Anthropology of waste:
a research agenda for the study of
cities in the era of climate change

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Abstract

The article theorizes the anthropology of waste as a field of knowledge appropriate for thinking and acting in the contemporary world marked by climate change. Responding to the Anthropocene and the subversion of 'modern' boundaries, waste is taken here as a privileged analytic framework for understanding how cities have become reconfigured as 'Anthropocenic urban landscapes.' By defining the anthropology of waste as an 'epistemology of the Anthropocene,' the text provides a conceptual panorama of the contemporary debate from which a set of theoretical, methodological and political questions emerges. The concept of 'residual infrastructures' is explored through two ethnographic cases based in Rio de Janeiro, demonstrating the potential of waste to renew the anthropology of cities by articulating the growing fields of waste and infrastructure studies. In the article's conclusion, the politics of waste, which emerges from residual infrastructures, is also conceived as a politics of knowledge, outlining a research agenda for this expanding field of studies and indicating possible ways forward in an uncertain future.

Keywords: Residues; Plastics; Anthropocene; Urban infrastructures; Cities.

Antropologia dos resíduos: uma agenda de pesquisa para o estudo das cidades na era das mudanças climáticas

Resumo

O artigo teoriza a antropologia dos resíduos como campo de conhecimento apropriado para pensar e agir no mundo contemporâneo caracterizado pelas mudanças climáticas. Diante do Antropoceno e da subversão das fronteiras "modernas", propõe os resíduos como chave de análise privilegiada para compreender como as cidades se reconfiguram enquanto "paisagens urbanas Antropocênicas". Ao definir a antropologia dos resíduos como"epistemologias do Antropoceno", o texto traça um panorama conceitual da discussão que fornece um conjunto de questões teóricas, metodológicas e políticas. O conceito de "infraestruturas residuais" é discutido a partir de dois casos etnográficos no Rio de Janeiro para demonstrar o potencial dos resíduos de renovar a antropologia das cidades, articulando os crescentes campos dos estudos dos resíduos e os estudos de infraestruturas. Na conclusão, a política dos resíduos, que emerge das infraestruturas residuais, também é concebida como uma política do conhecimento, delineando uma agenda de pesquisa para esse campo de estudos em expansão indicando caminhos possíveis para a ação em vista de um futuro incerto.
Palavras-chave: Resíduos; Plásticos; Antropoceno; Infraestruturas urbanas; Cidades.

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What are the limits of the residual city?
Approaching "Anthropocenic urban landscapes" ethnographically

Since the beginning of the twenty-first century at least, the Anthropocene has been defined by specialists as a new geological age marked by the reconfiguration of the planet's biogeophysical processes and composition due to the impacts of human activity, including its role in climate change. This debate has acquired ever more space in scientific discussions and the public sphere, becoming the subject of disputes and diverse epistemological developments.

In the humanities, anthropology especially, the Anthropocene has kindled a range of distinct approaches, conceptual formulations and critical debates (Todd 2015; Tsing 2019; Haraway 2015; Chua & Fair 2019; Chakrabarty 2021; Eriksen 2021; Moore 2016; Ferdinand 2022; Spivak 2003; Spiegel 2013; Hecht 2018b; Liboiron 2016). One of the main analytic strengths of the notion is the way it destabilizes entrenched dichotomies "between 'nature' and 'culture' and 'human' and 'non-human,' as well as the academic disciplines built around them" (Chua & Fair 2019: 2; Chakrabarty 2021). The Anthropocene proves capable of questioning and reconfiguring conceptual, material, epistemological and ontological boundaries.

One feature of this field is to demand and provide connections between distinct areas of knowledge (Eriksen 2021), a shared 'critical zone' and a 'common ground' (Latour 2020: 21) between the natural sciences and humanities. Another emergent potentiality is the trend for an "imbrication of the analytical with the political and the ethical" (Chua & Fair 2019: 2), oriented towards urgent action in the present.

While the planetary scale foregrounded by the Anthropocene is revealed as a conceptual and political force, this same aspect is also a weak point. The notion has been subject to numerous critiques that emphasize its homogenizing effect. These critiques highlight, above all, the way in which it conceals the disparities in the distribution of the risks and harm and the inequities and injustices that permeate the forms in which populations are exposed to and suffer from the effects of the Anthropocene across different parts of the planet.

These critiques tend to emphasize the Eurocentric matrix of the dominant narrative of the Anthropocene (Todd 2015, quoted in Chua & Fair 2019), as well as the "historical contingency, political contestation, and socio-economic inequality" involved in its constitution (Chua & Fair 2019: 10). Simultaneously, alternative definitions like the Capitalocene (Moore 2016), Negrocene and Plantationocene (Ferdinand 2022), or 'planetarity' (Spivak 2003; Spiegel 2013), have been advanced that stress the imperative for reparation and accountability, recognizing the specifically anthropogenic character of climate changes and its colonialist, slave-owning and patriarchal origins – arguments located at the core of the idea of 'environmental racism.'

Climate change – materialized in phenomena like the rise in sea levels, the extinction of biodiversity, plastic and toxic contamination of aerial, marine and terrestrial ecosystems, global temperature rises and disasters like flooding, landslides and erosion – is manifested as a consequence. The mass production of waste and its contaminative effects comprise one of the central elements of this process, leading some authors to define a *wasteocene* (Armiero 2021).

By acknowledging human beings as 'geological agents' (Chakrabarty 2021) responsible for climate change, these critical considerations call attention to inequality, diversity and the importance of considering the multiscalarity and local contexts involved in the knowledge produced on such complex phenomena (Eriksen 2021). Here I set out to explore the advantages of the anthropological perspective "from below and within" (ibid) in order to think about waste as a critical analytic concept to comprehend the Anthropocene and climate changes. My hypothesis is that through waste we can methodologically operationalize the Anthropocene, descending from the planetary scale to the urban. In this proposal, 'planetary' and 'urban' are not opposed but contiguous. Moreover, it is this interscalar dynamic that allows the adoption of an ethnographic starting point, anchoring our perspective in a local and specific 'terrain' to then trace and comprehend the relations between the multiple dimensions and scales involved without homogenizing or rendering invisible the power relations that compose them.

Waste, like the countless phenomena that constitute climate change, is not limited to pre-established dualities, conventions and boundaries: it is a transgressive object. Hence Moore's suggestion in her study in the Bahamas (2015: 7) for us to think of an 'Anthropocene space' to be explored – rather than taken as a given – serves here as a methodological proposal to reflect, via waste and the residual, on the city as an Anthropocenic landscape.

This analytic movement allows us to question the habitual forms of thinking about urban boundaries, while simultaneously transforming the boundaries of cities themselves, their dynamics and their limits, into an object of analysis allowing us to observe how waste reconfigures them. At the same time, it also interrogates and ethnographically qualifies the concept of the 'Anthropocene' along with the concept of the 'city' itself.

This article thus explores waste as an emergent object of study, capable of renewing the anthropological perspective on cities and the analysis of urban studies more widely. Waste has the potential to operate as a valuable gateway for reflection since it exposes issues now unavoidable in the life of cities in a present marked by environmental crises and climate changes. As an object of study, they provide analytic access and allow us to touch on key points that challenge contemporary social theory, leading to deep reformulations of the latter and expanding its scope.

An anthropology of waste thus proves a fruitful avenue of research in at least two senses, both connected to the centrality of the ethnographic approach. First, it enables an expansion and reconfiguration of the scientific field in which waste was traditionally conceived and interpreted as objects of study. In the Brazilian intellectual context, converging with a more general tendency, wastes were historically conceived in a strictly 'technical' form, appropriated by areas of the 'hard' sciences like social medicine and engineering (Reno 2015; Miziara 2001.[1] Over the last 15 years, though, the topic of waste has shifted from the margins to the centre of debates, forging a new field of studies in the humanities, the social studies of waste, also known as waste studies or discard studies.

The humanities and anthropology in particular have a substantial contribution to make in this debate due to their capacity to promote a critical gaze that denaturalizes the belief in the neutrality of technique and the possibility of technical control of the world, an idea central to modern and modernist conceptions (Brouwer et al. 2010; Latour 2005). Waste management techniques thus reveal dimensions that "are and always were as moral and political as they are mechanical and mathematical" (Reno 2015: 566). Anthropology enables us to incorporate cultural perspectives into the reflection on waste that dialogue with questions of power, class, gender, race, identities and territorialities at the core of contemporary society.

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[1] With significant social implications insofar as these specialists founded ways of thinking about the city and urban policies (Chalhoub 1996; Machado et al. 1978; Valladares 2005).

Second, waste as an object of study also enables a renewal of perspectives and ways of thinking about urban contexts within the diverse traditions of urban anthropology itself, stretching and reshaping the limits of what historically and conventionally has been conceived as 'urban.' Waste problematizes the dualisms of nature/culture and society/environment, promoting a conception in which 'nature,' its elements, fluxes, dynamics and effects, is considered – on the contrary – to be co-constitutive of cities.

The insight that land, water, hills, air, human and non-human bodies, their fluids and excrements, are agents intrinsic to the production of the urban changes the way we think about urbanization processes themselves, expanding the anthropology of cities to include the anthropological analysis of urbanism and urbanization. This adds a strong historical and processual dimension to analysis of the urban. In this way, we can also think of cities as the residues of complex long-term processes marked by sets of sociotechnical interventions that become juxtaposed and superimposed over time. The results are always provisional since their elements, effects and relations extend into the present with unpredictable – or at least not entirely controllable – effects.

These processes are also marked by violent interventions guided by colonial (geo)political dynamics and projects of modernity, which prompt us to imagine cities as the ruins of imperial formations (Stoler 2013). However, waste, putridity and rubbish should not be conceived as simply a metaphor of the colonial legacy, but as a permanent everyday material and practical formation that constitutes biopolitics and actualizes colonial power structures on a global scale (Reno 2015; Liboiron et al. 2018, 2021; Lima 2023).

The idea I wish to stress here is the productivity of waste in the construction of 'worlds' (Latour 2020; Haraway 2016) in epistemological, ontological and political terms. This potential is due largely to the heterogeneity of this '*sui generis* object,' which presents both possibilities and challenges for anthropological analysis. Reflecting this characteristic, the text contains a conceptual discussion of waste based on the qualities that define its materiality and its mode of existence in the world. This also concerns the possibilities of producing knowledge about waste and the ways of studying it and acting on the basis of this knowledge. As well as an object of study, waste is conceived as an object of action that engenders specific ontologies/worlds and forms of doing politics.

I present a panorama of the discussion on waste in anthropology, centring on three main theoretical approaches, which open up a series of analytic, ethnographic and political questions. This presentation of the topic does not aim to review the bibliography pertaining to social studies of waste – an interdisciplinary field that, although recent, has been expanding rapidly over the last decade with an increasingly diverse international literature. Instead I seek to demonstrate the fertility of this field of studies for anthropology by highlighting a set of problems that delineate a conceptual panorama, providing theoretical prisms, epistemological entry points and methodological possibilities for research.

Setting out from the concept of residual infrastructures, I discuss the potential of waste for the anthropology of cities and urban studies to articulate two internationally emergent fields of research: waste studies and infrastructure studies. To this end, I present two cases of residual infrastructures that draw from the ethnographic research developed by myself over the last decade and demonstrate how waste makes the city and makes politics. Finally, the politics of waste, which emerges from residual infrastructures, is conceived as a politics of knowledge. Thus I seek to delineate a research agenda as a strategy for identifying possible alternative paths for this expanding field of studies in a global scenario marked by climate change where, faced with an uncertain future, knowledge must be combined with action.

Epistemologies and ontologies of waste: from modernity to the Anthropocene

The history of waste is profoundly marked by the emergence of the urban-industrial era in a double sense, material and epistemological. Waste possesses an intrinsic relationship to human forms of inhabiting the world and the transformations in ways of life associated with these modes of dwelling. The dynamics of this process articulate the forms of classifying residues, their physical-chemical composition, with the practices associated with their management, which include techniques, lay and specialist knowledge, legal regulations, institutional and administrative apparatuses, commercial networks, and the configurations of urban landscapes and their infrastructures.

Although no human activity is unaccompanied by the generation of waste, for a long period its presence among people and amid human activities occurred in close and unproblematic form (Miziara 2001) to the extent that agrarian societies successfully avoided pollution by solid waste. Waste, its production and the ways of dealing with its presence, is a phenomenon constitutive of cities and urban modes of life, which progressively intensified with industrial development and mass production (Melosi 1981).

From the urban-industrial modern era, the growing production and consumption of commodities made the scale and size of the problem of waste much greater than those faced by previous societies. City dwellers were forced to confront mass pollution in many different forms. In this context, waste emerges "as a major blight" (Melosi 1981: 6). This is when waste also began to be inscribed in regimes of invisibility, entering modern technologies for its disposal and elimination. An apparently paradoxical combination surfaces at this moment: just when waste is being more produced than ever, it is also more systematically made invisible.

The set of practices and techniques composing waste management systems constitute what I have called 'technologies of concealment' (Lima 2021a) in that they do not provide an effective solution to the problem but merely remove discarded material to landfills on urban outskirts (Melosi 1981; Reno 2008; Gabard 2011; Lima 2021a; Mauch 2016). The result is their elimination from the field of vision with the removal of discarded materials from the range of the senses, like sight and smell, but also their elimination from the field of reflection and action. As Carenzo (2011: 21) emphasized, the quotidian connection established with *lixo* (waste or garbage) acquires a markedly functional and instrumental meaning, namely that of ridding ourselves of it, saving us from having to reflect even minimally on what happens in terms of its management, treatment and disposal.

The popularity of this 'model of invisibility,' the basis on which the production and disposal of waste in the United States, Brazil and many other countries of the Global South are organized, can be credited to the "*importance of keeping waste hidden from view*" (Reno 2008: 8). In material and cognitive terms, the kinds of management and concealment that this model imposes on waste connects to modern epistemology, marked by the idea of 'purification' (Latour 2005). This epistemology is bound to the possibility of dominating the disorder of the natural world through technical-scientific control. The belief system of the world order of twentieth-century modernism "was informed by the vision of technology as a tool of reduction, which could purify nature from a state of randomness into one of cleanliness, controllability and perfection" (Brouwer et al. 2010: 9).

For a long time, waste figured in economic analyses as 'externalities,' the unplanned by-products of industrial processes, "entities that escape the cost and profit calculations of business accounting" (Liboiron et al 2018: 334). Hence, waste remained non-apprehensible in cognitive terms, operating its effects in the world protected by the absence of reflexivity on the part of the diverse actors interacting with it.[2]

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2   The rupture of this process of concealment occurred with the discovery of the toxic exposure suffered by peripheral working class and racialized communities, affected by pollution or by living in contaminated localities such as former landfills. This gave rise to the movement campaigning against environmental racism and injustice (Lerner 2010 Bullard & Johnson 2009; Cole & Foster 2001).

Invisibility was constituted as a device of liberal governance where the more the operation and flows of waste management remained invisible, the better (Reno 2015: 561). As a result, waste, pollution and toxicity should not be understood as unintentional by-products of these systems but as a constitutive dimension of industrial capitalism and the corporate organization into global production and destruction networks (Dicken 2011; McGrath-Champ et al. 2015; Herod et al. 2014).

However, the progressive development of this process, with a monumental volume and quantity of diverse kinds of waste accumulating continuously in the world, led to a rescaling in which waste moved from invisibility to ubiquity. The inscription of waste in modern technical flows and regimes of invisibility ceased to conceal them effectively and the twenty-first century marked a turning point in which it became characterized by its mass presence across the planet (Liboiron et al. 2018).

The inevitable exposure to the massive and growing quantity of waste generated by human activity, including carbon molecules, toxic chemical substances, plastics and so on, configured a new era of toxicity defined by scientists as the Anthropocene (Haraway 2015, Hecht 2018b; Liboiron 2016). The existence of waste, relegated to invisibility under the epistemologies of modernism (Latour 2005), acquires centrality in the Anthropocenic perspective. It becomes central not just as a symbol (Eitel 2021) but also as a methodological and epistemological possibility: "in important ways, tracking (toxic) wastes is how we know the Anthropocene" (Hecht 2018a). If the Anthropocene is the "apotheosis of waste," monitoring the discarded and the dumped is a "key technique of Anthropocene epistemology" (Hecht 2018b: 111).

The fact that waste and traces of human activity have become visible in the depths of the planet's crust was the initial motive for classifying our present era as the Anthropocene (O'Hare 2019). This categorization is related not just to the quantity and extent of waste now in existence but also to the quality and composition of what is 'thrown out' in contemporary societies, marked by mass consumption linked to a logic of disposability (Cooper 2010; Strasser 1999). If there is not just one single epistemology of waste (Alexander & O'Hare 2020), this is because there likewise exist multiple ontologies of waste (Eitel 2021).

The anthropology of waste thus needs to focus its ethnographic gaze on the concrete dimension of waste and its modes of existence in the world. By following waste in all its material heterogeneity – excrements, toxicities, plasticities, metals, radionuclides and so on, as well as its agencing (Cochoy 2014: 117)[3] and the multiple relations and networks it produces, we can discover its 'productivity' and the forms in which they co-participate in the making of the world in which we live. This is also a secure methodological path to escape the limiting prism of the modern epistemologies of purity. In these, the material dimension of 'garbage' is made invisible by 'technologies of concealment' that seek to eliminate it, while, as a category, it is invariably inscribed in a negative semantic field, associated with dirt, contamination and worthlessness.

This ethnographic investment in waste is essential to overcome the 'technologies of (un)knowing' (Alexander & O'Hare 2020) that permeate the modes of comprehending what is discarded and rejected. These technologies work to silence alternative forms of knowing these things and objects, concealing the political dimension of situations in which waste matters (Eitel 2021). After all, the production of ignorance, as an absence of knowledge, can also be strategic (Hecht 2018b).

For this reason, amid all their diversity, studies in the field of the anthropology of waste converge towards abandoning the prism of abjection, concentrating instead on the form in which waste and its management can produce new social relations, cultural forms and political demands (Hecht 2018b; Hawkins & Muecke

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3   The French concept of "agencement" and the equivalent Portuguese term "agenciamento" have been translated in this article as "agencing", following Franck Cochoy's (2014) discussion of the concept. Here it means both arranging the world (agencing as producing specific agencements, i.e. arrangements/assemblages/networks) and putting these in motion (agencing as 'giving agency', i.e. converting some people, non-human entities, or 'hybrid collectifs' [Callon & Law, 1995] into agents, or rather actors).

2003, Hawkins 2010; Gille 2010; Reno 2015; Liboiron 2016, 2021; Millar 2008, 2018; Lima 2017, 2021a; O'Hare 2022; Carenzo 2020; Perelman 2010; Fredericks 2018).

In the epistemologies of the Anthropocene, waste is a privileged object due to its planetary dimension, reflecting the scalar magnitude it reaches in both spatial and temporal terms. As Hecht (2018b: 112) warns, though, we cannot lose sight of the fact that "*the violence associated with the Anthropocenic apotheosis of waste is not merely planetary – it also has particular, differential manifestations.*" For this reason, the anthropologist proposes to consider an 'African Anthropocene' as her starting point for the analysis of these multiple and differential forms of violence.

Mapping the effects of waste, the ways in which it acts differentially in diverse contexts in the Global North or South, in urban peripheries, at the intersections of class, race and gender, among marginalized populations and minority ethnic groups, is fundamental to comprehending waste, pollution and toxicity. This is especially so when it comes to understanding how waste is agencied and distributed unequally in space, operating as an agent that produces difference, inscribed in the world through diverse forms of violence, racism, colonialism and injustice (Liboiron 2021; Jaffe 2016).

At the same time, waste is also given new meanings by marginalized social groups, who, through discarded objects, encounter livelihoods and claim rights, making the material politics of waste operate along collective lines, appropriated as a 'commons' (O'Hare 2022; Solíz Torres 2019). In this way, its inherent political condition comes to the fore. As highly mediating and relational, ambivalent and ambiguous objects, they configure "entanglements of labor, power and possibility" (Reno 2015: 558). Through distinct theoretical and ethnographic approaches, the anthropology of waste provides analytic paths to explore and discover these multiple waste worlds (Doherty 2021).

Waste in anthropology: three theoretical approaches and their challenges

This text is based on Patrick O'Hare's (2019) formulation of waste in anthropology in which he proposes a genealogy centred on three main approaches. Here I adopt the author's schema to discuss how each approach raises a series of specific questions, casting a spotlight on key characteristics and aspects of the anthropological reflection on the life of waste, the worlds that it engenders and the challenges it poses to us. It should be noted that these framings in themselves are limited and each seeks to respond to the evident shortcomings of the others, the relationship between them being one of complementary rather than mutual exclusivity. My reading also is not intended to be totalizing, other theoretical angles and readings being possible.

The first approach, symbolic-structuralist, has its origins in Mary Douglas's classic work, *Purity and Danger* (1976). In her analysis of the idea of ritual purity and the relationship between the sacred and the profane through pollution rites, Douglas highlights the systemic, symbolic and relative character of what is considered impure. Her formulation of dirt as 'matter out of place' is frequently cited as a source of inspiration that functions as a foundational origin myth in the field of social studies of waste. Douglas's pioneering analysis is important since it underlines the cultural dimensions of the ideas of pollution and dirt, as constituted by their distribution in a classificatory system, both challenging and reaffirming a determined cultural order.

This perspective, which places the emphasis on the cognitive and linguistic dimension by stressing forms of classification, reveals how making something disposable is also the outcome of a classificatory act that produces specific effects. In my own work, resulting from my doctoral research (Lima 2021a), I discuss the use of the category *lixo* (waste/rubbish) and its consequences. I argue against the analytic use of the term due to the fact that it proves to be "an epistemological straitjacket for things by enclosing them in a framework that objectifies them, in negative fashion, and even conceals their physical qualities, preventing their appreciation" (ibid: 37). I demonstrate that this category and its agency pose three main questions for the reflection on waste:

visibility, transitivity and value. I also stress that bringing the residual to the centre of analysis, eschewing the modern epistemology of purification and negation in favour of pursuing alternative forms of knowledge, logic and meanings, is an ambition that can only be realized empirically and ethnographically.

The modern epistemology of waste is also founded on the hygienist paradigm, which obeys a logic guided by notions of cleanliness and purity. Based on this paradigm, the subjects responsible for handling discarded objects are symbolically assimilated with them, becoming stigmatized and seen as a problem that oscillates between dirt and disease. When applied to the people and places related to waste, this conception and imaginary operate as "images of control" (Hill Collins 2019) of specific populations. Transformed into part of the problem, these populations began to suffer the consequences of the hygienist and civilizational framing that advocated their elimination as a health and safety measure for 'society,' as conceived from the viewpoint of the dominant classes. Consequently, these subaltern social groups were subject to relocations, evictions, violence and expropriations, becoming the target of invisibilization devices (Lima 2021a; Reno 2008; Fredericks 2014; Sharma 2021; O'Hare 2022).

These prevailing representations and imaginaries concerning waste can assume authoritarian dimensions, composing the bases for infrastructures of domination. This occurs insofar as these representations separate waste from their particular sociocultural context, projecting apparently 'universal' properties onto them. Eitel (2021) called this normative understanding of how waste should be perceived – and through which elimination strategies they should be treated – 'waste fantasies.' These fantasies are established as the sole relevant interpretation and affect how we perceive our planet, rooted in histories, narratives and imaginaries of the future.

The symbolic dimension, the imaginaries and conceptions surrounding waste, which underpin its forms of classification and the ways of thinking about and treating waste, thus prove central. The understanding of modern epistemology and waste 'fantasies' and their effects in terms of the exercise of domination converges with Liboiron's reading (2019) of Douglas's formulation of dirt as 'matter out of place.' This does not just concern the forms of classifying and ordering the world but is also an analytic trope on power, which entails the elimination of whatever appears to pose a threat to the order of the system that sustains power.

In this context, materiality, space and morality matter since they perform roles in power structures, sometimes sustaining them, other times challenging them. The materialities of waste are what stretch, destabilize and have the capacity to reconfigure our cultural categories and scientific concepts. Through them not only can we construct a more accurate form of knowledge, we can also elaborate action strategies in response to the complex problems they pose. "Material specificity matters for action" (Liboiron 2016: 5) and thus we arrive (once more) at the material politics of waste.

The precursor to the second, economic-materialist, approach is Michael Thompson and his work *Rubbish Theory* (1979), dedicated to understanding the circulation of materials between different regimes of value, focusing on the creation and destruction of value through material flows. To comprehend how objects are subject to radical transformations in value, the author proposes a tripartite schema of types of goods. The third category of his schema, goods that are neither increasing nor decreasing in value but have no value at all, are rubbish.

The field of the social studies of waste developed and extended its scope through the exploration of the question of value. This poses a challenging analytic problem insofar as "there is no material which is intrinsically trash" (Whiteley 2011: 24), although anything can become it. The discussion shifted therefore away from the 'absence of value,' which essentialized waste in modern epistemologies of purification, towards what was identified as a significant characteristic of the modes of existence of waste: its indeterminacy.

The ontological indetermination of the dialectic waste/value formed a starting point (Hecht & Gupta 2017). In this problematic, matter may be waste in one context and a commodity, resource or art in another, such that a change in value can occur even when the physical characteristics of the discarded objects remain unaltered. The processes through which 'trash becomes treasure,' with waste transforming into a resource, have drawn the attention of anthropologists in a series of ethnographies. These studies have analyzed the world of reprocessing discarded objects in contexts related to the recycling economy, including the work of waste pickers in landfills, dumps, in the streets or in cooperatives (Millar 2008; Reno 2009; Carenzo 2011; Lima 2017; O'Hare 2022; Fredericks 2018).

In the "cultural economies of waste" (Hawkins & Muecke 2003), these pickers perform a complex role in the formation of value, whether monetary, symbolic or social. For this reason, they are characterized by processes of indeterminacy, "introduced by the gap or moment where value is yet to be decided" (2003: xii). This indeterminacy makes waste a 'plastic' material – in the sense of its opening to and potential for a change in form (Millar 2018) – and also 'transitive,' subject to deviations in trajectory and reversals in status that transform its value, always at risk (Lima 2017). As I have argued, "this transitivity appears to be at the centre of the question of waste and allows a positive light to be cast, in terms of displacement, circulation and flow, on what supposedly has no proper place, the 'out of place'" (Lima 2021a: 168).

Since "[c]hanges in value are never clear, unidirectional, or fixed in time and space" (Hecht & Gupta 2017), the ethnographic focus should be on the materiality of waste and its flows. This enables us to investigate how waste, in all its ontological heterogeneity, follows its own paths in global processes at diverse scales (Alexander & Reno 2012; Knowles 2017). In its trajectories and 'social lives' (Appadurai 1986), waste traverses distinct regimes of value, markets and exchange circuits, mediated by management technologies, regulatory devices and political disputes. Its circulation does not merely compose flows, it also simultaneously produces spatialities and relations whose effects are multiple and remain largely unknown.

The physical-chemical composition and material properties of waste are fundamental to determining the types of flow, nature, extent and duration of the networks that engender it and the heterogenic actors that form part of it. As a strategy to draw attention and give analytic centrality to materiality and its productive agency, scholars have theorized waste as 'vibrant matter' (Bennet 2010) that possesses 'liveliness' (Hird 2012). The use of this kind of metaphor has been criticized as a 'waste fetishism' (Gille 2013; Hecht 2018b) by lending it an agreeable and even mystical connotation that can render invisible the brutal dimensions that accompanies its production in many parts of the world.

Thinking about waste anthropologically is not thinking in general but describing specific materialities to show the ways in which these substances and things have agency and how the materials that are constitutive of waste remain active in the world. When we speak of rubbish or waste, there is a tendency for us to interpret them as solid. Reno (2015) warns about the mistake of thinking of solid waste as a metonym for every kind of waste, calling attention to the simultaneous existence of biological, food, hospital, industrial, toxic, electronic and nuclear waste, among others. At their diverse scales ranging from local to global, the flows, regulations, knowledge, management infrastructures and final disposal are not identical but transform with the historical context, forging distinct 'waste regimes' (Gille 2010).

The perspective of economic anthropology, focused on the materiality of consumer goods and on their flows through distinct regimes of value, goes beyond the pollution-purity, dirt-cleanliness dualism that constitutes the symbolic-structuralist approach. It highlights problematics that explore the waste-value binary not as opposite poles. Hence, we shift from the idea of one single cultural approach to the multiple practices that constitute the "political economy and government of waste, and how these are impacted by contemporary knowledge about waste and its effects" (O'Hare 2019: 6)

Waste is not something out of place – not least because when we throw something away, this 'away' simply does not exist, as Surak (2011) reminds us. Rather waste is a material inseparable from the production of spatial relations at diverse scales. The flows and politics of waste connect people at huge distances and become actively entangled in planetary processes (Reno 2015: 564). Conceptually and materially, these geographies of waste reconfigure the relations between the Global North and South (Millington & Lawhon 2018). At the same time, they also decisively impact the boundary between 'nature' and 'culture' to the extent that human and non-human agents interact from molecular level up and become hybridized in unpredictable ways. In this way, they shape anthropogenic landscapes, marked by the reproduction of inequalities and by the massive presence of contamination, toxicity and climate crises.

The third approach, intersubjective and posthuman, doubles down on the interest in the dynamics and flows of waste and their effects with "a focus on subjectivity and the kinds of relationships and identities that are created through associations with waste" (O'Hare 2019: 7). The posthuman approach expands the analysis of the kinds of relations involved in waste assemblages, decentring humans by considering them "just another animal involved in cross-species interactions" (ibid).

The investigation of the ways in which waste, in its diverse trajectories, produces subjectivities is concentrated more emphatically, though not exclusively, on the domains of postconsumption, legal and illegal flows, the formal and informal management of waste and the various kinds of work that it engenders. After all "[f]or waste to end up somewhere else, regardless of what is done with it, requires labor" (Reno 2015: 561).

The question of work mobilizes a substantial bibliography in the anthropology of waste, focused on multiple aspects of the recycling economy sustained by workers worldwide. This literature is composed of a series of ethnographies that move forward discussions on the practices of waste pickers and other waste professionals in the global context (Medina 2007), especially in the global south (Schamber & Suárez 2007, 2011a, 2011b). These include the various sociocultural, spatial and subjective dimensions of the informality of work in dumps and landfills (Lima 2017; Millar 2018; Knowles 2017; Samson 2015, Perelman 2010; Reno 2008; O'Hare 2022); the forms of citizenship, privatization and (neo)liberal and popular modes of waste management (Sorroche 2017; Carenzo & Fernández Álvarez 2011; Samson 2015; Fredericks 2018); cooperativism, solidary economies and circular economies (Gutberlet et al 2017; Carenzo & Sorroche 2021); the formalization of work and political organization (Lima 2018, Perez 2019); the dialogue between work studies and gender (Gorban 2014; Dias & Ogando 2015); management technologies and the final disposal of waste, which may be supposedly 'green,' entailing the invisibilization, displacement and dispossession of the urban poor (Lima 2023; Fredericks 2014); or innovations from below that show the potential of these social groups to propose creative and participative alternatives to the 'integrated' management models forged in countries of the Global North through processes of 'vernacularization' (Carenzo 2020; Carenzo & Sorroche 2021).

This set of ethnographies explores diverse relationships and dimensions pertaining to the recycling economy, the worlds of labour and the practices of handling and managing 'solid' waste. However, the literature dedicated to the exploration of materialities reveals the limits of these conventional forms of classification and the complexity that pervades the modes of existence of waste more broadly. Plastic is paradigmatic in this sense and through it we can highlight the importance of the complementarity between the theoretical approaches presented above and the ways in which they interconnect, deepening our understanding of how challenging these are in ontological and epistemological terms.

The unsustainable plasticity of plastics: a material politics of waste in action

The introduction of plastic was an irreversible turning point in the history of the composition of waste, marking the emergence of synthetic materials.[4] Its resistance and flexibility and its capacity to replace other materials afforded a diverse range of uses and 'facilities' that transformed the practices of consumption and domestic life, turning plastic into an icon of modern life. Its properties as a raw material and its physical-chemical characteristics proved especially favourable to reproducibility (Fisher 2012). This enabled capitalism to enter the era of the disposable and acquire a new level with the "refuse revolution" (Cooper 2010).

Since their introduction, plastic materials have become embedded in all aspects of everyday life and amass everywhere across the planet's surface on a daily basis. There currently exist more than 10,000 types of plastic polymers in use (Gabrys et al. 2013). In the first decade of the twentieth century, plastic consumption exceeded 260 million tons per year (Thompson et al. 2009). Faced with this scenario, scholars like Gay Hawkins and others have highlighted the 'vibrant' dimension of plastic in contrast to the idea of an inert and always 'bad' matter, analyzing its productive agency in political terms. Their research explores the processes and modes through which plastic, as a "complex and heterogenic artifact" (Hawkins 2009: 184), relates to life and shapes it. Whether as water bottles (Hawkins 2009, 2013), plastic bags (2010) or through a potentially infinite variety of other objects, these materials configure subjectivities, including in ethical terms. For these scholars, "the material force of plastics prompts new forms of politics, environmental responsibility and citizenship" (Gabrys et al. 2013: 4). Tracing the entire trajectory of the production of a flip-flop from petroleum extraction to a waste dump, Knowles (2014) proposes reconceptualizing globalization. She shows the fragility and precariousness of the latter through the 'backroads' that articulate global and local scales, inserting people's lives in their everyday textures into her analytic framework.

Ethnographies of the recycling economy in Rio de Janeiro, which discuss the centrality of plastic and explore the heterogeneity and diversity of plastic materials in the conformation of the worlds of work of recyclable waste pickers known as *catadores*, argue in favour of the idea of 'plasticities' (Lima 2017; Millar 2018). I show how the work of waste pickers, historically disqualified, is based on a sensible knowledge of the properties of plasticities, which derives from a sensitive knowledge developed through the everyday intimate relationship with these materialities (Lima 2017). In this way, I underline the productive dimension of the work of waste pickers, showing how they recreate the value of these materialities and generate new forms of doing politics. The material politics of the pickers is founded on a "capillary, qualitative and artisanal management of waste and on a popular model of recycling" (Lima 2021a: 373), which opposes modern corporate and income-concentrating waste treatment technologies.

In her ethnography, Millar (2018) considers the activity of waste pickers 'forms of life.' Analyzing the plastic economy of this work environment, she explores plasticity as a theoretical instrument capable of forging a conceptual language that can account for this world in positive terms, moving beyond the formal/informal duality that characterizes how economic universes are conventionally conceived. Understanding plasticity as the quality of changing form, anthropology reveals the relationality of economic life and the ways in which diverse materials, relations and practices 'take shape' within it. Hence, based on histories of plasticities, it foregrounds the creative dimension of the work of waste pickers, offering a critique of any supposed lack of form: "the notion that some things in the world, whether matter like garbage or an act like collecting recyclables on a dump – lack order in themselves" (Millar 2018: 15).

However, the life of plastic waste goes far beyond 'final' disposal sites like dumps and landfill sites. "The most common way of dealing with waste is to dump it, whether in bodies of water, in streets and alleys, in geological depressions, or on open land" (Reno 2015: 562). Recycling activity in the Global South is constituted

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4   I analyze this history in more detail in Lima (2021a).

as forms of life, means of subsistence and political struggle of peripheral urban populations. Its importance is thus multiplied since, beyond the environmental question, it also engenders more inclusive and fairer development models and city projects. Yet, however active and necessary this activity may be, the amount of plastic existing on the planet far exceeds the capacity for its reprocessing, reuse and recycling. In this scenario, the recycling of plastic "is like a band-aid on gangrene" Max Liboiron declares[5] (which only reinforces the value and indispensability of the work of waste pickers without which the scenario would be even worse).

Liboiron's research on plastic pollution in the oceans (2016, 2021) provides various innovative scientific, methodological and political perspectives concerning knowledge of the presence of plastic materialities, their forms of interaction and effects on the planet. While we tend to think of marine pollution as plastic bottles floating on the ocean, microplastics constitute 92% of all plastics in the world's oceans (Liboiron 2016: 1).

To comprehend the phenomenon of plastic pollution in all its complexity, heterogeneity and magnitude, the author deepens and radicalizes the investigation of plastic materiality at cellular level. This is significant insofar as plastic materialities differ among themselves – "the materials fragment, travel, and influence bodies differently" (Liboiron 2016: 5) – and the diverse types of harm also vary in different and unpredictable ways, depending on their interactions and agencings in the world.

Microplastics act distinctly from other plastics, being invisible, dispersed and toxic, although the characterization of toxicity is part of a scientific controversy over whether plasticizers (or monomers), chemical substances that are routinely added to polymers (plastic itself), should be considered as plastic or not (Liboiron 2016). Nonetheless, they cause harm and are known as 'bad actors' since they interfere in 'natural' systems by altering genetic material, among other effects. Hence, plastics pollute in two forms, physically and chemically, and both frequently occur in conjunction.

All these chemical substances are endocrine disruptors, present in the bodies of living beings (our own bodies and those of other species). Microplastics actualize the ubiquity of waste and its pollutive scale, as well as questioning the boundaries between humans, non-humans and the 'environment.' This is because "no body, ecosystem, consumer product, or landscape is likely to be without plastics or their associated monomers for long" (Liboiron 2016: 11). They also rescale our temporal perspective of these phenomena, since, while becoming an imbricated part of bodies and ecosystems, the temporality of their agency can persist and continue to interact for generations and indeed millennia. Liboiron calls for a 'radical' action-oriented science whose researchers operate in networks as activists and advocates. In this way, their knowledge can be used to force through legislative changes that target the (industrial) sources producing plastics in order to reduce or ban their accumulation in the oceans (and in the world).[6]

The case of plastics shows how these materialities are challenging, how they problematize theories of pollution and force a redefinition of the ways of knowing and acting in relation to them. It becomes clear how waste, as "signs of life" (Reno 2014), is a key object of study in an era characterized by the impact of human activity in all terrestrial systems. The massive and unprecedented presence of industrial materials across the planet is having unintended effects that threaten life on earth in unpredictable ways. Investigating the life, forms of action and material politics of waste is an indispensable research path in the Anthropocene, which emerges as a socio-material theory of planetary change.

Marked by multiple kinds of flows and by the massive and ever-increasing presence of waste in every corner of the planet, this entire scenario is formed by structural dimensions relating to the development and dissemination of the political economy of capitalism at a global level, along with its crises. This process is

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5   Declaration made in the documentary *Guts* (2019), directed by Taylor Hess and Noah Hutton, part of The Atlantic Selects, available at https://www.youtube.com/watch?v=QgLKoJZodHw

6   Their own work and the activities of the Civic Laboratory for Environmental Action Research (CLEAR) that they direct are an example of this perspective.

deepening the glaring inequalities between rich and poor across the world, leading to ethnic conflicts and wider disputes on forms of knowledge and (ethical, legitimate, fair and sustainable or not) ways of living, existing and appropriating life on earth, which entail specific dilemmas for life in cities.

Waste making the city and politics: residual infrastructures in Rio de Janeiro

This text conceives the anthropology of waste as a particularly appropriate field of studies for thinking about life in the contemporary world marked by climate crises. Waste as an anthropological field of study 'forces thought' (Gabrys et al. 2013: 5) and this analytic perspective provides methodological, epistemological and political instruments for making visible, accessible and comprehensible waste and its worlds in their multiple ontologies. This means eschewing a limited understanding of waste as merely 'discarded objects' in favour of a more inclusive comprehension. This considers waste as multiple human and non-human agents, which constitute heterogenic networks of relations in interactions in permanent expansion. These networks of agents and their relations produce unpredictable effects that far surpass the possibility of technical control of the world along the lines that modern epistemologies made believe possible.

The anthropology of waste thus contains the potential to ethnographically revitalize contemporary anthropological theory and social theory. Faced with this panorama, my proposal is to think about the potential of this perspective to reinvigorate the anthropology of cities and urban studies in the humanities more broadly, recognizing the extremely complex scenario characterized by the Anthropocene. I take as inspiration the proposal of Hecht (2018b) to think about waste as "interscalar vehicles for the Anthropocene" to 'anchor' the ethnographic perspective in urban contexts at a local scale. The advantage of this perspective is to forge an analytic framework that allows us to avoid "cutting the network" (Strathern 2014) and losing sight of the potential connections with other regional and global scales.

The central argument here is that waste makes cities and also makes politics. This idea gains legibility, conceptual substance and methodological instrumentality through the proposal to articulate social studies of waste, in particular the anthropology of waste, with the field of infrastructure studies. Although relatively recent, this field has expanded notably over the last two decades since at least the publication of Star (1998).

Infrastructure studies, marked by their interdisciplinarity but also by their ethnographic perspective, have provided, through a diversity of approaches, significant contributions towards thinking about the complex dynamics and varied dimensions constituting cities (Larkin 2013; Anand 2017a; Simone 2004; Anand et al. 2018; Von Schnitzler 2016; Graham & McFarlane 2015; Hetherington 2019; Murphy 2013; Venkatesan et al. 2018). The very notion of infrastructure and the theoretical debate on its 'plasticity' (Lima 2020) as an object of study reveal convergences with the discussion on waste, making this dialogue highly productive.

Infrastructures, as "things and also the relation between things" (Larkin 2013: 329), are materialities that enable the movement of other materials. Hence, they constitute "the architecture for circulation, literally providing the undergirding of modern societies, and they generate the ambient environment of everyday life" (ibid: 328). Infrastructures are systems that encompass systems; they mediate exchanges at a distance, composing an amalgam of technical, administrative and financial expertises with their political rationalities and material arrangements. These arrangements constitute the basis for the functioning of modern economic and social systems. Infrastructures possess a symbolic, aesthetic and affective dimension, shaping subjectivities, as well as a highly mediating character, placing persons, objects and spaces in dynamic interaction. In this way they also show themselves to be interscalar objects, operating at multiple levels simultaneously.

Originating in science and technology studies, governmentality studies and other areas, infrastructure studies add ethnographic insights into the practical materiality that sustains and configures cities. In this way, they facilitate the exploration of the political dimension unveiled and disputed through its everyday texture

(Venkatesan et al. 2018; Larkin 2013; Von Schnitzler 2016; Pilo & Jaffe 2020). Similarly, in the literature on waste, its political dimension is set in relief (Liboiron et al. 2018; Cirelli & Maccaglia 2021; Millar 2012; Jeffe 2016; Rial & Colombijn 2016). As political matter, waste is permeated, in its most latent dimension, by asymmetric and very often unjust power struggles, which reproduce racialized structures of inequality embedded in urban geographies. These inequalities are inscribed more durably in the continuous processes of city-making through the construction, maintenance and transformation of infrastructures.

More recently, these two fields of studies have been converging through the production of ethnographies situated at the intersection between waste and infrastructures (Harvey 2020; Fredericks 2014, 2018; Doherty 2021; Butt 2020; Chalfin 2016; O'Hare 2022; Stamatopoulou-Robbins 2020). These works highlight a set of aspects showing the centrality of waste management infrastructures for urban life and the ways in which they unequally constitute and modulate the population's rights, access, risks and opportunities in distinct spaces of cities. The epistemological contributions provided by this conjunction reside in the capacity to analytically articulate multiple dimensions, relations, spatialities and temporalities. These show the ways in which waste and its infrastructures constitute urban processes, making politics and the city.

Following on from the above, I situate myself in this debate by presenting the concept of 'residual infrastructures,' elaborated as an analytic outcome of my research on waste, developed in Rio de Janeiro over the last ten years. To discuss the concept and show its analytic yield, I summarize two cases that offer distinct examples. While the first involves solid waste in Jardim Gramacho, a district of Duque de Caxias, a city neighbouring the state capital and forming part of Rio de Janeiro's metropolitan region, the second focuses on toxic waste in Volta Redonda, an industrial city in the southern region of Rio state. Both point to the potential of combining waste studies and infrastructure studies to think about urban universes. They show how waste makes the city in specific ways, while also mobilizing different waste politics for the urban populations affected by them.

Discussing mining production in Johannesburg, Hecht writes that mining "makes mountains, as well as holes" (2018a: 2). To discuss the city, I take as a starting point the idea that waste makes mountains. This leads us directly to a consideration of waste and its agency in the production of the urban landscape, configuring wastelands (Chalfin 2016) and toxic landscapes (Stewart 2017). This process of producing mountains does not take place without the mediation of infrastructures, which sustain cities and our ways of inhabiting them.

Unlike the rock formations generated by natural processes, valorized as the singular relief that composes the urban landscape of Rio de Janeiro, the specificity of waste mountains is that they are produced symbolically, technically and materially as something not to be seen. Hence, the territories that these form in the cities, irrespective of their physical monumentality, are inscribed in regimes of invisibilities that systematically work to conceal them. Despite being 'invisible' and marginalized localities, however, these territories integrate and connect the city, composing infrastructures fundamental to urban life and in practice constitute social universes where peripheral populations make their lives.

These less visible or 'banal' (Anand 2017b) aspects prove central to comprehending the political and environmental dimensions involved in urban processes. This is because infrastructures radically alter landscapes and materially reconstruct the environment, while simultaneously differentiating populations and subjects through subordination, colonization, racialization and diverse forms of violence (Anand 2018: 5). It is through waste, residual infrastructures and their gaps between them, therefore, that inequalities are reproduced, while potentialities and tensions emerge that point to other city projects and alternative futures.

The notion of 'residual infrastructures' (Lima 2023) comprises a conceptual tool for the ethnographic analysis of the production of cities through waste, along with the politics that it engenders, by focusing on the *residual* dimension constitutive of urban infrastructures. Residual here is understood as the non-dominant or non-hegemonic aspects, relations and processes that operate not only in the worlds of waste (or residues)

but also in broader infrastructural processes that make the cities. In this sense, the notion is based on the 'forced thought' produced by waste but is not limited to the analysis of waste as a theme or object, being able to contribute at a broader theoretical level to the reflection on other contexts.

By focusing on the residual aspect of infrastructures, the notion can conceptually and ethnographically restore them from their previous invisibility, making palpable and legible the opaquest relations otherwise left in the shadows of urban processes and their disputes. Through the concept, what operates in practice from a marginal position can be located at the centre of analysis, thus emphasizing "connection, interdependence and reversibility by addressing relations between supposed margins and centers" (Lima 2023: 2). In this sense, it performs an integrating role, "assuming as part of a single infrastructure broader spaces of the city, intermunicipal regions and other connections that operate in practice" (ibid).

In distinct research projects, I investigated the history of two waste mountains, their politics and the way in which they make the city through the analytic framework of residual infrastructures. In the first case, which comprised my doctoral research and which I have analyzed in more detail in other publications (Lima 2017, 2018, 2021),[7] I examined the waste mountain located in Jardim Gramacho. In this research, my analysis of the infrastructure of waste management is articulated with the recycling industry in Rio de Janeiro's metropolitan region. This infrastructure was centred on the Jardim Gramacho Metropolitan Landfill (AMJG), planned by the military dictatorship governing the country at the time as a solution for urban cleaning and for waste management throughout the greater metropolitan region in the 1970s.

Despite the initial project, the landfill began to function as a 'dump' outside the technical and sanitary regulations existing at the time, generating social, urban planning and environmental problems for the locality. It continued to operate in completely irregular form until 1992, when the site underwent a process of recuperation and began to be run as a controlled landfill. This was prompted by the city's hosting of the UN Conference on Environment and Development, known as Eco-92 or Rio-92, a landmark event in the emergence of a more wide-ranging environmental debate in Brazil. In 2012, the year when the city would again host the UN Conference on Sustainable Development, known as Rio+20, the waste disposal activities of the Jardim Gramacho landfill would finally be wound up on the eve of the event after 34 years of operation.

In its final year of operation, the landfill was operating 24 hours a day, receiving 9,000 tons per day and the waste mountain at the site had grown to 40 metres in height. During its more than three decades of operation, the landfill activity attracted a substantial population of *catadores* (waste pickers) to the surrounding area, people who work in informally collecting and selling discarded objects at final disposal sites or in the streets. These people are central mediators in the recycling industry in Brazil and throughout the Global South. In 2012, at least 1,600 pickers worked at the locality directly and the recycling economy in Jardim Gramacho, mediated by the artisanal management work of the pickers, maintained global connections (Millar 2012). The international market of the recycling industry with which the waste economy of Jardim Gramacho was integrated presents a capacity to generate 200 billion dollars per year (Millar 2018: 8).

The closure of the Jardim Gramacho landfill was succeeded by the implantation of a biogas plant. Inaugurated in June 2013, the plant's objective was to sell the methane gas produced by decomposition of the waste matter discarded at the landfill to Petrobras's Duque de Caxias Refinery (REDUC) and also participate in the international carbon credit market (Lima 2021a). In parallel, as a replacement for the old landfill, a new waste disposal site was created, the Waste Treatment Centre (*Central de Tratamento de Resíduos*: CTR) in the municipality of Seropédica, 70 km from the capital, also based on technological solutions for treating waste as a source of energy generation (Lima 2021a).

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7 My ethnographic fieldwork was conducted over 14 months between April 2011 and June 2012 and involved accompanying the work of waste pickers in their everyday activities, meetings and assemblies relating to the process of closing the Jardim Gramacho Metropolitan Landfill.

I analyzed the closure of the landfill as an infrastructural event (Carse 2017), which extends in time and articulates past and future temporalities, permitting a mapping of continuities and discontinuities. By focusing on the reconfiguration of waste management engendered by this event, the notion of residual infrastructures allowed these multiple temporalities and spatialities to be incorporated into the analysis, integrating spatially distant enterprises within the same analytic framework (Lima 2023).

Scholars of waste have highlighted processes of waste dump closure in the Global South as examples of enclosures under late capitalism (O'Hare 2022; Sharma 2021), removing informal and poor urban workers from the spaces where they produce their livelihoods and make their lives. Although Waste-to-Energy (WTE) technologies do not eliminate the threat to pollution (Reno 2015: 564), the projects based on such technologies are sold as 'green,' competing for the same fluxes of waste accessed by pickers to recuperate materials (De Bercegol & Gowda 2019; Demaria & Schindler 2016).

Responding to this scenario, the concept of residual infrastructures provided a framework for the multiple scales, dimensions and broader processes that involved the spatial, temporal, technopolitical and symbolic transformation of the Jardim Gramacho landfill in its everyday textures. Through the concept, the specificities of the modes of urbanization of the city of Rio de Janeiro and its historical process of colonization are integrated into the analysis of waste management. The incorporation of long-term processes allows the mapping of "continuities and discontinuities and the degree to which changes actualize forms of reproduction or represent conditions of possibility for effective social and urban transformations" (Lima 2023: 2).

In this way, I sought to focus on the material, racial and bodily dimensions that compose urban infrastructures and the forms in which racism, colonialism and structural inequalities persist in the political dynamics of the present. By defining waste pickers as "people as embodied infrastructure" (Lima 2023), they could be qualified as a constitutive part of the sociotechnical waste systems. The presence of colonialisms in modern waste management systems was thereby set in relief, along with the way in which they (re)produce racialized structures of inequality given the "systematic attempts at exclusion of these people from the system itself, despite the centrality that they have in practice" (2023: 6).

The politics of waste that emerges from the residual infrastructures of Jardim Gramacho is inscribed within an unequal power struggle. In this struggle, waste pickers fight against large corporations associated with WTE technologies and against the packaging industry. The fight of Brazil's organized waste pickers has acquired increasingly global proportions (Gabard 2011) in the pursuit of rights. Their demands include formal participation in the conception and implementation of public policies for waste management and the reverse logistics packaging systems, developing strategies to regulate these infrastructures through legal devices and guarantees.

Brazil and its population have just been through the double trauma of a pandemic associated with the far-right government of Jair Bolsonaro and his project for destroying the moral foundations and constitutional framework sustaining the democratic state in Brazil. In response, the waste pickers have been working hard to oppose WTE technologies through a Brazilian Front Against Incineration[8] and against the Recycle+ Program (Federal Decree 11,044/22) instituted by the former president. This program revoked the previous regulatory framework of the National Policy for Solid Waste, passed in 2010 by the Workers' Party administration, a landmark in the institutional achievement of the waste pickers movement in the country.[9]

Controlled landfills and dumps remain in operation across all regions of Brazil, receiving a total of 29.7 million tons of waste, in inadequate conditions, in 2022 alone.[10] While waste can undergo processes of both

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commoning and enclosuring, the spaces of waste dumps may also operate as an "urban commons" (O'Hare 2022). In this sense, the fight of Brazilian pickers for rights and for an active role in waste management converges with the principal that "rubbish belongs to the poor" (ibid). The waste politics of Brazilian pickers takes form in the campaign for a solidary and popular recycling model as an inclusive and sustainable alternative to waste management. In the process, they design development models and city projects oriented towards the construction of socioenvironmentally fairer possible futures.

The second case, an outcome of my postdoctoral research[11] (Lima 2020, 2021b), examines the waste mountain located in Volta Redonda, a city in the southern region of Rio de Janeiro state. The case analyzes the steelworking infrastructure related to the production of the National Steel Company (*Companhia Siderúrgica Nacional*: CSN), created in the 1940s as a central element of the project for development of the national industry. The President Vargas Plant, its main unit, has the name of the president responsible for implementing national developmentalism in the country. This symbolically associated the company with the idea of Brazil's progress and modernization.

Steel construction gave rise to Volta Redonda, popularly known as 'City of Steel,' which grew up around the company and developed as a result of this industrial activity, following the 'city-company' model (Piquet 2012). This configuration has implications for the power relations between the steel plant and the city, which are inscribed in urban space through territorial control and in the population through the domination exerted over the workers under its control, influencing even municipal governments (Lima 2012). From its creation to the present, the company passed through significant organizational changes, altering their corporate strategies and business model with a privatization process that amplified its activities to a network of international production.

The company's activity was always a dominant factor in terms of the contours and possibilities for local development. However, the company's hegemony was counterbalanced from the 1980s by the strengthening of a workers' union movement and civil society organizations under the initiative of the Catholic church acting in support of popular causes. By the 2000s, this process had expanded with protests focusing on the impact of layoffs caused by the organizational transformations in the company and the emergence of an environmental movement with the forming of the Southern Environmental Commission (*Comissão Ambiental Sul*).

Dependent on the intense exploitation of natural resources, the activities of the mining and steel industries involve the generation of numerous pollutants (Milanez & Porto 2008). This has profound socioenvironmental consequences involving specific forms of violence and harm deriving from the production of toxic waste (Hecht 2018a; 2018b). One of the main characteristics of these toxic substances is their invisibility, which makes science the indispensable mediation to their identification and analysis, as well as to the transformation of the harmful effects of their existence into a public issue. This mediation is central to legitimizing policies for regulating business activities and public and environmental health, as well as mitigating and providing reparation for affected populations (Goldstein 2017; Liboiron et al. 2018; Boudia et al. 2014).

My analysis from the perspective of infrastructure studies of the contamination of the Volta Grande IV housing complex, located in a low-income district of Volta Redonda, by industrial waste from CSN (Lima 2020), led to my development of the concept of residual infrastructures.[12]

The Volta Grande IV housing complex or condominium is situated in an area used as a deposit for the industrial waste produced by the President Vargas Plant for more than four decades. Today this area is run

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11   Fieldwork was conducted over the course of 2017 by accompanying the meetings and public events on the contamination caused by the mountain of toxic waste, as well as qualitative interviews with key actors and the analysis of the press material and documents from the judicial proceedings. This research was financed with a postdoctoral award from the Support Program for Postgraduate Studies and Scientific and Technological Research in Socioeconomic Development through Application Process no. 42/2014 of the Coordination for Higher Education Staff Development (CAPES).

12   Although the concept was only coined in a later work (Lima 2023), I consider that I applied the idea of residual infrastructures *avant la lettre* through what I called 'steelmaking infrastructure' (2020).

by the company Harsco Metals, which stores the steelmaking waste and processes it for use in road building and civil construction. Leaks from one of the drainage pools, situated underneath four dwellings, led to the contamination of part of the residential area. As the floor of the houses deteriorated, the residents realized that the situation was abnormal and, fearing the potential risks and harm to their health, began a process of mobilization.

The gigantic 40 metre mountain of steel slag from CSN's activities receives around 80,000 tons of waste per month, totalling five million tons of toxic waste in the locality in 2018 alone (Lima 2020: 108). The volume of this waste is steadily increasing as Harsco's capacity to process and sell the material, around 30,000 tons per month, is lower than the total production. The yard where the company conducts its activities, bordering the housing complex, is also situated next to an environmental conservation unit. This is a permanent and fully-protected area on the Paraíba do Sul River, a source responsible for providing water to 11 million inhabitants in Rio de Janeiro state.

The conceptual framework of residual infrastructures allowed the discussion to centre on the invisible dimension of steelmaking, characterized by the toxicity of its waste. In this way, it enabled a reflection on the life of toxic substances and their agencings, which operate at the opaque pole of the infrastructure visibility regime, as an analytic strategy for ethnographically mapping the latent connections between company and territory, as well as the power relations and political disputes that they engender.

The description of toxic waste and its assemblages in the composition of the steelmaking infrastructure was explored in four scenarios: contamination, science, justice and mobilization of the affected population in the environmental arena. In this context, time emerged as a variable capable of articulating the heterogenic relations and complex dynamics that configure the politics of waste of steelmaking infrastructure. This politics unfolded in an "arena of dispute around security/ risk and potential damage to the local population in terms of environmental health" (Lima 2020: 88).

The temporalities that permeated and constituted the steelmaking infrastructure at its diverse levels were appropriated and mobilized by actors from the investigated universe with differential effects on the corporate strategies and on social contestation. The analysis showed that "the slow temporality of contamination, science, and justice is given agency and appropriated as a resource for the steelworks, constituting its corporate strategy" (Lima 2020: 117). Meanwhile, on the other side, "the dispute processes of contestation and the mobilization strategies of the actors, through waiting, foment the constitution of a politics of resilience" (ibid).

The accumulation of toxicity in Volta Redonda is thus revealed in a double sense: financially for the company, which accumulates profits, while residents from the contaminated area are exposed to more and more harm. The city's population suffers from the accumulation of toxic pollution in the environment, whose agencings include the soil, air, underground water, human bodies and non-human organisms, with diverse and unpredictable effects over time. Insofar as the entire urban space of the city composes the infrastructure for the steelworks, its toxicity materially shapes the territory in unequal forms. This produces not just isolated "zones of sacrifice" (Lerner 2010) but also a "slow infrastructural violence" (Nixon 2013; Truelove & Ruszczyk 2022) that affects bodies, communities and the urban landscape as a whole in diverse ways.

The gradually increasing perception of the effects and risks of toxic pollution has also led to the mobilization of Volta Redonda's civil society in a coalition that has been strengthening and driving the movement of contestations of CSN's activities and its power. This coalition comprises a network with the potential for expansion including the Volta Grande IV residents' commission, the Southern Environmental Commission, NGOs, research institutions like the Oswaldo Cruz Foundation (FIOCRUZ) and universities, the Public Prosecutor's Office, alternative media channels for making denunciations like Volta Redonda Abandonada, and social movements. These movements include the Volta Redonda Movement for Ethics in Politics, the Movement of People Affected by Dust from CSN, created in 2018, and environmentalist movements campaigning to protect

Rio state's waters like the Living Bay Movement. The latter has been pursuing networked actions against Law Bill 6475/2022, currently under discussion, which proposes the relaxation of regulations concerning the Middle Paraíba Wildlife Refuge (REVIS MEP), diminishing the band of protected shoreline along the Paraíba do Sul River that currently prevents toxic waste from being deposited. These movements have warned about the threat of the waste mountain collapsing and transforming into "another Mariana and another Brumadinho." This is a reference to the disasters caused by the rupture of two tailings dams in Minas Gerais state,[13] which would have a tragic effect on the 'hydrosocial cycle' (Ballestero 2019) of the entire region.

The two cases of residual infrastructures in Rio de Janeiro shed light on the multifaceted and multiscalar practices and dynamics that make the city. These involve not only regimes of monumentality and the logic of visibility but also the everyday residual dimension, produced in the shadows, in unspectacular form on the margins. The cases thus illustrate how waste and its infrastructures, along with the politics agencied by it, comprise a privileged object of analysis for the reflection on urbanization processes and the production of cities in the context of climate change.

The challenges posed by the ubiquity of waste include the innumerable forms in which toxic chemical substances and discarded objects, like plastic materials, circulate at the tiniest and most complex scales of ecosystems. They produce relations that are inscribed in unpredictable and uncontrollable fashion in spaces, reconfiguring the composition of soils, waterways, groundwater, air and the multitude of human and non-human bodies.

The environmental regulations and technologies developed to eliminate waste, or to remedy contamination from it, continue to operate without any structural alteration in the system. The latter continues to generate uninterrupted monumental quantities of waste in diverse urban environments and, consequently, across the planet.

In the case of Jardim Gramacho, the existence of a population of 1,600 waste pickers working day and night recuperating and collecting waste dumped at the landfill enabled a significant increase in its operational lifetime. But even with this work over the 25 years during which the landfill was functioning, the recycling activity had a limited effect in terms of controlling the growing amount of materials and substances accumulated in the environment. Whether through concealment technologies like landfills or with new technologies that claim to be green like WTE and biogas plants, contamination persists.

The pollution deriving from the accumulation of waste at the Jardim Gramacho Metropolitan Landfill and neighbouring sites, which include the industrial complex of the Duque de Caxias Gas and Chemical Hub, along with the REDUC Oil Refinery and innumerable polymer factories, compromises not only soil quality but also affects the region's water.[14] Guanabara Bay is one of the most scenic areas of Rio de Janeiro, a coastal city shaped by rivers, lagoons and tides along the Atlantic coast.

The hydrographic basin formed by the bay is a vital part of the landscape of the world's twentieth largest metropolitan area, home to 8.4 million inhabitants in 16 cities and towns (Alencar 2021: 31). With a surface area of 377 km, it is estimated that the 143 rivers and streams flowing into the bay discharge around 18,000 litres of untreated sewage into its waters per second, along with waste from the 14,000 factories operating in the region (ibid 53, 64). Whether in the form of slurry, solid waste, chemical substances or microparticles, the discharge of waste has turned Guanabara Bay into the environment with the most microplastic-contaminated surface waters in the world (Olivatto 2017: 124).

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13   I highlight the work of the Environmental Themes Studies Group (GESTA) coordinated by Andrea Zhouri with the populations affected by the disaster, including a study of the reparation policies.

14   REDUC, inaugurated in 1961, was a landmark in the region's industrial growth and the installation of other petrochemical industries. By 1975, when FEEMA, the environmental monitoring agency, was created, REDUC was already the largest source of pollution in Guanabara Bay (Coelho 1983, quoted in Sedrez 2004: 241).

In the case of Volta Redonda, the technologies for the management of steelmaking waste and the processing of steel slag for use in civil construction reveal the limitations and indeed the unsustainability of this strategy. The volume of processing remains below the volume of waste generated, which leads to the accumulation of this waste not only on the slag heap but also as particulates in the air, inhaled by the local population, and in the Paraíba do Sul River. This brings the risk of the mountain collapsing due to the silting of the river shore and the growing volume of material deposited at the site, which should be preserved given that it forms part of an environmental protection area.

Setting out from these two waste mountains, which compose distinct residual infrastructures, we are able to think about urbanization processes, industrial configurations and specific development strategies. Furthermore, we can analyze how, through them, urban geographies are fabricated with their own dynamics that challenge the borders established by cities, blurring the limits between urban and supposedly natural landscapes, water and soil.

Contamination and the relations mobilized by waste subvert and recompose the borders where the city conventionally begins and ends as the 'urban' spreads into bodies of water and their flows. In one case, it reaches Guanabara Bay and eventually the Atlantic Ocean; in the other, the Paraíba do Sul River, which flows into the north of Rio state, constituting water infrastructures and their own hydrosocial cycles, which can cover large regions and global connections.[15] It is these connections and borders reconfigured by waste, as well as the scales that they put under tension, that forge what I call 'Anthropocenic urban landscapes,' allowing us to think about the Anthropocene from the urban and its residual infrastructures.

The residual as a politics of knowledge: a research agenda for an uncertain future

This article has presented the epistemological, methodological and political potentialities involved in the constitution of an emergent field of studies in anthropology, the anthropology of waste. I argued that waste, due to its ontological nature, is a particularly appropriate object of study when it comes to theoretically and ethnographically confronting the complexities of the contemporary world, marked by climate change. Its exploration also enables us to respond to the challenges that the multiple water, sanitary, socioenvironmental and urban crises associated with these changes pose to us at diverse scales.

Insofar as it stretches and subverts the boundaries between nature and culture, society and environment, waste critically impacts the foundations of modern epistemologies. As a consequence, waste is capable of renewing the anthropological perspective on cities and urban studies, as well as contemporary anthropological and social theories as a whole.

While waste in the modern urban-industrial era, as a phenomenon constitutive of cities, emerges as a problem solved by its technical and cognitive inscription in regimes of invisibility, in the contemporary world it has passed from invisibility to ubiquity, demanding new forms of comprehending and dealing with it. In this sense, waste becomes a key analytic framework for accessing the Anthropocene, central to the formation of epistemologies adequate to the multiple ontologies and complexities of waste in terms of constructing worlds and their effects from a local scale to the planetary.

The central idea concerning the productivity of waste in the fabrication of worlds aimed to discuss the ways in which waste makes the city and also makes politics. Setting out from two ethnographic cases centred on the history of waste mountains in Rio de Janeiro, I argued in favour of the concept of residual infrastructures as a way to demonstrate the profitability of combining social studies of waste with infrastructure studies. This combination forged a theoretical-methodological strategy for understanding urban processes in a present

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15 See, for example, the doctoral research of Julia Dias Pereira analyzing the erosion of the Paraíba do Sul River floodplain and the infrastructural connections that produce this process, including the construction of a private port linking the region to China.

marked by the Anthropocene. In this sense, waste and its infrastructures, through their reconfiguration of the multiple boundaries composing cities, constitute Anthropocenic urban landscapes.

In Brazil, the anthropology of waste is still an incipient field. Although there exists a set of important works and research groups contributing to the socioenvironmental discussion with ethnographies on large-scale construction projects, conflicts involving industrial activities, the mining industry and its disasters, environmental justice and other topics, these groups do not tend to focus on the debate surrounding waste as an object of study. At the same time, the diverse ethnographies that discuss cooperativism, the solidary economy or the informal work of waste pickers, are scattered without configuring a specific field. The collections organized by Carmen Rial (2016; Colombijn Eckert & Rial 2020) are pioneering initiatives in the development of an anthropology of waste in the country. Likewise, the field of anthropology of infrastructures in Brazil has emerged recently with the publication of the collection edited by Alex Vailati and Anthony D'Andrea (2020) and the dossier organized by Marcella Araújo, Camila Pierobon and Mariana Cavalcanti (2023) with works produced by the Infrastructure Studies Group.[16] The latter connects a network of research on urban studies conducted by research groups based in Rio de Janeiro universities.[17]

By providing a panorama of broader theoretical and methodological questions pertaining to waste as an object of study, this text seeks to help consolidate the anthropology of waste in the Brazilian anthropological setting. At the same time, it extols the potential of this field of studies to renew the reflection on cities and the ways of thinking about urban contexts in the face of the climate crisis. Aiming to combine these two fields and stimulate production in this area, the works developed by ResiduaLab, the Laboratory of Social Studies of Waste, which I coordinate alongside Mariana Cavalcanti at the State University of Rio de Janeiro, help to delineate a research agenda in the Global South setting out from the specificities of Rio de Janeiro. The ethnographies produced inquire into processes of urbanization and infrastructural production of the city that include the idea of 'urban ruins' and their relations to temporalities (Cavalcanti 2021) and to Olympic urbanism (Cavalcanti et al. 2020), specific modes of governance of the urban poor and the relationship to water and sewage infrastructures (Pierobon 2021; Pierobon & Fernandes 2023), urban infrastructure policies in favelas (Cavalcanti & Campos 2022; Cavalcanti 2013), infrastructural violence, eviction policies and activism (Gama 2019).

This convergence of research in the fields of urban studies, infrastructure studies and waste studies with institutional exchanges between research groups and continuous collective dialogues, involving the training of researchers, development of postgraduate courses and production of publications, has led to the development of a new field of studies. As a development of this combined work, our research turned to the anthropology of urban water. We have been conducting research in this area since 2021, culminating in a more substantial collective research project centred on the history of the urbanization of Rio de Janeiro's central region and contemporary urban dynamics seen through water and its infrastructures.[18] This consolidates a theoretical and ethnographic investment, but also an institutional and political commitment, based on the networked collaboration of researchers from ResiduaLab and the associated research groups.

Drawing from this experience, I propose to return to the anthropology of waste in order to, by way of conclusion, think about residual infrastructures and the politics of waste more broadly as a politics of knowledge. The presentation of the laboratories and research of partners and students who make up this network may appear dislocated, but is significant insofar as, like wastes and cities, this knowledge is also produced in a localized terrain with its own specificities and differences. Here again "material specificity matters for action" (Liboiron 2016: 5) and as a racialized woman, mother and academic in Brazil, I should

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16   This studies group was formed in 2019 under the coordination of Camila Pierobon, Mariana Cavalcanti, Julia O'Donnel and Marcella Araújo.

17   The network is composed by Grupo Casa (IESP/UERJ), URBANO (PPGSA/UFRJ) and ResiduaLab (PPCIS/UERJ).

18   This is the research project "Hydric infrastructures: urban water and the production of the city in Rio de Janeiro" financed by the Support Program for Thematic Projects of the Rio de Janeiro State Research Support Program (FAPERJ) in 2022, coordinated by Mariana Cavalcanti.

point to some of the implications of how these specificities matter, highlighting how we – as women scientists and as members of research groups and universities situated in the Global South – produce knowledge about Anthropocenic urban landscapes and the huge challenges of living in the era of climate change in cities and countries of the South. Moreover, it is we, situated here, who experience and live these challenges, who make research a continuous way of acting with the people and populations affected by these processes. This foregrounds the context in which knowledge is produced and its potential role.

The local universities and research centres are knowledge production infrastructures and as such participate in the politics of waste of cities in the Global South. As kinds of infrastructures, these laboratories, research centres and universities are themselves traversed by colonialisms and unequal power structures that ground the geopolitics of scientific knowledge. These unequal infrastructures of knowledge production subtly continue to subalternize us through language and through institutional asymmetries in economic, social, symbolic and political capital, which limits the reach and circulation of our academic output. Given this situation, scientists and research centres situated in Latin America, suffering from precarious material conditions and underinvestment, are grateful to those who make possible the tools and platforms that operate an 'anti-restricted access' policy vis-à-vis scientific content. This allows high-level science to be undertaken in dialogue with the major centres of the Global North, even amid systematic attempts at exclusion, invisibilization and extractivisms.

Populations affected by climate collapse do not want to simply move somewhere else as a solution: they want to obtain just, secure and dignified living conditions that allow them to remain living in the localities where they have historical, material, symbolic and affective connections in the world. Likewise, scientists from the Global South do not want to migrate to the 'centres' to make science: they want to possess equitable and fair working conditions in the universities where they work so that they can assist and politically strengthen the affected populations through the knowledge constructed with them. Science, after all, when liberated from the illusory bindings of technical neutrality that make it primarily a corporate asset, can politically serve the welfare of the population and the reparation of a world in climate collapse. A commons science made with people and for people along with other species and forms of life.

It is in this sense that the research groups of the Global South form part of the residual infrastructures of the politics of waste. Universities have a role in exercising institutional and scientific support to politically strengthen affected populations and civil society movements, especially since these groups remain vulnerable to the lobbying of those who always and increasingly profit from catastrophes and the failed technological solutions that they invent in response to them.

In this text I have argued that waste is a doubly privileged object, both for *knowing* the world and understanding Anthropocenic urban landscapes and for *acting* in the world on the basis of this knowledge, forging a politics of knowledge that is not detached from transformative/reparative action.[19] Activists from the Global South reject the term 'climate change' in favour of 'climate justice' and increasingly look to set the climate agenda in terms of reparation through financial compensation. Communities directly affected by climate crises must be compensated for the losses they experience. However, investments that neither aim to go beyond reparation for damages nor include the potentialization and systematic stimulation of actions that produce real changes in the everyday making of people's lives, seeking to avoid future harm, will be insufficient.[20]

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19   The convergence here is clear with proposals for knowledge production committed to an 'anti-colonial' (Liboiron 2021) or 'decolonial' (Quijano 2005; Ferdinand 2022) approach. However, these categories can be appropriated as mere labels or 'currents of thought,' emptying them of any critical political meaning. For this reason, I prefer to define the residual as a politics of knowledge linked to transformative/reparative action.

20   One of the positive points of the UN Climate Conference - COP 27 in Egypt was the agreement to create a fund for losses and damages for developing countries to compensate for the destructive effects of climate change.

In recent years, we have been through a politics of extermination from the Jair Bolsonaro government. A necropolitics designed to destroy the set of infrastructures that guarantee health, environmental conservation, culture, employment, social policies, education, science and technology, the safety of women, black populations, LGBTQIA+, indigenous peoples, quilombolas, residents of favelas and urban peripheries, peasants and small rural producers. The politics of waste should be understood and mobilized, therefore, in all its ethical density, as a politics of life, the guarantee of forms of life in the Anthropocene. A politics that produces a governance that is not residual (Hecht 2018a) and forges infrastructures in which people are not disposable (Doherty 2017) but who are the centre of production of knowledge, values and the technopolitics of life.

On January 1, 2023, Luiz Inácio Lula da Silva climbed the ramp of the Presidential Palace in Brasilia to become the president of Brazil for the third time after a close and heroic victory over Jair Bolsonaro, who failed in his bid for re-election. During the ceremony, Lula did not walk up the ramp alone. Alongside him, as well as his wife, the sociologist Rosangela da Silva, were the Kayapó indigenous leader Raoni Metuktire, a black child, a teacher, a cook, an artisan, a disabled activist and digital influencer, a metalworker and a waste picker.[21] The presidential sash was passed from hand to hand, in a representation of the Brazilian people in all their diversity, until reaching Aline Souza. This black woman, wearing a t-shirt with the flag of the National Recyclable Material Waste Pickers Movement, then placed the sash on Lula, inducting him as the new head of the nation. Merrily accompanying the group was the mongrel dog Resistance.

This scene encapsulates the extremely hard challenges at stake in the contemporary global scenario. But it also captures alternative ways of doing politics in the era of climate collapse and the return of supremacist ghosts. Here the knowledge of those situated at the grassroots is essential, people who know better than anyone the ways in which we can continue to resist in order to exist. This collective work must be passed from hand to hand, ensuring the contribution of all. There is no solution if it is not collective, fair and inclusive.

Cities like Rio de Janeiro were fashioned by infrastructures founded on colonialisms and racialized structures of inequalities that still persist and continue to shape the life of peripheral populations. Amid the ruined promises of modernity and the violence of climate crises that wreak havoc on cities, invisibilized people find their worlds expropriated, removed, contaminated and relegated to the margins. It is in the residual, in the knowledge produced from the experiences, insights and struggles of these people, that anthropology can encounter other imaginaries and other possible paths and thereby contribute to alternative ways of living and inhabiting the world in response to such uncertain futures. In this sense, the anthropology of waste, as an epistemology of the Anthropocene and a politics of knowledge, confronts a task as challenging as it is necessary.

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21 The child Francisco Carlos do Nascimento e Silva, the teacher Murilo de Quadros Jesus, the cook Jucimara Fausto dos Santos, the artisan Flávio Pereira, the influencer Ivan Baron, the metalworker Weslley Viesba Rodrigues Rocha, and the waste picker Aline Sousa.

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