moment it must adjust again, there are small adjustments, that you almost don't perceive, there are others that are evident and there are others that are massive movements ... The depository should grow 20 centimeters per month, but sometimes it doesn't grow, doesn't grow, doesn't grow, it could remain a year and two months without moving ... and then, suddenly, it adjusts.

In Cuevas' words, the dragon appared as powerful and unpredictable, easily capable of radically altering the up-to-date WM system they have been implementing at Carén with one of its adjustments, as happened in April of 2006. It was a monster that you would not like to see fully awake, a circumstance in which you would "*have no option beyond entrusting yourself [to the saints], nothing more*." Carén-as-dragon is clearly an open challenge to his own WM program, and its aims of total control and ultimate abandonment; it is a monstrosity whose "very existence [acts as] ... a rebuke to boundary and enclosure" (Cohen, 1996: 7).

For this reason, the relationship with such a monster was not one of perfect control or submission, but of careful treatment, starting with taking the "beast's" own rhythms into consideration.

> ... Suddenly in two days [tailings level inside the] impoundment could raise 20 centimeters, but the water coming in is the same, after a rain sometimes the impoundment raises very little, we had a hard rain at the beginning of August, almost 70 millimeters fell, ... and the impoundment only raised 20 centimeters on the fourth or fifth day, but also sometimes, from one day to the other, without rain, in summer, it raises 20 centimeters, it means that the dragon [carried out] some adjustment and if it has started to adjust it means that it will keep adjusting for a while, I mean, a stretch from a beast of this size doesn't last a short time, it could take days ... it could last a week and then it stabilizes, it adjusts and then we restart [our work], but during the adjustment we only do the planning, there is no risk that the tailings will go out, so it can adjust as much as it wants.

Thus, the starting point in the relationship with this dragon was to respect its mobility, to wait until it stops adjusting. This respect means stopping any kind of process taking place inside the impoundment until the "beast" readjusts itself, a process that could last several days and involve a significant growth in the level of the sedimented tailings at the measuring point near the dam wall. This is a monster with no small degree of autonomy, that although sleeping is regularly adjusting, responding to its continual growth, an adjustment that cannot be predicted or postponed, only endured.

However, as the last section of the above quote reveals, this respect for the beast's adjustments rests on Cuevas' ultimate belief that they are going to be circumscribed within certain predetermined limits, so "there is no risk that the tailings will go out." The dragon is free to move, but only as long as it remains captive inside the impoundment. In this attitude, we can see his own rationalistic WM program at play again, or the belief that the new expertly-devised systems of control installed in Carén would ultimately be able to resist the ferocity of the beast, making it impossible for it to escape and unleash its fury on the surrounding areas.

The WM mechanisms with respect to the dragon consisted in a series of devices acting as a buffer, separating it from other components of the dam, especially the water discharge system, as seen in Figure 2. In this system, the water produced from the decantation of the tailings when arriving at Carén occupied a central role. As noted above, tailings water is constantly being extracted from the impoundment. This extraction responds mostly to the need to limit the growth rate of the impoundment. But also, and this is central to the productivism ethos of the whole endeavor. Carén is not only a resting place, but an industrial water producing facility, and this water (after being treated) is restored to the original riverbed, allowing CODELCO to keep neighbors downstream happy, as already seen. In line with Povinelli, in this productivism, we can see how the impoundment is never solely a desert, but it is also animated to produce an alternative kind of profitability in

the form of achieving corporate social responsibility goals, an issue of particular interest for mining corporations nowadays.

However, this water cannot be made completely productive, at least in relation to external aims. In parallel, tailings water is used to form a lagoon that acts as a "cushion", separating the sedimented tailings from the discharge point of the tower. This cushion is considered to be operating correctly when two predetermined thresholds are respected. The first one is that the lagoon must have a certain length starting from the dam, which nowadays is set at 1.6 kilometers. The second is that a security buffer of two meters has been established between the bottom of the lagoon, or the start of the sedimented tailings, and the point on the discharge tower through which the lagoon water is discharged (see Figure 2). This distance is continually checked and, as soon as it falls below two meters, or is close to it, a new entry point of the discharge tower is opened a couple of meters above and the existent one is blocked with concrete blocks, a process known as "*bloqueo*" (blockage). Such *bloqueos* constituted the main procedure through which the dragon and its destructive capabilities remained locked inside the impoundment, allowing the WM system to continue functioning while dealing with this quite strange and unpredictable "beast."

Thus in the end, the dragon is still a figure of governance, a geontology, through which actors such as Cuevas sought to rule over nonliving entities such as tailings, as was clear in the closing stages of this interview.

> Then this is a dynamic job, two or three [tower] blockages per year, it is not that much, not that much work, it is programmable, you can attend to other demands in between, you can postpone it depending on other commitments, it is a very important task, because of this I prefer to do it in a very ordered fashion, before you had to stay all night or until someone measured [and said], "we are below the criteria!" and you had to change the whole organization and priorities, not now, we could wait one more day, the dragon will keep moving anyways, you see?

This dragon is peacefully sleeping. It does move from time to time, adjusting its ever-growing body, but these movements are always contained within the limits laid out by the new Carén's WM system. Especially in comparison with the period before the 2006 spill, the present life of the dragon in Carén appears as a happy coexistence, in which both the beast and an up-to-date WM system can live in relatively peaceful proximity. In parallel, and centrally, such coexistence allows actors such as Cuevas to keep ruling over both the *viejitos* (whose professional judgment has been largely dismissed) and the surrounding community (whose fears of a new spill are dismissed as highly improbable and, hence, ultimately irrational).

In Cuevas' version, the Dragon is only partially animated, it is an utterly powerful but sleeping beast and, if everything is done correctly, it could be sleeping for a long time, even forever. But it could also awake at any time. In this last possibility, however, the dragon radicalizes the figures of geontology proposed by Povinelli, embodying in a prominent way the trembling status of late liberal governance. After all, the dragon is ultimately a figure of human powerlessness, of weakness. In a way, it proposes an inverse kind of geontopower, in which our aim of governing nonliving things rests only on our ever-sophisticated capacity to not disturb them, always knowing that such a disturbance, if it happens, will mean unleashing forces that are way beyond our capacity to control.

In a similar way than other complex chemical entities, as noted by DeLanda (1992), tailings at Carén appear then as "capable of undergoing several kinds of bifurcations that result in the self-assembling chemical clocks, traveling waves, spirals and other complex patterns" (p. 147), patterns that are utterly impossible to predict or model. As a result, their

only option has been to impose tentative buffers, hoping that they will be able to contain the next adjustment, being the only alternative "*entrusting yourself [to the saints]*". Tailings-as-dragons are governed through weakness; it is a geontology that assigns power to them, and weakness to human, but still aims at governing them through establishing a liminal space of precarious control over the figure of a beast that we know how to keep sleeping.

However, as we will see on the next section, the dragon was not the only monster roaming at Carén.

The trickster

One of the first things that we heard on our early visits to Carén was that "*el tranque está vivo*," the impoundment is alive. Although we didn't heard anyone calling it a "dragon" at Carén, from there the impoundment appeared as even more alive and unpredictable than in Cuevas' office, always prone to act in unexpected ways and overflow the systems devised to keep it sleeping.

We were able to witness this vitality, and the frictions it caused, one morning in January 2015 when, standing at Carén's control room, we heard the following exchange between Juan Carvallo, Fernando Hermosilla and Sergio Inostroza, three *viejitos* who have been working at the impoundment for a long time, regarding the recent growth of the tailings level and the need to carry out a new blockage on the discharge tower.

> Carvallo: The lagoon grew 60 centimeters last month, I mean, it grew 20 centimeters in 10 days and we, with two *losetas* [tilings], are going to be only 18 centimeters above [the 2 meters buffer], I mean, it could be said that in 10 days more we are going to be below the 2 meters [buffer]... in the last blockage we had a buffer of 2.88 meters... and now we are going to have 2.18...
>
> Inostroza: So, we should make a 75 [centimeter] blockage?
>
> Carvallo: Mmm... the last time it was one meter ... the problem is what happens if the [water] pressure is low afterwards...
>
> Hermosilla: If you do this you open up the risk of having to take off the last tiling, and if the thing is glued on with concrete, how are you going to remove it?
>
> Carvallo: Yes, that's what I meant...
>
> Inostroza: A pure mess...
>
> [Carvallo keeps making calculations for himself a couple of minutes, mumbling]
>
> Carvallo: No, we're fucked...
>
> Flores: Why do you say that we're fucked?
>
> Carvallo: Because we have too little water, the height of the tower runs out, if we had been two meters below, three meters below, we could have done a one meter blockage, a 50 centimeter, but now we can't do it.
>
> Hermosilla: We are... more than fucked.

The image that emerges from this exchange is quite different from the one described by Cuevas in his office in Rancagua. Here, we are not seeing blockages that are programmed and executed in a timely fashion, nor buffers that are never surpassed in order to keep the dragon sleeping. Here, we are seeing a monstrous entity that continually "*atrapa*" (catches) the personnel of the impoundment unprepared, as they repeated over and over again, raising rapidly from one day to the next and trespassing into the two-meter cushion. Instead of the perfect planning promised by Cuevas' WM program, management of tailings at this location looks more like a game of hide and seek, in which CODELCO personnel play the part of the ones being prosecuted and being forced to flee every few months, reacting to the ever changing movements of the tailings.

From this location, the impoundment does not seem to be a sleeping dragon at all. It is still enormous, monstrous in nature. But it is also fully awake and active, usually in a rather unstable fashion, continually changing its behavior just at the point when they thought they already knew how it was going to react next. In this sense, this version of the monster better resembles the figure of the trickster, or "the spirit of disorder, the enemy of boundaries" (Turnbull, 2000: 92), a figure whose function is "to add disorder to order and so make a whole, to render possible within the fixed bounds of what is permitted, an experience of what is not permitted" (Turnbull, 2000: 28) Offering an open contrast with top-down technocratic projects such as the one championed by Cuevas, the trickster forces us to "check on the arrogances of a reason that would uncover all disguises and force correct vision of a recalcitrant nature in her most secret places" (Haraway, 1992: 90).

So, instead of the planned and ordered process needed to keep the dragon sleeping proposed by Cuevas, at Carén we witnessed a rather messy and hurried assemblage of heterogeneous components looking to counter the last moves of this trickster. On such a response, "judgment requires a nuanced appreciation of the details of a situation that cannot be reduced to a set of rules" (Frodeman, 2003: 35); a judgment that isdone in situ and tends to be followed by direct intervention to deal with the issue, using any means at hand in highly creative ways.

Such way of acting is, however, under attack at CODELCO. As explored by Soto (2006), a key component of the corporation's current modernizing efforts has been to erase such informal working practices, based especially on the *viejitos* "competence", replacing them by scheduled procedures based on formal WM standards and technical mediations. In locations such as Carén, such program "translates into different tensions with management … in particular conflicts about the regulation of maintenance activities in situations of productive emergency, in which precisely their practical competence is put to work" (Soto, 2006: 144). Under the new paradigm emergencies, such as a sudden adjustment of the tailings, must be dealt with by following the standard WM procedures, not only the *viejitos* technical competence. The tensions between these two contrasting ways to deal with an adjustment were vividly illustrated by Carvallo later on the above conversation when he declared with exasperation that "*for me that Mr. Manuel [Cuevas] hasn't seen the work that's needed. From Rancagua it's so fucking easy to do!*" Things look rather different when you have to face a reckless trickster face to face, when you work (even live) under his shadow, instead of seeing a sleeping dragon from a distance.

Such conflicts became clear a couple of days later in an conversation between Carvallo and Juan Pinto, another *viejito*, about the lack of concrete blocks to carry out an urgently needed blockage of the discharge tower.

> Pinto: … what the fuck are we doing? Because the [tailings below the] fucking tower are catching up with us, the machine is catching up with us, and then we are thinking 'what can we do?' and

> then [the bosses] say to you that no, that we should stop messing around and avoid making the blocks, then we don't make the blocks...
>
> Carvallo: No! We need the blocks; this is why I have been pestering Mr. Cuevas for days!
>
> Pinto: And then I said 'you know, Mr. Cuevas, I'm going to say something, in one instance, in April of 2006 ... they cut off the balls of the environmental [area] boss, of the boss of [this] ... and the boss of [that]... 'And why?', he asked me, and I told him 'because the fucking tailings from Carén got out! Because the machine caught up with them ... And, you know what? This mess happened because of the tower blockage,' and I said to Cuevas, 'where are the blocks?' 'Shit', he said, 'which blocks are you talking about?' 'No', I said, 'we need the blocks to seal the tower, or do we leave the crappy thing as it is? Shouldn't we build something?' ... so for like five years we have been asking for blocks and nothing has happened and it was out of sheer luck that we realized [the level of the tailings] at tower 5 and saved ourselves, remember?

From the perspective of the *viejitos,* to avoid tailings spilling outside the impoundment is a constant struggle, in which the treacherous vitality of the trickster pairs up with bosses who do not understand the urgency of being always prepared to carrying out blockages at the last moment, and insist on seeing them as an operation that need to be well scheduled in advance and (usually) carried out by external contractors. Contrary to this, the *viejitos* deal experientially with the impoundment, especially with its unexpected adjustments, as a result of which they "have developed their skills at making sense out of the hints contained in the rocks or the streams" (Frodeman, 2003: 36). Such skills are based on their experience, on years of dealing with this trickster, and not on up-to-date assessment techniques or formal standards. Thus, the sleeping dragon opposes the trickster at this junction, and as a result the *viejitos* feel that they are badly prepared to deal with an unexpected move on the part of the last one, using the 2006 spill as the ultimate example of this.

As any other geontology, behind such conflicts we should also seen not only different attempts to rule over nonhuman things, tailings on this case, but also as an attempt to rebalance the distribution of power inside El Teniente. As explored by Soto, for actors such as the *viejitos* "the central legitimization of their professional activity ... continues to be their competence on performing activities of maintenance in the field" (Soto, 2006: 144), activities on which improvisation and informal knowledge occupies a central place. However, the current modernizing program, especially on the WM area, is challenging such competence, directly transforming the *viejitos* on a "threatened [kind of] actor because the competences that they mobilize ... only have sense in the traditional way of organizing their work" (Soto, 2006: 149). Then, beyond being merely descriptive, the trickster is also a strategy of geontopower because it reaffirms the *viejitos*' centrality in a context of organizational change on which their expertise is under menace. The sleeping dragon, most of the time, does not need *viejitos*. Only the trickster does.

Conclusions: From WM to geo-teratology

What does these joint figures of the dragon/trickster tells us about the possible futures of large mining waste impoundments and the kind of late liberal capitalism they represent? In contrast with the figures developed by Povinelli, here we are not seeing a "set of dominant patterns, constantly tinkered with and revised according to local materials and conditions" (2016: 249). There is little "dominance" in the relationship between CODELCO employees and this monster, even in its sleeping form. At most this is a relationship of unconscious

tolerance on the part of the dragon, a situation that could always change with the unavoidable result that you would "*have no option beyond entrusting yourself [to the saints]*," quoting Cuevas again. Even beyond the possibility of events such as massive spills, the sheer scale and permanence of tailings impoundments forces us to accept a monstrous spatio-temporality that greatly exceeds human capacity to calculate and prevent. This enactment of monstrosity unsettles the monstrous-as-usual (as summarized by Cohen, 1996): this dragon/trickster will never be defeated or disappear, there is no safety net, we cannot "turn on the lights" on tailings' monstrosity.

From the traditional position of the mining industry geontopower, such an outcome is utterly unsettling, given that it signals the impossibility of achieving the ideal of the "ultimate sink" (Tarr, 1996) sought by most WM programs. From this position, mining waste impoundments such as Carén are deserts, spaces denuded of life where the "non-economic sulphide" (Dold, 2014) is put to rest for eternity. The only way in which this space could become animated again is through tailings' reprocessing, aimed at further capitalist profit making. Any other figure, such as the virus of environmental protection movements or angry local communities, must be policed and, ultimately, brought into the desert model behind current mining imaginaries.

However, if we leave aside the mining industry's fantasies of total control, geontologies such as the dragon/trickster can be seen as promising paths, pointing to the emergence of alternative arrangements of the distinction between life and nonlife in late liberal capitalism. After all, the dragon/trickster is not a figure of power, or even of strangeness (such as the virus), but of powerlessness. It inverts the relationship between the living and the nonliving, with the latter holding most of the cards sustaining our precarious orderings. It is, adapting from Povinelli again, a trembling geontology, especially well suited for our trembling late liberal order.

Yet, in the same movement on which it claims our powerlessness against the nonliving, the dragon/trickster looks to re-inscribe power hierarchies among human beings. As seen on the tensions between managers such as Cuevas, the *viejitos* and the Carén community at large, different versions of this monstrosity also served as tools on the double movement of reaffirming certain kind of powerful actors and devices and dismissing others. Sleeping dragons and tricksters were not merely fanciful metaphors, but ways to enact different power hierarchies among human beings. In a way, this operation aims to function as a form of compensation, on which the loss of power to nonhuman entities is partially alleviated by the reaffirmation/challenge of human power relations.

To better deal with such monstrosities, we need to start seeing "the world, for a moment, through … [our] monster's eyes" (Cohen, 2012: 456). Taking such a position, as seen in the words of Cuevas and others, forces us, first, to cast aside fantasies of establishing a harmonic community with entities like tailings, in the form of a "parliament of things" (Latour, 2004), or any other form of human-designed political sphere of the sort. As seen here, there seem to be few (or no) options for establishing any kind of dialogical relation between tailings and human beings. This impossibility derives mainly from the practical incapability of truly establishing a language or space in which each party could really put forward and discuss their demands and queries. As vividly recalled by Povinelli (2017: 295), "what's the postal address of rocks and riverbeds? Can they be addressed as 'you,' that is, within the demanding structures of (human) language? Can they refuse to take up subjectivity in (human) language?"

Therefore, to produce alternative ways to live with tailings, we are forced to base our politics not on WM sociotechnical fixes or expectations of communality, which are eminently flawed projects on their own. Rather, accepting these notions should lead to the

development of what could be called a *geo-teratology*, or a mode of governance based on the careful (and fearful!) consideration of our geological monsters. Although this is not the place to fully develop how such a *geo-teratology* should look, the geontologies of tailings as dragons/tricksters contain certain elements that necessarily should be considered in its formulation.

Firstly, *geo-teratology* calls upon us to rethink our waste politics in terms of an "ethics of vulnerability" (Hird, 2013). This is especially so given that in anthropogenic times we continually face different kinds of waste that are recalcitrant and utterly indifferent to us, but on whose benevolence, conscious or unconsciously, we depend to continue existing. Secondly, we should view practices of care as central to our waste politics (Mol, 2008; Puig de la Bellacasa, 2011; Ureta, 2016), meaning the patient process through which the multiple beings and processes affected by waste's monstrosity are continually, and temporarily, recomposed, a recursive process in which we never cease to reassemble precarious orderings. Third, as the tensions between the figures of the dragon and the trickster reveals, in developing a geo-teratology we should be always aware of the different positions of social actors in relation with these monsters, especially the ones who are on a position of vulnerability and struggle. Finally, our waste politics should never avoid questions of existence, that is, they should continually question the need to waste. Especially given how intractable and indifferent some of our waste has proved to be, and the negative consequences that this indifference entails for multiple other beings, probably the foremost ethical question remains whether we need to produce dragons/tricksters at all, in the first place.

Geo-teratology, then, should be focused not on devising increasingly sophisticated ways to "manage" entities such as tailings, but on accepting humans' ultimate powerlessness and recognizing that we are merely developing ever-precarious ways to momentarily appease these entities. Such a *geo-teratology*, we believe, could act as a catalyzer to reverse the mining industry's usual waste geontopower, or its capacity to stipulate that tailings are inert and dead, matters to be ultimately forgotten or exploited in further turns of capitalistic profit making.

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Notes

1. This analysis will be based on the material collected by the authors while carrying out participant observation with employees of the Waste Management Department of El Teniente, between 2014 and 2015.

2. In contrast with most places on which large scale mining activity is developed, during fieldwork none of the people living on the Carén area recognized him/herself as belonging to (or having connections with) any indigenous group. This is probably due to the fact that the area has been already fully colonized by the end of the 16th-century, so no memory of its indigenous inhabitants remain. As a consequence, the conflicts studied here were not based on contrasts between settler and indigenous ontologies, as in most of the literature (including Povinelli's), but mostly between different internal enactments about the capabilities of tailings and how to better deal with them.

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