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Hinterlands of the green transition

Atacama, lithium and the extended geographies of the zero-emission city

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Turin, July 23, 2021

Summary

The Atacama plateau is a bio-geographic region shared across the territories of Bolivia, Chile and Argentina. In the last decade, it has been also known as the ‘Lithium Triangle,’ an expression pointing to the vast mineral reserves contained in the region. The global demand for lithium has drastically increased through the growing adoption of electric vehicles and renewable energy storage systems as fundamental components of the so-called ‘green transition’ occurring in many urban cores across the globe. This thesis investigates the urbanization of the hinterland through the geographies of extraction that emerge together with the progressive decarbonization of cities. In considering the metabolic interactions that exist between cities and the geographies of extraction that sustain them, it seeks to advance knowledge around the question of extended urbanization as the planetary geography of hinterlands, operational landscapes and extractive peripheries.

In doing so, this thesis draws upon recent efforts in the field of urban studies directed at both exceeding the physical and conceptual boundaries of the city in researching urban questions and at more accurately comprehending the metabolic interactions embedded in the process of planetary urbanization. Mobilizing existing studies on extended urbanization and urban metabolism, extractivism and commodity chains, this thesis foregrounds two original propositions: to explore such metabolic exchanges via the study of commodity chains; and to centre extraction squarely in the study of global patterns of urbanization. In this sense, this thesis unpacks the metabolic interactions underpinning the green transition of cities by following a portion of the commodity chain of lithium.

Researching the urban beyond the city, though, demands novel methodological approaches. This work responds to this question by both challenging the telescopic standpoint of planetary urbanization and not settling in the impractical visions of embeddedness offered by postcolonial, queer and feminist critics. Instead, it attempts at building new ground by constructing a practice of mobile, relational and thin ethnography across a portion of the li-ion

commodity chain in the Atacama, capable of holding together thin slices of local dynamics and global patterns, thus more aptly responding to the transcalar imperative embedded in the ideas of urban metabolism and commodity chains.

This moving ethnographic sequence is articulated across three case studies along the 'lithium route' that links the mineral deposits in the Andean cordillera to the port infrastructures on the Pacific coast. These cases explore different conceptual issues and multiple dimensions that characterize the making of extractive processes across the operational landscape of the Atacama while expanding the notion of extraction beyond the often restricted definition of natural resource extraction. Firstly, the establishment of a lithium mine in the Olaroz basin (Argentina) reveals how the process of strategic coupling, when observed from the ground, is largely different from the balanced mechanism described in the literature and instead is built on multiple levels of socioeconomic unevenness. Secondly, the construction of South America's largest solar field in the Cauchari basin (Argentina) reveals the entanglement between the dynamics of large investment funds and the making of renewable energy landscapes, highlighting how the large financial investments that actually build such mega infrastructures are forced to translate into microfinancial arrangements affecting everyday life in the hinterland. Thirdly, the daily geographies of Antofagasta, one of Chile's main port cities, unveil the endurance of logistical infrastructures as axes of continuing dispossession, taking cue from recent hype around the arrival of the China-centric Belt and Road Initiative in the region to show how, despite the different source of funding, the extractivist principle of logistical infrastructures in the area remains unchanged.

In its conclusions, the thesis highlights how the different dimensions of sociospatial transformation in the territories of extended urbanization unpacked across this work point to the urgency of a critical, decentred perspective on the urban. In a broader sense, these findings speak to emerging debates, both popular and academic, around alternatives to capitalist development in general and to the urgency of decoupling urbanization from resource extraction by imagining post-extractivist urban agendas.

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*To the yarumo and the gypaetus,
to the Andes and the Alps.*

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Introduction

[...] the commodities that feed, clothe, and shelter us are among our most basic connections to the natural world. If we wish to understand the ecological consequences of our own lives—if we wish to take political and moral responsibility for those consequences—we must reconstruct the linkages between the commodities of our economy and the resources of our eco-system. — William Cronon

Atacama and the Lithium Triangle

The Atacama is a biogeographic region shared across the national territories of Argentina, Bolivia and Chile. These now consolidated national boundaries have in the past been an object of dispute in the region, with the Pacific War of 1879-1884 seeing clashes by an expanding Chile and a Peruvian-Bolivian alliance. Crucially, the Pacific War is also known as the Saltpeter War, a testimony to the vast gains in resource-rich territory that the Chilean state obtained by defeating its adversaries. In this sense, for how much divided by material and administrative boundaries the Atacama is today, it emerges as a vast territorial unity once observed through its geophysical characteristics. As a strategic resource-bearing territory, this region has seen a progressive layering of extractive cycles since the mid-1800s, initially founded upon the exploitation of guano, the Spanish translation for the Quechua word *wanu*, meaning fertilizer. Later came the discovery of silver and nitrates, and in the last two decades the extraction of copper in the area has shifted a great deal of Chile's economic weight to its Northern regions. In some of the remotest corners this Andean range, however, lie hydrogeological formations which give rise to salt flats known as *salar*es (saltpans), physical geographic features that have begun to gain attention well beyond their longstanding role in the networks of global tourism. These remote environments have in fact become known for the abundant lithium deposits which lie beneath their surface as the high-altitude saline water bodies that can be clearly recognized even in large-scale satellite imagery have come to signal the presence of an untapped underground bounty.

Across media accounts, mining companies' portfolios and financial reports it is more and more common to see cartographic representations picturing these salt pans enclosed within a regional-scale triangular polygon. Drawn differently according to the different economic interests that underlie from time to time, often from company to company, the so-called Lithium Triangle commonly emerges as an extractivist territoriality (Observatorio Plurinacional de Salares Andinos 2021) with the goal of constructing a market-friendly image of this territory and its unexploited wealth. The Lithium Triangle, however, is more than a simple geometric figure stretched at the regional scale, reproducing across investor's pitches in well-known stock exchanges. It is a material reality for the human and nonhuman ecosystems that come to constitute this high-altitude territory, ecosystems that are experiencing a new cycle of mining-related exploration, infrastructuring and resource extraction. Attempts at mapping an often extremely cloudy trend of resource exploration, where sampling is often carried out far from the eyes of public scrutiny, describe both the effective proliferation of new mining operations and the increasing of production volumes at established sites. Besides its hardly mappable economic frontiers and shady geographies of speculation, this rising extractive sector is already legible in the national export figures of the countries that exercise sovereignty in the area. Lithium products exports still pertain to a small percentage of the total Chilean and Argentinian exports, but their share has grown significantly (38% and 185% respectively) between 2013 and 2017¹. As a result, Chile and Argentina together have come to export 57% of the world's lithium products in 2017². From a resource perspective, these two countries hold 59% of the world's lithium reserves, while the Atacama region that is shared with Bolivia holds 51% of the world's resources³ (Jaskula 2018). The majority of the planet's untapped lithium then, and the one which is likely going to absorb a steadily growing demand, lies beneath these salty crusts.

Lithium is a tradable commodity and an element found in the alkali metals family. Recently dubbed as the world's 'hottest metal' (The Economist 2016), its outstanding physical and chemical features make it a hardly replaceable substance in the fabrication of high-performance batteries. It is lightweight and has an outstandingly high electrochemical potential, so it is well-suited for technological applications which are expected to store high quantities of energy in little space and weight. Despite lithium being a long-extracted commodity, its industrial use has shifted significantly over the last decade (Goonan 2012), with li-ion battery technology steadily absorbing a growing share of the globally extracted resource. Crucially, lithium is never naturally found in its elemental form, as it is always bound with other minerals, and commonly found in two types of deposits: hard rock, mostly of the spodumenic type, and brine, a resource-rich water. These types of deposits often pertain to distinct geological contexts, with Australia strongly dominating the market for lithium of spodumene origin. In turn, the operations

¹ author's elaboration from the [UN Comtrade Database](#) (HS 282520 and 283691).

² author's elaboration from the [UN Comtrade Database](#) (HS 282520 and 283691).

³ In natural resource parlance, a mineral reserve is the portion of a mineral resource that is currently exploitable from a commercial and technical standpoint.

which allow its extraction vary according to the type of deposits: if they resemble traditional mining practices in hard-rock deposits, they involve evaporative concentration when encountering lithium in brine form. Although the majority of this resource is currently produced from spodumene (Jaskula 2016), the majority of reserves and resources—those which are likely to absorb its future demand—are found in brine form. The latter is the case for the entirety of the lithium resource found in the Atacama.

As the global demand for lithium steadily ramps up, the dynamics of territorial transformation in the Atacama cannot be explained without observing the global trends in which they are located. This rising demand for this particular resource cannot be explained if not through the current global efforts to reduce the emission of greenhouse gases and the transition away from fossil sources of energy, as technological changes in the field of mobility and energy provision more and more heavily rely upon li-ion technology. Following the global travels of lithium as a fundamental ingredient of modern energy storage technologies connects the dynamics at play in the Atacama to broader territorial reorderings in distant elsewhere.

Li-ion technology and the green transition

Among the many possible chemical compositions, lithium-ion cells are to date the most widespread form of energy storage for everyday applications and their use has been diversified and expanded as far as to constitute the material landscapes of contemporary tropes of sustainability. A technology marketed by Sony thirty years ago in order to power their newly designed handheld video-cameras, the lithium-ion chemistry has allowed an unprecedented concentration of energy in a compact form and can be seen as one of the forces behind the progressive miniaturization of portable devices which has occurred in recent years (Merchant 2017). From handheld cameras, the industrial uses of this cell technology have radically expanded and came to be employed in increasingly larger applications, becoming the leading technology for electric vehicles and Energy Storage Systems (ESS) from renewable sources. Although largely invisible, arrays of li-ion cells populate the endless rows of photovoltaic panels and electrical transport solutions that define visions of sustainable urbanism. As such, li-ion technology emerges as one of the foundational pillars of the current green transition.

Such terminology, that of the green transition, is inevitably loose as it emerges differently in different contexts. This definition primarily highlights the effort of several national economies to become climate neutral in the following decades by cutting greenhouse gas emissions. In the last years, this policy direction has taken hold of the public scene through the Green Deal formula, meaning policy packages directed at harmonizing national economies with the mutated conditions of a warming planet (Aronoff et al. 2019). For how vague the green transition parlance could be, the deployment of li-ion batteries is a

materially unfolding trend, as renewable energy and electrical mobility assume a fundamental role in many sustainability strategies recently elaborated by many city, regional and state governments across different parts of the world. Norway, the Netherlands, France, Germany, the UK, China and India have announced intentions to ban the production and sale of vehicles that run on fossil fuels, while Stockholm, Mexico City and Athens have already set goals to ban diesel cars by 2030 or earlier (World Economic Forum 2018). California runs a Zero Emission Vehicle Mandate, Montreal inaugurated a Transport Electrification Strategy and Oslo has been marketed as the Electric Vehicle Capital of the World. As these few policy examples recount, the implications of this emerging world-scale transformations exceed the purely technical realm. Instead, their technical feasibility involves complex social, spatial and geopolitical reorderings at many scales. In this sense, China will make its often make its appearance throughout the most empirical sections of this work as a technical, geopolitical and financial superpower. Firstly, and perhaps more intuitively, China experiences a growing internal market demand due to its shifting demographics. This demand, however, exceeds consumption patterns and lifestyle trends and cannot be fully appreciated without considering the country's effort to reduce air pollution, especially in its most urbanized areas. This is exemplified by the well-known 'blue sky' challenge. Chinese public institutions in this sense have a driving role in the adoption of electric vehicle (EVs) by both subsidizing part of the costs to new consumers and by financing and building EV-charging infrastructure (Hertzke et. Al., 2017). As part of this domestic effort, China has designed and operationalized a shift in its industrial system from the production of 'cheap' items to the goal of becoming the global leader in technologically intensive applications such as photovoltaic panels, artificial intelligence and high capacity energy storage solutions, as embodied by the Made in China 2025 industrial policy. This shift in its industrial policy is perhaps constitutive of an unparalleled concentration in the manufacturing of lithium cells. Lastly, Chinese banks emerge as financial powerhouses capable of shifting capital flows into the financing of large scale renewable energy systems beyond the territories of China, as chapter 4 will describe in detail. The roles of China in the material constitution of such green transition are then multiple and relevant. But despite this significant factors, China has not been the central object of inquiry of this dissertation and its domestic and international policies are accounted for but do not see empirical focus across this work. In pursuit of the main objectives and contributions foregrounded by this dissertation and summarized in the following sections, the role of China across the global green transition remains in the background. Put squarely, as the traits of this global effort to curb emissions and convert entire economic sectors suggest, China is rather framed here as a factor that cannot be ignored when considering the trajectories of sociospatial transformation in the Atacama with respect to emerging tropes of sustainability at the planetary scale.

The rapid multiplication of these strategies gives an account of the rising market demand in e-mobility solutions, where a shift away from fossil fuels in urban agglomerations signifies a large-scale process of electrification. Surely, li-

ion batteries are, today, already ubiquitous. They dwell in our pockets, populate our homes and increasingly allow our individual and collective mobility. They power electronic devices from the portable to the stationary, from smartphones to neighbourhood-scale renewable energy grids. Batteries evoke the magical power of storing energy and transporting it, decoupling its site of consumption from that of production. Despite lithium already permeating the multiple creases and daily interactions of contemporary urban life through smartphones, laptops and other digital devices, these new ‘green’ technologies significantly increase its presence as a hardly visible yet defining element of contemporary and near future urbanization, as electric mobility growingly populates urban centres worldwide as a hallmark of emerging strategies towards the goal of reaching net zero emissions. A commodity chain approach to the production of li-ion batteries is perhaps a strategy to recompose the multiscale shifts that the advancing green transition entails.

Across the li-ion supply chain, not only the moment of consumption is a site of radical transformation, but the production geography of li-ion cells is equally responding to shifting market needs. One significant spatial phenomenon which has emerged concurrently with this increased demand for li-ion cells—and that is a paradigmatic manifestation of the acceleration that occurs throughout the chain—is that of the ‘gigafactory.’ As this is a rather novel phenomenon, literature on the subject is only beginning to emerge. Such novelty and the relative scarcity of public analysis on the subject, as well as the speculative interests that surround this emerging economic, entail moving between speculative reports on projected market growth and sensational press releases. The gigafactory, a terminology initially popularized through Tesla’s operation in the Nevada desert, stands firstly to signify the physical dimensions of the factory itself. Tesla’s operation is, in fact, projected to have the world’s largest footprint, the spatiality of which evokes an economic process of agglomeration economy and rapid scaling-up. More crucially though, the giga- prefix also represents the volume of production that these plants are capable of, that equals to an annual output greater than 1GWh in energy storage capacity. Through this terminology, the gigafactory performs a predictive role as the basis for speculative calculations towards a projected planetary-scale transition to renewable energy sources. Tesla’s CEO speculates that one-hundred of these factories will be sufficient to complete a planetary transition to renewable energy sources.

Although Tesla has been the most marketed case, the majority of li-ion cells is currently being produced in China, and it is likely China that will build the large majority of the world’s gigafactories in the next ten years (Rawles 2018). In a recent article starting from the case of the Tesla gigafactory in Fremont, Nevada, Cooke (2020) claims that the industry organisation of production in place possibly reverses much current conventional wisdom regarding production geography. While Cooke’s claim might be premature given the novelty of such operations, it confronts us with important emerging features that picture the scale of the energy transition to come. Firstly, the gigafactory model entails a phenomenon of vertical integration, whereby car manufacturers increasingly stipulate alliances with other

sections of the e-vehicles supply chain, integrating their functions both in terms of ownership and of shared space. In the case of Tesla, this has meant either the direct buyout of component manufacturers or the request to locate their production environments within the Tesla industrial park in the Nevada desert (Cooke 2020). Secondly, this possibly involves the persistence of agglomeration economies, since the gigafactory model has already given birth to new industrial parks, where an increasing degree of integration between industrial production and workforce reproduction is pursued. These brief hints already depict how profound sociospatial transformations are embedded into this emerging economy of transition.

Although the lithium content in a Tesla Model S battery pack amounts to a very modest percentage of its total weight (1,3%), this weight still amounts to several kilograms (~7 kg.). If compared to the few grams (>1 gr.) required to power an Apple iPhone battery pack (Merchant 2017), this figure alone materializes the radical shifts in the dynamics of lithium extraction which have occurred in conjunction with the progressive adoption of electric vehicles and stationary storage applications. Lithium is just one of a family of minerals which has come to be defined as ‘battery metals.’ As battery chemistry evolves, so does the list of ingredients to be extracted from the planet’s bowels, but the more common battery raw materials are identified with lithium, nickel and cobalt, standing out, as Pitron defines them (2018), as the hidden face of the energetic and digital transition. While pertaining to very different geographical locations, forms of extraction and resulting sociotechnical arrangements, all three materials are characterized by their role as fundamental battery ingredients—a factor which is determining in observing the unfolding social and spatial landscapes which surround their extraction. As the battery market grows, li-ion technology already constitutes the leading industrial use for both cobalt and lithium (Jaskula 2016; Shedd 2016), while a significant increase in this share is forecast for graphite (Olson 2016). Before reaching Tesla’s facilities in the Nevada desert, battery metals often emerge from equally barren landscapes. The required input for these raw materials, often located in distant and remote locations, is deemed to constitute the most unpredictable portion of the entire li-ion battery supply chain (Olivetti et al. 2017; Pehlken, Albach, and Vogt 2017).

Lithium extraction sites have entered the public imaginary through aerial photographs which depict an endless array of rectangular pools across many shades of bright yellow, green and blue, a testament to the stronger role of brine extraction over hard rock deposits. These different colours represent the various stages at which the lithium-bearing brine is purified and concentrated through the evaporation produced by the high solar radiation and the dry winds hitting the landscape, their hues correspond to the different solutions from which scarcely profitable salts such as sodium chloride, potassium chloride and magnesium chloride are progressively removed. Brine is certainly more iconic from a visual perspective, so akin to the traditional practices of salt extraction that it easily lends itself to tropes of clean extraction. More importantly though, and perhaps a key to reading the popularity of brine deposits in the public imaginary, brine extraction is

far cheaper than hard rock mining, since the heavy work of machinery required to crush the resource is substituted by the free evaporative action of sun and wind. As I have learned in conversation with company CEOs and engineers met across my fieldwork in the Atacama, the physical construction of a lithium mine starts precisely from these evaporation ponds. This operation is typically subcontracted to external groundwork companies, as the shaping of the ponds involves highly skilled design and labour: their shape affects the efficiency at which the lithium-bearing brine is evaporated and circulated at the various stage of concentration, therefore determining the productive capacity of the system and hence its profitability. As soon as the first pond is excavated and lined with waterproof fabric, brine is pumped from the different wells which extract it from the underground water bodies and sent through the evaporation process. After an average of 18 months through the different ponds, the brine is purified from the unprofitable salts and reaches the desired 6% lithium concentration. It is then stored in barrels and moved to the chemical plant for the production of different lithium products, mostly lithium carbonate and lithium hydroxide. These products are differentiated by their purity and this affects their potential use in different industrial applications: the manufacturing of batteries requires the purest of these forms and lithium products targeted at this industry are labelled as “battery-grade.” Sometimes the site of extraction and that of refinement coincide, some others the mine and the chemical plant occupy different geographical sites. In the second case, transport of the concentrated brine has to be organized by truck or railway. This choice is often affected by the distance which separates resources from potentially advantageous locations such as pre-existent industrial areas. This is the case of the Albermale and SQM operations in the Salar de Atacama: both rely on the geographical proximity to the industrial zones bordering the port city of Antofagasta.

Forging a material connection between the transformation of urban environments beyond the paradigm of carbon emissions and mines in distant elsewhere, between the material articulation of zero-emission cities and the geographies of sociospatial transformation in the Lithium Triangle, the li-ion commodity chain forces us to think about the geographies of extraction that underpin global patterns of urbanization. This is the subject of the next paragraph.

Exploring the mine–city nexus

What is it that makes the spaces of natural resource extraction relevant to urban studies? What do distant resource hinterlands, soaring commodity prices and global supply chains have to do with global patterns of urbanization?

Mines and cities seemingly exist in a relation of co-production: on one hand, and quite literally, it takes an infinite cohort of natural resources to make any kind of human settlement, least the one that we commonly understand as a city. In this sense, the processes of urbanization and those of natural resource extraction seem inextricably tangled: once triggered, the lens of extraction makes it hardly possible to think of an urban environment without thinking about its often distant

material origins. A hole in the Earth's crust—a mine shaft, a cave-like tunnel, the sharp corners of a stone quarry—is an archetypal figure, one that embodies the performance of extraction which lies at the root of all the other ramifications of anthropic activity on the planet. At least one hole corresponds to each material artifact that we interact with in our daily life. Objects as mundane as the flip flops that many of us wear in warmer temperatures, for example, emerge from the oil wells of the Middle East (Knowles 2015). The palm oil contained in many of our daily foods almost exclusively comes from Indonesian plantations (Topalovic 2016). And this is visible at all scale: as Maria Kaika highlights⁴ the very bricks that gradually built the cities we inhabit come from expanding holes in the clay fields. In a world of finite resources, matter is extracted somewhere, transformed and accumulated somewhere else: a hole is the necessary counterpart of any three-dimensional object, not least an entire human settlement.

Conversely, it is also mines that are in many ways made by cities, as resources are never resources per se, but become such when a market demand for a certain kind of material emerges. Paradoxically, there is nothing natural about natural resources, as the status of resource for a certain material is always exclusively socially determined. In this sense, it is the market demand for carbon-reducing technologies in cities that make lithium a resource and not just a mineral salt dissolved into underground water reservoirs. Architects Liam Young and Kate Davies say 'Here lies the shadow of those cities [...] the silent twin'. The spatialities of extraction are deceptive, because they mostly exist beyond our everyday gaze. And yet, extraction sustains everything that we do on a daily basis. Maria Kaika (2004; cited in Gavin Bridge 2010, 8) has underlined the exclusion and denial of the extractive activities so central to the production of modern life.

But while this has possibly been the case across histories and civilizations, the magnitude and scale of extraction has increased significantly together with the demographic growth of the global human population and its advancing social and technical development. Plotting the shifts in global land use occurred in the last 2000 years, figures show how built-up areas have increased rapidly, but very modestly with respect to those dedicated to grazing and cropland. And while such statistics are inevitably spoiled by technical discrepancies and institutional unevenness, the numbers at stake are rather clear: grazing and cropland areas have grown six-fold respectively in the last five centuries, reaching a total surface of 4.8 billion hectares. What is counted as built-up areas, instead, has increased to a comparatively modest 60 million hectares, doubling in the last five decades. Plotted against a generally steady population growth, built-up areas appear as just a fraction of the total land-use change generated by increasing anthropic pressure on ecosystems. This, at a very first sight, clashes profoundly with our imaginary of an 'urban world' made of skyscrapers, highways, railways and, ultimately, cities. And it suggests that maybe, if we are to understand anything about that extraordinarily elusive phenomenon which is the urban one, we have to look elsewhere. This elsewhere could be the space of resource extraction.

⁴ Urban Political Ecology (online lecture, [link](#))

The year 2017 saw an all-time record in the world's total extraction of raw materials, a figure ranking at 97.4 billion tonnes of extracted matter. This number has grown steadily in correlation with the world's population at least from 1970, the oldest available data record (United Nations Environment Programme (UNEP) 2018). But while the world's population has "only" doubled in the last five decades, the extraction of natural resources has increased four-fold in the same period. These differing rates, which could signal an average trend of increased per capita consumption, can perhaps be interpreted by further specifying which among those raw materials have been more intensively exploited over time. According to the United Nations International Resource Panel dataset, construction-dominant non-metallic minerals such as clay and sand have primarily lead such growing rate of extraction. The mining of these minerals has increased by 500% in a span of fifty years.

Comprised within such non-metallic minerals category, materials such as sand, gravel, clay, lime and gypsum (OECD, 2011) are required for the production of bricks and concrete. These, in turn, underpin the modern construction of buildings and physical infrastructure: recent studies in the field of industrial ecology have shown how the transition to an industrial and urban metabolic profile in national economies such as China, India and Brazil has increased the rate of materials use by an unprecedented factor (cited in Miatto et al. 2016, 1). The recent, well-known massive urbanization of these regions would have been unimaginable without an unparalleled production of cement and therefore an unparalleled extraction of lime.

These connections begin to illuminate what is at stake in the present work: that the dynamics of urbanization and those of natural resource extraction are fundamentally inseparable. And consequently, if we are to understand anything about an urban world, we ought to lay our eyes well beyond the long-gone walls of the city. Such intersection between natural resource extraction and processes of urbanization, which I will call the 'mine-city nexus,' addresses a number of interrelated debates and key contemporary questions within the broader field of urban studies, which I will present in the remainder of this introduction and discuss throughout the following chapters. This nexus between mines and cities is not my original conception, but it has been used before referring broadly to studies that have traced the multiple linkages existing between cities and natural resources. It has been more recently employed by Arboleda (2019) to illustrate how the reorganization of extractive industries into transnational supply chains has "brought together natural resources and built environments, as well as city and non-city space into novel and more intricate ways" (3). Starting from Harvey's idea of capital switching, the Mine/City nexus seemingly describes varied but interrelated phenomena such as the reinvestment of surplus capital from extractive industries into real estate, be it through physical construction or through the expansion of credit schemes. This makes it urgent to explore the resource/urbanization nexus, as it is beginning to emerge also in the wider field of urban studies and planning (Rizzo and Sordi 2020). As Stephen Graham writes in his vertical *tour de force* of the spatialities of contemporary urbanization (2016),

“[c]onnecting mining and extraction to the cities that depend on them [...] is important because, as our planet urbanises, the extraction of commodities is inevitably becoming ever more central to global capitalism” (707). It stems that we have to look at the social and material landscapes of raw materials extraction and circulation in order to deepen our understanding of contemporary dynamics of urbanization. What happens in the hinterland *is* what happens in the city.

The mine–city nexus points to the root of human interaction with earthly resources under capitalism. This has profound political implications, in the sense that localized, ameliorative modifications aimed at dealing with the present climatic emergency (such as improved carbon-free mobility, the generation of energy from renewable sources and more ‘sustainable’ consumption patterns in cities) appear rather modest with respect to the burgeoning scale of extraction which keeps sustaining life in those very settlements. It is then a productive alley into how urban environments interact with the present climatic emergency because, by stressing the primordial act of extraction, it questions at their root the technocratic solutions which monopolise current responses to these challenges. As Kate Aronoff and colleagues note towards the conclusion of *A Planet to Win* (2019) “[t]he global stakes of energy transitions are high: previous transitions to coal and oil deepened imperialism and racial capitalism”: each energy transition of the past has both been premised upon and generated itself planetary-scale geographic transformations. This has been the case with the emergence of coal as a leading source of energy in England in the late 1800s, with industries, capital and workers relocating away from traditional sites—windmills (Malm 2013). The transition to oil as the main engine of society articulated the world as we know it today, with the ubiquity of the personal automobile, the making of new frontiers of extraction, the rise of entirely new materials such as plastics and surely the refinement of new techniques and technologies. Large-scale energy transitions have historically remade the world, yielding new articulations of life at every scale and in many corners of the globe. The transformational dynamics unfolding in the Atacama begin to hint at how these long-repeated trends extend into present forms.

Questions, objectives and expected contributions

Starting from the interpretive framework and empirical factors outlined in this introduction, this dissertation approaches the emerging lithium economy in the Atacama through a set of key research questions, both theoretical, methodological and empirical. Given its empirical focus upon the transformations brought about by the rising market demand of lithium products in distant elsewhere and observing relationally the making of the green transition initiatives and that of resource extraction landscapes, the thesis asks: how are urban environments co-constituted across multiple scales? Responding to this question, in turn, raises additional questions from the standpoint of method, as these theoretical questions presuppose an overarching methodological reflection upon the limits and

possibilities of comprehending urbanization at the planetary scale: how to overcome the zenithal perspective of planetary urbanization while remaining dissatisfied with the certainties of ethnographic embeddedness? How to construct a research tactic that both embodies and produces a truly transcalar gaze? Thirdly, and more empirically: how do green transition initiatives and the associated market demand in lithium products, spatialize across the landscapes of the Atacama plateau?

By articulating a response to these research questions, this dissertation pursues the following objectives. Theoretically, it seeks to explore the metabolic exchanges of planetary urbanization through the study of commodity chains on the one hand, and to centre extraction squarely in the study of global patterns of urbanization on the other. From a methodological perspective, it seeks to construct new ground between the telescopic and the embedded by experimenting with mobile, relational and thin ethnographies across a portion of the li-ion commodity chain in the field. Thirdly, from a more empirical standpoint, it pursues the objective to document and critically reconstruct the unfolding of lithium extraction in the plateau, paying attention to the multiple dimensions that an expanded notion of extractivism grants.

In the same way as for its original research questions, a number of expected contributions can be outlined across theoretical, methodological and empirical grounds. In considering the metabolic interactions that exist between cities and the geographies of extraction that sustain them, this dissertation seeks to advance knowledge around the question of extended urbanization as the planetary geography of hinterlands, operational landscapes and extractive peripheries, considering that any urban politics in the present state cannot avoid considering these spatial conditions. Secondly, by attempting a multi-sited ethnography of commodity chains, capable of holding together thin slices of local dynamics and global patterns, it seeks to both foreground a way of doing planetary urban research and to keep ‘humanizing’ economic geography. Thirdly, in an empirical vein and in dialogue with a recent upsurge in climate-oriented public debates, popular mobilizations and social movements, centering the critique of extraction in the production and reproduction of urban environments hopefully contributes to the imagination and construction of a radical politics beyond the paradigm of extraction.

Thesis outline

This dissertation, then, sets out to chart the dynamics of sociospatial transformation occurring across the Atacama in conjunction with the expansion of the lithium economy as an exploration of city geographies from a decentred perspective.

Chapter 1 discusses the potential of commodities and commodity chains as lenses for reading patterns and processes of urbanization at the planetary scale. In doing so, it brings together two research agendas which have surprisingly remain

separated: studies of urban metabolism in the field of urban political ecology and the commodity chain genealogy in economic geography. This potential reconciliation is illustrated by reconstructing commodity chain of lithium, an increasingly mined mineral for its centrality in the manufacturing of high-performance batteries. Chapter 2 focuses on the methodological and empirical issues that emerge when following commodities both on and off the ground, arguing for a ‘methodologically adventurous’ geographical practice. The following three chapters deal with the unpacking of the constitutive dynamics which characterize the Atacama as an urbanizing hinterland. Beyond the general conceptual and methodological questions outlined in these first two chapters, each of the following three case studies illuminates each a more specific conceptual issue and addresses relevant fields of studies. Taken together, the subjects of strategic coupling, of the interplay between energy and finance and of infrastructure-led development coalesce into a description of the dynamics marking the everyday realities of extended urbanization, thus responding to the general objective of this thesis.

Chapter 3, introduces the empirical section of this dissertation by focusing on the making of lithium landscapes in the high-altitude territories of the Puna de Atacama in the Argentinian province of Jujuy. Since resources only emerge as such when plugged into global networks of production, institutional actors across the area never fail to emphasize the importance of harnessing the high economic benefits of this linkages. In economic geography, this is described as ‘strategic coupling’. This chapter takes issue with this terminology, too smooth to capture the contradictions that emerge as soon as strategic coupling effectively hits the ground. To substantiate this argument, I focus on three distinct but deeply interrelated issues appearing throughout the making of this new lithium economy in the Olaroz basin in the Argentinian province of Jujuy.: land use and property, salaried labour and water consumption and pollution This chapter offers an account of the dynamics by which mining companies and the local State are producing such shifts. While the literature on extraction zones has concentrated on the explicitly violent means by which these sociospatial configurations are established, this is hard to retrace on the Atacama plateau. Building on Tania Li’s concept of infrastructural violence, this chapter proposes an additional reading of this notion, one that maintains violence as structural to the formation of these landscapes but beyond outright manifestation. The violence scarring these operational landscapes is a hardly visible one: like infrastructure, it only manifests itself when friction appears in an otherwise apparently smooth operation. The infrastructural violence sustaining these landscapes of extraction stands in sharp contrast with popular narratives of ‘clean’ extraction employed to justify an equally clean mode of urban development.

Chapter 4 lays its focus just a few kilometres South of the Olaroz basin. Surrounded by proliferating enclaves for the extraction of lithium, the Cauchari solar plant in the Jujuy province of Argentina is the largest photovoltaic installation in South America, the highest globally and the first piece of a planned 1GW solar complex expected to be the world’s second largest. Besides its sheer

magnitude, Cauchari incorporates an equally considerable amount of financial capital. In fact, it would not be in place without the existence of big finance, in this case embodied by a 330 million US dollar loan granted to the provincial State of Jujuy by the State-controlled Export–Import Bank of China. Cauchari is a flagship project in the Argentinian RenovAr program, of which 3/4 of solar and 1/2 of wind projects are also linked to Chinese finance and technology. This is descriptive of the unrolling geographies of a ‘green BRI,’ an infrastructural vision materialized through the deployment of Chinese technological components and injections of financial capital. Regionally, this solar plant is part and parcel of the prospected transformation of the entire province of Jujuy into a ‘power province,’ a developmental model premised upon the generation of renewable energy, the extraction of mineral resources and the smooth circulation of goods. In this chapter I observe the relationship existing between the flow of large-scale monetary investments in this solar infrastructure with the multiplication of micro-financial support to rural communities and individuals. By drawing on document analysis and participant observation at the Cauchari construction site and in nearby communities, I explore the reasons and modalities through which ‘big finance’ has to mutate into ‘microfinance’ in order to hit the ground and realize itself into physical infrastructure.

Chapter 5 expands the perspective of extractivism by observing the dynamics of regional planning which configure these territories. The Capricorn Integration and Development Hub is a 15 million-dollar investment plan comprising 77 infrastructural projects running across the territories of five Latin American states. The hub is one of the seven conceived by the Initiative for the Regional Integration of South America (IIRSA), a longstanding project initiated in the year 2000 by the Interamerican Development Bank and further developed by UNASUR. Almost twenty years later, in June 2017, Panama became the first country to officially join the Belt and Road Initiative (BRI), China’s most comprehensive present-day foreign policy instrument marked by the goal to develop infrastructural projects on a global scale. By the end of the year, Latin American and Caribbean countries had been formalized as the BRI’s “natural extension” by the Chinese government and by late 2019 six additional Latin American countries had signed Belt and Road Cooperation Agreements, while others have struck deals within the framework avoiding formal memberships. Possibly, IIRSA and the BRI are being aligned through the common goal of financing and building hard infrastructures of connectivity. At the intersection of these two trajectories, large-scale Chinese-funded operations are being developed within the area of influence of the Capricorn Hub. It is here that the rapidly growing infrastructures for the extraction of lithium from the Atacama salt flats become enmeshed with the urban fabric developed through the Capricorn Hub’s network of customs integration procedures, road and railway construction and the establishment of logistics zones. Reliance upon Chinese finance and technology is anything but novel in the Latin American region, however the current phase seems to be based on novel ideals of development centred on digital technologies and renewable energy unrolled by China both at home and abroad. As activists

and academics in the region link Chinese investments with indigenous rights violations and environmental destruction, these projects remain susceptible to established critiques of development: the corridors they project remain premised upon the constitution of enclaves, frontier economies and resource extraction and have been understood as “axes of dispossession,” rather than development. In this chapter I advance considerations on how strengthening political and economic ties between China and several Latin American states within the BRI framework might allow us to think about a ‘third phase’ for the IIRSA project, questioning whether this might be substantially different or structurally equal to preceding shifts. In order to do so, I review extant literature on the socio-spatial features of the Belt and Road Initiative in the Eurasian and African context, highlighting its connections with Chinese domestic environmental and industrial policies. Secondly, I briefly sketch the developments of the IIRSA project and reconstruct the recent history of strengthening sino-Latin American ties by highlighting the progressive alignment of IIRSA and the BRI. Thirdly, I turn to examining these dynamics in the unrolling of extractive projects along the Atacama section of Capricorn Hub. Through the arguments presented in this chapter I seek to advance knowledge around emerging debates on logistical urbanization and on the geographies of development corridors by describing the sociospatial features of the Belt and Road Initiative in its emerging Latin American manifestations.

In connecting these individual achievements, the concluding chapter advances three major contributions that emerge from the development of this dissertation: first, by centring global networks of production as a tool for urban research it both adds to the toolkit of metabolic studies of urbanization and expands efforts to strengthen the spatialization of commodity chains. Second, it foregrounds a methodological orientation for studying extended dimensions of urbanization by charting a practice of mobile, relational and thin ethnography that is neither content with the telescopic distance often practiced by planetary urbanization, nor seeks to reside in the certainties of ethnographic thickness. Third, by placing the standpoint of extraction squarely at the centre of metabolic studies of urbanization, it proposes to uncover the planet of planetary urbanization and hence to bring this agenda in tighter dialogue with the challenges of contemporary environmental struggles. Lastly, by focusing on the major limits that remain in this work, it outlines the future challenge of researching and imagining post-extractive urban futures well beyond their customary geographical and conceptual sites.

Chapter 1

Urban global production networks

Introduction

The unfolding scenarios of sociospatial change in the Atacama, resulting in newly assembled landscapes of extraction centred upon the quest for lithium resources, pose the conceptual problem of how to approach the geographies of urbanization beyond, but including, the traditional physical and conceptual site of urban analysis: the city. The relations that connect the territories of the Atacama to emerging urban practices in distant elsewhere and across the li-ion commodity chain, as I have posed in the introduction to this thesis, call cities into questions while clearly escaping their physical limits. And as much as they escape their physical boundaries, so they do with their conceptual contours. Indeed, any clear-cut definition of a city is both impossible and undesirable, thinking of the endless social, political, spatial and ecological forms that this human settlement takes across time and space. Yet, for how problematic and questionable these city traits might be, they still work in the background of much urban analysis, capturing its longstanding concepts and methods. The commonplace conceptual toolbox of urban studies, centred upon the mostly Western experience of urban agglomeration, population density and spatial concentration possibly falls short of grasping the both detailed and extended geographies of sociotechnical transformation in the Atacama in its relational and transcalar dimensions. The Atacama does indeed contain “city geographies,” by supplying raw materials and sociospatial orderings functional to the new developments of urban agglomerations. At the same time, it clearly exceeds such city geographies by extending this system of production at a large regional scale and escaping diagrams of agglomeration and concentration. The mutating geographies evolving in the Atacama are both a distant offshoot of cities, of any city as it could be, as the figure of the mine-city nexus highlights, and also clearly not cities in themselves. In this sense, these geographies cannot be researched with the traditional conceptual and methodological toolbox of urban studies, more attuned to researching cities rather than urbanization.

The following sections move through the conceptual problems of conducting urban research in an allegedly non-city space and across what Brenner and his coauthors (Brenner 2014) have visualized as ‘extreme territories of urbanization’: spaces characterized by processes of urbanization that exceed the city form. The purpose of the following paragraphs is to trace the conceptual coordinates of this problem and to unpack current debates within urban theory at large that help frame and conceptualize the dynamics at play across the Atacama.

This chapter reconstructs intersections across three main literature strands emerging from the mine–city nexus discussed in the introduction. It brings together recent evolutions within the research agenda on planetary urbanization, focusing on the metabolic flows across the planetary urban fabric and the question of extended urbanization; it presents a rich Latin American debate on extractivism and more broadly the geographies of resource extraction, seeing them as conceptual tools for understanding the metabolic exchange underpinning the planetary urbanization hypothesis; finally, it discusses a longstanding literature on global commodity chains existing mostly in the perspective of economic geography, seeking to observe how global networks of production constitute the both conceptual and material footholds for researching urban metabolism beyond the city scale. In constructing a conceptual framework suitable for capturing and discussing the dynamics at play in the Atacama (and beyond), the main purpose of this chapter is to ‘urbanize’ the geography of global production networks, that is proposing to employ global networks of production as conceptual tools for urban research at the scale of the planet.

1.1 The metabolism of extended urbanization

In recent years, the research agenda which has more vocally illuminated the problem of the various scales at which urban environments emerge and pointed to the simultaneous co-production of many urban environments across agglomeration and extension, is the planetary urbanization research agenda. Planetary urbanization is now widespread jargon in urban studies for identifying a genealogy of studies originating from a number of core works by Neil Brenner himself and Christian Schmid (Brenner 2013; Brenner and Schmid 2014, 2015), often in dialogue with other scholars (Brenner 2014). As it is well-known, the hypotheses developed through the planetary urbanization agenda conceptually stem from Henri Lefebvre’s work, especially his 1970 *La Révolution Urbaine* (Lefebvre 1970), only translated in English more than thirty years later after its first publication (Lefebvre 2003). In *The Urban Revolution*, Lefebvre famously posits the complete urbanization of society, conceived as a sociospatial phenomenon which, through the planetary expansion of an urban fabric, sanctions the definitive dominance of the city over the country. This basic claim has a number of implications and raises some questions which I will try to unpack in the following paragraphs.

Working from the hypothesis of an all-encompassing planetary urban fabric hypothesized in Lefebvre's work, Brenner and Schmid have developed a cardinal critique directed at the centrality of urban agglomeration, developing an argument that seeks to produce an 'urban theory without an outside' (Brenner 2014, introduction; see also Brenner, 2016), whereby urbanization is not confined to the city but wraps around the surface of the planet as a diversified whole. As we will see, these ideas have spurred both productive extensions and critical cuts, giving birth to a complex and wide debate in the field. Besides the multiple ramifications of this very large debate and looking in retrospect at the research genealogy which has developed since the first publications emerging from this agenda, though, it seems to me that the problematization of the city scale as the predominant unit of analysis in urban studies has proven to be the most incisive and enduring aspect of the project. For this reason and for the research questions pursued by this thesis I will therefore centre my review upon this theoretical problem, leaving aside other important aspects yet secondary for the purpose of this chapter.

The problem of city-centrism is part of this agenda since its first instances and a cardinal point of departure: in one of their most well-known papers, Brenner and Schmid (2014) famously take issue with the 'urban age' thesis. By deconstructing the still ubiquitous claim that the majority of the world population now lives in cities as both statistically flawed and conceptually chaotic, they claim that the urban age thesis is a completely inadequate lens for understanding patterns of global urbanization as it is centred on the city-form and its anachronistic conception as a bounded and static settlement. In their 2014 paper, Brenner and Schmid's critical argument is directed at a formula which has been coined and popularized by an international institution as case in point. While departing from the institutional realm, the scope of their argument proves equally functional when addressed beyond the domain of policymaking and urban praxis and rather to the theoretical field of urban studies in general. By taking issue with the problem of city-centrism, planetary urbanization perspectives help us conceive of urbanization in a different light, that is as a multiscalar, multiform and dynamic process.

One of the most vivid formulations emerging from this body of work is that which—recurring to a figure coined by Lefebvre himself—sees the planetary urban fabric as an interconnected mesh made of implosions and explosions. This is also the title of one the main contributions on the subject (Brenner 2014). What is meant by this figure is that physical and economic processes of agglomeration and extension are constitutive and coexisting moments across patterns of global urbanization. This formulation points to a profoundly relational conception of urbanization processes which looks at the co-constitution of the urban across different physical and social forms and throughout multiple scales. While large sections of contemporary urban analysis grant almost exclusive attention to the large urban agglomerations that have emerged over the last decades especially in Asia, planetary urbanization extends the scope of urban analysis to landscapes that are apparently non-urban but remain socially, economically and spatially related to moments of agglomeration. In this sense, agglomeration is not erased, but

rather re-positioned as one of the many moments existing across the urban spectrum. Such an extension of the scope of urban analysis is legible through the emergence of a lively debate on the extended forms of urbanization, which I will discuss some paragraphs below.

The word ‘moments’ through which urbanization processes are addressed is case in point for the second aspect that I want to underline as I move through the essential arguments of planetary urbanization. The contradictory coexistence of implosions and explosions, in fact, should not be regarded as a static phenomenon. One of the fundamental distinctions brought about by the critique of city-centrism is the one that opposes the city as an *object* to urbanization as a *process*. To be sure, this is a longstanding open question in urban studies at large, one that Harvey was already posing twenty-five years ago (1996) by asking: cities or urbanization? Through this apparently simple dichotomy, one that still remains unsolved at the centre of contemporary debates, Harvey aimed not only at shedding light upon the conceptual predominance of the city over the concept of urbanization, but also its temporal fixity, as he asked (38): “Is our way of seeing dominated and limited by an obsession with ‘the city’ as a thing, one that marginalizes our sense of urbanization as process?” Seen in this perspective, urbanization appears as a dynamic process rather than, first, a static reality or, most importantly, a bounded object that can be distinguished as a settlement type. Besides this simplistic dualism lies a third argument rooted in the planetary urbanization agenda: that the city and the country, once separate and clearly distinct entities, have now become indistinguishable and their complex interactions expand across the planetary scale.

Conceiving of urbanization as a multiform process implies a reconceptualization of the dialectic between city and country. If Lefebvre’s was positing the complete dominion of the former over the latter through the hypothesis of generalized urbanization, it needs to be highlighted how this basic observation was already at the root of Max Weber’s economic analysis of the city in his 1921 masterpiece (Weber 1958). In his analysis, Weber argued that the city exists in a relationship of domination over the country since it is at the city market that the price of commodities produced in the countryside is established. For how reductionist this argument is—obscuring the more complex more-than-economic and more-than-human relations of co-production that city and country are bound within—Weber’s medieval urbanism was descriptive of a condition where the city limits were legible both in form and jurisdiction. As famously depicted in Lorenzetti’s *The Allegory of Good and Bad Government* (1338–1339), cities and their *contado* were allocated clearly distinguished functions and jurisdictions and stood in a legible relation of geographic immediacy. Planetary urbanization unsettles the deep-seated conception by which city and country are separate and geographically immediate territories. On the one hand, while the normative limits of the city have remained more or less anchored to its physical form, processes of economic globalization have de facto rescaled its material and social boundaries. This results in patterns of metabolic interaction between city and country, between agglomeration and extension, between density and sparsity that are illegible at the

local scale and should rather be charted across the entire surface of the planet. On the other hand, as the fabric of urbanization expands across this scale, the distinction between city and country becomes increasingly untenable: how are we to understand the geographies of plantations, fisheries, timber forests or any other place of primary production once allotted to the country? As pesticides, industrial irrigation, warehouses and transport hubs come to constitute the everyday grammar of what once seemed to be the idyllic countryside? This novel condition concerning the radical rescaling of the relationship between agglomeration and extension, between ‘implosions’ and ‘explosions,’ between the city and the country can be understood as it is held together through the concept of urban metabolism, itself extended across the planetary surface.

The concept of urban metabolism is a staple of urban political ecological (UPE) research, and a helpful conceptualization for charting the multiscale and processual dimension of urbanization in a planetary perspective across the city–country, city–mine conundrum. Studies in the field of UPE have long worked to uncover the many, often invisible flows that constitute the contemporary city (Gandy 2004, 2014; Swyngedouw 1996, 2006). According to Heynen and coauthors (Heynen, Kaika, and Swyngedouw 2006) capitalist cities foreground a condition where nature is urbanized in the form of commodity: as a glass of water, as an orange, as the concrete pillar that sustains a building. “This commodity relation veils and hides the multiple socio-ecological processes of domination/subordination and exploitation/repression that feed the capitalist urbanization process and turn the city into a metabolic socio-environmental process that stretches from the immediate environment to the remotest corners of the globe” (ibid., 5). The centrality of the commodity form in an urban analysis informed by such metabolic perspective should come at no surprise, as the concept of metabolism itself sinks its roots in Marx’s work. Borrowing this term from the then-flourishing natural sciences, through the concept of *Stoffwechsel* Marx sought to describe the process of human appropriation of nature for its own sustainment through the labour process (Marx 1976; Foster 1999). Since its conceptual origins, the concept has inspired well-known historical environmental perspectives into urbanization processes. Two books are fundamental milestones in this environmental history of the city: Cronon’s *Nature’s Metropolis* (1991) and Brechin’s *Imperial San Francisco* (1999), both of which reconstruct a history of city-making in relation to the urbanization of nature. The concept of urban metabolism, thus, re-centres urbanization beyond its narrow spatial interpretation and rather illuminates it as a fundamentally socio-ecological process.

Metabolic studies of urbanization, then, do precede the latter developments of planetary urbanization, but they have come under critical analysis from this perspective. In the words of Angelo and Wachsmuth, in fact, existing studies of urban metabolism suffer from what they have called a latent ‘methodological cityism’ (Angelo and Wachsmuth 2015). By reconstructing the recent history of UPE, these authors argue through this formulation that the concept of urban metabolism has remained confined to the concept and empirical site of the city, instead of having been deployed to its full potential in a Lefebvrian conception of

urbanization. Contra this particular reading of the history of UPE, Connolly (2018) has more recently argued that an analysis of the interconnectedness of multiple urban forms lies at the basis of many studies in urban political ecology. Yet, the empirical research sites making their appearances throughout the studies that I have cited are, more often than not, sites of urban agglomeration. It is worth noting how the planetary urbanization agenda implied early interests in the idea of urban metabolism. As a case in point, Brenner spoke in a footnote of “urban metabolism [...] as a fruitful analytical tool for advancing” historical-geographic materialist approaches to sociospatial theory (Brenner 2013, 99). More broadly following the cues suggested by the idea of urban metabolism beyond the city scale directs urban inquiries towards the many distant elsewhere that sustain the geographies of the city. Overcoming the methodologically cityist blind spot of urban metabolism, in Angelo and Wachsmuth’s view, generates the possibility of practicing a political ecology not of the city but of urbanization. A methodologically non-cityist reading of urban metabolism directly points to the problem of extended urbanization.

The concept of urban metabolism in fact, when unbound from its methodologically cityist pitfalls, has been accompanied by a rejuvenated interest and new research in territories of urbanization that clearly escape the physical contours of the city. Seen across this planetary framework and as a metabolic process of exchange and co-production, urbanization escapes a specific form and rather becomes—as Angelo has graciously formulated—‘a way of seeing’ beyond a persistent ‘city lens’ (Angelo 2017). Urbanization emerges as a way of seeing that seeks to ‘decentre’ perspectives on the urban (Schmid 2018), undocking this idea from its persisting city-centrism and seeking to study the imprint of the urban upon all landscapes rather than classifying what is urban and what is not, confining this concept to preconceived categories. As new ways of seeing require new ways of naming things, a vibrant scholarship on extended urbanization has emerged and began illuminating unexplored corners of the urban fabric away from the centrality of urban agglomeration (Castriota and Tonucci 2018). This has produced a growing terminology (Schmid et al. 2018) helping to uncover often invisibilized territories of primary production that exist in a metabolic relation with moments of urban agglomeration. Avoiding, perhaps strategically, any clear definitions, Brenner and Katsikis interchangeably point to the many ‘operational landscapes’ (Brenner and Katsikis 2020; Brenner 2013, 206) and hinterlands of primary production to highlight these under researched spatial formations. This language composed of metabolic exchanges, operational landscapes and resource peripheries is particularly tied to a neomarxist legacy which centres capital as a world-making agent. The underlying forces that shape the planetary fabric of urbanization, as in Lefebvre’s original proposition, are the relations of production that characterize the spatial ordering in capitalist relations. This literature has only begun to enter in dialogue with Moore’s work on the Capitalocene as an analytical framework that puts capital squarely at the centre of planetary-scale transformations (Moore 2015). The centrality that its Marxist political and

philosophical lineage allot to capital as transformative agent has—predictably—spurred burning critiques from feminist and postcolonial perspectives.

Brenner and Schmid’s efforts towards recasting urban theory as ‘without an outside’ has raised important critiques in terms of which epistemologies come to constitute such theory. A special issue of *Environment and Planning D* published in the summer of 2018 collected wide-ranging critiques from feminist and postcolonial grounds, charging the planetary urbanization agenda of “coopting feminist conceptions of relationality and hybridity” (Derickson 2018), of occluding the urban as the space for difference and the everyday (Ruddick et al. 2018) of erasing the possibility of a constitutive outside capable of remaking the urban itself (Oswin 2018; Reddy 2018; Jazeel 2017) and perceived as imposing a normative totality (Goonewardena 2018). I am sympathetic to these critiques when divested of their wrecking identity politics and much is to be done to improve and diversify planetary perspectives of urbanization. In this sense, while acknowledging the limits problems that exist within this framework, I think that the pluralist possibilities for thinking relationally about urbanization (Brenner 2018) outweigh its more apparently doxic formulations. I will unpack these critiques and attempt at possible standpoints as I discuss my reflections on methodologies and methods for researching planetary urbanization between the zenithal and the everyday in Chapter 2.

Urban metabolism is an evocative concept that can be substantiated in many ways, as the material and immaterial exchanges existing across the planetary urban fabric are naturally multiple and multiform. By the nature of their leading allocated function in the metabolism of urbanization (think of the ‘lithium triangle’ formulation), the territories of the Atacama present us with a metabolic flow centred upon the primary sectors of the global economy in general and to the political economy of natural resource extraction in particular. The conceptual frameworks surrounding recent studies of resource extraction are thus the subject of the next paragraph.

1.2 Extractivism and the political ecologies of urban metabolism

Approaching the question of how natural resource extraction transforms landscapes from a Latin American perspective grants a solid theoretical and political background. The question of extraction is in fact very present across the continent and has coalesced into a very generative debate around the idea of *extractivism*. Latin America has been a vital laboratory for this growing debate (Bebbington 2012; 2013; Correa 2016; Coy, Ruiz Peyré, and Obermayr 2017; Svampa and Viale 2014; Arboleda 2020) in conjunction with the particular geophysical configuration of the continent and its political-economic history. The so-called commodity super cycle—a generalized growth in primary commodity prices conventionally dated across the 2000s and originating from the increased

demand of goods from industrializing and urbanizing economies—marked a significant impact upon the continent. Not only this has meant the generalized expansion of extractive industries in a traditionally resource-rich context (Auty 1993). The commodity super cycle translated here into the vast spatial expansion of extractive frontiers, where not only fossil fuels such as natural gas and oil were increasingly searched for their escalating values, but also metals such as copper and nickel needed for the galloping dot com economy and the increasing diffusion of digital devices. This has meant the generalized expansion of extractive frontiers, with already shrunk bits of wild nature were brought into the global economy, but also a shrinking availability of high-grade ore veins, itself pushing further the spatial contours of resource extraction towards less pure resources.

From a political standpoint, the commodity super cycle emerged in connection with the well-known transition to left-wing governments known as the ‘pink tide.’ Even though pink tide governments emerged slightly before the conventional beginning of the commodity super cycle, the economic benefits deriving from increased commodity prices have functioned as the material foundations of their expansive social policies, thereby allowing for their sustenance and successful reproduction (Lopes and Pimenta de Faria 2016). The reliance of these socially progressive policies across different states in the continent has been defined as the rise of a ‘neo-extractivist’ cultural, political and economic regime, intended as a renewed reliance upon the global export of primary commodities especially proper of progressive governments, to be distinguished from classical (neoliberal) extractivism and instead implying “the partial rejection of neoliberal policies, the partial nationalization of certain raw material industries (oil, gas, mining), stronger political control of resource appropriation and profits, and the expansion of socio-political programs” (Brand, Dietz, and Lang 2016, 129–30). Svampa (2015) similarly identifies a novel result of these paradigmatic transition from a Washington consensus oriented towards the Atlantic to what she calls a ‘commodity consensus’ as the material base upon which new sociospatial arrangements and new geopolitical ties are forged. Similarly, Riofrancos (2020) identifies *extractivismo* as the clear-cut shift away from *neoliberalismo*.

Despite the expansive policies of redistribution generally promoted by pink tide governments through the annual economic growth generated by the commodity boom, mining projects have been met with broad popular resistance across the continent (Observatorio de Conflictos Mineros de América Latina (OCMAL) 2019). In this sense, the extractivist framework in Latin America is both widely debated in academic circles and widely spoken in popular language. This second aspect has strongly emerged from my fieldwork too, as the landscapes that I traversed following the lithium line were dotted by actions of mobilization and resistance under the flag of anti-extractivism. This framework has both been produced by and informed a great number of popular struggles against mining projects and their associated environmental and social disasters across the continent. A second effect associated with the neo-extractivist paradigm, its violent outcome and unfulfilled promises for the many, is a broader

attempt to ‘clean up’ natural resource extraction. This has resulted in an expanded parlance of risk awareness, community-based trust and ultimately green forms of extraction. Especially in conjunction with the global attempt to clean up existing and unchanged patterns of capitalist development, industry-led shifts to sustainability and responsibility should be regarded with suspicion (Dunlap and Jakobsen 2020).

Beyond its relevance in the Latin American context and its at times successful localized applications, extraction has increasingly become a largely employed terminology, perhaps thanks to a growing global awareness around the environmental emergency and the finiteness of planetary resources. Beyond the strictly Latin American debate, extractivism has gained large diffusion both in the social sciences and increasingly in public discussions. This rapid expansion has rightly generated a debate on the limits and possibilities that a wide use of the term grants, leading to the radical question: what analytic function does this term actually serve (Szeman and Wenzel 2021)? New scholarship focusing upon the lens of extraction has surely granted deeper analytical purchase on the human and social experience of extraction (Arboleda 2020) paving the way for a relational and material understanding of natural resources but, despite being a widely employed framework, the subject has focused on a very restricted notion of extractivism, one centred upon the material extraction of natural resources from the earth’s crust.

This limitation has come under the spotlight not to deny the many successful localized applications capable of stopping the expansion of global mining, but rather to investigate what more could be done by expanding the analytical scope of the term. The progressive diffusion of extractivism beyond the borders of Latin American extractive peripheries has gone in parallel with an expanded notion of the term that tries to frame other value-extracting activities such as financialization or data mining, plantation agriculture and industrial forestry (Gago 2015; Gago and Mezzadra 2017; Mezzadra and Neilson 2019). These authors have incorporated readings of extraction into the analytical framework on the operations of capital, an intellectual project that seeks to track down the material aspects of capital’s intervention in specific situations and their wider articulation into systemic patterns through a logistical rationale (2015). Extraction, in these writings, overflows the traditional site of mines, smelters and warehouses and penetrates the multiple layers of urban space and daily life. Arboleda’s work in response to these developments (Arboleda 2019; but also 2015) problematizes the analytical weakness of this conceptual stretch, arguing that, while these developments should be welcomed as positive and useful, they need stronger theoretical work. As the post-workerist lineage largely informs this expansion, extraction is seen as a new phase of global capitalist accumulation beyond the industrial paradigm in an underexplained fashion and the relations between the many ‘landings’ of capital on the ground are, if not taken for granted, at least only hinted at. In Arboleda’s view, the extraction and circulation of natural resources should not recede from view, as “it is by placing natural resources squarely at the centre of the dynamics of late-industrialization, that the

organic relations between the primary, secondary, and tertiary sectors of the economy can be most adequately fleshed out” (Arboleda 2019, 2). Beyond the current contours of this debate and due to the relevance that this notion is gaining across popular struggles for more just environmental futures, both the expansion and analytical clarity of what we mean by ‘extractivism’ is an urgent intellectual and political project.

The potential of this perspective is perhaps best exemplified through an episode occurred during my fieldwork in the Atacama when participating to a meeting among indigenous communities in the village of Carrizal, Argentina, where members gathered with the goal of sharing awareness and enlarging mobilization against lithium mining projects in the area. Among the different speakers, who described their mobilization or the outcomes of other communities’ agreement to mining projects in their locales, members of the collective asked me to speak in front of the assembly. Initially embarrassed and uncertain about the potential contribution that my then-developing perspective could offer to these directly affected collectivity, I set out to describe the dynamics traversing the lithium commodity chain, attempting to connect the dynamics in place in their locale to wider dynamics of capitalist organization at the planetary scale. The members of the collective were very satisfied with my improvised presentation. Contrary to what I had expected, their wonder for the global dynamics that I briefly touched upon signalled how the interconnection between the local facts of extraction and the planetary dynamics of capitalist organization is not automatically clear. In this sense, the conceptual instrument of the commodity chain can act as a powerful device for grounding concepts of metabolism and extraction, thus grasping a transcalar perspective not only on the contemporary dynamics of capitalist organization, but of the ongoing co-constitution of urban environments at the planetary scale. This is the subject of the next paragraph, where I discuss a long-lived tradition of commodity studies in the field of economic geography.

1.3 The geography of global production networks

Things are a mysterious fact. As Vinay Gupta writes in his forthcoming book, “Stuff magically comes into existence when we buy it, and magically leaves existence when we throw it away” (Gupta, forthcoming). This “magical stuff illusion,” as he calls it, conceals the social and material processes that allow things to come into existence. This is directly reminiscent of commodity fetishism, a Marxian concept that, among others, Harvey understands as “the seeming significance, even power, of its immediate ‘thingness’ [that] conceals and thus diverts our attention from the material circumstances of its origination and circulation” (Harvey 1990, 422–23). Objects articulate social life across urban environments, but their biographies (Appadurai 1986) remain often concealed. Commodities—that is, objects in a market economy—famously figure in the very first line of Marx’s *Capital* (Marx 1976, 125):

The wealth of societies in which the capitalist mode of production prevails appears as an 'immense collection of commodities'; the individual commodity appears as its elementary form. Our investigation therefore begins with the analysis of the commodity.

Commodities constitute the centrepiece of Marx's analysis in that their 'de-fetishization' unveils the mechanics of the capitalist mode of production. Crucially, Marx does not call them objects, things or stuff, but instead the word commodity points to the double existence of objects under capitalism, that of use value and exchange value. This terminology enables the study of objects throughout their economic, social and political trajectories. The very notion of commodities has of course been of great interest in academic geography—as explicitly witnessed for example by a rich follow-the-thing literature (Cook et al. 2007)—and beyond, since tracing objects back to their origin points and production processes is common practice in many activist groups and networks, as for example the fair trade movement. I will discuss these approaches to commodity research when dealing with questions of methodology and method in chapter 2. For the time being, my intention is to sketch out a foundational hypothesis by spelling out how the study of commodities can be a productive line of inquiry into the making of urban environments at the planetary scale. Marx's figure of an 'immense collection of commodities' could stand out as an aspect of any site of urbanization. As discussed in the introduction to this dissertation, processes of urbanization are intimately connected to and premised upon the extraction, refinement and circulation of resources. As commodities travel across the globe being extracted, altered, assembled, circulated, sold, consumed, discarded, recycled and disposed, they reveal the dialectics at play between multiple urban sites across many scales.

With these methodological orientations in mind, the first section will introduce and discuss the commodity chain genealogy in economic geography, highlighting productive insights and blind spots along its arguably weak engagement with spatial issues. Secondly, I will explore how diverse urban environments are brought together by commodity chains by reconstructing the li-ion commodity chain by focusing on what I call the 'lithium roads.' These are, on the one hand, the social and material infrastructures through which li-ion batteries are designed, manufactured, distributed and consumed. They are, however, also metaphoric roads in the sense that they signify the main pathways along which ideas and practices of sustainability are being articulated. I explore their biographies across the making of zero-emission urban zones, the manufacturing of batteries and the extraction of battery metals. In conclusion, I will reflect on how commodity chains offer a precious tool in investigating both persisting and emerging urban metabolisms of planetary urbanization.

Commodity chains have a long history in geography and a rich field of studies has consolidated around this concept over the last forty years, throughout a

diverse stratification of terminologies and methodologies. This has particularly occurred in studies of economic geography and business sociology, giving rise to what is commonly recognized as the commodity chain genealogy. I propose here a brief reconstruction of these interconnected literatures from the point of view of urban studies, my core argument being that while commodity chains are a powerful descriptive lens for urbanization processes the engagement of this genealogy with issues of urban space has remained limited.

This genealogy is often indicated as taking its first steps from the work of Terrence Hopkins and Immanuel Wallerstein who, in a 1977 programmatic paper appeared on the newborn journal of the Fernand Braudel Center, articulated the hypothesis of a 'commodity chain' (Hopkins and Wallerstein 1977, 128). In this first formulation, the concept stands to signify a concatenated ensemble of materials and processes which are necessary for the production of a single item (128):

Let us conceive of something we shall call, for want of a better conventional term, "commodity chains." What we mean by such chains is the following: take an ultimate consumable item and trace back the set of inputs that culminated in this item — the prior transformations, the raw materials, the transportation mechanisms, the labor input into each of the material processes, the food inputs into the labor. This linked set of processes we call a commodity chain. If the ultimate consumable were, say, clothing, the chain would include the manufacture of the cloth, the yarn, etc., the cultivation of the cotton, as well as the reproduction of the labor forces involved into these productive activities.

Within this context, the commodity chain forms an integral piece to the development of world-systems theory, of which one of the conceptual markers is to theorize the expansion of the modern world-system as corresponding to an expanding frontier of commodification (of labour, land, natural resources and so forth). Its function in world-systems theory is that of moving beyond long-held assumption of a linear internationalization of trade, a common conception by which "commodity chains developed first of all within the boundaries of states and later began to cross state frontiers" (Hopkins and Wallerstein 1977, 128). World-system theorists, simply put, argue that commodity chains are 'global' in the first place. Within this setting, the commodity chain is proposed as a means to explore the articulations and mechanisms of an ever more integrated global capitalist economy, so scholars have argued that the concept has emerged as a strategy to study the operations of global capitalism beyond the territorial confines of the national economy (Bair 2005, 156). Still, for how deeply the efforts could have gone, the deeply-rooted 'methodological nationalism' of world-systems theory has come under scrutiny through the claim that the persistence of the state as a unity of analysis is unsuited to the spatialities of contemporary capitalism,

where separate economic sectors are more tightly integrated than ever (Arboleda 2020, ch.2). This prompts us to recount the complex interactions that exist between states and the global networks of production—as I will discuss in chapter 3—whereby states not only facilitate capital’s operations as in a classical critical analysis of the state, but perform also other roles to stabilize or compromise the capitalist economy (see Werner 2020).

World-system theorists have understood commodity chains as webs that connect sets of productive activities with the reproduction of labour power as its critical centrepiece (Bair 2005, 155), as well as how a hierarchical world-system is produced and reproduced through such commodity chains. Since Hokpins and Wallerstein’s article, though, a great range of scholars has expanded the initial construct and used it to investigate different dimensions of the global economy. This has given rise to a distinct genealogy of terminologically diverse connotations: Global Commodity Chains (GCC), Global Value Chains (GVC) and Global Production Networks (GPN) are the main strands. While many review articles on the subject stress the respective shortcomings of one frame with respect to another (Leslie and Reimer 1999; Bair 2005; Coe, Dicken, and Hess 2008; Coe 2012), I observe this research tradition from the vantage point of urban studies, highlighting blind spots and asking which cues can be repurposed to follow the transformations of urban space through the lens of commodities. All of these acronyms share a common concern towards “the globally coordinated interorganizational relationships that underpin the production of goods and services, and the power and value dynamics therein” (Coe 2012, 390), albeit with substantial difference when observed in closer focus. While extending many concerns of the original commodity chain formulation, the GCC (Gary Gereffi and Korzeniewicz 1994) and GVC frameworks (Gereffi, Humphrey, and Sturgeon 2005) mark a clear break from the original world-systems tradition. As Bair (2005) has claimed “GCC researchers understand commodity chains as a set on inter-firm networks which connect manufacturers, suppliers and subcontractors in global industries to each other [...] and they are principally concerned with the question of how participation in commodity chains can facilitate industrial upgrading for developing countries exporters” (Bair 2005, 156). While the GCC tradition foregrounds a rather sociological approach to global networks of production, the GVC framework has been more directly influenced by the international business literature, and has thus privileged a focus on sectoral dynamics and industrial upgrading. Within these traditions, inter-firm relations constitute the central analytical focus.

The Global Production Networks framework (GPN) (Henderson et al. 2002) has partially emerged as a response to this analytical shrinkage, where the semantic shift from “chains” to “networks” is also an epistemological rift. Coe and colleagues (2008) have underlined how the network distinctively allows to produce a much more relational analysis which goes beyond the necessary simplifications of an impossibly linear chain, as well as a tool to recast a broader attention which allows the inclusion of non-firm actors. By reclaiming a

somewhat larger perspective, these authors explicitly refer back to Hopkins & Wallerstein's work.

Other approaches to the commodity chain problem comes from the Francophone *filière* tradition—perhaps more familiar than the ‘chain’ or ‘network’ terminology to Romance language speakers. As Raikes and colleagues (2000) explain, the *filière* is not a uniform concept but rather a broad range of approaches drawing from heterogeneous epistemological traditions, that has been mostly applied to agricultural commodities originating from former French colonies. From the vantage point of its culturally and historically specific usage, the *filière* perhaps foregrounds a sensitivity to historical depth, and a broader range of analysis beyond the exclusive industrial focus of the other chain paradigms through the inclusion of agricultural produce. Given the many resemblances that exist between the extraction of minerals and that of agricultural commodities, this sensitivity might prove useful in investigating the origin points of our case.

But for how tied to geographic interpretations and research questions the commodity chains literature was in its first instances, these subsequent inflections have only marginally engaged with geographic issues—and less so with questions of urbanization. While a geographic approach to commodity chains has been called for since at least two decades (Leslie and Reimer 1999; Hughes and Reimer 2004), Vormann (2014) still argues that “it is curious that how the global integration of commodity chains actually happens spatially - creating a quantitatively new, global organization of production, distribution, and consumption processes - remains understudied.” Such missing engagement with spatial and urban issues might be observed through a number of interrelated issues.

Firstly, it seems that the spatial observations that have been so far included in commodity chain studies have been developed with the purpose of enriching knowledge about the chains themselves, rather than the opposite. This is particularly evident in a special issue of *Global Networks* where urban space is often accounted for in many of the papers (Coe et al. 2010; Derudder and Witlox 2010; Hesse 2010; Jacobs, Ducruet, and De Langen 2010; Sassen 2010), but hardly investigated. At the centre of these inquiries are the dynamics of commodity chain organization, rather than the constitute dynamics of urban space—cities are “critical nodes in Global Commodity Chains” (Parnreiter 2010). This orientation is well depicted in a more dated statement by Leslie and Reimer who claim that “[s]pace and place shape the nature of systems of provision in significant ways” (Leslie and Reimer 1999, 402). Secondly, when they did include urban issues in their analyses, it seems that studies of commodity chains have remained gripped in the same ‘methodological cityism’ that Angelo and Wachsmuth attribute to the field of urban political ecology (Angelo and Wachsmuth 2015). By relying on highly dualistic node-network models of urbanization, they underplay or completely invisibilize the role of the much broader fabric of urbanization discussed in the introduction. Lastly, these studies have substantially remained detached from an otherwise vibrant research agenda

which has recently focused on a critical analysis of logistical capitalism through its social and spatial dimensions (Tsing 2009; 2013; Cowen 2014; Easterling 2014). Perhaps as a result of this deeply-rooted ‘cityism,’ the spatialities of the chain, however articulated and diverse, have so far failed to acknowledge the centrality of the global infrastructural space so central in the contemporary phase of global capitalism.

And yet, from its beginnings, a commodity chain has never solely been a sequence of transformative operations which culminate in a consumable item, but rather, through these steps and interactions, scholars have observed different aspects of social and economic life. Through this concept, world-system theorists have spelled out the hierarchical articulation of global capitalism. Through this concept, GCC and GVC scholars have observed inter-firm networks and industrial upgrading, while the GPN tradition has observed the multidimensional layers of production. Moving across the roads of lithium, in the following section I describe how a commodity chain brings together a range of diverse yet interconnected urban spatialities at the planetary scale.

Conclusions

In a recent review of Tsing’s seminal book on the planetary trails of the matsutake mushroom (Tsing 2015), Stefan Ouma speaks of commodities as the basic unit of global capitalism: “If commodities are the blood cells of global capitalism, then commodity chains are its veins” (2018). Throughout this chapter, I have worked to expand this idea beyond its economic scope by proposing global production networks as urban phenomena, and hence as potent heuristics for charting contemporary patterns of global urbanization.

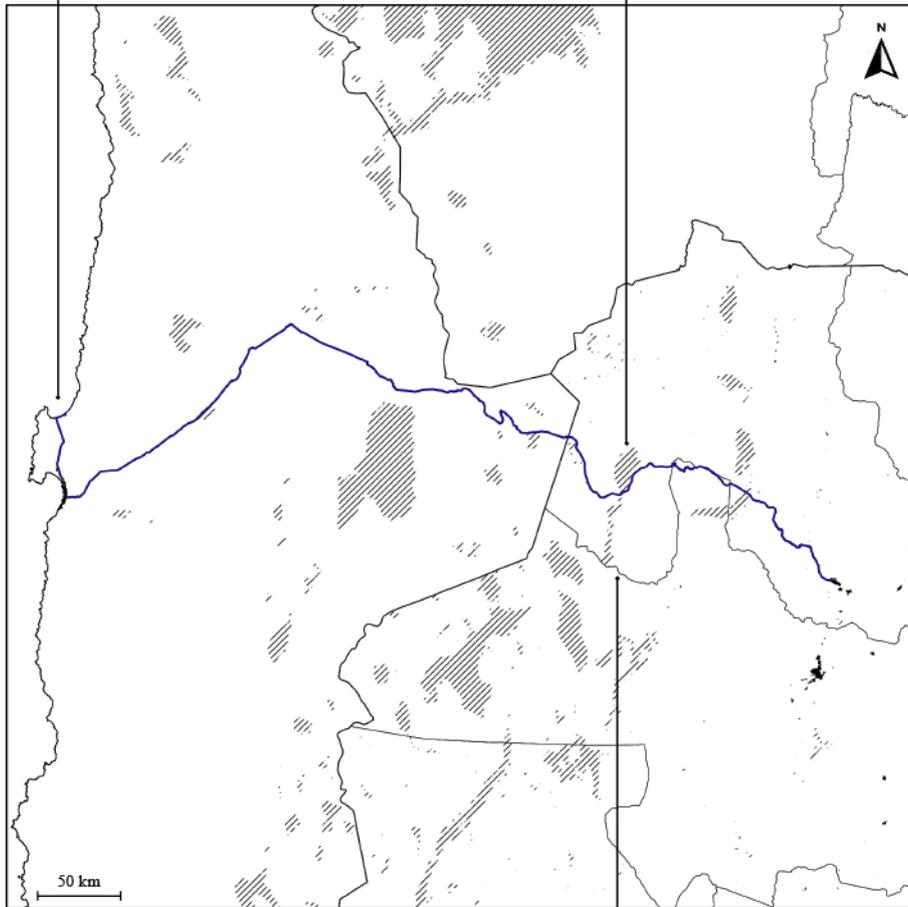
This chapter has defined the conceptual contours that emerge when approaching the expanding lithium landscapes of the Atacama from the perspective of critical urban studies. Despite their usefulness as a conceptual structure for the following chapters and the overall development of this dissertation, I think that the encounter between the debates discussed in this chapter has much to offer in itself. Firstly, while recent developments in critical urban studies have shifted attention to the metabolic aspects of global urbanization, explorations of urban metabolism have largely remained anchored to the physical and conceptual form of the city. Global networks of production as discussed in a long-lasting tradition of studies in economic geography present the potential of filling this gap by anchoring the metabolic exchanges of planetary urbanization not to a specific settlement type, but rather to material and immaterial infrastructures of planetary metabolic exchange. Secondly, when looking at Latin American regions and the Atacama in particular and at operational landscapes and resource hinterlands as forms of extended urbanization in general, natural resources become the leading form of metabolic exchange marking these landscapes. Yet, as the idea of extractivism overflows the bare sites of extractive industries, the contemporary debate has sought to enlarge the

meaning of this term in the attempt to capture the wider extractive logics at the root of contemporary capitalism. While expanding the meaning of extractivism is a vital intellectual move for understanding contemporary planetary conditions, it is equally vital to anchoring its explanatory potential to the molecular infrastructures of capitalist extraction, bridging the specific and the general. As the following chapters attempt to put into practice, urban global production networks allow for bridging the gap between local experiences of extraction and the extractive dimension of contemporary urbanization at the planetary scale. Lastly, and from a larger conceptual standpoint, the encounter between the concepts of extractivism and that of global production networks contributes to ongoing efforts of exploring a decentred perspective on global urbanization.

By unearthing the urban from the form of the city, the spatial grammar of resource hinterlands and operational landscapes recently emerged through the debate around extended urbanization unsettles the customary methods of urban studies. As the methods of urban inquiry have remained largely city-centric, the question becomes: how to conduct urban research in apparently non-urban territories from the standpoint of urban studies, assuming urbanization not as a form but as a ‘way of seeing’ (Angelo 2017)? The limits, openings and possibilities granted by this conceptual stance are the subject of the following chapter.

Mejillones port complex

Salar de Olaroz



Cauchari solar plant

Chapter 2

Thin ethnographies of planetary urbanization

Introduction

Deploying the conceptual frameworks articulated and discussed in the previous chapter means, in practice, pursuing the goal of charting urban transformation in and of the Atacama across multiple scales. When observed through the lenses of planetary urbanization, the urban emerges as a complex and contradictory patchwork composed of many moments at very different scales. The concept of urban metabolism further complicates the determination of boundaries as it imposes a relational view of urbanization phenomena, conceived not as independent and bound spatial entities but as bundles of connections. Global networks of production substantiate these abstract flows into tangible networks of physical and social infrastructures. While offering productive insights into the planetary conditions of urbanization patterns, these conceptual orientations are not comfortable ground, as they make the very ‘field’ of ‘fieldwork’ a rather unclear idea.

As urban geography increasingly relies upon an almost intuitive use of qualitative methodologies (Hitchings and Latham 2019a), it remains to be determined how these qualitative methods are sustainable across a territory that extends across several hundreds of kilometres and takes days to traverse via ground transportation, let alone on foot. How to comprehend the geographies of urban transformation not of a neighbourhood, not of a municipality, but of a regional economy traversed by planetary circulations of matter and value? In short, how to define the very field of this research, and hence through which methods to approach it?

In order to find a response to these challenges, this chapter builds upon a number of current debates within urban studies in particular and the social sciences in general. Firstly, it discussed how the planetary urbanization hypothesis has almost exclusively relied on a telescopic viewpoint from afar by reconstructing feminist, queer and postcolonial critiques directed at this framework as briefly mentioned in the previous chapter. At the same time, it remains dissatisfied with the response that these critical positions have so far

offered, a perspective that dwells upon ideals of embeddedness and long duration that, I argue, are impossible in practice and incoherent in theory with the very extendedness of sociospatial phenomena across landscapes of extended urbanization. In this section I will propose a methodological assemblage which emerges from the dissatisfaction with either perspectives, that from afar and that from within. Centred upon a relational practice of following things through mobile and thin ethnographies that allow to compose thin ethnographic slices into a multiscalar perspective on global patterns of urbanization.

I begin by discussing more in details the problem that emerge when organizing how to do research in and of territories of extended urbanization, shedding light upon critiques directed at the telescopic gaze of the planetary urbanization agenda, arguing that the dominant visualizations of the planetary urban fabric have so far remained trapped into a zenithal viewpoint. In parallel, I present the problems that emerge with concepts of long duration and embeddedness when researching questions that are mobile and relational in nature. In concluding that both terms of this debate are unsatisfactory for the research questions posed in this dissertation, I propose that other ‘visions’ of planetary urbanization must be explored. In order to do this, I draw upon two current debates across the social sciences in general: one particular literature going under the flag of ‘follow the thing,’ as in research that has sought to track processes of globalization in a relational and transcalar way by following the life of single items; and secondly on discussions around modalities for doing ethnography that seek to overcome deep-seated concepts of long duration and embeddedness by proposing multi-site, mobile, relational and thin ethnographic practices. Before venturing in the more empirical sections of this dissertation, I conclude by presenting the details of the fieldwork which I have carried out along the lithium route.

2.1 Visions of planetary urbanization

Planetary urbanization’s strategy to unsettle the centrality of the city in urban analysis has, at least in the core sections of the agenda, mostly relied upon cartographic if not strictly quantitative visualizations of the planetary urban fabric. One of the many renowned leverage arguments to visualize this rescaled patterns of urbanization is the nighttime lights satellite image also employed by Brenner in the *Theses on Urbanization* (Brenner 2013, 87) as a representative image of the “geographies of urbanization having exploded the boundaries of city, metropolis, region and territory” and hence having assumed a planetary scale. Moreover, at a closer look this image reveals how extended moments of urbanization so strongly exceed popular imaginaries of urbanization patterns that they have been actively deleted from this representation, resulting in the outright denial of extended moments of urbanization from the planetary landscape. As a case in point, Brenner’s entire paper (2013) is riddled with cartographic and quantitative representations, culminating in a powerful visualization of the Earth’s globe

surrounded by a cloud of points: satellites and space junk, their staggering accumulation having ultimately declared the complete saturation of the atmosphere by extended forms of urbanization (107). This cartographic viewpoint has also been the staple of Katsikis' work in the planetary urbanization agenda and has arguably been the most characteristic approach to the question. This work is paradigmatic of an attempt to visualize the planetary urban and to diversify commonsense imaginaries of urbanization heavily rooted in the image of the city. By mobilizing a vast array of quantitative data on land use, primary production, land cover and population density this work seeks to uncover the question of extended urbanization under planetary reconfigurations of sociometabolic exchange (Katsikis 2018). While this cartographic imperative can be thought of as an expression of a somewhat early interest in the hinterland question and a first strategy to bring it back to the public attention it deserves, it is equally true that the persistence of this perspective still characterizes even more recent contributions in the field (see Brenner and Katsikis 2020). This large-scale cartographic perspective has had the undeniable merit of illuminating what can be considered as an elephant in the room of urban studies, and the surprising visualizations that have characterized this agenda have certainly played an important role in bringing the problem of extended urbanization to current debates, alongside its conceptual strength. While this kind of approach has been pioneering in this sense, is not unproblematic.

This methodology, of course, exceeds the purely visual realm and instead overflows into important methodological questions. Visualizations are not simply visualizations but they imply certain conceptual framings and methodological positionings. A strongly emerging aspect from the visualizations employed by the planetary urbanization agenda is how they almost exclusively rely upon a view from afar, *de facto* promoting a viewpoint that is apparently nowhere to be located and always seems to be non-terrestrial. Brenner and Katsikis seem to be looking at the urbanization of the planet as if they were observing it from outer space. This is understandable, given the ambition of this agenda to comprehend the entirety of this new urban condition at the planetary scale, but—despite these all-encompassing attempt—also incomplete. As noted in Chapter 1, this is an entry point into the burning critiques that have been moved to the agenda from feminist, queer and postcolonial grounds. While recognizing the necessity for theory-building and abstraction, Derickson has called out the epistemology promoted by planetary urbanization scholars as a 'celestial' form of knowledge (Derickson 2018, 558) that implies a universalizing and totalizing tendency. As a directly symmetrical challenge to these totalizing impulse, Ruddick and colleagues ask not what is *comprehended* by this seemingly all-encompassing perspective but rather what is *occluded* by it (Ruddick et al. 2018), and hence by the analytical framework it constructs. This 'telescopic' form of knowledge, in their view, occludes the urban as the site of everyday practices, erases the urban as the space of difference and, perhaps most importantly, cancels the presence of a constitutive outside capable of remaking the urban. These critical positions in fact reclaim the existence of an outside to planetary urbanization (Roy 2016), rejecting the very

idea of “an urban theory without an outside” (Brenner 2014), and instead propose this outside as the fundamental site of transformative urban practice (Oswin 2018). Placing planetary urbanization in other fields of vision (Peake et al. 2018), then, becomes as much an analytical imperative as a political urgency.

In responding critically to the visions mobilized by planetary urbanization and arguing against the distanced and universalizing forms of knowledge employed by this framework, these authors ultimately argue for more embedded and situated, difference-sensitive knowledge-building. In critiquing the opportunism embedded in the views of ‘telescopic urbanism,’ Arabindoo proposes forms of situated knowledge capable of revamping the anecdotal dimension alongside the numerical obsession promoted by planetary perspectives (Arabindoo 2013), urging to lay a more detailed focus on the particular and variegated experiences of urban life across multiple environments. Indeed, what a more finessed planetary perspective has to mobilize, despite and perhaps through the necessity to construct a gaze that must be capable of “comprehending the phenomenon at the scale of its expression” (Derickson 2018, 2), is a full acknowledgment of the ever-present partiality and incompleteness of any perspective, even the most ‘planetary’ one. This would be an important caveat that is nowhere to be found in the planetary urbanization agenda. But while the positions outlined above claim the urgency of more situated and embedded takes on the urban, these adjectives cannot be taken for granted as the privileged perspective upon which to dissect the complexity of urban realities, nor they are completely devoid of problems. The particular qualities of an attentive and detailed focus on the everyday experience and subtle differences can in fact be unworkable in practice and untenable in concept for developing urban research in a transcalar perspective such as that demanded by extended forms of urbanization.

For the research questions mobilized by this dissertation there is, already at first sight, a problem of defining a tightly bounded empirical field, the contours of which should define the borders of the researcher’s situatedness. Surely, the Atacama as a biogeographic region does have clear cartographic boundaries that can be charted, say, through geographic information systems. These administrative boundaries are however nowhere near sufficient. Firstly, the fully regional scale of the processes at hand poses significant if not insuperable challenges to experiencing its particular geographies of the everyday, geographies that can only be charted with the bodily engagement of the researcher. In this sense, it is worth remembering that the ‘extendedness’ of extended urbanization is not only a conceptual lever, but also a physical geographic characteristic imposed on the bodies of those who do research. Secondly, an impossibility to define the boundaries of spatial dynamics is another obstacle to defining the boundaries of the empirical field, since even the most apparently local fact is, in one way or another, tied to more-than-local dynamics. As is, the very ‘field’ of ‘fieldwork’ becomes only loosely defined, thus questioning how a practice of situatedness and long duration could be organized and defended in this scenario. These apparently trivial features not only pose practical challenges, but most importantly point to the conceptual limitations of an approach that fetishizes the particular and the

specific and that is connected to the conceptual frameworks adopted while approaching the field. If, according to the elements discussed in the previous chapter, urbanization can be observed as a dynamic of sociometabolic exchanges at the planetary scale through the idea of urban metabolism and the concept of global production networks, the site of analysis becomes not a specific site but a system of relations across places. Hence the gaze that is employed in order to recount its empirical dimensions must be construed at the scale of the observed phenomenon: by holding true to this conceptual framing, what is to be found is a research methodology capable of holding together multiple scales without locating any privileged point of observation. Doing research in territories of extended urbanization requires methods capable of moving incessantly between the planetary and the specific. Any vision that privileges any of these scales over another is therefore inappropriate to the task.

As both extremes of this current debate prove unsatisfactory, different methods for researching the making of urbanization patterns at multiple scales must be assembled. In reality, those which appear as limitations of both extremes open to generative possibilities for doing research in territories of extended urbanization. The following section unravels these opportunities by drawing upon two distinct literature bodies: one concerned with troubling consolidated notions of ethnography, the other involved in following things across global networks of production and exchange. Taken together, these two genealogies contribute to building research methods that neither rest upon the convictions of telescopic urbanism, nor on the seeming certainties of ethnographic depth.

2.2 Thing-ethnography beyond thick descriptions

The methodological constructs mobilized for the empirical sections of this dissertation hence need to respond to a double objective. For one, they should be able to overcome the telescopic gaze of planetary urbanization, an impulse that immediately calls for pausing the quantitative obsession and instead trying to deploy more broadly qualitative methods. A well-acknowledged staple in the practice of geography, qualitative methods were ‘the new orthodoxy’ already twenty years ago (Crang 2002) and their growing adoption has gone unabated through more recent times as “the taken-for-granted way of generating empirical data” (Hitchings and Latham 2019a, 3). Among the different methods involved under the ‘qualitative’ label, Hitchings and Latham (2019a) recognize a primacy to interviews and ethnography as the most widely used, leading these authors to state that “maybe it is not longer important to justify their use” (3). On the contrary, a rich debate has emerged in recent years around the question of ethnographic practice itself. These recent discussions around the practice of ethnography from across the social sciences seem to be particularly helpful for the second purpose of a foreseeable methodological construction, since they have strongly revolved around the idea of divesting ethnography from its preoccupation with thickness and depth. By drawing upon these recent debates, it becomes

possible to construct a practice of thin, mobile and relational ethnography that helps overcoming the preoccupations with situatedness and embeddedness that have so far been the main critical response to the telescopic urbanism of planetary urbanization, hence paving new methodological grounds as discussed in the previous section.

In retracing the recent upsurge in the adoption of ethnography across geographic research, Hitchings and Latham (2019b) note how a somewhat blind faith in an established and all-encompassing notion of ‘ethnography’ in fact “casts a shroud over our research practices” (6). Ethnography indeed possesses a sort of mystique, perhaps connected to the exotic preconception of the ethnographer traveling to far-flung regions—an enduring image rooted in the origins of Western social science. In Ingold’s view (2014), the language of ethnography has become so overused in anthropology that it has lost its meaning and is best to be abandoned. Instead, I think there is deep potential in making the effort to describe *which* ethnography can respond to the challenges posed by extended forms of urbanization, since ethnography is not one and its problems and opportunities not set in stone. Despite the recent upsurge described by Hitchings and Latham, the diversification of ethnographic practice is not a recent attempt, but rather contributions that unsettle the long-lasting convictions associated with a practice which dates back to the origins of anthropology as a field can be traced back to almost three decades ago. Marcus (Marcus 1995) hails the emergence of multi-sited ethnography as an apt response to the thickening of globalization processes and as a viable method for doing empirical research in the perspective of world systems theory. As Hannerz has pointed out (2003) multi-sited ethnography is concerned with the construction of a field which encompasses different locales, something that Streule (2020) loosely defines as ‘mobile ethnography.’ In a similar vein, Desmond takes issue with the crucial task of selecting a very ‘field,’ which in his view is a problematic term. His proposal for a relational ethnography (Desmond 2014) is a shift in focus: “studying fields rather than places, boundaries rather than bounded groups, processes rather than processed people, and cultural conflict rather than group culture” (548).

Although emerging in different times and through different problems, these perspectives can work in tandem with more recent critiques that have worked beyond established convictions around ethnographic practice in the discipline of anthropology. Jackson (2013) has brought up a notion of ethnography that takes issue with the field’s traditional practice—and perhaps obsession—with ‘thickness,’ that is taking issue with Geertz’s famous take on the necessity to produce thick descriptions (Geertz 1973). Such thick descriptions aim at interpreting social life, with the adventurous ethnographer acting as a sort of investigator unlocking the most hidden and recondite dimensions of life as it goes. This practice, in turn, requires extensive periods of ‘immersion’ at site, both impractical for the tight time currently imposed to academic labour and for the multiscale of contemporary spatial phenomena. In addition, it reproduces a fictitious distinction between researcher and researched, between those we learn with and those we learn about (Ingold 2014), a distinction which is sadly

reminiscent of the colonial and eurocentric legacies of established ethnographic methods and the very idea of a field (Mattern 2016). A position premised on thickness is almost unworkable across territories of extended urbanization and global production networks in general, and especially so in traditionally disenfranchised locales around sites of resource extraction across Latin America. So it would be helpful to do away with any pretension of thickness and instead fully embrace the thinness of our doing research in the world.

Multi-sited, relational and mobile ethnographies inspired by an idea of thinness, in fact, appear as a very workable opportunity across the scales of extended urbanization and throughout global networks of production. They allow for the grasping of connections across vast territories, to pursue the effort of moving incessantly between the particular and the telescopic, producing thin slices of multiscalar connectivity than focus on what is visible and tangible, not what is concealed. Ethnography then, rather than a clear methodological cheatsheet, rather becomes an orientation for being in the world as a practice of care and attention. Ingold's idea of *correspondence* (2017) captures the process of attunement which potentially boundless and dynamic research objects demand from the attention of the mobile ethnographer. Contra the preoccupation to access the deepest meanings of social life as it is, I respond with a 'thin' ethnographic practice, in attunement to the idea of tracing 'a geography of what happens' and not of what is concealed beyond the most visible and tangible expressions of social life across space. Perhaps in a less polemic vein, thin ethnographies allow us to see simply other things. They allow us to attempt a reflexive and situated gaze all while centring movement squarely in our analysis of the urban as a system of relations. An ethos of practical experimentation, ethnography allows testing out what helps us to identify and answer our own research questions (Becker 2009).

The question then becomes: how to do ethnography along global networks of production? Commodity chains are a concept rooted in economic geography and their conceptual translation into an instrument of urban research needs a methodological translation as well. The proposed methodology implying to use global networks of production as instruments of urban research, how are we to do it without privileging the telescopic over the embedded, or the other way around? The first of the two seems particularly challenging, as global commodity chain research has mostly relied upon a large-scale, mostly quantitative perspective. Mostly relying upon inter-firm network analysis, this literature has largely overlooked the particular geographies and specific experiences that emerge together with global production networks. An observation similar to the one directed at the celestial knowing of planetary urbanization can be addressed at the customary methods of global commodity chain research. Because much research in the GCC/GVC/GPN agenda, despite a handful of exceptions, is largely based upon quantitative and desk-based research, commodity chains as they have been conceptualized in that field prove impractical for a qualitative and on-field analysis, for the thin and mobile ethnography that this chapter argues for. Luckily, an enduring research genealogy in human geography, albeit with a different focus

and referring to different intellectual traditions, has sought to explore commodity chains from a grounded perspectives by following the things that effectively make these chains. Despite its differences with other commodity chain genealogies, following things most literally adheres to Hopkins and Wallerstein's idea of 'tracing *back* the set of inputs that culminate in an item' (Hopkins and Wallerstein 1977).

One notable exception to this ubiquitous telescopic perspective in commodity chain research comes from the so-called 'follow the thing' literature. Geographers have long been interested in the various life stages of commodities and have built diverse methodologies for exploring these questions, and this literature mostly revolving around the work of Cook et. al. Appadurai (1986) builds upon the juxtaposition of particular scenes and can work as a device for connecting and relationally analysing apparently distant, unrelated and uncomparable geographic sites and moments of urbanization. Other similarly helpful cues come from the idea of 'object trails,' which have been developed in the past years (Barndt 2008; MacGaffey and Bazenguissa-Ganga 2000; Marriott and Minio-Paluello 2013; Knowles 2014; Tsing 2015). These studies are relational biographies of objects which should be credited for proposing an important attempt at expanding commodity chain geography (Knowles 2015). Recurring the many vivid scenes depicted by this literature, following things across their production stages really can be a way of cutting and superimposing thin ethnographic slices across multiple sites and scales. These geographies of commodities, focusing on their production, circulation and consumption, offer precious insights into the multiscalar and relational dynamics which actively make the urban fabric. While this has relative antecedents in studies on the geographies of urban metabolism (Brechtin 1999; Cronon 1991; Ferguson 1999; Gandy 2004) it should be seen as an attempt to practice urban metabolism research beyond the city and hence expand that range of conceptual tools, methodological orientations and empirical techniques of urban studies. For the purposes of this chapter, as a glimpse into the detailed social life of commodity production, a follow-the-thing is well equipped for constantly move between the telescopic and the embedded.

In the last paragraph of this chapter I detail the schematics of the fieldwork that has emerged in concurrence with these reflections.

2.3 Fieldwork along the lithium route

The fieldwork that I have carried out for this research consisted of five weeks spent on the ground—on foot and by bus—across the emerging lithium economy of the Atacama. In this sense, I took the suggestions of follow the thing research quite literally, planning to travel from the mines where resource is extracted to the port where it is shipped. Understanding important details such as exact mine locations, ownership and timelines, or the prevalent export direction of lithium carbonate from these Andean heights involved a lot of desk-based research, a detail which already troubles established notions of qualitative versus quantitative,

on-field versus off-field research. I finally settled to travel from San Salvador de Jujuy, the major city in the mining boom region of Jujuy, to the port of Antofagasta on the Northern Chilean coast. Initially, I had foreseen an even wider multi-sited field, aiming at conducting empirical research across the Pacific Ocean and into mainland China, the global refiner of lithium products and active materials production. As soon as I travelled back from fieldwork in the Atacama, I realized how this would have been completely unviable for the sheer scale and complexity of the involved field. Initially tasting like a failure, this shift eventually evolved into an observation on the richness and complexity of capturing the particular dynamics at play in those territories that, despite the appearing flatness suggested in the definition of operational landscapes, the empirical sections of this work unravel how complex and diverse dynamics coalesce into the making of extractive landscapes.

To provide substance to the relational dimension of ethnography that I had explored in theory, I arranged an initial series of meetings which involved a variety of actors and spaces composing the lithium production network across these territories. The initial shortlist involved mining industry CEOs, electrochemical engineers, indigenous rights and anti-mining advocates and activists, conservation biologists and economic and political geographers in the field of resource extraction. This initial shortlist naturally developed into a complex network of interrelated actors as I sought contacts moving through the field. I hence ended up engaging in 51 conversations throughout the duration of my work on the ground. The diversity of professions, positions and roles embodied by the group of people I met points to an expansion of the very idea of an object trail. A decidedly narrow conception of an object trail as the one that I had absorbed from my initial literature review and fieldwork preparation proved inaccurate once observed on-field, as connections continuously overflowed the literal lithium route. An expanded notion of lithium route, then informs the articulation of the empirical chapters of this thesis which focus on different yet strictly interrelated dynamics such as resource extraction, energy production, financialization and infrastructure-led development.

Interviews, as noted above, constitute one of the main staples of ethnographic research together with participant observation. In my case, interviews were both an act of collecting empirical material and as strategy to try and obtain access to often secluded sites. Beyond this opportunistic perspective, interviews have been for me a more formal and understandable entry point into building confidence with those I was learning from and with. Of course, this sometimes succeeded and sometimes failed. Despite the apparent length of a five-week journey across logistically difficult territories, these encounters were substantially brief and, most importantly did not allow for any repetition, leaving me with scant possibilities for further refining the material initially collected across these first encounters. These critical aspects led me to reflect upon the theme of fieldwork duration.

Across my ethnographic travel along the lithium line, differences with the commonsense of ethnographic practice began to emerge almost immediately. At

an inter-community meeting in San Miguel de Los Colorados, I met an Argentinian anthropologist who was standing aside the crowd. Speaking to him, I quickly discovered how his research on the traditional farming practices of the Puna was premised upon a months-long presence in the small settlement where we were located: he had been there for three months, and had another three months left to stay. The trivial, intuitive comparison of our respective fieldwork practices immediately highlighted how the long duration of his engagement with the field dwarfed my rather ephemeral presence on site. A similar point can be found in Hitchings and Latham's rundown around geography's recent falling in love with the practice of ethnography (2019b). In the sample of papers they analysed, those geographical ethnographers who travelled far away from home have all made a point about the duration of their fieldwork which "never dipped below six months" (2). This detail brings them to note how duration is often employed as a route to authorial authority: a strategy "based on the assumption that cultural understanding comes through a slow process of engagement" (3). A few moments after our brief conversation, the people that had invited me to the meeting asked me to present my work and my ongoing reflections to the communities. Initially embarrassed by the seemingly paradoxical task of narrating tales of extraction to those who experience it on a daily basis, I ultimately settled upon charting the global and more-than-local dynamics that made those locales affected by mining. In the attempt to engage carefully but in a multiscalar fashion to local issue that this brief encounter points at, I started to see some of the possibilities that a thin ethnographic practice based on volatile encounters could offer to us: not the power to excavate into the recondite structures of social life, but a possibility to juxtapose and connect detailed life scenes across many locales.

The thin slices emerging from this practice of juxtaposition and connection have initially taken the form of quick diary notes, later recompiled into more thorough reasoning while en route. I made the deliberate decision to consign these contents to written notes instead of recording these conversations in order to avoid placing too tall a barrier across these brief and often single-happening encounters. Not only these encounters, conversations and observations constitute the material source of reasoning across the following chapters, they are also referred to in more punctual ways. Emerging from different points across the lithium route, these scenes hopefully describe the complex and diverse mosaic that landscapes of extended urbanization actually present when 'zoomed in' and observed from the ground. I have pursued the effort to juxtapose specific scenes across a physical sequence by filming them with a portable device while on the field. Film still emerging from this loosely visual engagement with a geography of what happens form a non-written introduction to each of the following three chapters.

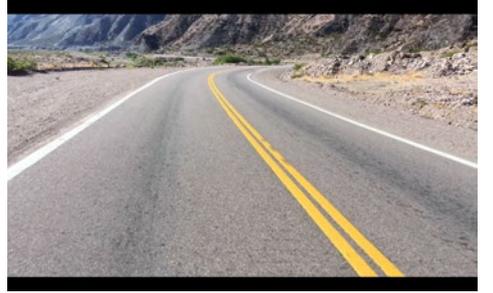
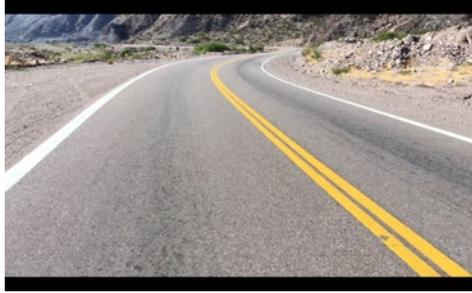
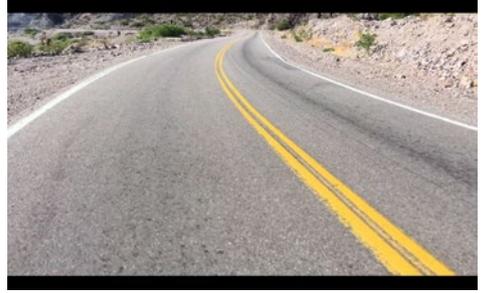
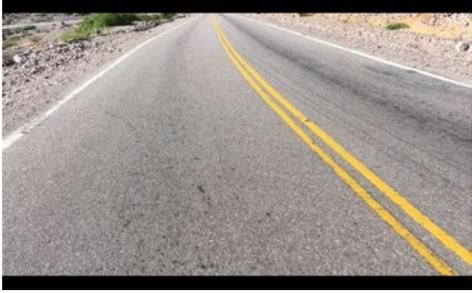
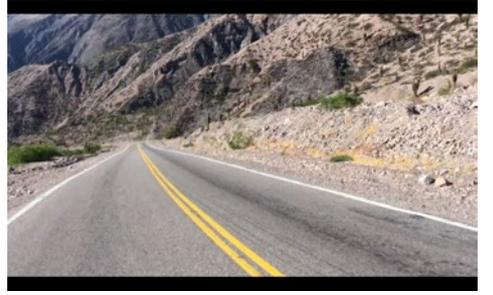
Conclusions

This chapter has sought to highlight the manifest lack of specific points of view as one of the most critical points which have been attributed to the

framework of planetary urbanization. By retracing the postcolonial, feminist and queer critiques addressed to it, I suggest that this research agenda would benefit from a non-telescopic perspective in order to explore the complexities and contradictions of an urbanizing world and to preserve its necessarily multiscalar gaze. At the same time, the geographies of extended urbanization make clear how a situated practice of ethnographic engagement founded upon notions of depth and long duration is physically impossible and conceptually inappropriate. I have hence attempted at constructing new grounds emerging from the dissatisfaction with both extremes of the current debate. This new ground might be shown by a practice of ethnographic engagement that does away with any pretension of thickness, instead embracing the possibilities offered by a thin, multi-site, mobile and relational observation of a geography of what happens across global networks of production. This experiment can be inscribed into wider attempts at shaking the certainties of ethnographic practice as much as their deployment goes beyond its traditional home of anthropological inquiry. While not strictly a domain of traditional commodity chain research in economic geography, these possibilities are nurtured by mutuating methods of juxtaposition and connection from a vibrant literature concerned with following things along object trails. As much as these methodological reflections emerge from the objective difficulties imposed by forms of extended urbanization, I think that the possibilities they show outweigh the limits they outline.

The next section puts this theoretical construct to work by unpacking three case studies encountered throughout the ‘lithium route.’ My analysis hence begins from the lithium-rich lagoons of Northwestern Argentina, which are the subject of the next chapter.





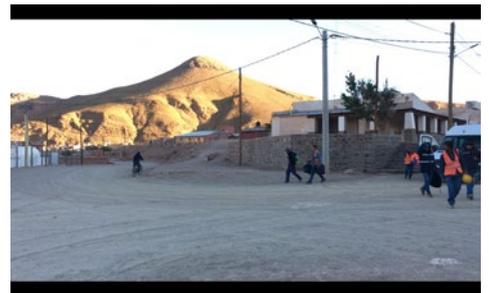




















Chapter 3

Exploring strategic coupling in the extractive periphery: the making of Jujuy's lithium economy

Introduction: resisting lithium extraction in Jujuy

“A nosotros tampoco no nos interesa JEMSE. No nos interesa el litio. No nos interesa la consulta. Por qué? Por qué nos violaron todo el derecho. Y ahora nosotros decimos: no. La palabra dice no. No al litio. [...] Nosotros no queremos nada. No. Eso tiene que respetar ahora. Esa es nuestra decisión. Y esa decisión la hemos tomada nosotros como asamblea. Y ustedes son parte del estado y así ustedes tienen que respetar nuestra decisión. Guste o no le guste. Y esta es nuestra decisión y la hemos tomada como comunidades.”

“We do not care about Jemse, we do not care about lithium, we do not care about being consulted. Why? Because they violated all of our rights. And so now we say: no. The assembly says no: no to lithium. [...] We do not want anything. No. This is what you have to respect now, this is our decision. This is the decision which we made as an assembly, and since you are part of the state you have to respect our decision. Like it or not. This is our decision and we have made it as a community.”⁵

Observed from large-scale satellite imagery, the earth-toned surface of the Atacama plateau appears frequently dyed by the white tints of saltpans and lagoons, their salty crust vividly reflecting the hard sunlight hitting these altitudes. Compared to neighboring Chile, the saline water bodies on the Argentinian side of

⁵ translation by the author.

the Andes are characterized by a generally smaller size and wider geographical distribution. While Chile's and Bolivia's huge reserves of lithium are concentrated in the Salar de Atacama and Salar de Uyuni respectively, much more distributed and diverse deposits fall under the Argentinian jurisdiction, scattered among the provinces of Jujuy, Salta and Catamarca. These geophysical configurations perhaps facilitate what has really become a mining bonanza: observed from a closer distance, the apparently pristine surfaces of the salt pans reveal a maze of geometric signs, a web of lines, dots and rectangular shapes—the marks of a contemporary quest for new resources, of a mining-oriented exploration in the making.

Through many resolute statements quoted in the opening of this chapter, an assembly of 30 Kolla communities inhabiting the Northwestern provinces of Argentina addressed Carlos Oehler, president of the Jujuy Energía y Minería del Estado (JEMSE) in February 2019. Their main demand is that the Guayatayoc lagoon and the Salinas Grandes basin, two of the most important water bodies of the Puna de Jujuy, be free of lithium exploration and mining. Like many other high-altitude water ecosystems in the region, the saltwater bodies and connected livelihoods that these indigenous communities are striving to defend are under pressure from the increasing rate of lithium extraction and exploration. As the global demand for lithium rises steadily, this growth has spatialized here into the acceleration of lithium-related exploration projects. Although the exploration sector in the area is incessantly transforming through company mergers, conflicting reports and unauthorized scouting activities and geological probes, Ruiz Peyré and Dorn (2020) list a total of 53 exploration and evaluation projects currently underway across the three provinces of Jujuy, Salta and Catamarca. In recent years, in fact, the Northwestern provinces of Argentina have become a hotspot in the global scramble to identify, secure and extract lithium resources (Fornillo 2015; Nacif 2015). Despite the entire Andean range of Argentina being historically dotted by extractive projects, the lithium boom is a relatively recent phenomenon in the Jujuy province, especially when compared to its immediate neighbours. Lithium mining has been ongoing in Chile's Salar de Atacama since 1984 and in the neighboring province of Catamarca since 1997 through the operations at the Salar de Hombre Muerto. The first mine in the Jujuy province, owned and run by Sales de Jujuy S.A. in the Olaroz basin, only became commercially operational in 2016, with an annual output of 6.896 tonnes (Orocobre 2017). The result of Sales de Jujuy entering the global lithium market has been quite impactful in terms of national output, since Argentinian exports have climbed to the fourth position in the global market for lithium products after 2016. Not only the operations in the Olaroz basin have influenced exports, but it has indirectly stimulated exploration activities in the quest for more resources and more profits: Argentina now ranks third in terms of known lithium reserves (USGS 2020), which means that much resource remains to be extracted and commercialized, much more than what is actually exploited. While lithium mining is certainly not the first extractive activity marking the landscape of the Argentinian Puna, its mineral exploitation dating back to pre-Hispanic times

(Lencina, Peralta, and Sosa-Gómez 2018), albeit obviously at a different intensity and scale. However the new lithium economy seems to be constructing a new resource frontier across these regions of the Argentinian Northwest, where the limits of exploration are pushed further both horizontally and vertically, to more remote valleys and at greater depths.

The apparently simple mathematics of resource localization certainly shed light upon the configuration of this new resource frontier: mining economies arise where mineral deposits lie. However, the daily geographies of this particular extractive zone appear to be heavily connected to the specific conditions of the territories they land upon: the quest for new and sustainable resources is advanced here hand in hand with enduring ideals of socioeconomic development that many wish for these territories, the very ‘backwardness’ of the province being one of the argumentative substrates upon which extraction-led development is advanced.

The insertion of territories into global production networks has been studied in economic geography through the concept of strategic coupling. In the context of urban and regional development, Yeung (2009) describes it as “the dynamic processes through which actors in cities and/or regions coordinate, mediate, and arbitrage strategic interests between local actors and their counterparts in the global economy” (213). Strategic coupling features centrally in the GPN framework, as it normally highlights the benefits that regions obtain when they accrue their participation into transnational supply chains, in a similar vein to the concept of economic upgrading which usually refers to firms (Werner 2019). Despite at least two decades of existence, the notion of strategic coupling is nowadays at the centre of vibrant intellectual activity within the GPN 2.0 agenda (Coe and Yeung 2019; Scholvin, Breul, and Diez 2019), mostly through the critical attention that it has received from a number of standpoints. In particular, the focus on the advantages gained by territories when inserted into global networks of production has come under increasing scrutiny through the argument that this exclusive focus risks concealing the constitutive dynamics of unevenness embedded into processes of strategic coupling. In MacKinnon’s (2013) view, the GPN literature depicts strategic coupling as a “balanced process” that, by omitting processes of devaluation, disinvestment and exclusion (Werner 2016) risks normalizing its developmental outcomes. More broadly, Phelps and coauthors (Phelps, Atienza, and Arias 2018) accuse the GPN paradigm of having forgotten its once strong political economic roots, a shift through which “the unevenness of development has receded from view” (5). Perhaps this has to be ascribed to the firm-centrism of recent GPN literature, which by emphasizing the meso-level of analysis prevents the framework from engaging with the “macro-scales questions of global inequality” (Werner 2019, 4). The language of strategic coupling, in sum, risks being an excessively smooth one which conceals the structural deficiencies, conflicts and contradictions that occur throughout the process. Taken together though, these critiques invite to explore the many ‘dark side(s)’ of economic geography in general (Phelps, Atienza, and Arias 2018) and of the process of strategic coupling in particular.

The relevance of this concept extends beyond its relevance in contemporary debates in economic geography and, in my case, emerges across the extractive economy blooming in the Atacama. Throughout my fieldwork across the region, both public and private subjects never failed to emphasize the advantages that the region would enjoy through the making of new landscapes of extraction directly tied into the emerging li-ion global production network. Strategic coupling, albeit through slightly different wording, has been a constant point of reference and an immovable assumption throughout the many conversations I engaged in across the Atacama. In the eyes of some actors involved, the process of strategically coupling the region and its resources to the global production network of lithium and li-ion batteries is a direct pathway towards bountiful visions of development and prosperity.

As exploration and extraction accelerate in the area, social scientists have begun to shed light upon the dynamics of territorial transformation swaying across the Atacama region. In Izquierdo and colleagues' (2018) view, the Argentinian dry puna "is currently undergoing land use changes that are poorly understood." Elsewhere they argue that, despite the promises of li-ion technology in the fight against global warming, the extraction of lithium might worsen the effects of this phenomenon at the local scale (Izquierdo et al. 2015). Beyond the climatic impacts, it is increasingly evident how, despite claims of cleanliness and sustainability, lithium mining generates as much tension as other more conventional forms of mining (Anlauf 2015; Marchegiani, Hellgren, and Gómez 2019), especially in relation to the significant presence of local indigenous communities (Gundermann and Göbel 2018). What these studies have not deeply explored is a specific appreciation of how the dynamics of global integration forcibly intersect with local and regional characteristics. In an effort to cross and traverse multiple scales of engagement, this is the attempt of this chapter. In order to more thoroughly understand the particular territorial configurations of global production networks (Breul, Revilla Diez, and Sambodo 2018) and their mutual constitution with the process of strategic coupling as it hits the ground, this chapter brings together a number of empirical questions emerging from Jujuy's unfolding lithium economy. As the opening scenes of this chapter briefly described, the unauthorized exploration of lithium resources in the Guayatayoc lagoon and Salinas Grandes basin is what the Kolla communities across the provinces of Jujuy and Salta are contesting to the local state and mining companies. The confrontation staged by their members through roadblocks and sit-ins might, at first sight, appear as a paradigmatic dynamic occurring in extractive peripheries when a new deposit is revealed and mined. Their experience is certainly replicated across thousands of resource peripheries across the globe, but for how common it might seem, it is illuminating of a few particular dynamics scoring the daily geographies of global resource peripheries. Like many other struggles, theirs brings into focus three main issues: land, labour and water.

This chapter is driven by the intention to understand more deeply how the flaunted procedure of strategically coupling the Andean territories of the Jujuy province to the global lithium market actually occurs on the ground. The first

section unpacks a GPN approach to extractive peripheries, drawing upon emerging research on the contemporary geographies of extraction, land grabs and enclave economies. I highlight how the language of strategic coupling might obliterate important (and critical) questions stemming from the extension and deepening of extractive frontiers and the consequent insertion of territories into global networks of production and trade. A second section illustrates this argument by turning to the particular lithium landscape of the Jujuy province, charting dynamics around three distinct but interrelated issues: land, labour and water. Firstly, the particular ordering of land property and use in Argentina and in the Jujuy province brings native people in a complex relation with both mining companies and the state. Secondly, the provision of salaried labour plays a crucial role within such relation, fostering visions of stability and development of unpredictable duration and hampering the material possibilities of resistance. Thirdly, the gains and opportunities of mining-led development, aggressively marketed through tropes of environmental sustainability, ultimately collide with pressing issues of water depletion and contamination. Conceptually speaking, this chapter seeks to contribute to the emerging GPN 2.0 agenda by critically enriching the concept of strategic coupling and associated sociospatial phenomena through an observation from the extraction zone. As MacKinnon (2013) contends, GPN research has historically derived its conceptual underpinnings from the industrial experience in the West and has only recently begun to engage with issues beyond that geographic and conceptual site. In a more empirical vein, this chapter offers evidence on the multiple forms of sociospatial and multi-species inequality produced by the strategic coupling of the region into the lithium GPN in order to counter the recurring tropes of sustainable development, fair and informed consultation and clean extraction which allow the advancement of extractivist territorialities in the region. In observing the notion of strategic coupling from these three vantage points, the chapter contributes to the ongoing reworking of the GPN framework in pursuit of its original goal: explaining uneven development in an interconnected world economy (Coe and Yeung 2019).

3.1 Strategic coupling in the extractive periphery

In a broad description of JEMSE—the entity specifically created in 2011 by the Province of Jujuy in order to shape and foster the extraction of lithium and other resources—its president Carlos Oehler speaks of the importance of better tying the province’s reserves into the global commodity chain of li-ion batteries⁶. In particular, his and his colleagues’ work at JEMSE is admittedly aimed at aggregating economic value to an otherwise scarcely profitable, export-oriented activity as mining usually is. The provincial administration—of which JEMSE is the direct operational arm in this sector—pursues this goal through a variety of strategies: binding every lithium project in its jurisdiction to formally include

⁶ San Salvador de Jujuy, November 14, 2018

JEMSE as a partner, ostensibly gaining more control over resources and royalties from their exploitation; by establishing a research centre where chemical engineers experiment with new ways of lithium extraction and battery designs; and by forging partnerships with small-scale battery manufacturers both nationally and internationally. These actions point to expanding the provinces' gains from the booming lithium market and, most importantly, rest upon the assumption that the gains received from this tighter integration into the commodity chain of lithium will yield better living conditions for its inhabitants.

Yeung's (2009) original conceptualization denotes strategic coupling as "the interface mechanism between TNCs and cities/regions." This concept emerges then as an analytical lens that is primarily concerned with understanding the role of transnational corporations in dynamics of urban and regional development. In this sense, strategic coupling seems productive gaze into the processes that converge into making landscapes of extraction, largely dominated as they are by transnational capital and corporations. In the case of Jujuy, the province appears to be unable to fund and develop its own mining apparatus, so its range of action is fundamentally limited to bargaining better conditions in the interaction with the TNCs that effectively operationalize the extraction, handling and commercialization of its natural resources. Despite its apparent aptness, however, the conceptual deployment of strategic coupling in extractive peripheries has remained rather limited, and its applicability in this context has actually been quite debated. This section discusses the conceptual leads and heuristic possibilities that emerge when looking at extractive territories through the lens of strategic coupling.

This concept is currently at the centre of wide-ranging empirical and conceptual explorations within a debate that has been termed 'GPN 2.0' by its own initiators (Coe and Yeung 2015). What is meant with such a definition is a second wave of research seeking to advance the original GPN debate (see chapter 1), explaining regional development patterns through the incorporation of their assets into (inter)national global networks of production via the process of strategic coupling, intended as the key concept that delimits the different ways in which regional and national economies intersect with global production networks. Coe and Yeung (2019) locate two major innovations that have characterized this idea in its most advanced developments:

For over a decade now, GPN research has productively used the key concept of *strategic coupling* to delimit the different ways in which regional and national economies intersect with global production networks. GPN 2.0 sought to enhance such work by parsing different *modes* (e.g. indigenous, functional and structural coupling) and *types* (e.g. innovation hubs, logistics hubs, assembly platforms, etc.) of strategic coupling which reflect how certain kinds of value capture trajectories and couplings often come to dominate at the regional level. (780)

Coe and Yeung are equally explicit in underlining how strategic coupling is a "dynamic formulation" (2019, 781), an incessant process of coupling, decoupling and recoupling: from a conceptual point of view, the role of time in the analysis of the development patterns associated with mining-led development patterns is

fundamental given the generally susceptible nature of these economies (Barratt and Ellem 2019). Following such dynamic nature of couplings, it is important to understand how instances of coupling, decoupling and recoupling incessantly transform certain economic landscapes. The outcome of these variegated economic processes produces equally variegated outcomes, as harnessing territories to global networks of production drives both positive and negative developmental outcomes (MacKinnon 2012; Coe and Yeung 2015). A third element of variation that can be registered in this literature is the nature of the actors involved in the temporary coalitions that materially constitute couplings and decouplings: this perspective grants possibilities for including more variegated actors than just firms—the traditional locus of analysis of GPN-informed research. This has brought to the fore the crucial role of public bodies in performing these couplings, with a focus on the extensive work of the local state in terms of infrastructure, labor and urbanization economies (Gao et al. 2017), on the tight cooperation between private developers and central government agencies (Indraprahasta, Derudder, and Hudalah 2019) and on the institutional underpinnings of strategic coupling (Dawley, MacKinnon, and Pollock 2019). If in general these temporary coalitions cannot be unpacked without carefully observing the multiple actors that originate them (Dawley, MacKinnon, and Pollock 2019), this is particularly tied to mining economies where the different layers of sovereignty, scale and economic capacity produced complex institutional landscapes which almost always bring public and private actors tightly together. Finally, the very fact that resources are seldom consumed on site, but are instead “made” in relation to the needs and capacities of distant elsewhere makes the transcalar perspective of strategic coupling an essential lens to understand the making of resource economies and landscapes.

These premises seem to grant some conceptual cues to approaching resource peripheries through the lens of strategic coupling, however this question remains widely debated in the field. More than a decade ago, Gavin Bridge’s work (2008) has been pioneering a GPN approach to extractive industries and their problematic connection with patterns of regional development. In his view, a GPN approach to extractive-based regional development allows for moving beyond a static debate that observes resource-based economies primarily at the national scale, that is through the much popular ‘resource curse thesis.’ Instead, a GPN-informed perspective on resource economies highlights their existence in “a relational production network made up of multiple firms, states and other actors” (411). By locating the complex and changing interactions between different actors squarely at the centre of the analysis, such approach helps moving beyond analyses that attribute poor regional development outcomes in extractive-based economies to the ‘failed state.’ Instead, a network-based analysis as the GPN framework observes complex actor networks where the state is fully enmeshed with other institutional entities such as transnational and local enterprises and public and private organizations. As a result, Bridge concludes that the GPN perspective emerges as “a tool for understanding the complex linkages between the organization of production in an extractive industry and its implications for

regional development” (415). If Bridge’s verdict was positive with respect to the possibility of understanding extractive economies through a GPN framework, others have sought to underline the limits of such an approach by considering the problems surrounding the idea of strategic coupling, one of its staple concepts. In Vicol and colleagues’ view (2019), the concept’s origins in the manufacturing and service experience of the West and East Asian economies foreshadow concerns around its applicability to patterns of rural development in the Global South. In deliberately testing the limit of GPN 2.0 by observing rural development in smallholder-led economies, they conclude that more attention should be deserved to how strategic coupling actually occurs beyond the actions of the lead firm, but in the livelihoods encountered on the ground. Vicol and colleagues’ contribution speaks from the perspective of agricultural workers in the Global South, yet their points provide useful indications for approaching extractive economies from the ground. Their concerns around the dynamics of strategic coupling beyond industrial and service economies are shared by MacKinnon (2013), for whom the apparently “balanced process of strategic coupling depicted in the GPN literature” (306) results contradictory when observed from resource peripheries, his core argument being that the encounter of mining capital with regional actors in the Pilbara is more akin to “an unbalanced form of structural coupling” (306). MacKinnon has elsewhere suggested that the very notion of strategic coupling is unusable in the context of extractive territories and should rather be superseded, drawing instead attention to coupling, recoupling and decoupling processes that take place between regions and GPNs from the perspective of evolutionary economic geography (MacKinnon 2012). Taken together, the views expressed by these authors deem strategic coupling as an unsuitable language for assessing regional development outcomes in extractive-based economies. Despite the potentially misleading language of strategic coupling underlined in their work, its wide employment by the powerful actors seeking to plug the lithium resources of the Atacama into the li-ion commodity chain should have us reflecting on the analytical and political drawbacks of refusing this terminology. Perhaps, it is true the opposite: only by maintaining this analytical horizon and sharing the language that I encountered on the field I can unpack its inherent ‘dark sides’ (Phelps, Atienza, and Arias 2018).

These analytical problems, in my view, pertain to more general questions currently debated within GPN studies. As Marion Werner has recently underlined in multiple occasions (2016, 2019) GPN research seems to have lost its critical edge, privileging an analysis of the benefits originating from regional participation into global networks of production over one that considers uneven development more centrally. Coe and Yeung (2019) have responded to these critiques by defending the critical dimension of the GPN framework in general, and of strategic coupling in particular. Their central argument is that GPN theory is a “*necessary* but not sufficient tool for understanding uneven development in the global economy” (793) and “is not intended to explain all dimensions of capitalist dynamics, let alone the multifarious outcomes of global capitalism” (792), their preoccupation being that the boundaries of this framework might be

‘overstretched’ (782). Perhaps the lights and shadows that surface by observing resource landscapes through the concept of strategic coupling can contribute to reformulating the vocabulary and enriching the critical toolkit of GPN theory in particular, and of economic geography in general. Tracing the uneven contours of the global economy, as Breul, Revilla Diez and Sambodo (2018) conclude, is perhaps a matter of being more sensitively oriented to the particular territorial configurations of global networks of production.

The following section considers these conceptual markers while focusing upon the specific and uneven territorial articulations yielded by the effort of harnessing the advantages deriving from the global lithium boom in the territories of the Puna de Jujuy. It explores the making of Jujuy’s first lithium mine, established in the Olaroz basin in 2015, in order to describe the spatial, social and environmental ‘dark sides’ that emerge throughout the apparently smooth process of strategically coupling the Jujuy province to the global circuits of the expanding lithium economy.

3.2 Making Jujuy’s lithium economy in the Olaroz basin

In order to understand the tensions and contradictions that crisscross the making of Jujuy’s lithium economy—epitomized by the material gatherings and vocal contestations that marked the opening of this chapter—we have to travel further along the Ruta Nacional 52. Passing the settlement of Susques and entering the highest sections of the plateau, a few tens of kilometres before the border with Chile at the Jama pass, lies the Olaroz basin. Here the first operational lithium mine in the province began industrial production in 2015. Located at the centre of the lithium boom in the province, the operation at the Salar de Olaroz has been the first industrial-scale mine and chemical plant in the province. Its lithium carbonate production, rising to more than 12,000 tonnes of lithium carbonate in 2018 (Orocobre 2018), has had generated a sharp rise in national export figures of lithium carbonate, giving a sense of its sheer scale within the national context. As of 2017, the Olaroz operation came to produce nearly a third of Argentina’s national export.

The operation at Olaroz is run by Sales de Jujuy S.A., an Argentinian company resulting from a joint venture by the Australian mining firm Orocobre, the Japanese automotive Toyota Tsuho Corporation and a private company of the Provincial State of Jujuy, named Jujuy Energía y Minería del Estado (JEMSE) (fig.). More specifically, Orocobre and Toyota converge into a holding company named Sales de Jujuy Pte Ltd, based in Singapore, where the latter acts as the exclusive sales agent. This holding company and JEMSE converge into the project company of Sales de Jujuy S.A., with JEMSE holding 8.5% of shares and the holding company formed by Orocobre and Toyota owning the remaining 91.5%. JEMSE is clearly a minority shareholder in the project company. Sales de Jujuy’s company structure ultimately derives from the combination of global

capital, in the form of players in the automobile industry and transnational mining, and local actors, in the form of a publicly owned provincial energy and mining company.

Orocobre, as the leading actor shaping Sales de Jujuy, can be taken as paradigmatic of the mining frenzy currently unfolding in the province. Not only the company runs the first operational lithium mine in Jujuy, but holds a diversified presence on the Puna plateau, its operations scattered across a range of activities through holdings in different companies. Orocobre holds a 33,5% investment in Advantage Lithium, a 100% owned subsidiary for the production of boron (Borax Argentina S.A) and an 85% share in a resource exploration company (South American Salars SA) (Orocobre 2018). A visual inspection of Jujuy's mining cadastre shows the abundant surface of Orocobre's total mining claims in the province (insert fig.). By and large, the diversity of these operations render the complexity of a single company's presence in this extractive frontier and captures the dynamism of a mining economy in the making. This leads me to a methodological disclaimer: getting hold of Jujuy's blossoming lithium economy in its full unravelling is nothing short of complicated. With exploration constantly increasing in the province, new claims made and projects foreseen once every few months, capturing the dynamics of transformation in their occurrence is further hindered by the generally opaque governance of mining in the area and the highly speculative dimension characterizing extractive economies in general (Tsing 2000). Mining companies, in fact, tend to use press releases and other public communications in a highly speculative manner with the purpose of attracting both relevance and financial credit. While these companies' communicational apparatus is hardly a reliable source of information and its constant focus on the present time a potentially misleading one, in the next sections I focus upon a larger timescale. Instead of tracing a complete panorama of Jujuy's lithium frenzy, I consider the dynamics that have marked the emergence of the Olaroz lithium operation across multiple years, attempting to observe the making of this lithium economy—and associated sociospatial phenomena—from this site.

Sales de Jujuy shipped its first commercial dispatch in April 2015 (Orocobre 2017), yet dispatching the first container required more than seven years of work on and off site. As recounted by another company official, this time from the Chilean SQM mining company⁷, a lithium mining operation typically begins with a preliminary exploration phase, where a team of geologists perform the characterization of the resource. Generally speaking, this involves negotiations with public authorities and local communities—although indigenous leaders and international organizations often report illegal exploration activities involving the drilling of sample minerals from the underground. As one of my interlocutors in San Salvador⁸ pointed out, these landscapes are so wide and loosely controlled that flying in, drilling a hole and shipping the minerals to a European or North

⁷ Santiago de Chile, November 9, 2018

⁸ San Salvador de Jujuy, November 16, 2018

American laboratory is easily done. Returning to the legal workflow, a second phase involves the refining of these primary results.

As soon as the resource is confirmed for being profitable enough due to its overall dimension and chemical composition (in terms of purity and concentration), an external company begins the groundwork. Evaporation ponds, the most iconic spatial feature of lithium extraction from brine, are designed to second the particular topographies, orientation and overall climatic conditions of the site. As soon as the first pond is excavated, the wells are ready and the taps are open: lithium brine begins to fill the shallow pond to begin its progressive cycle of evaporation and purification, a cycle which lasts an average of 18 months. Given this somewhat long time constraint, each pond is immediately filled as it is completed. The different colour hues characterising each group of ponds signals the different phases of brine concentration, where unprofitable salts (sodium chloride, potassium chloride and magnesium chloride) are progressively excluded through crystallization and the desired 6% of lithium concentration is reached. Intuitively, such evaporative process is highly dependent upon climatic conditions. Because it involves just wind and sun, both of which are free sources of energy, it is comparatively cheap compared to mining from hard rock sources such as Australian spodumene. Yet, it can also be easily hampered by unusual atmospheric events such as repeatedly overcast skies and abundant rainfall, which contribute to the slowing of the evaporation rate and to the dilution of the resource. In parallel to the ponds, companies typically build at least some processing facilities on site. Certain companies, like Argentina's most dated operation in the Salar de Hombre Muerto, directly process the entire mine output at site. Others, such as both SQM and Albermarle in Chile's Salar de Atacama, transport the concentrated brine to a chemical plant elsewhere. Both models present different comparative advantages but rather pertain to the regional topographic, infrastructural and industrial conformations of each mining operation.

In his analysis of the SQM operations in the Salar de Atacama, this official alludes to but forgets to describe in detail how the making of a mining operation is neither a self-contained endeavour nor a completely transnational effort. Beyond the mined resource, other both local and regional, material and immaterial resources ought to be exploited in order to mine the desired resource. The following three sections describe the dynamics of sociospatial reordering associated to the making of Sales de Jujuy's Olaroz facility. Taken together, these offer an account of the specific territorial dynamics that instantiate the process of strategic coupling in extractive peripheries along the three interrelated axes of land, labour and water resources.

3.3 Land, labour and water in the process of strategic coupling

Land

I am traveling with a group of mining engineers on a white pickup to the Jama salar. Crossing the desert plateau one of them asks: "How can people live off of this desert? What do they eat? There is nothing here!" Despite its apparent transparency, the desert conceals its own riches, and this is what has brought generations of explorers and miners (the two are often tied together) to these remote landscapes. The industrial engineer who is driving the pickup says that his team is engaged in a number of field tests for a new extraction method. The apparent flatness and openness of this desert plateau conceals its complexity. My mind goes to a conversation with a public official in the planning department, who was showing me the vast infrastructural plans and property disputes that mark these sandy grounds. Invisible lines shifting in the dry sand, evoking a mutating geography made of land acquisitions, land reorderings and border displacements.⁹

Since mineral resources are found under the ground, one fundamental question in mining economies in general is that of land regimes. In Argentina, Fornillo and colleagues (2015) explain, the property and management of natural resources is articulated at different scales and competes to different public bodies. Article 124 of the Argentinian constitution establishes that provinces own the original domain of the resources comprised in their territories. This has led to each province constructing different legal parameters and operational strategies in order to exploit such resources. The national Mining Code, however, while recognizing such "original domain," prevents provinces from exploring and profiting from the natural resources within their jurisdiction, a right which is instead granted to private actors. The Code establishes a difference in surface and subsurface property, where the latter is only granted to the discoverer of the resource upon concession by the state. Fornillo and colleagues, in their extensive study on the emerging geopolitics of lithium in Argentina (2015, 101) conclude that "the body of laws that regulates mining is distinctive in that it enables the provinces to implement - under their particular legislation - the mechanism for granting search permits and launching explorations"¹⁰, a mechanism which they see as favouring large-scale transnational mining firms. The provincial state, nonetheless, emerges as a fundamental link existing between the underground resource and the subjects who are allowed to exploit it, as that pivoting mechanisms which actually enables a process of strategic coupling. Returning to

⁹ Ethnographic diary extract, November 21, 2018

¹⁰ translation by the author.

the Olaroz facility, both the particular institutional configuration of Sales de Jujuy and the mining jurisdiction of Argentina invite to understand how and why transnational mining firms need to partner not only with local but de facto public companies in the making of the extractive landscape of the Atacama.

Among the different strategies deployed in every Argentine province, Jujuy has adapted the national legal framework to its own conditions. On paper, the approach in the area is centred upon maximizing public participation in the extractive business, with the dual objective of both developing further the natural resource sector and increasing the amount of royalties that the state receives from those activities. This goal, as mentioned before, has been pursued through the constitution of JEMSE, established by provincial decree in 2011 and a compulsory collaborator in each new lithium operation within the province.

As highlighted by its statute, the existence of JEMSE is motivated by the appearance of large mining projects in Argentina, with the function of managing the exploration, exploitation, industrialization and commercialization of mineral resources, hydrocarbons and renewable energy sources. In addition to advancing the extractive and logistics sectors in Jujuy, JEMSE plans to do so while capturing more value from these activities. For example, its president Carlos Oehler¹¹ estimates that the royalties deriving from lithium mining would jump from a mere 1,2% to a much higher 8,5%—established in the form of shareholder participation in every lithium operation within the province. This is described by Oehler as a strategy to increase the revenues obtained by the province from mining activities in an effort to curb the economic loss that comes from an exclusively export-oriented industry. JEMSE, in his view, should be read as part of a wider strategy by public actors in the region to capture more value from the resources within their jurisdiction, a strategy which is visible in the unprecedented wave of lithium-related laws that the province has produced since 2011 and is seen as a response to the classic problem of resource theft. Lithium, within this view, has been declared a strategic mineral in the province, with the effect of submitting every lithium exploration and exploitation project to a previous study conducted by a Comité de Expertos para el Análisis Integral de Proyectos de Litio, coordinated by the provincial Ministry of Production (Fornillo 2015, 73). Moreover, the province established a scientific and technological pole in the capital, named CIDMEJu and based at the National University of Jujuy, with the explicit purpose of prospecting vertical integration in the region beyond the mere extraction of resources. JEMSE, as an operational subject, is paradigmatic of the provincial state's strong public policy towards the exploitation of lithium resources.

The role of JEMSE in the Olaroz mine, however, is far from unambiguous. Firstly, on paper and in public discourse, State participation in the lithium boom is publicized as a strategy to increase local benefits through higher royalties. These royalties, however, appear to be quite unsubstantial, since they are earned by JEMSE in the form of a preferential buying line of lithium products mined in the Olaroz basin. These in fact would produce tangible value in a vision of industrial

¹¹ San Salvador de Jujuy, November 14, 2018

development in the region, where local actors would be capable of manufacturing batteries and electric vehicles, effectively aggregating economic value to the extractive activity. The province was, at the moment of writing, still developing plans in this direction through the establishment of CIDMEJu and joint partnerships with both national and international battery manufactures, and many local actors encountered in the field spoke vividly about this strategy. This vision of local industrial development, however, has produced little tangible outcomes on the ground and seems difficult to implement given the market structure of the battery sector, dominated by a handful of transnational companies. Hence, the more substantial royalties advocated for by JEMSE have remained within the sphere of marketing.

When attempting to understand the different motivations circa the position of JEMSE within the lithium mining coalitions that are being established in the province of Jujuy, another aspect of this institution seems relevant. An often overlooked aspect, but one that Oehler briefly remarks in our conversation¹², is that JEMSE detains land rights. Among its other powers, the company has the exclusive right to acquire mining leases that are declared expired—such as, for example, past boron mines now deemed unprofitable but which might contain very cost-effective lithium concentrations. JEMSE appears then to function as a sort of ‘land leverage,’ a private-public tool capable of bringing devalued resources back into the market by assigning mining leases to those who discover a profitable resource and have the means to mine it.

Generally, the active participation of the local state in the mining business must not be regarded as a unique feature of this particular landscape but—as Marchegiani and colleagues (2019) observe—this participation is a deeply contradictory position. On the one hand, the local mining secretariat is the political entity responsible for the safeguarding of local communities and environmental protection. On the other, it heavily promotes the expansion of extractive industries, through marketing means, by acquiring land and granting permissions. Ultimately, it directly profits from extractive operations through its own private company, albeit still in a speculative way.

In the case of Jujuy, the local state and its private company are a central element in the formation of extractive landscapes in the Puna plateau. Its role appears to be more fundamentally tied to its ability to acquire decayed mining rights rather than to the increased royalties often trumpeted in public appearances of its members and official documents. The state, however, is not the only subject owning land rights on the plateau, as the indigenous and tribal peoples’ jurisdiction also constitutes an influential aspect—and often a problematic one. The next paragraph focuses on the strategies that are employed by the firm-state complex to acquire and secure permission from the indigenous and campesino communities inhabiting the plateau. These attempts are often performed through a sinister and hardly traceable cocktail of explicit forms of violence, bribing,

¹² San Salvador de Jujuy, November 14, 2018

intimidation and more subtle forms of persuasion. The most effective of these appears to be the provision of salaried labour.

Labour

On paper, the indigenous communities of the Argentinian Puna are endowed with certain land rights which sometimes come into play, sometimes into collision with the unfolding of the lithium economy on the plateau. In particular, the Argentinian constitutional reform of 1994 has incorporated the ILO convention n°169, also known as the Indigenous and Tribal Peoples Convention. The origin and subsequent development of any mining project insisting upon land which is collectively managed by legally recognized communities holding these rights is bound to a prior and informed consultation and following approval by such communities.

The violation of the rights established by the convention n°169 has been a subject of conversation with all of the individuals and groups living on the plateau whose lives have been negatively affected by mining. On the one hand, individuals and organizations from the Salinas Grandes and Olaroz basin denounce the outright violation of these rights, making of this violation one of their flagship arguments in the effort to publicize the impact the global lithium boom has had on their livelihoods. On the other hand, mining companies are known to achieve the communities' approval by more or less subtle, more or less coercive means. Imported construction materials can be found here and there around the streets of Susques and nearby communities, with members of local collectives reporting donations of aluminum roofing sheets and concrete construction blocks, offered to the local inhabitants in exchange for a position of endorsement in the local assembly. Some of the most influential people in the local communities have been offered cash, motorbikes or a pickup truck in a barter for their vote¹³. Speaking of nearby Chile, Arboleda (2020) reports episodes that trespass practices of corruption and bribing and instead burst into outright violence, with the deployment of paramilitary militias and gangs for acts of intimidation, kidnapping and murder directed at groups and individuals who oppose the expansion of mining in their territory. Reports of these episodes can also be easily found on popular social media platforms. Throughout my travels across the Argentinian Puna I have heard of widespread corruption, but have never personally been exposed to such explicit episodes of violence. However this does not mean that such violence does not exist there, nor that more subtle forms of pressure are structural in the formation of that mining economy.

When darkness falls in Susques, the main dirt road becomes filled, engine noise, reflective strips and orange work suits, pickup trucks and minibuses. Thinking about it there are only a few men in Susques throughout the day. After sunset, some

¹³ Susques, November 28, 2018

retreat to their homes, yet many go back to their dormitories or can be found eating dinner in the Comedor Nachito facing the state road. As some of these workers told me over a bowl of rice and vegetables, their work schemes rely on a 7-day work and 7-day rest schemes, commonly defined as FIFO (Fly In, Fly Out). [...] There's a corner in front of my accommodation where people profit from a publicly available Wi-Fi network. Other of the few encounters that can be made in a small frontier village like Susques and its frosty desert nights include other migrant workers, found capturing Wi-Fi signals, streaming cumbia and passing along a cup of mate, originally from other regions of Argentina and neighboring Paraguay.¹⁴

While members of the local communities compactly speak of the violation of their rights by mining enterprises, representatives of the mining industry are equally compact in their own mantra, that is the provision of labour to members of the local community. Across my encounters, this has been a pervasive narrative emphasized whenever possible, a foundational pillar in their vision of regional development in the province in general and in the Puna in particular. To this respect, it must be made clear that neither representatives from Orocobre¹⁵ nor from JEMSE¹⁶ were able to discuss their claims through figures, their narrative remaining on an entirely discursive level. Firstly, they have not been able to discuss the effective rate of members of the local community on the total workforce at the mine. While there certainly are local employees, I have met many FIFO¹⁷ workers from other neighbouring provinces. Secondly, none of them were able to estimate the duration of such jobs. As a comrade recalling his father's experience as an ex boron miner who lost his job due to increasing mechanization reminds me, the duration of a job in the mining industry is always inscrutable, subject as it is to resource availability, to fluctuations in the global trade market and to the technological advancements in the industry¹⁸. Thirdly, none of them has been able to present and discuss figures on the profile and overall quality of these positions, while making general claims about courses of professional training that the company had offered to these workers.

Lastly, it is evident how these territories are inhabited by the least wealthy sectors of the province's population, mostly relying upon a subsistence economy which has itself been damaged by extractive activities. In this sense, a clear asymmetry is visible in the negotiation between companies and members of the local community, between the prospects of a regular salary and the unwillingness to allow the further expansion of a dubiously healthy activity. One question

¹⁴ Ethnographic diary extract, November 26, 2018

¹⁵ San Salvador de Jujuy, November 20, 2018

¹⁶ San Salvador de Jujuy, November 14, 2018

¹⁷ Fly In Fly Out. A common practice in the mining industry, where workers are asked to work across blocks of multiple days and then enjoy their rest time at their often distant homes. The duration of such schemes varies between companies and even within a single company.

¹⁸ San Miguel de Los Colorados, November 24, 2018

remains unanswered throughout these interrelated phenomena, as a fair and redistributive land use would not, in normal conditions, pit the provision of labour against the concession of land rights. The interference between the two has to be found in the processes of environmental degradation that presumably underpin the extraction of lithium despite its heavy marketing as a practice of ‘clean extraction.’

Water

Since an early Washington Post article (Frankel and Whoriskey 2016), lithium and its extractive practices have increasingly attracted public attention due to their intensive use of freshwater resources. Lithium carbonate, in the Argentinian Puna, is produced by extracting lithium-rich brine from underground water bodies. This feature should be understood as specific of, but not limited to, the lithium resources found in the South American continent: the resource can be extracted with very few means, letting the resource-rich brine evaporate en plein air through the intensive action of the sun and the dry winds. The high altitude and low humidity of these territories make this process less capital intensive than hard-rock mining, with a resulting process of extraction that is relatively cheaper compared to other forms of obtaining this metal.

At first sight, extracting such volumes of underground water in order to let it evaporate into the atmosphere presents a striking contrast with the evident water scarcity that characterizes the environmental conditions of the plateau. The Dry Puna biogeographical region is characterized by extremely low levels of annual precipitation: a rapid data extraction from the two closest pluviometric stations to the lithium mines show approximately 300mm of rainfall in Abra Pampa and less than 100mm in Hornillos for the year 2018.

Beyond managing tensions with local communities in order to achieve their cooperation, as we have seen, Orocobre is wary of the increasing public scrutiny that its water consumption practices have attracted. In order to respond to potential critiques, Orocobre has begun estimating a measure of water intensity in its Sustainability Reports. This index calculated as the amount of extracted groundwater per ton of produced LCE (Lithium Carbonate Equivalent). This measure has been floating around 50m³ per ton between 2016 and 2017 (Orocobre 2019). Beyond this measure of water intensity, the critiques moved to the water intensity of lithium extraction are substantially addressed by Orocobre in two ways: first, the company foregrounds a distinction between the brine extracted from the underground and what they define as ‘industrial water,’ described as already polluted water that cannot be employed for agriculture or grazing. Second, the company seeks to “debunk the myth” of water overconsumption by examining the position of their wells into the WRI’s AQUEDUCT Water Stress Risk Map (Orocobre 2019), concluding that their extractive practices do not pose additional harm to the problem of water scarcity.

The indiscriminate consumption of water is, in sum, fundamentally denied by the company in particular, and by the lithium mining coalition in particular.

If press articles are progressively intensifying their reporting activity on the topic, these dynamics seem to be clear to certain portions of the local population. As a day-long meeting with affected communities¹⁹ and an encounter with an indigenous leader of the Colectivo Apacheta²⁰ recounts, activists in the area contest that, beyond the narrative offered by the local state and mining companies, a fair a regulated use of freshwater resources is not implemented on the plateau. Their claim is that underground water is an extremely precious resource in a desert climate with very low average precipitation. As the cacti and shrubs grow pointed leaves to collect humidity from the atmosphere, people too have adapted to a dry climate through a number of careful techniques, such as excavating channels and wells for preserving freshwater from the intense action of the sun. “Water wants to do two things”—as the saying goes—“to travel downwards and to escape towards the sun as fast as possible.”

Beyond the sustenance of indigenous and campesino livelihoods, underground water functions as an important factor supporting plant and animal life on the plateau. Izquierdo and colleagues (2015) note how since lithium is extracted from the wetlands that contribute a significant proportion of primary productivity, maintain vertebrate populations, and regulate hydrological resources, its growing extraction risks heavily affecting biodiversity in local ecosystems. Brine desiccation to obtain lithium, in fact, causes a decrease of the base level of groundwater in the basin, thus reducing fresh water outside the edges of the salt flats, affecting the functioning of lakes and associated peatbogs (Gallardo 2011), which are themselves fundamental hotspots for the flourishing of plant and animal life.

Orocobre’s defense is readily challenged by the collectives’ views on the problems. Firstly, they describe how both Orocobre’s water consumption index and the placement of their wells within the WRI map fail to implement the holistic approach to the question that the local communities are aware of, declining to observe the effects of their practices beyond the immediate premises of the mine. Secondly, the exact localization of freshwater wells in the complex hydrogeology of the salar is still relatively unknown, as freshwater resources are intermingled with saline water bodies in a way that is still not understood in a systematic way. This makes Orocobre’s distinction between ‘industrial water’ and freshwater ambiguous and potentially inexact. In the collectives’ view however, not only there are problems of water consumption, as the company reports highlight, but also others concerning its contamination. The first is not only connected to a problem of quantity, but also to one of temporality. Members of the collectives explain take the case of the Olaroz basin, describing how before the establishment of Sales de Jujuy, the site had been employed for the extraction of borates. Borates are collected through dry surface operations, much like classical salt

¹⁹ San Miguel de Los Colorados, November 24, 2018

²⁰ Susques, November 28, 2018

extraction as the one occurring in the neighbouring basin of Salinas Grandes, now a popular tourist destination. The extraction of borates, they recall, had been practiced by local inhabitants on a seasonal basis: the cosecha de boratos had been traditionally carried out from May to November, during the dry season, allowing the aquifer to recharge during the rainy season. The second problem, that of water contamination, is reflected in two particular sceneries. First, discarded materials such as potassium, magnesium, sodium are left on site in huge stockpiles, the wind carrying them to unknown distances with unknown effect. Secondly, they denounce opaque practices with respect to the management of the discarded materials resulting from the chemical processes of lithium carbonate production.

Ultimately, Orocobre's—and by extension the vision proposed by the lithium mining coalition on issues of environmental degradation—is in clear contrast with local and indigenous visions on the subject. The environmental degradation brought about by the indiscriminate exploitation of precious water sources likely furthers the economic and political marginalization of rural and indigenous livelihoods depending from local environmental conditions. This is particularly striking when compared to the discourse of clean extraction that has been publicly constructed around lithium resources.

Conclusions

When observed from the lithium-rich landscapes of the Puna de Jujuy, the apparently smooth language of strategic coupling spoken both by scholars of the GPN literature and by powerful economic actors on the ground presents much more contradictory effects than it might suggest on paper. By examining a selection of interrelated directions of territorial transformation emerging in association with the Olaroz lithium facility, this chapter has described how local inequalities in state participation, land use and freshwater access hamper the making of an extractive landscape which is otherwise presented as a win-win scenario for all. Coupling the resources in Jujuy to the global commodity chain of lithium is performed through complex institutional arrangements, where public bodies act in cooperation with transnational mining and manufacturing capital. By describing the role of JEMSE, I suggest that the role of public bodies across these landscapes is that of granting access to land and resources, rather than redistributing the captured value and promoting and obtaining fair social and environmental outcomes. Secondly, the chapter has described how, on paper, local communities are endowed with the right of being previously and transparently informed and that every form of extractive land use within their jurisdiction be submitted to their approval. By examining the provision of salaried labour in the mine, I have sought to describe how this negotiation, while seeming equal on paper, is fundamentally imbalanced. Thirdly, a last section examines issues of freshwater overconsumption and contamination. Despite being heavily marketed as 'clean' forms of extraction, the practices of Sales de Jujuy raise significant

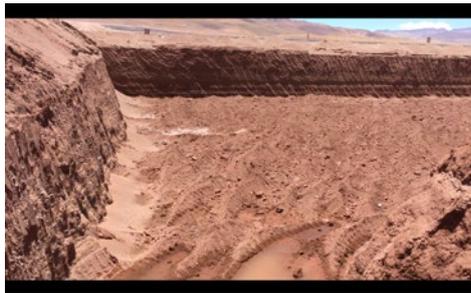
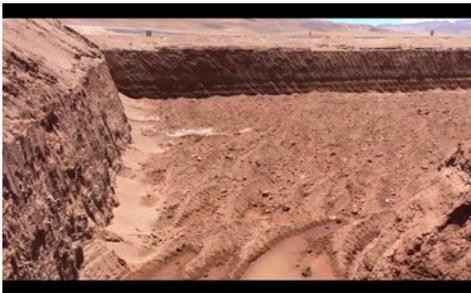
concerns with respect to environmental protection when observed from the perspective of those who inhabit those territories.

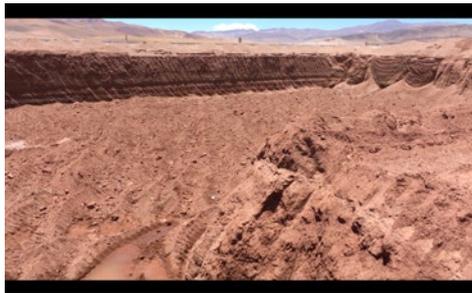
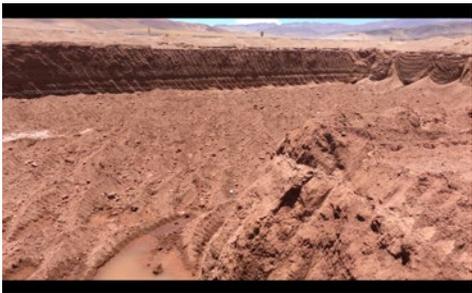
Taken together, these vectors of territorial transformation attempt at narrating the making of an extractive landscape from a grounded point of view. In particular, they show the complex interactions between several actors that constitute the making of strategic coupling, while raising important concerns with respect to the true recipients of the *strategic* of such couplings. Given that the conceptual and empirical roots of GPN theory in general and of the concept of strategic coupling in particular are deeply embedded in the economic experience of the West of the late 20th and early 21st century, perhaps observing the concept from the perspective of the extractive periphery can contribute to the project of observing economic geography from the South in the effort to rethink its basic categories and to explore its ‘dark sides’ (Phelps, Atienza, and Arias 2018) This argument should be understood in terms of advancement and not correction, given its potential relevance in pursuing the historical goal of GPN research: explaining uneven development in an interconnected world economy (Coe and Yeung 2019). In my view, this does not imply ‘overstretching’ the GPN framework (Coe and Yeung 2019), a framework which, as this chapter hopefully affords, is perfectly apt to locating and critiquing global inequalities in local situations.

Not only, however, the mere localization of lithium deposits makes these landscapes a global hotspot for the mining of this precious mineral. The Argentinian Puna is, in fact, a territory that receives a very high average solar radiation, due to its particular physical geography: low humidity rates, high average altitude and no tree cover. As noted above, it is the free energy of the sun that makes lithium extraction so cheap in these territories. The strong action of the sun here, however, foreshadows another yet more subtle form of extraction. The Puna de Jujuy has in fact been the selected site for one of the world’s most ambitious solar energy projects, located just a few dozens of kilometres south of the Olaroz lithium mine. The next chapter investigates the emerging geographies of energy production through the case of the Cauchari solar field, as an effort towards moving the notion of extractivism beyond the physical and conceptual site of mines and into an expanded meaning.

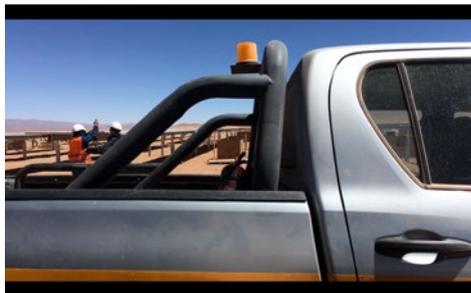










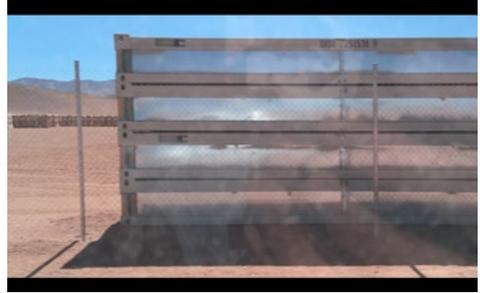














Chapter 4

Energy and finance: global and micro-finance in the Cauchari solar plant, Argentina

Introduction: South America's largest solar plant

On December 7, 2019 the president of the Jujuy Province Gerardo Morales declared the mechanical completion of Cauchari I, the last remaining section of South America's largest field for the generation of solar energy. The plant's installed power reaches 300MW across three adjacent fields named Cauchari I, II and III generating 100MW each. The field currently occupies a surface of 800 hectares—a large area in comparison to the sheer anthropized portion of these territories—but the project already foreshadows its even more gigantic expansion, as the company has already obtained land permits for a total of 10.000 hectares. This expansive scenario can be at least partly understood through the locational advantages that the Cauchari basin provides for the generation of energy from the sun.

As the plant's technical director explains to me in his office in San Salvador²¹, the plant has been positioned, designed and built at a particular intersection of many natural advantages. This area, according to a map of Argentina's global horizontal irradiation, excels in the amount of average energy received from the sun. This is mostly due to the area's high average altitude and its consequent proximity to the sun. However, differently from the neighbouring Chilean Atacama desert—also a privileged site for solar energy and home to EDF's Bolero solar field—average temperatures are much lower in the Puna. This results in a higher productivity for photovoltaic (PV) panels, which notoriously reduce their efficiency when exposed to high temperatures. As a result of these overlapping factors, the Northwestern territories of Argentina and especially its high-altitude environments are rated with very high potentials for the generation of electricity through PV panels: here, the ratio of Kwh of generated electricity per Kw of installed PV capacity is exceptionally high.

²¹ San Salvador de Jujuy, November 16, 2018

In addition to these environmental factors, a fortuitous coincidence has generated a very suitable site for the production of solar energy in the Jujuy province. As my interlocutor recalls by gesturing over satellite imagery of the area, the Cauchari basin is the only site where the high voltage Cobos–Andes power line enters the province’s jurisdiction. This was not the case a few years back, as the power line was entirely included in the neighbouring province of Salta, the border between the two provinces being historically set along the course of the Rio Tocomar. In recent years however, the course of the river had been diverted a few degrees North in order to reduce the damage resulting from seasonal flooding in the municipality of Olacapato Grande, once lying very close to the riverbed. This work of geoengineering produced, in turn, an administrative side-effect as the border between the provinces had been dislocated together with the course of the river. This shift ultimately resulted in some high voltage pylons passing from the jurisdiction of Salta to that of Jujuy, and hence in the province gaining access to the Cobos–Andes power line in this area, unlocking the possibility of generating electricity on site and distributing it nation-wide.

The operations in the area had begun in October 2017 with additional geoengineering operations in order to adapt the site to the desired function: clearing it in order to host the energetic facilities and connecting it to the outside in order to regulate the incoming and outgoing flows of energy and construction materials. Such works included the construction of a 50-km dirt road (70b) to connect the site to the Ruta Nacional 52, the main national and international traffic axis in the area. Equally impressive has been the complete levelling of 800 hectares of rugged terrain with the consequent elimination of two entire hills as well as plant and animal ecosystems. What remains is an expanse of red sand, an inevitable reduction of an otherwise rich yet scarcely visible desert life. A total of 26 kilometres of wire fencing was then wrapped around the area, as well a customs post being relocated here from the Jama pass in order to avoid choking the regular customs with the 2.800 containers required for building the project. The containers made visible the large quantities involved in such operations, performed in a remote corner of the plateau: two weeks earlier, a fellow traveller recalled noticing an unusual number of articulated lorries along the RN52²², allegedly transporting panels, inverters and trackers from China to Cauchari.

The Chinese origin of the entire technological apparatus needed for making Cauchari noted by this fellow traveller is, by and large, no secondary feature. Beyond pointing to the generalized upgrading of China’s manufacturing system—a process epitomized by national plans such as the Made in China 2025—it is a productive cue into the institutional architectures and financial arrangements that articulate the material making of a large-scale operation such as the Cauchari solar field. Much of the required liquidity, in fact has come through the support of the Export-Import Bank of China (Exim) through a \$331.5M bond. As the next paragraphs will illustrate, this configuration is not particularly exceptional and instead characterizes large portions of Argentina’s national energy transition. The

²² Ruta Nacional 52, November 11, 2018

Cauchari solar field is in fact one of the flagship projects of the RenovAr plan, a nation-wide operation initiated in 2016 by the national government in order to increase the share of energy generated from renewable sources in the national matrix. The entire RenovAr plan is defined by an outstanding presence of capital of Chinese origin.

Beyond its significance for Argentina's coming energy transition, the Cauchari solar field is a significant component within the extractive ecosystem forming in the province of Jujuy, of which the lithium mines are also an integral part. The two are in fact connected in many ways. Firstly, the solar field and the mines are brought together by foreseeable flows of energy and capital. Cauchari is in fact legally bound to sell the entirety of its energy output to CAMMESA, Argentina's national energy contractor, but has the rights to sell its exceeding energy volume freely on the market. As its technical director points out during our conversation, the neighboring lithium operations in the Cauchari and Olaroz basin currently run their machinery on hydrocarbons such as natural gas and oil and, according to him, have already expressed interest in buying Cauchari's 'clean' electricity. This seems plausible as these companies' public discourse is deeply entrenched in tropes of environmental sustainability. Solar energy and lithium mining, however, are not only held together by such material transfers, but share many aspects in terms of their social and technical composition. Eight-hundred people—mainly native to the nearby communities of Olacapato and Puesto Sey—are estimated to work in the construction of the plant. Again the company's narrative, made explicit for example by a plant engineer that accompanied me during a field visit on site²³, presents the choice of employing the local workforce under the banners of local development and prosperity (see Chapter 3). Time and again, however, the duration of this employment remains dubious, as this same engineer admits that only sixty of these eight-hundred employees are estimated to remain beyond the completion of the plant in order to carry out the necessary (and menial) maintenance work.

The analogies existing between the mine and the field perhaps allow us to explore the notion of extractivism past its familiar site of analysis—the mine—and instead exploring its use as a lens into a variety of urban processes. This notion has in fact found large political use in mining-related resistance in Latin America and beyond, but as recent debates around this idea are starting to foreshadow, its analytical and hence political potential lies much beyond the immediate locus of natural resource extraction. This chapter, then, is an attempt to contribute to expanding the notion of extractivism beyond the material site of the mine and the conceptual locus of resource extraction by focusing on the microfinancial tactics put into place by the Cauchari operation and proposing how looking at the financial dimension of renewable energy production might help us focus on the multiple aspects of capitalist extraction. In order to observe the plant from this vantage point I draw on perspectives coming from the field of energy geography in general, and in particular from an area of studies which has focused

²³ Cauchari solar field, November 27, 2018

upon the interaction between the flows of energy and those of finance. Seen from this perspective, Cauchari and its interplay between global financial flows and microfinancial tactics show how these operations, despite being premised upon tropes of sustainability and local development, can be understood as another incarnation of the extractivist paradigm supporting old and new forms of territorial development.

The chapter is organized as follows. The first paragraph frames current research in energy geography, highlighting connections between the concept of energy landscapes, growing attention towards the spatialities of renewable energy sources and the movements of global finance. Secondly, I focus on the complex financial arrangements that made possible the Cauchari operation, tracing back the intersection between the fostering of renewable energy sources in Argentina and the movements of global finance. Thirdly, I describe how these macrofinancial arrangements effectively landed in the Cauchari basin, determining the emergence of microfinancial schemes in the nearby communities and thus contributing to the transformation of daily geographies on the plateau. The concluding paragraph highlights how a multi-level financial perspective contributes to continuing the task of energy geography as an entry point into unpacking the contemporary geographies of capitalism, while seeking to advance our common understanding of expanded framings of extractivism.

4.1 Geographies of the energy-finance nexus

In the opening paragraphs of *The Birth of Energy*, Cara New Daggett (2019) presents energy as an “invitation to grand thinking.” In her view, “[e]nergy’s meaning is capacious: it is provided by coal, oil, wind; it is a scientific entity; a metaphor; an indicator of vigor, tinged with virtue. Energy feels trans-historic and cosmic, but it is also material: it pumps through pipelines, sloshes in gas tanks, and spins wind turbines” (1). While energy, together with Smil (2017), can be rightly thought as an all-encompassing entity in abstract, energy systems are indeed very material and tangible systems, complex architectures of grounded infrastructures, ultimately social and spatial articulations.

A take on energy that considers it as a socially organized system rifted by social contestations and an uneven distribution of power is relatively uncommon in socio-technical approaches to energy transitions, as Bridge and Gailing argue (2020). Socio-technical approaches to energy transitions, in their view, have long suffered from “something of a political blind spot, downplaying the plural, messy and contested character of its constituent processes” (1039). Beyond this long-lasting impasse, as they recognize, much work has been done in the field of energy geographies, the defining character of this thematic area being, as the name suggests, to offer a spatially-sensitive approach to the subject of energy (Pasqualetti and Brown 2014). A spatially-sensitive perspective highlights how energy should not only be seen as the abstract ability to ‘do work’—its somehow standard thermodynamic definition and a common trait of many social scientific

studies of energy—but also as an agent ‘making space’ (Huber and McCarthy 2017; Bridge and Gailing 2020). As trivial as it may seem, every form of energy requires space. This aspect is often forgotten in the public discourse on the zero carbon energy transitions, where the vast swathes of land dedicated to solar, wind, geothermal and marine energy lie much beyond sight. Space and energy, though, are not only brought together by the latter occupying the former, but can rather be understood as mutually constitutive terms. The form of the employed energy has far reaching effects upon the spatial articulations of its use. Huber and McCarthy (2017) illustrate this case by analysing the shift from a ‘horizontal’ reliance upon biological forms of energy (wood and other organic sources) to a more ‘vertical’ one brought about by the world-scale employment of fossil fuels. In considering the current transition to renewable energy sources, they note how their extensive nature raises crucial questions in terms of land use and livelihoods, particularly in rural areas. Broadly speaking, this is the perspective that I adopt in approaching the case of Cauchari, where the abstract and world-scale process of transitioning to renewable energy sources translates into a localized process of sociospatial reordering. While adopting energy in general and energy systems in particular as a vantage point into geographic transformation might appear trivial at first sight, it is only recently that social science approaches to energy have took part in what Castán Broto and Baker call a ‘spatial adventure in energy studies’ (2018).

Energy geography is, in this sense, a diversely populated, ‘borderland’ area (Bridge 2018; Calvert 2016; Baka and Vaishnava 2020) in its ability to cross multiple geographic concepts and debates. Energy, the wide-ranging concept evoked by Daggett (2019), in fact stands at the intersection of multiple research fields. This interdisciplinarity and the sheer expansion of the field per se requires, according to Huber (2015), the necessity to better understand energy’s role in the social construction of space and, in particular, the role of energy in shaping the material infrastructures and uneven nature of cities within socioecological approaches to urbanization. Indeed, the social demand for energy is one of the main drivers of landscape transformation (Pasqualetti and Stremke 2018) at the planetary scale. In order to proceed in this direction and for the purpose of investigating the processes of sociospatial reordering that emerge together with the transition towards low-carbon energy systems, the concept of ‘energy landscapes’ seems a particularly productive lens. Energy landscapes emerge as a way of seeing the landscape as “reflecting the spatial arrangements of energy systems accumulated over time in particular places” (Kirshner, Castán Broto, and Baptista 2020, 3). Energy landscapes are tangible expressions of the shifting social demand for different sources, quantities and timings of energy which determines a continuous rearrangement of urban and spatial configurations for its production and distribution.

In terms of research objects, even if the emphasis on energy systems transitions highlighted by many of these reviews evokes an attention to emerging sources of energy and their spatialities, geographical approaches to energy remain solidly anchored to its fossil forms. Much of the literature in energy geographies is still focused upon the commodity chain of hydrocarbons and fossil fuels in

general and remains anchored to a spatial grammar made of carbon molecules, oil wells and pipelines (Branch and Martiniello 2018; Haarstad and Wanvik 2017; Bouzarovski and Bassin 2011; McCreary and Milligan 2014; Valdivia 2015; Kennedy 2014). Despite the recent public emphasis upon renewable sources, fossil fuels are still an extremely valid point of entry into the contemporary geographies of capitalist urbanization, since the origins of capitalism sink into the discovery, quantification and mobilization of fossil sources of power (Malm 2016) and, despite significantly increasing rates in the adoption of renewable energy technologies, the material energy basis of contemporary capitalism remains largely fossil still nowadays (Oskarsson et al. 2021). Even when we consider the more explicitly ‘urban’ fringes of energy geography, the geographies that emerge seem to remain largely fossil-centred (Simpson 2020; Woodworth 2019). More attention, though, is also increasingly devoted to emerging energy regimes centred upon non-fossil sources such as wind and solar, as their globally installed capacity increases at a steady rate, a trend determining a tangible reorganization of energy landscapes at the planetary scale (Bedi 2018; Cantoni and Rignall 2019; Cross and Murray 2018; Fontaine 2020; Harrison and Popke 2018; Power et al. 2016; Ockwell et al. 2018; Stock 2020; Zimmerer 2011).

The complexity of the new energy landscapes emerging in association with the transition towards low-carbon systems invites to think through the complexity of what a landscape is, beyond its intuitive reorganization as a physical space. Naturally, capturing energy from the sun and the wind requires new spatial orderings at multiple scales and, as noted above, perhaps a larger sheer horizontal surface with respect to fossil sources. What a small portion of this literature has begun to underline is how equally large reorderings are needed from a financial point of view: world-scale transitions in energy systems imply the deflection of large fluxes of financial capital away from investment into fossil sources and into solar and wind material and immaterial infrastructures. Purcell and Martinez (2018), for example, observe Ecuador’s transition towards hydroelectricity beyond the state’s attempt to end its dependence upon finite fossil resources, instead reconnecting this transition to vast flows of foreign investment. Baker (2015) examines the growing role of different mode of finance in shaping South Africa’s growing popularity as a renewable energy investment destination, finding that the influx of foreign capital has generated a reconfiguration of South Africa’s longstanding Mining and Energy Complex actors. In another recent contribution, Kennedy (Kennedy 2018) charts the deepening discrepancies that characterize Indonesia’s booming solar energy sector, discrepancies that exist between the demands of investors and the actual needs of Indonesians who lack access to electricity. A finance-focused approach to Indonesia’s emerging solar energy sector allows Kennedy to uncover how, as transnational finance flows into the country with the alleged goal of improving access and transitioning its energy matrix to renewable energy, much of the majority of economic gains brought by this inflow actually flow out to distant elsewhere and hardly remain on site. Knuth (2018), speaking through the case of Solarcity in the U.S. context, similarly asks whether clean energy firms are not actually financial technology firms with

an expertise in solar, equally questioning the destination of the economic and social benefits of these transitions. Taken together, these recent advancements within the field of energy geography underline how the development of renewable energy technology is tightly bound with novel geographies of finance—and how a financial perspective might reveal largely unseen aspects of new energy landscapes.

One perspective which is surprisingly underexplored in this literature is that which observes finance not (only) in its transnational instances but, from the perspective of its localized effects on the daily geographies of the places where these large investments land. Financial geographies of the energy transition, in fact, have tended to privilege a macrofinancial analysis of this nexus, seeking to chart dynamics of foreign direct investment, the role of private finance and the movements of venture capital firms. In developing the empirical insights offered by my ethnographic work in and around the Cauchari solar field, I attempt at enriching a multi-scalar perspective on the geographies of the finance–renewable energy nexus, seeking to track down the interplay between large-scale transnational investments and the resulting microfinancial geographies in the everyday experience of the communities of the Cauchari basin. In doing so I propose two conceptual moves that contribute to current debates in these interrelated fields: first, I use the perspectives on the financialization of popular life developed in the extractivism debate in order to complement perspectives on the finance–renewable energy nexus within the energy geography literature. Second, I elaborate on such nexus in order to speak back to the extractivism debate, adding up to recent work that seeks to expand its meaning beyond the physical and conceptual locus of natural resource extraction, addressing the problem outlined in the first chapter of this thesis (§1.3).

The following sections explore how a transforming energy landscape emerges together with the transformation of a financial landscape, both at the scale of global finance (tracking the complex financial architectures that materially resulted in the Cauchari solar field) and at the scale of the everyday geographies of its surrounding (charting the financial mechanisms that ‘trickled down’ in the form of microfinancial operations), arguing how the strict interrelation of the two is an important perspective in understanding local development within the extractive matrix unfolding in the Atacama and beyond.

4.2 Argentinian renewables and global finance

Crossing the seemingly endless arrays of solar panels that compose the Cauchari operation is an unusual experience. For one, I had never walked or driven through a solar field before, but only experienced them from afar, through the windows of a driving vehicle or through the eyes of a satellite. Experienced from within, the solar field is astonishing in its extension. The eye follows the regular grid until it merges into the surrounding red hills. While I cross the field guided by Carlos, an engineer who drove from San Salvador in order to supervise

the advancement of the construction works, several men unload pallets of photovoltaic units, their bodies entirely covered in work suits and protective devices, worn in order to shed the potent sunlight that hits the basin.

When the field visit is over and it is time to head back to Susques, a young woman shows up next to the white pickup truck in which I am sitting. She had been working and living on site for two full weeks and her shift is now over, so she is getting a lift back to San Salvador in our vehicle. Shortly after while driving on the dirt road that connects the solar plant to the main road, the conversation turns on the subject of the Chinese technicians that form part of the employed workforce of the plant. She recalls one aspect of their lifestyle that surprised her particularly: the Chinese employees are the only ones who do not eat the local food, but—according to her—have instead “their own food” shipped in containers from mainland China together with the technical bits that materially compose the plant. Her short description of some mundane aspects of their daily life on site is a somewhat expected concoction of stereotype and detached perplexity²⁴.

The presence of a small Chinese workforce employed in the solar plant at Cauchari is perhaps not so surprising when we zoom out to consider general trends in the Argentinian renewable energy sector. Rather than an exotic curiosity, it is a productive cue into the complex financial architectures that brought to the very materialization of the plant in these Andean heights.

The Cauchari Solar operation has been funded by a winning bid in the first round of the RenovAr program, Argentina’s nation-wide plan to boost the country’s share of energy from renewable sources. Renewables now cover a mere 4% of Argentina’s energy matrix and the plan importantly contributes to the set goal of reaching a quarter of the total by 2025. In particular, the financial scheme allowing the construction of Cauchari relies upon a package of green bonds issued by the Argentinian government. The majority of this expenditure including transmission infrastructures and the planned expansion (\$551 millions) is covered by a sovereign debt credit granted by Eximbank financing 85% of the liquidity needed for the project. This amount is to be compensated in 15 years with an annual interest rate of 3%, while the remaining \$220 millions are covered by a green bond issued by the Jujuy provincial government. Cauchari, as one of the largest projects funded by RenovAr and a centrepiece to Argentina’s effort to transition its energy matrix, has often emerged throughout my fieldwork and in press articles as a signal of the expanding role of Chinese finance and technology in renewable energy production outside of China’s national territory. Rightly so: a recent study of Natural Resource Governance Institute (Mihalyi, Adam, and Hwang 2020) found that, in more general terms, China Development Bank and

²⁴ Ethnographic diary extract, November 29, 2018

Eximbank alone accounted for 77% of the total of the oil-, mineral- and metal-backed loans obtained by Latin American and sub-Saharan Africa between 2004 and 2018. Despite renewable energy not being classified as a natural resource, a brief analysis of the RenovAr program displays strikingly similar characteristics to those markets: a staggering three quarters of solar and half of wind projects selected in the first project financing round of the plan can be connected to Chinese capital and technology. This trend is also legible beyond Argentinian renewable energy sector, as China's major commercial and policy banks are rapidly scaling the share of power generation and transmission projects in their investment portfolios (Zhou et al. 2018). The case of Cauchari not only illuminates shifting geopolitical scenarios—which will be further illuminated throughout chapter 5—but most importantly highlights the growing intersection between large-scale renewable energy production and the geographies of global finance. Exim, being one of China's state-owned policy banks, functions as an important tool for supporting the national government's domestic and international policy agenda. Its goals include advancing the process of industrial upgrading of the Chinese manufacturing sector through, as in the case of Cauchari in particular and the generation of renewable energy in general, the opening of new markets overseas.

In fact, as even my interlocutors, the strategic partnership with Chinese financial institutions should be understood beyond the supplied liquidity: not only Chinese banks provide the necessary monetary flow, but Chinese manufacturers provide most of the technical components of the plant such as photovoltaic panels, inverters and electrical cables. The institutional articulation of the Cauchari project clearly reveals this strategy. The tender has been advanced and won by the provincial government of Jujuy through JEMSE (see chapter 3) in 2016. JEMSE, as the project leader, enrolled two Chinese companies to build the solar park, namely Powerchina and its subsidiary Shanghai Electric Power Construction as the engineering, procurement and construction contractor for the entire project. These companies, in turn, engaged a number of Chinese manufacturers in the field of renewable energy: Talesun Solar supplied and installed the photovoltaic modules; Huawei provided the inverters; Prysmian delivered cables and monitoring systems and the supervision services from its factories in mainland China. Given the sheer scale of the solar park, manufacturers provided an enormous amount of components, contracts reportedly including more than 3,600km of cables, 1,100 medium-voltage accessories and other similar volumes of commodities.

As the technical director of Cauchari explains²⁵, the state of Jujuy—owner of Cauchari solar—is able to obtain energy from renewable sources and to sell it on the market at a price of \$60/MWh thanks to the intercontinental partnership with China-based finance and technology. Cauchari in fact established a sales priority with Argentina's electricity wholesale market administrator CAMMESA within a

²⁵ San Salvador de Jujuy, November 16, 2018

20-year power purchase agreement. The scope of this agreement makes it so that Cauchari is obliged to sell the entirety of its calculated output.

Concerning this aspect, it is interesting to note how the financial calculations and arrangements that made the Cauchari operation possible actually exceed the scale of government bonds and international banking, and instead ‘trickle down’ to much more molecular forms, pervading it at multiple scales. During our conversation, the technical director of Cauchari²⁶ recalls the terms of the power purchase agreement with CAMMESA. He explains how the contract had been established upon an expected output of 660GWh, a quantity which, thanks to the particular atmospheric conditions of the Puna de Jujuy, he hopes to exceeding. He suggests with a certain sense of pride how this foreseeable output would allow the company to sell its unplanned excess of electricity on the market, squeezing more profit out of the desert sunshine and making the operation even more lucrative. While this detail has more of an anecdotal than analytical value, it points to the multi-level financial strategies that converge into the making of renewable energy landscapes in the Cauchari basin. An analysis of the financial arrangements and flow solely centered upon the transnational scale would be insufficient to describe with accuracy and care the social and spatial transformations affecting this portion of the Atacama. As much as financial operations spanning the globe have reached these remote lands, so did more intimate and microscopic forms of financial calculation. The unfolding of microfinancial arrangements in the neighboring communities of Puesto Sey and Huancar, a differently-scaled counterpart to the global finance fuelling the construction of the Cauchari solar field, is the subject of the next section.

4.3 Microfinancial tactics in and around the Cauchari solar plant

Even through a short visit and across its fair extent, human activity in the Cauchari solar field remains tangible. Workers move across the solar arrays in pickup trucks, while others head to the base camp in order to have lunch or engage in meetings. Others can be found in small groups mounting photovoltaic modules or connecting inverters in some remote location under the burning sun.

Cauchari Solar, according to the president of JEMSE Carlos Oehler²⁷, employs a total of 800 workers throughout its construction phase. This estimate is confirmed by the many articles in the local and national press that had generally welcomed the beginning of the construction works a few months before my travel on site. The voices of company managers and public officials presented in these press articles always mention the origin of this workforce, arguing—in a very similar manner to the lithium extraction business—for the importance of hiring a

²⁶ San Salvador de Jujuy, November 16, 2018

²⁷ San Salvador de Jujuy, November 14, 2018

local workforce. A plant manager encountered on site²⁸ estimates that 90% of the workforce hired for its construction comes from within the provincial territory and 600 of these workers are hired from the surrounding communities, especially from Puesto Sey. I have not found any other source for verifying these numbers, and rarely I have been left alone out of the pickup that was being driven around the plant, let alone speak to some of these workers. Their exact quantity or precise origin, however, is scarcely relevant. While the details of these employment strategies and most importantly their real limits have already been discussed in this thesis (see §3.3), for the purposes of this section it is sufficient to know that Cauchari Solar produces a tangible direct employment, allegedly preceded by specific training particularly directed to the inhabitants of the nearby communities.

One aspect that has not been discussed in the previous chapter, despite being present both in the Cauchari solar field and in the lithium business in Olaroz, is the formation of a secondary labour market, generated by the energy and mining companies vastly outsourcing many of the services that they require. This is repeatedly presented as another favourable opportunity for the local population, or better as an explicitly beneficial policy adopted by these companies: not only offering them a stable salaried job, not only allowing them to enhance their skills by specifically training them for that position, but even—and perhaps more crucially—allowing them to shape their own economic activity in tandem with the emerging solar energy (or lithium, for that matter) market. In other words, companies pride themselves of accelerating and facilitating the role of local inhabitants as ‘entrepreneurs of the Puna,’ as one manager at Cauchari put it²⁹. Oehler, in a similar vein, lists the creation of more than thirty Small and Medium Enterprises (SMEs) across the eight communities that surround the Cauchari operation³⁰, citing this bit of information among the beneficial effects that Jujuy’s growing extractive economy has spurred. The plant manager at Cauchari also mentions how the entire operation actually relies upon these SMEs for its transportation and catering needs.

Those involved in the Cauchari operation whom I have been speaking to have only vaguely discussed the strategies by which such entrepreneurial strategies are being fostered by Cauchari Solar and, when asked to describe them in more detail, were neither able to respond nor to point to others who might have. Their vague gesturing towards the cognitive and financial support offered to local SMEs in the form of credit lines and entrepreneurial crash courses is, however, so similar to that proposed by actors involved in the extraction of lithium that I think it would be useful to consider the slightly richer insights offered by a marketing representative of Sales de Jujuy on this matter³¹. According to the scarce information that she is inclined to share, this representative makes a quick mention to a zero-interest credit line that the company offers to inhabitants of the

²⁸ Cauchari solar field, November 27, 2018

²⁹ Cauchari solar field, November 27, 2018

³⁰ San Salvador de Jujuy, November 14, 2018

³¹ San Salvador de Jujuy, November 19, 2018

surrounding communities in order to conceptualize, fund and initiate their own companies. The specifics of these companies remain vague, however. Even more telling is a particular feature of these credit lines: given the finite amount of such funds, the company implicitly compels individuals to pay their debt off as soon as possible, otherwise running the risk to prevent their fellow or even neighbour from obtaining such credit line him or herself. In this marketing manager's view, this pushes the investment turnover time to be as short as possible, privileging the initiatives which are rapidly profitable and hence stimulating "a healthy competitive environment."

A strategy premised upon microfinancial tactics that stimulates the entrepreneurialization of the local population is fully encapsulated in the visions of local development promoted by market and institutional actors in the area. If done right, this strategy could be a beneficial contribution towards fostering local and indigenous initiatives, by providing for example financial support to projects that normally struggle to attract funding. These credit lines, however, are solely directed towards shaping a workforce that supplies services to the plant—and is moreover precariously tied to its decisions without being stably employed. From another point of view, this subject has been an object of conversation also with members of the various collectives that have consolidated around opposition to lithium mining in particular, and to extractive projects in the Puna in more general terms. The perspectives emerging from a day of inter-community meetings and conversations in the proximity of the Salinas Grandes basin³² point to the divisive effects of such microfinancial schemes. The creation of these credit lines has allowed companies to bypass the political and deliberative entity of the community and instead to bargain deals with individuals. Although they sometimes seem to project these sociospatial transformations upon a scenario of lost unity, it is useful to remember that the word 'community' in this context does not evoke a nostalgic vision of the past but a legally recognized entity in the Argentinian Republic. Carlos Guzmán, member of the Colectivo Apacheta, points to the opportunities foreshadowed of these schemes as one of the reasons for the still limited grip of their political opposition to extractive projects, since many of its neighbours and fellows have indeed accepted to engage in them³³. Not that these credit lines should not exist, as we discuss during our conversation, but they should be negotiated collectively instead of predating the hopes and dreams of economic improvement at the individual scale. Furthermore, the volatility of these economic opportunities, he says, is hardly under the spotlight and instead looms behind the rosy opportunities of individual economic improvement. In questioning the development model underpinning these schemes, oriented towards the rapid extraction of profits and structurally blind to the long-term consequences of these operations, the united collectives of Salinas Grandes seem to see clear: *Pan para hoy, hambre para mañana*—bread for today, hunger for tomorrow.

³² San Miguel de Los Colorados, November 24, 2018

³³ Susques, November 28, 2018

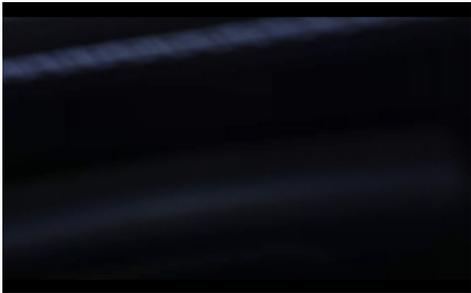
Conclusions

This chapter's empirical sections have, firstly, focused on the global financial architectures that materially built the Cauchari solar field, illuminating how new energy landscapes are strongly determined by the deflection of consistent financial flows at the planetary scale. Secondly, this chapter has proposed an ethnographic gaze upon the processes of financialization that are constituted around and in connection with the making of solar energy in the Cauchari basin, complementing a conventional macrofinancial perspective with insights on the diffusion of microfinancial tactics and credit lines for fostering local entrepreneurialism.

The complementary articulation of global and micro-finance sheds light upon the multiscale process of sociospatial transformation affecting the urban hinterland of the Atacama in relation to other distant elsewhere. In particular, such multi-level financial perspective contributes to continuing the task of energy geography as an entry point into unpacking the contemporary geographies of capitalism (Bridge and Gailing 2020). Beyond the field of energy geography *per se*, these empirical reflections have something to offer to current debates around the idea of extractivism. The pervasive role of finance at multiple scales within the making of new energy landscapes and, especially, the transformative power of its most intimate form, point to the possibilities of using the lens of extractivism to read the sociospatialities of capitalist urbanization beyond the literal sphere of natural resource extraction. In fact, the drive to squeeze profits seems to underpin not only the quest for minerals in the underground cavities of the Atacama, not only the capturing of the sun rays hitting its landscapes, but pervades the daily geographies of popular life through its growing financialization. The task of reading landscapes of extended urbanization from the point of view of extraction continues in the following chapter.

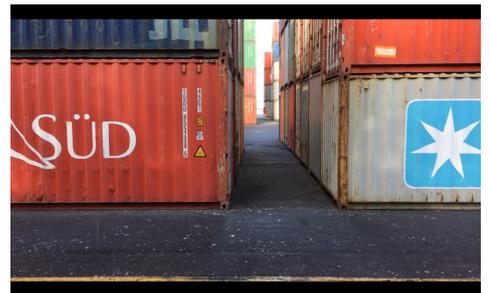
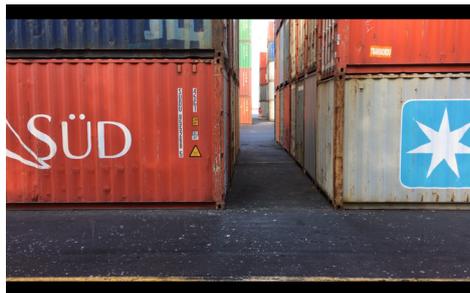
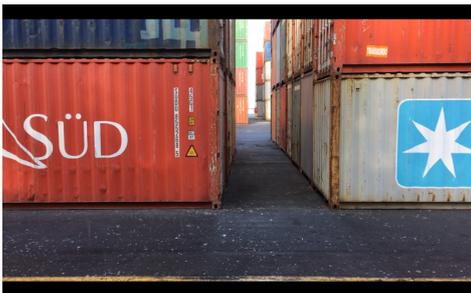
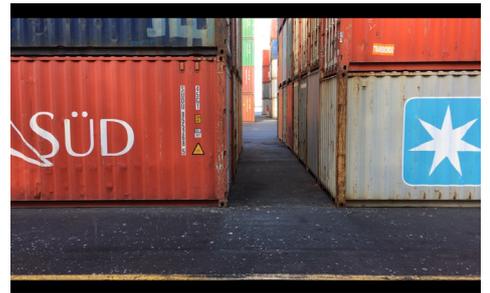
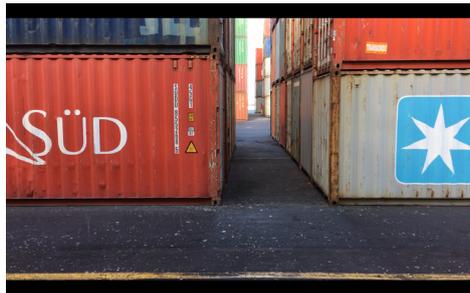
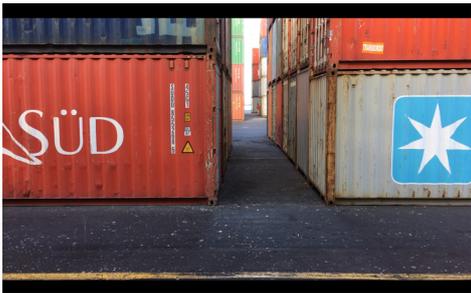
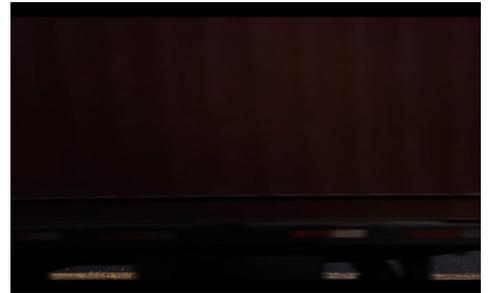
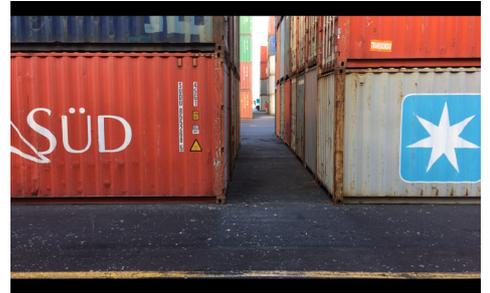
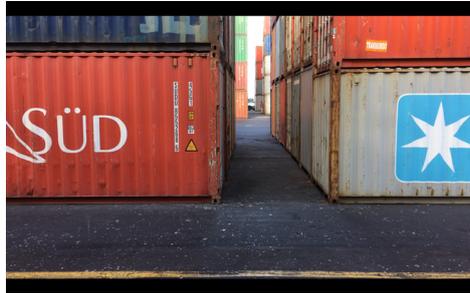
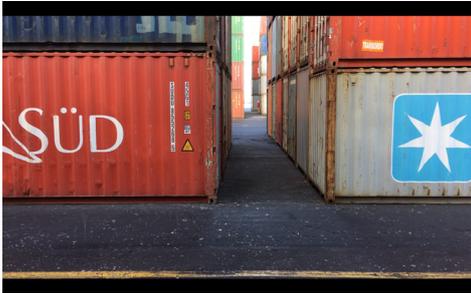
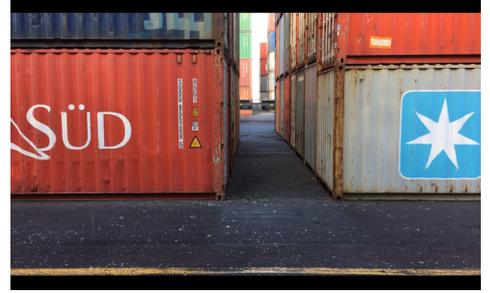
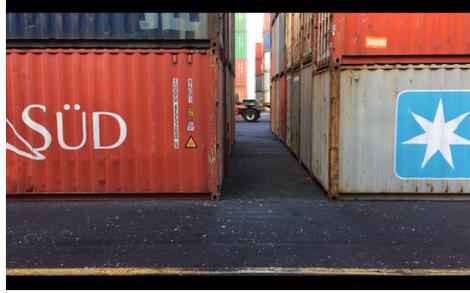
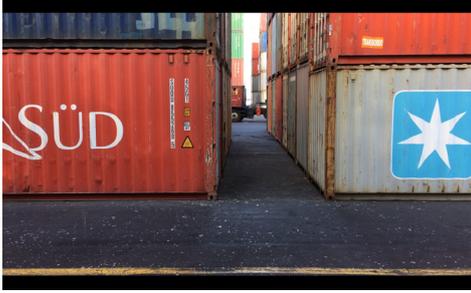
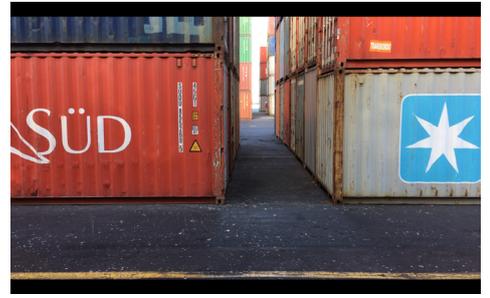
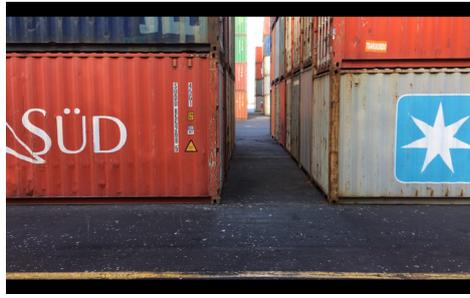
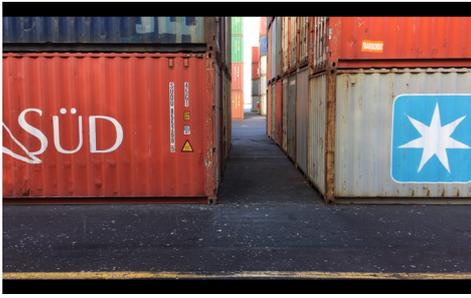
Despite this chapter having mentioned extensively the growing Chinese influence in the region and the recent financial and geopolitical shifts which characterize it, the next chapter shows how the development patterns underpinning these 'new' Chinese influence are not a great novelty in the region and instead retrace entrenched logics of infrastructuring and dispossession. Lithium extraction in the Puna de Atacama cannot be studied independently of the much wider system of 'production' which sustains its formation. The following chapter links the geographies of natural resource extraction and energy production with those of circulation in the wider Atacama region, as the geographies of production so far encountered in this work curiously culminate in the same site. Both the lithium carbonate resulting from the Olaroz saltpan and the containers that allowed the capturing of energy in the Cauchari basin are shipped or received through the port of Antofagasta. The next chapter then examines how the geographies of extraction unpacked in this and the preceding chapters are deeply intertwined with both recent and long-standing geographies of circulation.

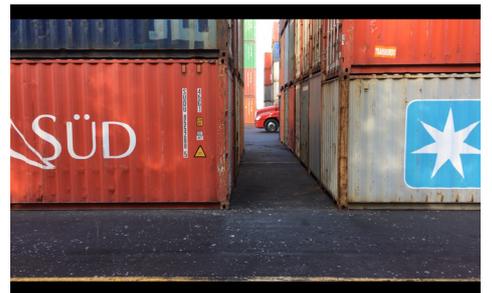
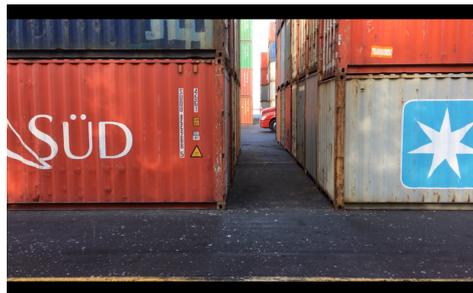
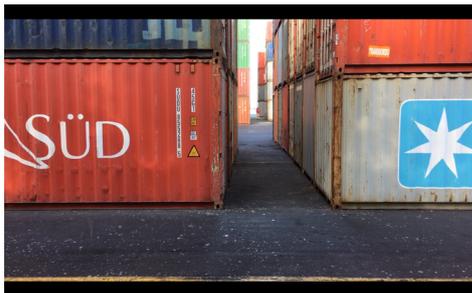
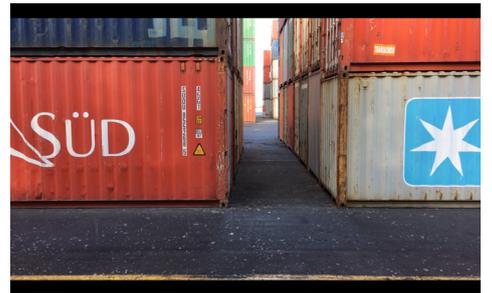
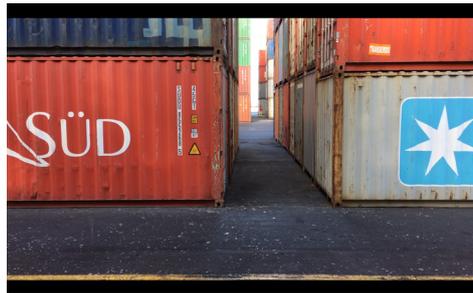
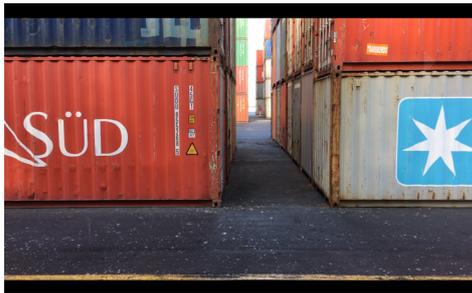
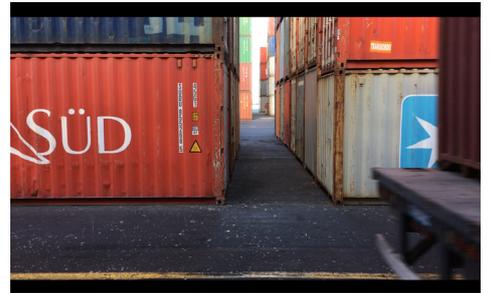
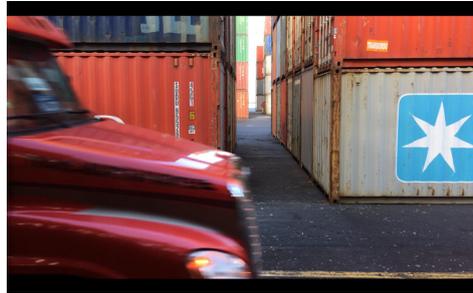
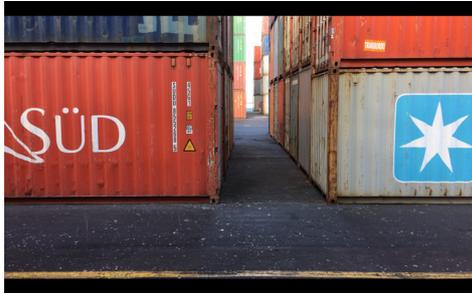
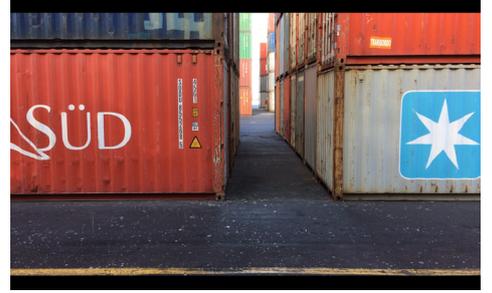
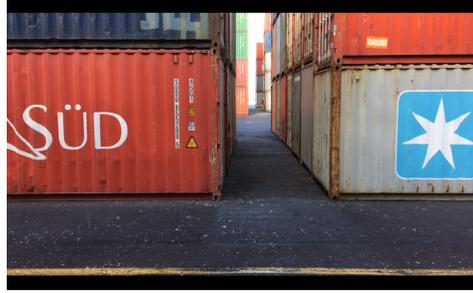
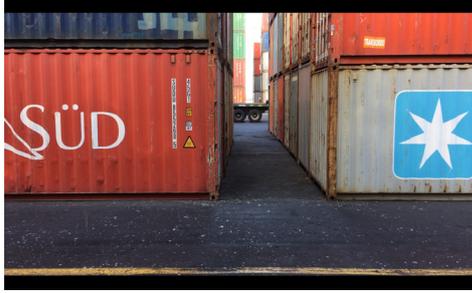
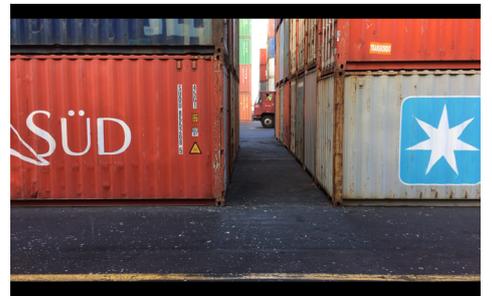
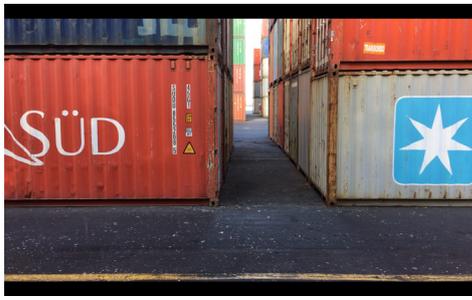


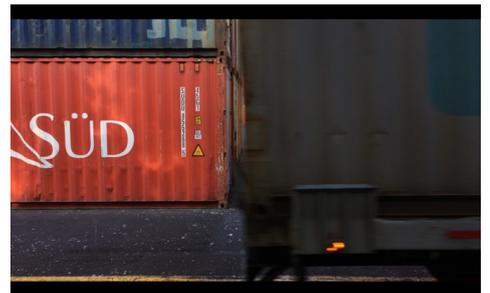
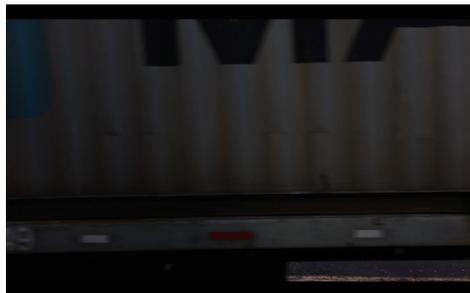
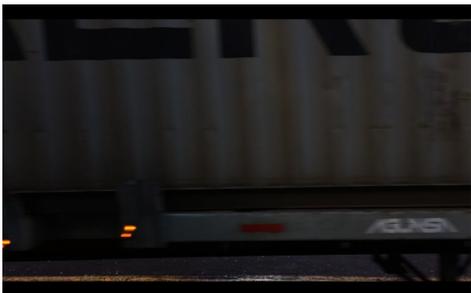
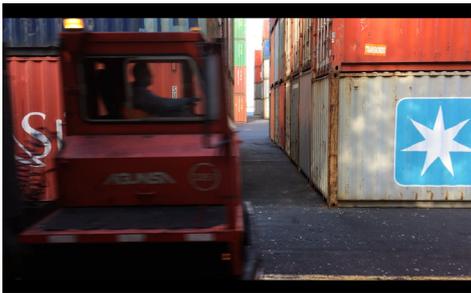
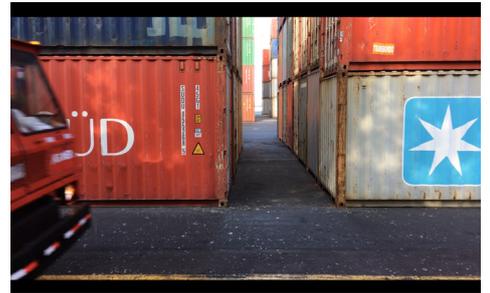
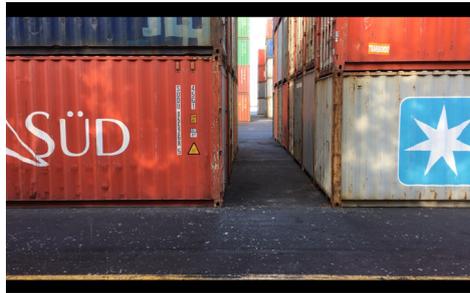
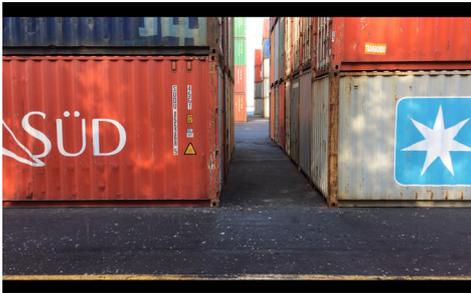
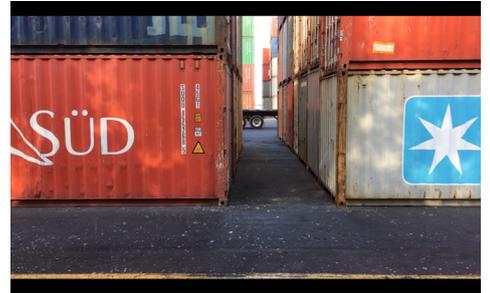
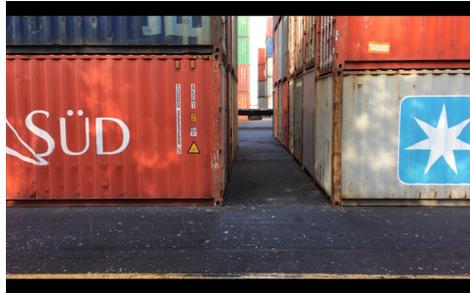
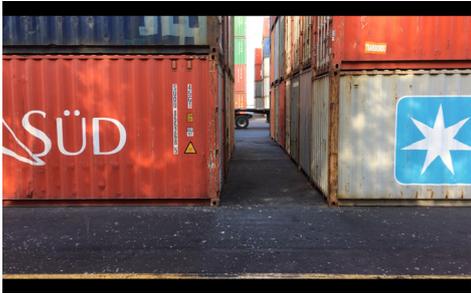
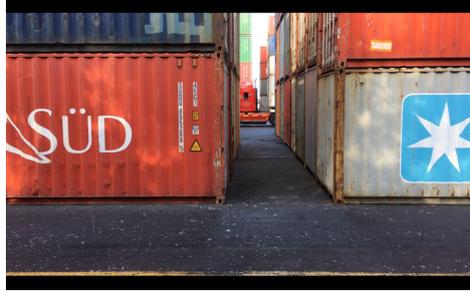
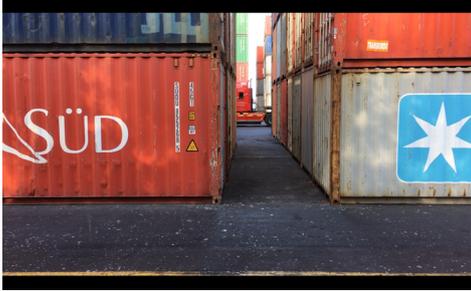
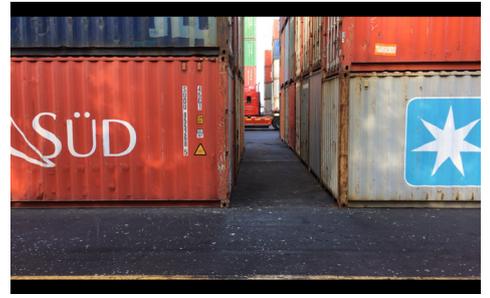
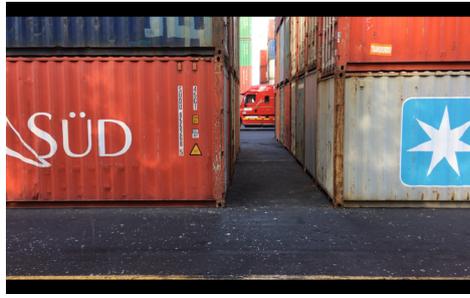
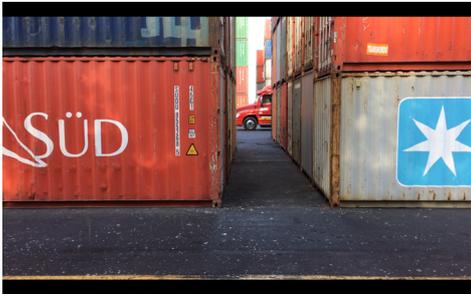


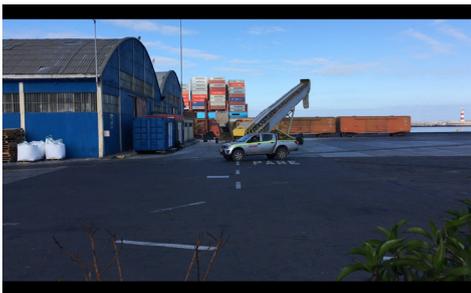
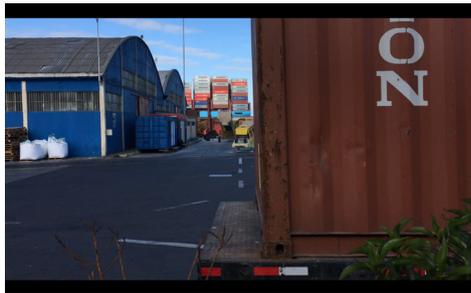


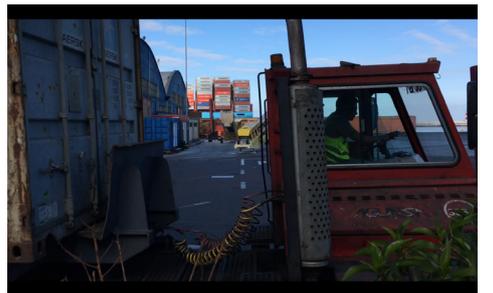
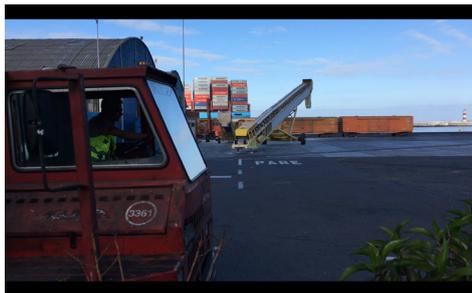
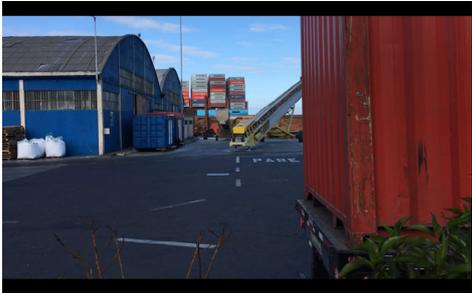
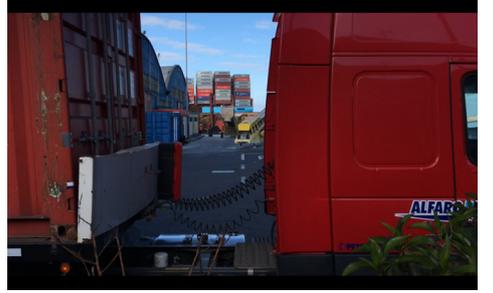


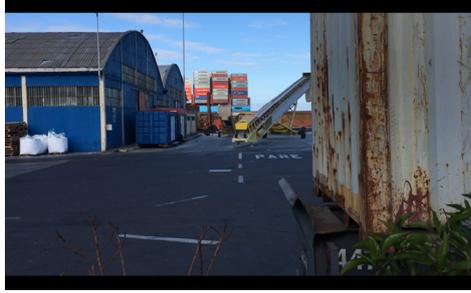












Chapter 5

Enduring axes of dispossession: Emerging geographies of the Belt and Road Initiative in Latin America

Introduction: Antofagasta's extractive matrix

Multiple lines of train tracks twist and turn across the seemingly arid landscapes of the Atacama, their almost linear dimension being difficult to follow through aerial satellite imagery. Following the train tracks on foot instead, a visible element in the everyday landscape of Antofagasta, leads me to a large deposit of sodium carbonate stored in the city's port terminal occupying a good portion of its surface. Sodium carbonate can be used as a proxy for investigating the geographies of lithium carbonate, since the first needs to be mixed with lithium concentrate to produce the second. Particularly, the import of sodium carbonate generally signals an export of lithium products, since shipping companies tend to reduce the mobilisation of empty containers along a route by filling them in both directions: import sodium carbonate, export lithium carbonate and hydroxide in the same containers.

The terminal point of the South American lithium stream is the port city of Antofagasta, where lithium products leave the continent and are shipped to Asia across the Pacific Ocean. As an employee of one of the most recent industrial terminals in area confirmed, the Complejo Portuario Mejillones handled roughly 85% of all South American lithium in 2018, including resource extracted from the saltpans of both Argentina and Chile. Not only Antofagasta functions as the crucial passage from land to sea for these products: its role at the regional scale extends well beyond the lithium supply chain. The city and the vast territories lying to its West have historically entertained a tight relationship from an economic, ecological and geographic point of view, as Antofagasta's metabolism is condensed in its historical challenge of channelling in a rapid and secure way the vast mineral wealth of its immediate hinterland: the Atacama desert.

Before the discovery of large mineral deposits in the area throughout the XIXth century, the region of Antofagasta was characterized by scattered and scarcely populated settlements. In his *Orígenes Historicos de Antofagasta* (1966), Bermúdez argues that—contrary to what had been commonly retained—the area had not been ignored by the Spanish, yet it featured only sporadic economic activity and permanent settlements. The coastal lands between the Loa river mouth and the Paposos cove had actually been explored by the colonizers, who maintained the indigenous names where known and gave new names to new discoveries (17–18). Due to the scarcity of freshwater and profitable minerals, though, the area remained demographically and economically marginal. It was only throughout the XIXth century that Antofagasta emerged as a regional pole, a role that extends into the present and makes the city one of Chile’s largest industrial ports and the transit point for the majority of its copper exports (see Grappi and Neilson 2019). This role, as Fernandez and Atienza (2011) illustrate, is inextricably tied to its long-lasting legacy as a mining settlement.

In August 1866, Bermúdez (1966) recalls, the cove in which the city of Antofagasta would be later established was a “deserted beach”: the silver deposits of Caracoles had not yet been discovered and the Salar del Carmen did not experience any extractive activity (108). It were in fact these two sites of extraction which would allow for a permanent settlement to be formed on the shores of what the then-only inhabitant of that waterfront—the Chilean explorer and mining entrepreneur Juan Lopez—would call Peña Blanca. As for the neighbouring village of Mejillones, founded upon the exploitation and intercontinental trade of guano, the foundation itself and later fortunes of Antofagasta reside in the bounty of silver and nitrates first, and copper later. The foundation of the city in 1869 corresponds with and is directly premised upon the industrialization of the large nitrate deposits discovered in 1860 by José Santos Ossa in the Salar del Carmen. One year later was the time for silver discovered in Caracoles in 1870. The ensuing industrialization of the Caracoles deposits allowed the city to experience a sudden development from an economic and demographic point of view in the following five years, while ‘the discovery of an artificial substitute for nitrates during World War I and the definitive nitrate crisis in 1930 resulted in copper mining becoming the mainstay of local exports, a situation that persists’ (Fernández and Atienza 2011, 658). This long-lasting economic legacy still shapes the present of the city and its daily sociospatial fabric, with several billion tonnes of copper and other minerals flowing through its streets and large numbers of migrant workers occupying the immediate surroundings of its city centre in order to participate in the bounty induced by the city’s still booming mineral economy.

Not only extraction matters to the history of the city, though, but the circulation of the extracted matter is the true hallmark of its development. Suffice to think how in 1867, prior to its foundational act, the city consisted of nothing more than Lopez’s shack and a berth for the shipment of nitrates from the Salar del Carmen operation (Bermúdez 1966, 108). Why did Antofagasta and not other well-established ports in the area enjoy the bounty of the nitrate boom? The

answer to this question is to be found in the natural advantages that this location enjoyed with respect to the extraction and ease of circulation of its surrounding mineral resources (Fernández and Atienza 2011, 653). Something seemingly banal as its the topographic features of the area have shaped the urban reality of Antofagasta: starting from the discovery of Caracoles, the Peña Blanca cove presented itself as a convenient transport node from the interior across the geologic fault line and as a port protected from Northern swells by the Mejillones peninsula. The reinforced linkage between Caracoles and Antofagasta, according to Fernandez and Atienza, “reinforced the path-dependent trajectory that would convert the latter city into the region’s core city” (654). Several decades later, Arboleda (2020) as well highlights how “Antofagasta is where the major logistical networks of the mining industry converge” (130), in an astounding accumulation of port terminals, cargo ships, pipelines, industrial train lines, red pickups and a resulting cityscape that has been “aggressively splintered between the zones that directly partake in the supply chain of extraction and those that aspire to do so but have been left behind” (76). Antofagasta reveals its profoundly unequal mineral economy in the high-rise condominiums that occupy the waterfront, surrounded in an almost symmetric way by the *villas* that saturate its barren hills. It reveals it in its ever-growing four international port terminals and in its average income, so different from the rest of the continent that it has granted the city the nickname of *la Dubai de Latinoamérica*. Observed from here, the infrastructures of extraction which mark the spatialities of the Atacama plateau in Argentina, even though separated by hundreds of kilometres, are constantly made present by the infrastructural exoskeletons which have outgrown on the Chilean coast. Not only connected, the geographies of resource extraction are inseparably entangled with those of circulation and distribution.

In recent years, a broad range of infrastructure projects in the fields of mining, energy, transport and communications across Latin America is being increasingly discussed through an expanding presence of Chinese financial institutions and economic actors. Within the enthusiasm generated by the launch of China’s Belt and Road Initiative (BRI) in 2013, this has led to an increasing attention directed at the progressive extension of this framework to Latin American and Caribbean (LAC) regions. While there is a growing critical attention to the role of Chinese investments across LAC regions, the extension of the BRI to these territories is still relatively unexplored in the emerging literature on the planetary geographies of this large-scale project. On the other hand—and concerning the larger topic of this dissertation—the geographies of logistics epitomized by the case of Antofagasta reveal how the making of new resource frontiers would be only partly understood without considering the transformations that affect their associated circulatory fabric. Recalling how the long-lasting legacy of extraction and logistics in Antofagasta and its regional ramifications extends into the present time, I explore how its recent history and contemporary geographies can offer insights into these dynamics through two connected case studies: the Capricorn Integration and Development Hub promoted by the Initiative for the Integration of

the Regional Infrastructure of South America (IIRSA) and the Mejillones port complex.

The remainder of this chapter is therefore organized as follows. A first section reviews emerging literature on the extension of the BRI to LAC regions through the geographies of IIRSA, while contextualizing these dynamics in a growing literature on infrastructure-led development, arguing how the two are fundamentally intersected. Such a deep entanglement between the development of logistics infrastructure and resource extraction in the region highlights these development corridors as ‘axes of dispossession.’ A second section returns to the extended territories of Antofagasta and explores dynamics of logistical integration currently underway in the region through an empirical exploration of the Capricorn Hub, its connection with the emerging lithium trade and its Asian orientation being deep-seated in the institutional history of ZICOSUR. Thirdly, I focus on the Mejillones port complex as a fundamental component of the Capricorn Hub and an early symptom a regional (re)configuration based on Antofagasta as a ‘window to Asia.’ By examining the intersected developments and present-day spatialities of these two projects, I describe how their orientation towards Asian markets predates the extension of the BRI to LAC countries and argue how their development is indicative of the enduring geographies that underpin this apparently novel transformation. In conclusion, the chapter reflects on how emerging frontiers of resource extraction and associated urban landscapes, even when they are branded under the hallmark of sustainability, are actually deep-seated in enduring neoliberal images of trade and development, embodied by large-scale logistical infrastructures.

5.1 BRI, IIRSA and the unevenness of infrastructure-led development

Several authors have started to highlight an increasing penetration of Chinese finance and trade in a number of Latin American regions. This process is often analysed from a geopolitical perspective signalling a growing Chinese influence in the continent at the expense of the North American one, a process which has been captured by Ramo (2004) as the transition from the Washington consensus to a Beijing consensus. In recent years, commentators have started to analyse how this process of political and economic integration might occur through the extension to Latin American regions of the Belt and Road Initiative (BRI) framework. Although Latin American and Caribbean (LAC) countries were not originally included in the One Belt One Road project—a traditionally West-facing endeavour for China—its evolution into the Belt and Road Initiative has facilitated the making of such ties (Myers 2018). As a result, several countries in the region have signed Belt and Road Cooperation Agreements with the Chinese government so as to achieve formal inclusion in the project. While Panama has been reported as the first Latin American country to sign a bilateral agreement in

June 2017, an official list of the others that followed has not been published to date. One important caveat is that this is not strictly bounding, as the absence of formal Memoranda of Understanding in many LAC countries should not be understood as an absence of economic cooperation with China. The case of Argentina, Brazil, Colombia and Mexico is paradigmatic in this sense: these countries, who together produce 70% of Latin America's GDP, have not signed any cooperation agreement with China but have comprehensive bilateral cooperation agreements in place and are host to many Chinese infrastructure projects. This ambiguity poses challenges to recognizing which projects should be classified as 'BRI projects,' but also generates important questions on the effective articulation of the BRI on the ground and its time scales.

In any case, Latin American regions have been recently described as the BRI's 'natural extension' (Barrios 2018). A growing literature is starting to analyse different dimensions and implications of this process. The BRI is often presented as an opportunity for LAC countries to attract foreign investment that could address the "significant shortage of infrastructure investment, particularly the type of infrastructure that aids connectivity and the development of an internal market as well as an export-oriented connectivity" (Ramon-Berjano 2018, 186). These infrastructures are seen to primarily facilitate the insertion of regional economies into global value chains, with policymakers and pundits associating a trickle-down effect to enhance local and regional standards of living. The transformation of local and regional economies could potentially occur in tandem with the supposed diversification of Chinese investments granted to LAC governments by the arrival of the BRI away from the natural resources sector and towards a contribution "to a greater regional interconnection" (González-Sáez 2019, 128). However, it should be noted how "Chinese interests focus on projects that are of most value to the PRC's own economy, meaning the extractive industries, foodstuffs, and Atlantic-to-Pacific infrastructure endeavours that will reduce the time and costs needed to transport these commodities to China and bring back Chinese goods for sale in the LAC" (Dreyer 2019). Moreover, as the BRI advances across LAC countries, independent organizations have highlighted concerns over the ecological integrity of many Chinese investments in the region (Cooperación et al. 2020) and over a number of cases of human rights violations across projects financed by Chinese banks (Colectivo sobre Financiamiento e Inversiones Chinas, Derechos Humanos y Ambiente 2019).

An important factor to consider when observing the unrolling geographies of the BRI, however, is that Chinese presence in Latin American economies is far from being a recent phenomenon. In a much-needed counterpoint to the sense of novelty which characterizes many among the both enthusiastic and critical comments that the BRI has stimulated, Palma and Montt-Strabucchi (2019) demonstrate how "Chinese businesses were part of the urban landscapes of several Latin American and Caribbean cities" since the end of the XIXth century. Amid a generally enthusiastic approach to this process of integration and to a seemingly new intensity in sino-Latin American relations, Serrano Moreno and colleagues (2020) have noted how "in LAC, the BRI does not represent a new

policy, but rather the updating and rebranding of a pre-existing one.” They explain how “The BRI primarily consists of an official discursive framework which aims to build a coherent narrative for a wide range of different projects and policies geared toward the improvement of connectivity with China through the development of trade and investments.” These remarks are echoed by Stevenson (2018) who calls the BRI a ‘branding campaign’ and raises concerns over its ability to substantially transform entrenched patterns and challenges in China–LAC relations, while Myers (2018) recognizes that “Latin America could possibly attract more state-backed finance from China as a result of BRI linkages, but the region has already received approximately US\$140 billion in disbursements since 2005” (241). In this sense it is important not to overlook the historical dimensions of China–LAC relations when discussing the inauguration of the Latin American branch of the BRI and to consider how entrenched patterns of infrastructure development still characterize this apparent novelty.

Given the BRI’s focus on financing and building infrastructure at the regional scale, analysts have started to point to pre-existing projects of regional integration via infrastructure building in LAC countries as potential recipients of Chinese funds through the BRI framework. One of these ‘host schemes’—and indeed one of the most durable projects of regional integration via infrastructure in the continent—is the Initiative for the Integration of the Regional Infrastructure of South America (IIRSA). Conceived at the Summit Meeting of the South American Presidents held in Brasilia at the end of August 2000, it was proposed by the then Brazilian president Fernando Cardoso as a way to improve communication infrastructure across the twelve states (Kanai 2016). Born and operated with an explicit focus on “infrastructure project planning as a key component of territorial development” (IIRSA 2017, 9), the central goal of the initiative has been that of modernizing regional infrastructure and adopting specific actions to promote their integration and their social and economic development. In 2011 the initiative has been formally included with the South American Infrastructure and Planning Council (COSIPLAN) of the Union of South American Nations (UNASUR). As of 2017, IIRSA counted with 562 projects with an estimated total investment of US\$198.901 billion, of which US\$48.496 billion have so far been invested on 153 completed projects (IIRSA 2017). On the ground, the initiative functions as a platform for the integrated development of projects across the areas of transport, energy and communications, which are geographically grouped in ten different Integration and Development Hubs.

IIRSA has long received an often critical attention from scholars in the region and beyond. For Kanai (2016) IIRSA is an enduring form of neoliberal territorial design to the extent that its integration and development axes privilege the global competitiveness of select export sectors over all other infrastructure provision and macroregional planning considerations. These initiatives are symptomatic of the emergence of an infrastructure-led development regime (Schindler and Kanai 2019) geared towards the production of functional transnational territories that can be ‘plugged in’ to global networks of production and trade. The territorial figures

upon which IIRSA is based—development corridors—have been discussed in other geographical contexts and several issues have been raised. Despite the mainstream “win-win” narratives that accompany these projects, they are value-laden and exacerbate existing socioeconomic difference (Enns 2018, 2019), reinforcing marginalization in historically marginalized spaces (Mosley and Watson 2016), replicating patterns of highly uneven urban development (Wiig and Silver 2019) by distributing costs and risks in an unequal way (Kirshner and Power 2015) and ultimately providing limited opportunities for socio-economic development (Bridge 2008). Development corridors “produce spaces of extraction that open historically marginalised regions to new frontiers of appropriation and capitalist accumulation” (Lesutis 2019a, 7).

As such, the geographies of logistics are tightly integrated with those of resource extraction, and arguably in an increasingly more complex way (Arboleda 2020). Several authors have underlined how the construction of physical infrastructures of circulation allows for the making of new commodity-regions (Bustos-Gallardo and Prieto 2019; Daher 2003) and frontier economies (Watts 2018), characterized by the proliferation of neoliberal enclaves as ‘spaces of suffering’ (Lesutis 2019b). Concerning the South American case, Peregalli (2019) sees IIRSA as a ‘platform for the expulsion of commodities,’ a tool that has historically served to open up new spaces of extraction, deepening patterns of unequal exchange “The strongly modernized ports and the great enclaves of surface mines and soybean plantations represent the crucial nodes between which logistical corridors run in a way that is, at the same time, familiar with the regional history and [...] tremendously new” (9). Beyond the discourse on regional connectivity and sustainable development, the geographies of IIRSA remain intimately tied with those of resource extraction. These critical stances are often echoed by the work of activists on the ground, which have dubbed IIRSA’s Integration and Development Hubs as ‘axes of dispossession.’ I translate this expression from the Spanish *ejes de despojo*³⁴, often employed by those who actively oppose these projects together with the similar *corredores* or *vías del saqueo* (‘pillage corridors’ or ‘tracks’) or *infraestructura de la devastación* (‘infrastructure for devastation’) (Rodríguez Pardo 2014).

The landing of the Belt and Road Initiative in Latin America should be understood within this context and at the intersection with these pre-existing geographies of uneven development. While it is likely that “[t]he IIRSA plan is increasingly being linked to the New Maritime Silk Road (Peregalli 2019, 15) given both IIRSA’s and the BRI’s common focus on infrastructures in the areas of transport, energy and communications (Fang and Nolan 2019), the resulting spatialities of this alignment remain largely unexplored. Emerging research is beginning to link growing shares of Chinese finance and investments in the projects coordinated by the IIRSA plan (Álvarez 2020), however since the BRI is likely to be ‘plugged in’ to the pre-existing blueprints for urban and regional development embodied by IIRSA, these axes of dispossession are likely to endure

³⁴ the word *eje* in Spanish translates both as ‘hub’ and ‘axis.’

despite the new source of financing and investment. “The same physical infrastructure that served to the Free Trade Area of the Americas serves now for the integration to the new geographic center of industrial capital in Asia, in particular in China” (Porto-Gonçalves 2017; cited in Peregalli 2019). In particular, while the focus on new Chinese finance and investment is a useful gauge for sensing these unrolling dynamics and articulating political responses, it risks, on the one hand, downplaying the often long-lasting trade connections between the Chinese economy and resource extraction abroad in general and in LAC regions in particular. On the other, it risks intensifying a sort of “Chinese exceptionalism” while obliterating the long-lasting geographies of capitalist accumulation and dispossession that have historically marked patterns of unequal exchange. Infrastructure financing and development—the main thrust of both IIRSA and the BRI—has been a fixture of China’s approach to Latin America for over a decade (Barrios 2018). However, as reminded by Álvarez (Álvarez 2020, 2695), explicit political and commercial ties with China predate the elaboration of the BRI since China has been a fundamental actor in the territorial reordering of the region through the construction of bi-oceanic corridors that connect Latin American priority territories and resources with the main trade routes to the Asian market.

One of these bi-oceanic corridors coordinated by the IIRSA plan has been central in re-orienting flows of trade and production towards Asia in general and China in particular over the last two decades: the articulation of the Capricorn Integration and Development hub, conceived as an infrastructural mega-project along the Capricorn tropic to connect the ports of Paranaguá in Brazil and of Antofagasta in Chile. The corridor consists of several projects centred upon the construction or completion of hard infrastructures of connectivity, yet the images of bi-oceanic trade and development predate both the BRI and IIRSA and are deep-seated in the economic history of the city of Antofagasta and its business elites.

The following section turns to an empirical analysis of the Capricorn Integration and Development Hub that describe how bi-oceanic images of trade and development have oriented the geographies of its macro-region for more than two decades through the development of the Integrated Zone of the Centre West of South America (ZICOSUR), itself stemming from Antofagasta.

5.2 Bi-oceanic images of development and the Capricorn Hub

The Capricorn Integration and Development Hub is one of IIRSA’s ten axes of development. It articulates a majority of transport-related infrastructure projects the extension of which covers a total amount of 2.680.308 km² and affects a population of 53 million. “The Capricorn Hub runs along the Pacific coast of Chile, cuts across the Andean region of Bolivia, reaches the north of Argentina, covers the whole of Paraguay, and includes the Brazilian states on the Atlantic

coast (Rio Grande do Sul, Santa Catarina, Paraná, and a portion of Mato Grosso do Sul)” (IIRSA 2017, 129). It is intended to weave a tight fabric of physical infrastructures of connectivity that traverse this portion of the continent across its East–West axis, its bi-oceanic dimension being a recurrent feature. One of the project’s primary goals is to further integrate the most economically fragile regions of its entire area of influence, the North-Western and North-Eastern states of the Federal Republic of Argentina (NEA and NOA) and to a lesser extent those of Northern Chile and Southern Bolivia. As detailed in a “business vision” document on the areas coordinated by the Capricorn released by the Plata Basin Financial Development Fund (FONPLATA) the infrastructural projects foregrounded by the Capricorn Hub are strongly oriented towards the large primary production sector of these regional economies such as soy, meat and natural gas (Sosa Pinilla 2007). The historical deficit in infrastructures of connectivity in these regions is coupled with an inversely proportional abundance of mineral wealth. As a result, the top most five projects to receive funding in the area are three railway integration projects and two road connections, with transport infrastructures in general absorbing 90% of the total investments in the Hub, the vast majority of which funded with public capital (IIRSA 2017).

The importance of enhancing transport connectivity towards internal landlocked regions in relation to their mineral wealth extends into the present geographies of extraction that characterize the Atacama region in general, and in the emerging regime of lithium extraction in particular. The lines and nodes that together constitute the Capricorn Hub are often depicted as central features in the development of lithium mining on the two sides of the Andes. Three of these localized projects in particular make frequent appearance in lithium-related documents such as company reports and notices of discovery. After years of failed maintenance, Antofagasta is now connected to Salta (AR) via rail through the Socompa pass, allowing companies to ship lithium products directly to the port of Antofagasta. This is the most significant investment with a total amount of US\$527 million spread between the Chilean and the Argentinian branches. As a Ferronor company official mentioned during a field visit in the Baquedano train station, new agreements between the Argentinian lithium companies and Chilean railway operators are being developed. As a result, a Mejillones port complex employee highlighted during our conversation that the port operators are beginning to restructure their deposit space in light of this new transport possibility. Secondly, the customs integration project at the border crossing of Paso de Jama between Argentina and Chile has been completed in 2009, granting more efficient import-export operations between the two countries. Jama is one of the main mountain passes in this section of the Andean range and its proximity to the Bolivian border makes it a central element in the articulation of bi-oceanic trade routes. The upgrading of its customs building has been completed after the paving of the Argentinian section of the border crossing between Antofagasta and San Salvador de Jujuy along the Ruta Nacional 52, indeed the main axis along which lithium exploration is currently being developed. These infrastructural elements, taken together, form the logistical fabric upon which new extractive

operations can be installed. Mining companies, in fact, advocate the proximity of their resource to the circulatory infrastructures required for the distribution of the extracted matter in order to demonstrate the feasibility of their prospected operations and attract investment.

Observed through its socioeconomic performances and its spatial outputs, the Capricorn Hub is likely on par with the other nine axes structuring the IIRSA initiative. What is perhaps uncommon of this comprehensive regional planning instrument is its long history, rooted in the political and economic dynamics of the regions that it comprises, particularly when observed from the Northern regions of Chile. The idea of a bi-oceanic corridor linking internal regions to the Atlantic and Pacific ports as a ‘projection’ towards Asia predates the IIRSA initiative and its recent intersections with the BRI. Its origins are to be found some decades ago in the city of Antofagasta.

The first time that I heard of a bi-oceanic corridor was through a conversation with a former public official at the Universidad Católica del Norte in Antofagasta. Throughout our conversation, he described an integrated logistics system spanning from the Atlantic ports on the Southern coast of Brasil to the Antofagasta region, which was conceptualized in his parlance as a ‘logistical and port platform.’ This intra-regional system has been articulated through a sequence of primary production areas, waterways and railways, logistics areas and special economic zones, increasingly smoother customs and industrial maritime and freshwater ports. The idea of realizing a bi-oceanic corridor across the Capricorn tropic, he noted, had been the central objective pursued by the Integrated Zone of the Centre West of South America (ZICOSUR), itself a sub-national project of inter-governmental and business cooperation covering diverse economic actors across the North of Chile, the North of Argentina, the centre-South of Bolivia, the South of Brazil and the whole of Paraguay (Rivera 2011). The intellectual and political roots of ZICOSUR are to be found in the city of Antofagasta, where it was established in 1995 as an advisory committee of the regional government (Safarov 2019, 286). In retrospect, however, a significant precursor of this association of public entities and private business ought to be located in the Grupo Empresarial del Centro Oeste Sudamericano (GEICOS), which was created in 1974, but its activities significantly hindered by the cycle of authoritarian regimes which characterized the region in the following decade. After the re-establishment of democratically-controlled governments across the region, the project was partially born as a response to the centralism of MERCOSUR, of which the adherents to the ZICOSUR project constitute the geographic periphery, something which has been described as a ‘club of the forgotten’ (Vázquez Recalde 2008, 230) seeking to develop their own economic pathway.

Within this scenario, the deep-seated orientation of ZICOSUR towards Asian economies—and by extent of the bi-oceanic corridor as its flagship vision—is largely readable in its institutional history. Between 1997 and 2007, the association has organized ten international meetings, the first and last of which have taken place in Antofagasta, with representatives from Asian economies so as to foster integration and cooperation across the Pacific. According to Vazquez-

Recalde (2008, 227) the ZICOSUR project has been built upon a ‘double image’: that of developing the central zone of South America and that of the construction of a strong connection with the Pacific Ocean in parallel with Asia. In other words: the spatialities of the bi-oceanic corridor proposed by ZICOSUR had been imagined as a link between the internal, landlocked regions of central South America and growing Asian economies through the logistical engine of the Antofagasta region.

The present geographies forming across the Capricorn Integration and Development Hub should be understood across this history since its underlying bi-oceanic image, first proposed by ZICOSUR, in practice extends into the IIRSA framework. Mercado and Alcântara (2017) describe IIRSA and ZICOSUR as two concurrent yet separate integration projects developed by hegemonic actors, while Vazquez-Recalde (2008) notes how IIRSA is a “great opportunity” (234) for the bi-oceanic vision developed by ZICOSUR, highlighting the continuities between the two programs and suggesting how pre-existing images of development might have flown into subsequent initiatives. Although IIRSA and its axis of development are not presented as tools for enhancing the trade routes that extract commodities from the South American hinterlands and channel them to China through the Pacific, the specific development of the Capricorn Hub stemming from the regional history of Antofagasta and its local business associations provides us with a different image.

As witnessed by the institutional history of ZICOSUR, the process of infrastructure-building in the region of Antofagasta has been central to the unfolding of the Capricorn Hub. Antofagasta’s history demonstrates its long-standing role as a regional centre, emanating waves of territorial reordering that, as the persistence of bi-oceanic images of trade and development recalls, has been oriented towards Asian economies for more than two decades. Essential to the making of this large-scale process of economic and spatial reordering is the expansion of the industrial port of Mejillones located 60km North of the city.

5.3 The Mejillones port complex as a “window to Asia”

In 1995, a strong earthquake and a subsequent tsunami hit the city of Antofagasta, causing widespread displacement, significantly compromising urban infrastructures and bringing the then-only port terminal of Puerto Antofagasta on the brink of destruction (Taboada Rodríguez 2005). This event posed a serious threat to the city’s economy, highlighting the fragility of an export-oriented primary sector based on a single gateway capable of channelling such a great mineral output. Lying on a South-facing bay, in fact, the city had always been susceptible to Southern swells, but the 1995 tsunami marked the necessity to diversify its maritime infrastructure, highlighting the necessity to produce a new strategic analysis over the port development of the entire region. Attention then turned 60km to the North, to the bay of Mejillones, itself once a vital (and

competing) port hub for the export of guano, which however succumbed to the economic and strategic power of its rivalling neighbour (Bermúdez 1966).

Even walking through the city, it is difficult to ignore the port terminals of Antofagasta. Its infrastructural installations construct the everyday landscape of the city, as train tracks, fences, gates, industrial deposits and loading ducts dictate the spatial grammar of the city. Could it have been otherwise? As its urban history reminds us, the city itself evolved from a rudimentary loading berth and the city's mineral economy has since then remained hinged upon its gateway to the Pacific, marking a legacy which can still be recognized both across its urban core, its surroundings and in the geography of far away internal regions. Over the last two centuries, the port has evolved from a simple dock to a complex maritime and terrestrial ecosystem as the four ports of Antofagasta (Angamos, Antofagasta, Coloso, and Mejillones) together “handled 11.45 million tons of cargo in 2011, making them largest (sic!) port complex in all of Chile, with 18 percent of the country's total port volumes” (Arboleda 2020, 130). Among these four, the Mejillones port complex figures as the most prominent installation in the regional port infrastructure and one that has played a structuring role not only in the history and present of Antofagasta but in the articulation of the Capricorn Hub and its bi-oceanic images of trade and development.

At the time of writing, the Mejillones port complex consists of two main terminals. Terminal 1, informally identified as Puerto Angamos, has been the first infrastructure of the port complex, built in 22 months between 2002 and 2003. Its four docks allow for the mooring of post-Panamax ships, its infrastructures have handled the majority of the cargo in the region for at least five consecutive years and the majority of Chile's copper exports (Puerto Angamos 2019). In 2017 Puerto Angamos passed 2 million tons of bulk transferred thanks to the increase allowed by the company's adoption of a flip-up container system in 2014, a feature that is often publicized in the company's marketing strategies as the frontier of logistics efficiency and environmentally sound procedures. At the port entrance, endless queues of trucks line up waiting for the possibility to enter and unload their cargo. Driving his truck between Mejillones and Antofagasta, a driver describes to me his daily trips to transport containers from the lithium-refining chemical plants in La Negra to the Puerto Angamos premises in the Mejillones bay. Puerto Angamos also built and manages the Terminal Graneles Sólidos (TGS), itself the second phase in the expansion of the Mejillones port complex. A bulk-loading infrastructure completed in 2010, TGS operates in close connection with the nearby coal-fired Cochrane thermal power plant owned by AES Gener, itself selling the resulting electricity to the mining companies operating in the region.

The overarching port complex project is monitored by Complejo Portuario Mejillones (CPM), a subsidiary of the Chilean State-owned copper giant CODELCO. CPM had been established in 1996 with the specific purpose of consolidating a port and logistics pole in the bay of Mejillones following the 1995 earthquake, operating as a port landlord, whereby private concessionaires finance, build and manage each of its planned seven port terminals, as in the case of Puerto

Angamos. The existing two terminals, in fact, form part of a modular plan to expand the cargo handling capacity of the Antofagasta region. The terminal has been designed and built through a 50-year masterplan (Plan Maestro Portuario), conceived through a modular structure of independent docks and concessionaires which allows for a smooth and progressive expansion.

The expanding port infrastructure in Mejillones is not only essential to Antofagasta's mineral economy as its logistical outlet towards the Pacific, but also a centerpiece of IIRSA's Capricorn hub, as the bi-oceanic images of trade that have long animated the project could never be realized with a reliable and efficient maritime infrastructure. Both terminal 1 (operated by Puerto Angamos) and the Terminal Graneles Solidos (operated by Terminal Graneles del Norte) have been financed within the IIRSA framework. The first has been built through a US\$120 million investment, a combination of a loan by the Inter-American Development Bank and private capital and State funds in smaller proportions. The construction of the second terminal has been possible through an US\$80 million private fund also within the IIRSA initiative (IIRSA 2017). As this genealogy shows, the Mejillones complex has not been the direct destination of Chinese loans or investments, contrary to what has happened across other infrastructural installations in LAC countries and throughout some of the development corridors sponsored by the IIRSA initiative (Álvarez 2020).

However, despite not being directly tied to Chinese finance since the extension of the BRI to LAC countries, its development over the last two decades is nonetheless representative of the progressive reordering of the extractive and circulatory fabric in the region. Mejillones and its port are certainly those regional infrastructures that have absorbed the largest capital and media attention. However, as two economic geographers have also underlined during our conversation at the Universidad Católica del Norte in Antofagasta, the correlation between the industrial policies of mainland China and the sociospatial (re)configurations of Northern Chile can be equally observed beyond Mejillones and across other port terminals. China's copper refining industry, for example, has recently privileged the import of copper concentrate over copper cathodes, and this is the main reason behind the construction of BHP's pipeline connecting the Minera Escondida mine with the Coloso port terminal, designed to transport copper concentrate without interruptions from mine to port. Given the project's financing through intra-regional integration programs such as IIRSA, its current trade volumes and infrastructural dimensions, Mejillones historically constitutes the linchpin of a regional system oriented towards the Pacific Ocean. This is also recognized by Vazquez-Recalde (2008) when he argues that the city of Antofagasta has been constructing its image of *ventana al Asia* ("a window to Asia") on top of this large-scale infrastructural operation and through a combination of important maritime connections and geographic proximity.

Concerning future outlooks, this orientation is likely to happen within the emerging lithium business as well, since 85% of South American lithium products has been shipped through Puerto Angamos in 2018 and China is still the largely majoritarian producer of battery chemistry starting from these products. While

official data on these specific trade volumes is largely unavailable, it is likely that the majority of lithium passing through Mejillones is transferred to Chinese ports and internal regions.

Conclusions

The arrival of the BRI to Latin American regions has been welcomed with both critical and enthusiastic emphasis, highlighting both the possibilities and risks that might emerge from what is generally understood as a large-scale process of sociospatial reordering. This chapter has described how, given both IIRSA's and the BRI's common focus on infrastructures in the areas of transport, energy and communications, the two are likely to be at least partially superimposed. As emerging research is beginning to highlight, IIRSA might possibly function as a 'host scheme' for the new cycle of investments on infrastructure building embodied by the BRI.

The emerging lithium trade that this dissertation follows superimposes upon these geographies of logistics and particularly along the Capricorn tropic, itself one of IIRSA's fundamental axes of integration and development. Across this section of the South American continent, the projects promoted within the Capricorn hub foreground a projection towards Asian economies as a longstanding commitment. As an extension of the Paranaguá—Antofagasta bi-oceanic corridor proposed by ZICOSUR for more than two decades, the vision fostered by the Capricorn Hub stems from bi-oceanic images of trade and development founded upon a 'double image': that of developing the central zone of South America, with a particular emphasis on its internal areas, and that of the construction of a strong connection with the Pacific Ocean in parallel with Asia. In practice, the geographies of circulation promoted through the IIRSA initiative in the region remain intimately tied to old and new regimes of resource extraction. The deep-seated projection towards Asian markets since at least two decades can be equally retraced through the large-scale port complex of Mejillones, its recent history and continuing expansion which make it a logistical centrepiece of the infrastructure-led development proposed through such 'double image.' Through the Mejillones megaport, the Capricorn corridor is configured as an infrastructural fabric for the expulsion of commodities from its internal region and towards Asia in general and China in particular.

Through these circumstances, this is a first attempt to contextualize the emerging geographies of the Belt and Road Initiative in Latin American and Caribbean countries within a larger history of urban and regional development. The continuity between distinct but consistently oriented integration and development projects and their materialization on the ground demonstrates how the previous projections towards Asian markets in general and China in particular have long been marking the sociospatial articulations of the region. This gives continuity as well to the long-critiqued patterns of uneven development that these large-scale infrastructures carry with them. Given the deep entanglement between

resource extraction and infrastructure-led development which has characterized the region across its recent history, the arrival of the BRI rightly rises concerns with respect to the persistence, if not the deepening, of extractive regimes and dynamics of unequal exchange. As some have begun to stress, these underlying dynamics risk to remain concealed under the South–South cooperation scheme proposed by China in the region and elsewhere.

The reasons for this however, as this brief description of infrastructure-led development along the Capricorn tropic discloses, should not only be located in the present-day foreign policies of China but in the endurance of extractivist and neoliberal forms of urban and regional development. By ‘plugging in’ to the pre-existing blueprints for urban and regional development embodied by the IIRSA initiative, these ‘axes of dispossession’ are likely to endure despite the relatively new source of financing and investment. This likely continuity should have us thinking about the recurring ‘Chinese exceptionalism’ which seems to occur across the spectrum of commentaries on the emerging geographies of the Belt and Road Initiative.

Lastly, and returning to the planetary spatialities of the emerging lithium trade which are the object of this dissertation, it is important to note how emerging frontiers of resource extraction and associated urban landscapes, even when they are branded under the hallmark of sustainable development, are actually deep-seated in enduring value-oriented images of trade and development, embodied by large-scale logistical infrastructures. Hence, the unrolling of sustainable urbanisms across the globe remains premised upon the patterns of unevenness and dispossession which have long been associated to these images. The concluding chapter of this dissertation summarizes the empirical and theoretical findings emerging from an observation on multiple dimensions of the lithium trade across the Atacama in order to contribute to a widening critical agenda on the geographies of sustainable development and the renewable energy transition.

Conclusions

Emancipatory politics must always destroy the appearance of a 'natural order,' must reveal what is presented as necessary and inevitable to be a mere contingency, just as it must make what was previously deemed impossible to seem attainable. — Mark Fisher

Finding the planet of planetary urbanization

The journey of this dissertation has begun with the figure of the Lithium Triangle, intended as a territorial figure progressively materializing across the vast expanses of the Atacama region, the unpacking of which has characterized the three empirical chapters of this work. My analysis has initially focused upon the extraction of lithium, but the more I ventured across the expanses of the plateau, the more an expansion beyond the discovery of new deposits and the establishment of new mining sites became necessary. The three empirical sections that I have recomposed unpack a more complex territorial transformation in the making, where extraction progressively expands beyond the rationale of literal mining sites. Each of these individual chapters set out to contribute to specific debates according to the problems it presented, yet all of them provide conceptual, methodological and empirical contributions to the study of extended urbanization. This concluding chapter is organized across two sections, the first discussing the achievements and main theoretical, methodological and empirical contributions emerging from this dissertation. The second paragraph, conversely, weaves an analysis of the limits that remain with an outlining of the future research possibilities that emerge concurrently.

The lithium route, as the primary backbone of the fieldwork I conducted, intuitively started at the mining site where lithium makes its appearance from the invisible cavities which conceal it. As chapter 3 sought to demonstrate, however, the making of a lithium mine already overflows the metal fences delimiting the physical site of extraction. Charting the processes by which the extractive operation in the Salar de Olaroz is brought to life required observing and connecting processes of land acquisition, the articulation of indigenous rights, the provision of salaried labour and a problematic relationship to water resources. In

front of these complex sociospatial articulations, the smooth and simplified parlance of strategic coupling—widely employed both in economic geography and in the field encounters that I have experienced—seems scarcely descriptive. Instead, by connecting processes which are normally considered as economic externalities fully into the process of strategic coupling, the chapter hopes to make a conceptual contribution to one of GPN's most enduring concepts. This, as the chapter has argued, is possible by observing strategic coupling in particular and the field of economic in general—so rooted in the industrial and service economy of Euroamerica, from the standpoint of resource extraction and from a Southern position. If an analytical perspective focusing narrowly on the commodity chain of lithium seemed initially possible, already parsing the making of the Olaroz lithium operation openly contradicted this vision: the perspective of extraction seemed to drive territorial transformation not only in the quest for lithium or other strategic minerals, but as a developmental logic as a whole. The solar energy operation which was under construction during my visit in late 2018 was particularly descriptive in this sense. By charting the financial flows that materialized into the assembling of South America's largest solar field, the chapter addresses the multiple levels of financialization that affect these remote high-altitude landscapes. On the one hand, the large-scale global flows of financial liquidity required to materially produce several hectares of solar panels. On the other, much more subtle forms of finance in the form of microcredit schemes multiplying in the surrounding peasant communities. The chapter thus contributes both to ongoing efforts to unpack the multifarious intersections of renewable energy and finance in the growing literature of energy geographies, and to the general exploration of meanings of extractivism beyond the literal site of natural resource extraction. Such attempt is further explored in the following chapter, where a commodity chain-sensitive perspective upon both the recent history and the long-lasting legacy of the port city of Antofagasta finds its focus upon the infrastructures of circulation that sustain its extractive matrix. The chapter problematises the oft-trumpeted arrival of the Belt and Road Initiative to the Latin American region by observing its likely interactions with preexisting schemes of regional development such as the IIRSA initiative. As an initial attempt to contextualize the emerging geographies of the Belt and Road Initiative in Latin American and Caribbean countries within a larger history of urban and regional development, pursued by looking at the Capricorn Integration and Development Hub and the recent infrastructural reorderings at the Mejillones megaport, the chapter finds that the promises of development embodied by these projects are premised upon an extractivist logic despite being advanced through images of sustainable development. In this sense, the chapter contributes to the expanding agenda on infrastructure-led development and the 'infrastructural turn' in development studies by emphasizing the indissoluble connections that exist between the realm of circulation and that of extraction, as these large-scale infrastructural projects of circulation appear as enduring axes of dispossession rather than development.

Taken together, these targeted but seemingly disparate findings highlight the multiple dynamics that emerge when excavating into the exploration of extended urbanization. As highlighted throughout chapter 1, urban studies remains overly focused on moments of agglomeration and the phenomenon of extended urbanization has only recently began gaining more thorough attention. As such, extended urbanization has so far remained rather sketched out in theory and mostly observed from a distance, hence this dissertation is an attempt to open the black box of operational landscapes and resource hinterlands as they have been observed so far. The amount of different research agendas that this thesis had to speak to and weave together is a testament to the complexity that these territories confront us with, a complexity that is perhaps concealed by the very language of resource hinterlands or operational landscapes. As a venturing into the diverse dynamics of transformation that make the resource hinterland of the Atacama, and beyond the more targeted contributions to the different research genealogies outlined above, this dissertation hopefully adds to the general study of extended urbanization in *three* major ways.

Firstly, this thesis centres global production networks as a conceptual tool for studying urbanization in a relational way. By centring the spatialities entangled with the production of network of lithium as the leading ‘field’ of analysis, this thesis has tried to escape other units of analysis that are typically employed when conducting fieldwork, such as settlement types or administrative and geographic boundaries. Exploring global production networks as an approach to spatial research has meant only loosely defining a field of study through customary geographic boundaries. Instead, it has meant constructing a system of relations that piece together sociospatialities that national boundaries, settlement types, cultural traits and are instead held together by supply chain participation. Geometrically speaking, the empirical fieldwork and the conceptual reasoning thereof have escaped a conceptual framing based on areas in favour of one centred upon lines. The dynamics unveiled through a commodity chain approach to the operational landscapes of the Atacama unpack a complex system of sociospatial dynamics certainly existing at the local scale, but most importantly charting transformations that always exceed the boundaries of the site at hand. In this sense, thinking through urban problems via the concept of commodity chains foregrounds urbanization as a profoundly relational fact. This is important, I think, in at least two ways. First of all, attempting to practice urban research through an instrument only passingly mentioned in studies of urban metabolism can contribute to further unsettling the persisting city-centrism of much urban studies and public policies. In this sense, it proposes another conceptual instrument to the expanding toolbox serving those who think about the planetary dimension of contemporary urbanization patterns, trying to escape conventional sites of urban research. Secondly, this ‘improper’ use of the concepts of commodity chains and production networks possibly feeds back into those very research agendas that originally forged these concepts. As argued in chapter 1, despite its original intents and more or less recent efforts, research agendas associated with the commodity chain concept in economic geography have only sparingly unpacked

the spatialities of this concept beyond inter-firm relations. As this dissertation shows, commodity chains and production networks remain potent instruments for unpacking dynamics of uneven development, a testament to the original purpose of these agendas and a nod to the importance of thinking about economic geography in an unorthodox way. Employing production networks as the leading cue of urban research also means doing away with any pretension of completeness: as a potentially endless research driver, a commodity chain does not end or finish. This hopefully leads to acknowledging the inescapable partiality of the researcher's perspective: it would be impossible to enclose the totality of urban transformations occurring in the Atacama as a whole, yet the systems of relations encountered in following the production network of lithium are still capable of unpacking crucial empirical phenomena and to connect them across scales. This, hopefully, is a contribution towards a geography which is not afraid of *doing* something (Knight 1986). This leads me to the second major contribution that I envision through this dissertation.

Secondly, the challenge to invent and construct a methodological approach to extended urbanization lead to possibly meaningful advancements around the modes for researching this question. As I have argued throughout chapter 2, the planetary urbanization agenda has often relied upon a gaze from afar, a telescopic perspective aimed at capturing urbanization as a planetary totality. This, in the view of feminist, queer and postcolonial critics, too easily leads to the erasure of the more subtle aspects of the urban experience and hence to theorizations that occlude its specificities. As I have argued, the embedded perspective that these critics propose as a response is practically impossible and conceptually untenable across the vast expanses of extended urbanization. A truly transcalar perspective on urbanization patterns should not assign privileged positions to any point of view, be it telescopic or embedded. These considerations have emerged both from a reflexive fieldwork practice and from a close reading of current debates around the meaning and practice of ethnography. As urban scholars' attention gradually moves to extended moments of urbanization, the methodologies for researching territories of extended urbanization are all but consolidated praxis. Instead, they unsettle the customary methods of urban research, opening the field to possible experimentations. This dissertation, in this sense, has advanced a methodological construct that moves in this direction, building upon multi-site, mobile, relational and thin modes of ethnographic inquiry that move beyond the pretension of thickness and embeddedness. This, I think, represents a possible way of moving across and unravelling the multiscalar dynamics that come to constitute territories of extended urbanization.

The final contribution that this thesis proposes pertains to the more empirical and political aspects of the dynamics uncovered by this dissertation. Following the global production networks of the technological artifacts that are the emerging grammar of the 'sustainable city'—lithium-ion batteries, the initial stimulus to travel to the heights of the Atacama— and so opening the black box of the lithium landscapes of Argentina and Chile has articulated how the making of green transitions in urban agglomerations entails profound sociospatial transformations

in territories of extraction that span the scale of the planet. Uncovering the dynamics of uneven metabolic exchange founded upon a paradigm of extractivism has been possible by exploring further the idea of an urban metabolism that exceeds the boundaries of the city as a settlement type and a conceptual locus. It is thanks to this concept that it has been possible to forge a conceptual and material connection between the making of green transitions and the much less debated geographies of extraction in the hinterlands they depend upon, centred on to the murky spatializations of strategically coupling natural resources to global networks, on the proliferation of extractive financial schemes and on the enduring, large-scale extractivism embodied by logistics infrastructures. In this sense, I think that centring extraction in the study of urban metabolism beyond ‘methodological cityism’ has the power to bring the conceptual apparatus of planetary urbanization in a closer dialogue with contemporary discussions on the environmental emergency. The findings of my work suggest that the conceptual toolkit of the planetary urbanization agenda can productively work as a critical engagement with contemporary environmental questions. More specifically, through the conceptual and physical sites of resource hinterlands and the lens of ‘global extraction networks’ that put resources squarely at the centre of the geographies of human settlement on the planet, it stimulates a sharper edge to a transition that is recurrently presented as an undeniable necessity, as a new normality. Through the conceptual apparatus deployed by this thesis and its empirical explorations, a process of co-production between the city and its outside becomes visible at a higher definition, not at the scale of geographic immediacy as in classic discussions between cities and hinterlands, but at the scale of the planet. This perhaps foreshadows possible a way of think about Harvey’s famous question: what kind of geography for what kind of public policy (1974)?

Placing the multiple dimensions of extraction squarely at the centre by looking at extended moments of urbanization puts planetary urbanization as ‘a way of seeing’ at the service of contemporary socioenvironmental struggles, thus reasserting the centrality of the planet in the planetary urbanization agenda. A global production network approach to the study of urbanization patterns, in this sense, emerges as a sharp tactic to unmask what is increasingly presented as a new normality, bringing these green dreams literally down to earth, to their material roots deeply sinking into the bowels of this planet. As I move into the limits that the development of this work has encountered, I also outline the possibilities of future engagement that are foreshadowed by these reflections.

Post-extractive urban futures

In exploring the roots of the li-ion commodity chain, this thesis has travelled to sites of extraction that lie in a geographical context which is traditionally associated to this activity. Latin America, together with Africa, has a long history scarred by geographies of colonization and resource extraction. The many popular

struggles across the continent thoroughly witness this burning reality. In this sense, the first limit that this thesis still encounters is that it has studied the question of extractivism in its somewhat native context. This is of course connected to the original research questions of this work, geared towards a gaining a better understanding of how the different forms of urbanization are co-produced at the planetary scale through global networks of production. Traveling to the extractive territorialities brought to life through the emergence the Lithium Triangle, however, this thesis has also attempted at enlarging the notion of extractivism itself, seeking to observe it from beyond the empirical site of the mine and the conceptual locus of natural resource extraction. In part through the geographic localization of these attempts, this initial contribution to the debate calls for more thorough expansion. Given its empirical scope, this work has highlighted dynamic of dispossession and uneven development that are well known to those who are situated in the Southern portion of the hemisphere. As a consequence of its empirical location, the interpretive potential of extractivism still remains limited. Advancements could be done in this sense by studying the enduring geographies of extraction beyond those territories that lie South of the equator and that have long been coerced into economic activities that, as this thesis has sought to demonstrate, leave few benefits to the territories that they emerge from. Perhaps the Western imaginary of extraction as an exotic question, centred upon bountiful, wild and remote El Dorados is both unproductive for unpacking the dynamics of contemporary capitalism and, most crucially, hardly realistic.

Extractivism is, in fact, not only a problem of a geographic and conceptual South. As I move through these conclusions, the world is experiencing a severe shortage in raw materials that, in turn, is heavily impacting upon production landscapes across the globe, particularly within the Eurozone. This shortage in raw materials and, in turn, industrial products, is partly due to the slowdown of many production sectors through the Covid-19 pandemic (mining included), partly to a mismatch between such lagging supply and the demand rising with the progressive lifting of limitations in many countries across the globe. As these dynamics unfold, it is hard to pinpoint their exact roots, but what is apparent is how these crisis-tendencies fit into a more enduring attempt to at least partly reshore natural resource extraction that has emerged in recent times across countries of the Northern hemisphere. A recent Action Plan released by the European Commission in September 2020 (European Commission 2020) begins to sketch out such attempt at reshoring extraction and easily warns how Europe will be facing a massive increase in mining in the years to come. In the effort to secure the Eurozone's supply of raw materials for the unfolding environmental and digital transition, the Commission has concurrently updated its List of Critical Raw Materials. Among these, lithium has been added for the first time. Geographic scholarship is recently beginning to unpack the impact of this significant turnaround upon the European landscape (del Marmol and Vaccaro 2020). As investment banking and the financial sector begin to emit projections with respect to a new, worldwide commodity supercycle akin to that which

impacted vast regions of the Latin American continent twenty years ago (Goldman Sachs 2020), the empirical findings unravelled by this dissertation provide a critical counterpoint to these enthusiastic claims and contribute to grounding more thoroughly the unfolding transition towards speculative visions of sustainability.

In light of these transformations, the dynamics charted by this dissertation in distant elsewhere, characterized by strong continuities with past models of territorial development, appear as crisp lenses for observing the world as it recovers from the hard-hitting Covid-19 pandemic and navigates through the burning environmental crisis. Despite their emergence from far-flung exotic landscapes, the geographies of extraction that this thesis has unpacked might be closer to home for those of us who inhabit the Northern hemisphere. These geographies emerge to warn us how the lens of extractivism possibly unsettles the comfortable thinking by which dispossession resides exclusively in distant elsewhere, instead granting possibilities for further provincializing Euroamerica and exploring processes of the world becoming South, becoming black (Comaroff and Comaroff 2012; Mbembe and Dubois 2017).

Secondly, I am conscious that this dissertation engages in a limited way with the oppositional and imaginative practices of alternative world-making and, in this sense, reflects only briefly on the transformative potential embedded in the transformations of planetary hinterlands. This is, partly, a limit of the thin ethnographic practice presented in chapter 2, which has offered a limited engagement with the people that I have crossed throughout my ethnography and that inhabit the field. It has allowed me to capture some things while concealing others that, put simply, perhaps required more time and more trust. [...] Given the relative logistical and financial difficulties in organizing physical presence in such remote and distant territories, it has been very hard to keep in touch with many of the people that I encountered in the Atacama. I specifically refer to those oppositional and imaginative cultures embodied by the Colectivo Apacheta, the Biblioteca Andina Ñawpa Yachaykuna and the Asamblea in Salinas Grandes. This leads to the open question of how to reinforce the intimate and co-productive side of a mobile and thin ethnography. This limit is perhaps also connected the notion of operational landscapes itself. Albeit having developed a critique of it in chapter 1, this idea still informs the conceptual framing of this work and hence these resource hinterlands appear as inevitably subjugated to the willpower of globalized capitalism.

However, as Arboleda in the conclusions to his recent book (2020) and Riofrancos across her recent work on the daily dynamics of organizing and daily life across the oppositional community (2019; 2020) have begun to highlight, the hinterlands of capitalist urbanization are also sites of radical social and political transformation. This project, given its focus on the multiple dimensions of extraction that characterize the making of the resource hinterland of the Atacama as a decentred exploration of the emerging geographies of sustainability, scouts, highlights, recognizes and supports only passingly the revolutionary practices making their appearance across these landscapes. As the very idea of

sustainability gains credit in public discourse and policy, its meaning becomes more and more absorbed by technocratic and growth-oriented conceptions. In this sense, these resource hinterlands and those who populate them have the power of questioning such narrow meaning and asking for more just imaginaries. Even though this is not the subject of this work, the geographies that it has uncovered urge us to rethinking the word of sustainability not as the new normal, but as a truly political battleground. Beyond this conceptual stimulus, the oppositional practices that physically resist to extraction across these hinterlands can represent examples for practicing sustainability beyond the paradigm of extraction. In this sense an explicit engagement with indigenous knowledges and cosmologies as potential sources for a radical rethinking of ecological existence is lacking across these pages. This leads me to discuss the possible future research that could inhabit the furrow charted by the present work in order to strengthen the dialogue that the ideas developed in this dissertation can entertain with public discussions and political practices coalescing around the idea of post-extractivism and connected notions.

During the three years of development of this dissertation the battleground for environmental transformation has been radically reshaped. On the one hand, the global environmental movement has gained unprecedented media attention, its issues being catalysed by iconic coalitions such as Fridays for Future and Extinction Rebellion that have erupted into public and popular debates. While this certainly generates higher risks of greenwashing, a number of trends can have us mildly encouraged. Concurrently with a broader public alphabetization and growing sensitivity on the current environmental conditions of the planet and the more and more tangible effects of climatic devastation, attention on the landscapes of extraction in general (Schneider 2020) and on the Andean salares in particular has certainly increased (see Observatorio Plurinacional de Salares Andinos 2021). Across a number of press reports, the toxic ghost of green technocracy is more frequently exposed and more thoroughly recognised in public debates. Moreover, in addition to what I have argued in my literature review on the subject of extractivism, this term is progressively gaining traction beyond the Latin American continent and is now a staple of social movements across other parts of the world, beyond its contexts of origin. In this sense it seems fundamental to put the question of extraction—in broad terms, as this thesis has tried to advance—squarely at the centre of the urgent debates on planetary warming and climate justice (Hitchcock Auciello 2019; Klein 2015). By means of conclusion, as an analysis of the violent counterparts of current models of sustainable development, this thesis provides empirical and conceptual grounds for imagining patterns of urbanization capable of overcoming the paradigm of extraction.

If the prospects for the future of resource extraction in the current model of development are dire, they are met by an equally potent counternarrative revolving around an emerging debate on post-extractivism (Svampa 2015). The ideas developed and instruments gained in and through this thesis can further contribute to ongoing debates that are not confined to the walls of academic

institutions but are beginning to flood much larger social environments, ideas aimed at reinventing modernity beyond the unequal geographies of capitalism, such as notions of the pluriverse (Escobar 2018, 2020; Acosta et al. 2019) and the indigenous *ch'ixi* modernity developed by Cusicanqui (2012). Such post-extractivist imaginaries are, at least in theory, already working in tandem with a flourishing research agenda that tries to shift the centrality of economic growth (Acosta 2017; Demaria, Kallis, and Bakker 2019). These efforts perhaps, as some younger sections of the French environmental movement have rightly underlined, entail doing entirely away with the language of 'transition' (Désobéissance Écolo Paris 2020), a smooth terminology that, as we are seeing, inherently involves a firm maintenance of the status quo. Can an ecology without transition imply the interruption of planetary extraction?

If theoretical advancements around post-extractivist futures are gaining more and more traction, so are popular responses to green technocracy that begin to make their appearance. Initiatives such as the Pacto Ecosocial del Sur clearly bring to the fore an indissoluble unity between the social and environmental justice. Surely, this problem currently plays out as a contradiction of scales, as the global struggle to target climate action relies upon the impairment of environmental justice at the local scale. The sociospatial experience of the extractive hinterland has us thinking about regenerative economies instead of barely extractive ones, beginning from the halting of mining projects and the communities' 'right to say no,' onwards to plotting regenerative forms of settlement and economy. Research on practical and viable alternatives to the paradigm of extraction, especially in economically depressed locales, is still lagging but a precious way out of the current spiral pushing anthropogenic disaster deeper into the planet.

Any project that is promoted under banners of sustainable development yet fails to challenge the uneven metabolic flows and dynamics of violence that this thesis has outlined should be sharply unmasked and firmly refused. The challenge of any future ecological democracy depends upon our ability to decouple the experience of urbanity from the paradigm of extraction.

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