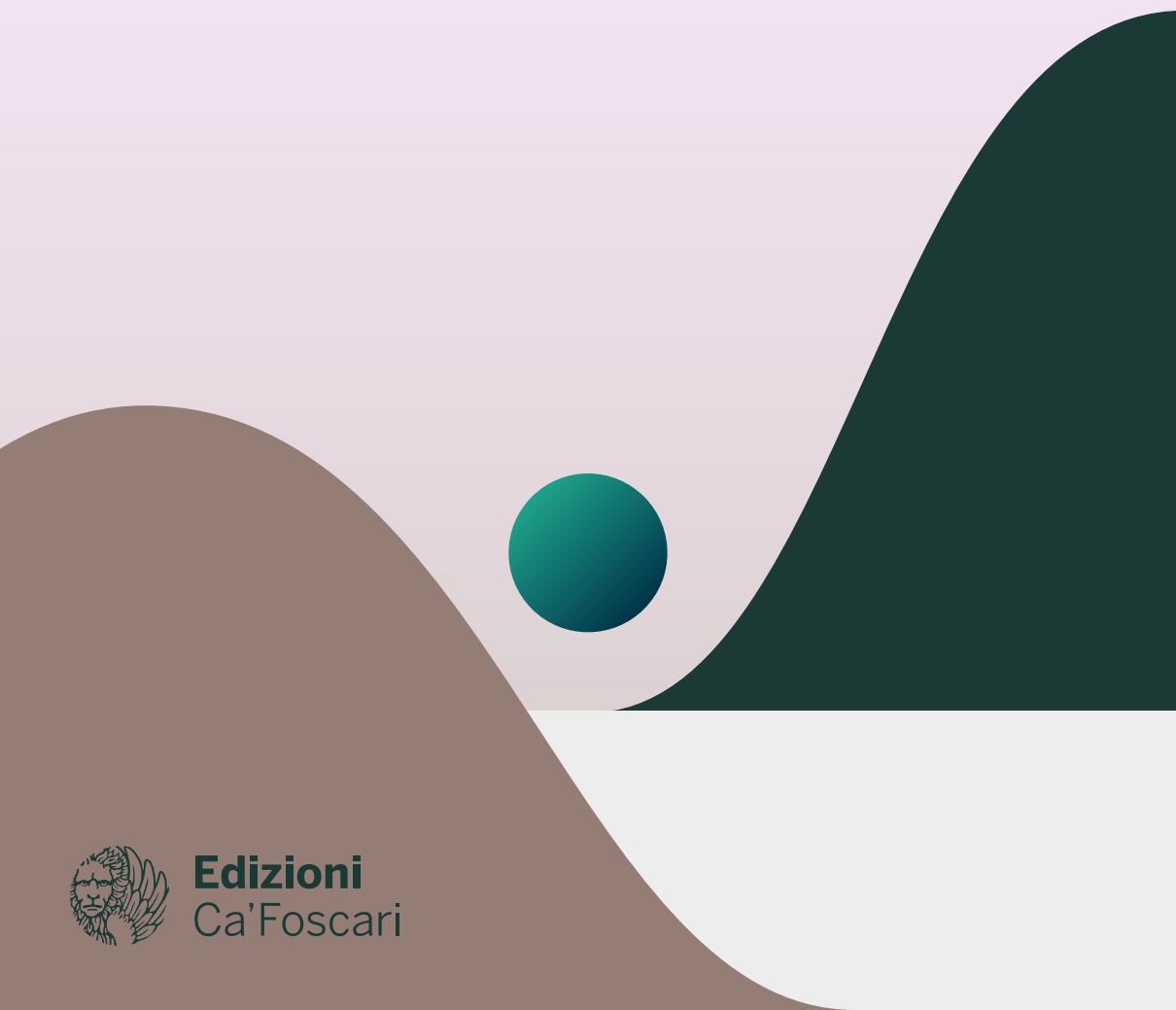
Lagoonscapes

Venice Journal
of Environmental Humanities

e-ISSN 2785-2709

Vol. 5 – Num. 1 June 2025



Edizioni
Ca'Foscari

e-ISSN 2785-2709

Lagoonscapes
The Venice Journal of Environmental Humanities

Editors-in-Chief
Stefano Beggiora
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Edizioni Ca' Foscari - Venice University Press
Fondazione Università Ca' Foscari
Dorsoduro 3246, 30123 Venezia
URL https://edizionicafoscari.unive.it/it/edizioni4/riviste/the-venice-journal-of-environmental-humanities/

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Semestral journal

Head office Università Ca' Foscari Venezia | THE NEW INSTITUTE Center for Environmental Humanities | Ca' Bottacin | Dorsoduro 3911, 30123 Venezia, Italia | hsc_journal@unive.it

Publisher Edizioni Ca' Foscari | Fondazione Università Ca' Foscari | Dorsoduro 3246, 30123 Venezia, Italia | ecf@unive.it

THE NEW INSTITUTE Center for Environmental Humanities at Ca' Foscari University of Venice gratefully acknowledges the support of THE NEW INSTITUTE Foundation gGmbH.

THE NEW INSTITUTE Centre for Environmental Humanities (NICHE) at Ca' Foscari University of Venice

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Summary

CRACKING THE SURFACE:
FLOWS BETWEEN ABOVE AND BELOW GROUND

URL https://edizionicafoscari.it//it/edizioni/riviste/the-venice-journal-of-environmental-humanities/2025/1/
DOI http://doi.org/10.30687/LGSP/2785-2709/2025/01

Cracking the Surface:
Flows Between Above and Below Ground

edited by Simone M. Müller and Livia Cahn

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Cracking the Surface
Notes from the Editors

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Summary 1 Volumetric Power and the Critical Zones. – 2 Sticking with Holes and their Movements. – 3 On Interdisciplinarity and Multimediality. – 4 Contributions.

During one of the workshops that preface the publication of this special issue, an instructor of a diving school talked us through the history of the Ilse Lake, a former pebble quarry converted in the 1950s into a leisure lake in the vicinity of the University of Augsburg campus. He vividly described the sensations of gliding through the water, breathing down there, and the kind of aquatic flora and fauna we would likely encounter at different depths – or zones – in, near, and around one of Germany's largest underwater diving platforms. At Ilse Lake, diving was a specifically eco-friendly proud spot where divers had vowed not to touch anything underwater, let alone stir up sediments of the lake floor. Meanwhile, divers had to be prepared for an encounter with Igor, a one-and-a-half meter-long male sturgeon, that had been rewilded from a private pond. Because Igor had grown up with humans, so the instructor, he liked to befriend the divers, sometimes settling on their backs for a ride in the underwater world.[1]

During our visit, we were not planning to dive into the Ilse Lake. At most some wet a fingertip or palm. From the solid, dry, ground the encounter with the underworld became most palpable when observing the specialised gear, the divers were equipped to submerge under the rippled surface of the lake reflecting the early

1 On Lake Ilse diving and Igor see https://tauchbasis-ilsesee.de/.

autumn light. Immersing themselves, the divers carried equipment, heavier, but otherwise very much like the conceptual baggage we were carrying, in order to attempt to compose with and better grasp the movements and interrelationships between, from and across, above and below ground: matters extracted, others dumped, ground that falls, water that rises, divers that delve, pollution that spills and percolates, villages that collapse and buildings that rise. How to write them up together in a way that is mindful both of human and more-than human actors, materials animate and inanimate, and their respective power relationships? 'Cracking the Surface' is a metaphor that resonates deeply with the contributions to this special issue that began from this question and that seeks to reassemble and reassess relationships between above and below ground.

Figure 1 Diver surfaces from Lake Ilse, Königsbrunn, Germany. September 2023. Photo by Livia Cahn

The hosts of the workshop and editors of this special issue, an environmental historian and an environmental anthropologist, did not seek a unison but built on their different, and similar disciplinarily baggage's bringing together two initial provocations. These conceptual questions would then proliferate with the input from the other workshop participants that added to a full reign of the inter- and transdisciplinary Environmental Humanities. Several of the participants of the workshop are authors of this special issue;

others were participants of a second workshop in March 2025 that crystallised as a writing retreat that took place in preparation of this publication. In the end, the issue is compiled with contributions from architects, art historians, anthropologists, cultural theorists, film makers, historians, photographers, and a sound artist.

The first of the opening provocations for the workshop grew from a concern with an overdependence on subsurface resources for above ground life. We sought a conceptual device to untether an above ground that is generally conceptually dealt with as separate from the below ground and as studied by archaeologists and geologists alone. Yet while "a vertical orientation" – and with this a recognition of the underground as a place to study and exploit – "perhaps began in geology" in the mid-nineteenth century, already by the mid-twentieth century "it was an important social perspective in many sciences" (Graf von Hardenberg, Mahony 2020, 64), that helped to produce both vertical territories and imaginaries. A place of darkness, adventure and the unknown, this vertical division has been theorized in the literary studies too (Williams 2008; Girard 2012). But as anthropologist, Richard Irvine points out "to isolate life [above ground] from those geological flows is to distort our understanding of society and humanity" and a little further "life is lived in relation to the geology, not just on top of it, and that through these interactions deep time protrudes into everyday life" (Irvine 2020, 2, 60). Bringing depth to the attention of humanities and social sciences marks geology as more than a technical question. It differs from the underground of what Yusoff calls "White geology", a discipline of a racist, imperialist project with a bent on steering extraction, by erasing the social (Yusoff 2018, 7). Today, several authors from the humanities and social sciences work to "remind us that seeking and producing subterranean knowledge is never neutral" (d'Avignon 2022, 28). Taking this heed the underground needs reconsideration.

The second provocation, that fuelled much discussion during the workshops, stemmed from an epistemic quandary both about the horizontal dominance in the humanities and social sciences and its connection to teleological and modernist surface thinking as proponents of vertical geopolitics / the vertical turn have pointed out (e.g. Braun 2000; Weizman 2007; Bridge 2013; Elden 2013; Billé 2020). In historical writings, for instance, most existing spatial imaginaries are anchored in the horizontal two-dimensionality of the political map. Historians are fixated on categories such as 'East' and 'West' or 'Global North' and 'Global South' and while they work on networks of people, trade, or infrastructure, on states and empires, on social movements and environmental resistance, they "privilege the logic of the topsoil, [...] cartographically-centric, [and] focused on crossing flat space with the eyes fixated on the horizon" (Barak 2009, 187; similarly, Reidy 2017). This implicitly assumes that the

logic of above ground is similar or superior even to the organization of the substrata. When scholars have departed from the surface, they looked up: towards a history of aviation, mountaineering, or to the emergence of high-rise buildings.[2] In environmental humanities, the gaze upwards beyond planet Earth, towards the satellites, has been crucial to understand the globe as a planet, the production of 'Spaceship Earth,' or, in the words of Peter Haff, the creation of the technosphere (Messeri 2017; Höhler 2016; Selcer 2018; Haff 2013). Yet, what we are left with, even with this upward gaze, so Barak, is "an implicit narrative of modernity as equivalent to ascent, not unlike the familiar nineteenth-century notions of progress as ladder one is bound to climb in order to advance" (Barak 2009, 190).

Much like lines of verticality, a diver, ascending to the bottom of a lake, leaves surface life behind, before emerging again, having pierced the so-called horizon twice. But the diver in a lake, unlike a person on solid ground, has far more possibilities than to move up and down, without any props, they can swoop, curve and even move diagonally though the water. Rather than a matter of place and location, of coordinates and territory, divers re-oriented themselves in Ilse Lake as a 'volumetric' entity.

Prompted by this observation, we similarly sought to suspend the downward pull of gravity and the physical limitations humans face when going down and underground with this special issue and to re-orientate our analyses through a perspective that makes a diversity of conceptual movement possible while challenging "the horizontal orientation of most theories of state and corporate power" (d'Avignon 2022, 16). To give depth to the surface, in our collective discussions, we progressively dismissed the vertical as an analytical lens for its incapacity to account for movements: twists, turns, flips, trembles and vibrations.[3] In its stead, we adapted the volumetric perspective (Squire 2017; Billé 2020; Rocha, Snelting 2022). This led us to the possibilities, as this special issue exemplifies, that cracks, holes, or pits – as mines, excavations, pits, or water reservoirs – confer conceptually when accounting, responding, or analysing the existential threats to our collective conditions of existence on this planet.

2 On this sky-facing history see Ortlepp 2017; Bradford Landau, Condit 1999; Hallion 2003; Taylor III 2010; Hansen 2013.

3 On the compression and stretching of glaciers for instance see Achermann 2020; for trembles see conceptual work on the archipelago in Glissant 1997.

1 Volumetric Power and the Critical Zones

The perpetuated horizontal reading of time and place, as well as the neat horizon that apparently separates the sky from the surface and the underground, the atmosphere from the biosphere, is suspended when paying attention to the movement of matter between and within above and below ground. To do so, this issue takes lead from Bruno Latour's concept of the Critical Zones. The Critical Zones designate a liminal space, several km's long or high respectively, that has been generated over eons of time by various life forms and mediates the exchange of energy, matter and information between the terrestrial and the subsurface realm.

Bruno Latour developed his work on the Critical Zones in a "thought exhibition" entitled *Critical Zones: The Science and Politics of Landing on Earth* held at ZKM in Karlsruhe, May 2020 to January 2022 (ZKM 2020). But the concept initially stems from a group of scientists and geo-chemists working in an interdisciplinary endeavour to focus on the interactions between water, air, rock and soil in a vaguely situated area from the ground water to the top of the tree canopy. This observatory (CZO) was funded by the National Science Foundation in the United States, in 2006. Latour was not himself a member of the observatory. In borrowing the term for the social sciences and humanities, where this issue picks up on it, Latour's proposal is that the physical mishandling of the ground is not disconnected from the conceptualisation of it. This becomes explicit in the work of Ballestero (2019) on how satellite imagery shape embodied understandings of subterranean water worlds and Cahn (2024) on how drill coring form extraction and burial projects. Environmental damage is both a social and conceptual problem and Latour consequently emphasises the work that interdisciplinary contexts, such as our Environmental Humanities endeavour "Cracking the Surface", can do in dissolving the singularity of the 'surface' while holding together epistemological analysis and environmental engagement.

Ultimately, Latour invites us to become critical "critical zonists", scholars that pay attention to flows, exchanges, and movements in "the thin skin of the living earth" and that explore new modes of coexistence between all forms of life (Latour, Weibel 2020, 2). Yet, addressing the flows, exchanges, and movements – the placements and misplacements – of matter from the field of Environmental Humanities is to understand them not only as physical entities, but as ideas and expressions of power (Graham 2004; Elden 2013; Weizman 2002). A growing body of extraction literature, particularly in decolonial perspectives point to the global disparities of the social, and environmental burdens of extraction, directed by changing market demands (Gomez-Barris 2017; Ferdinand 2022; Lessenich 2019). (Post-)colonial histories, geopolitical agendas,

socio-technical projects, economic interests, all participate in determining the movement of matter, the misplacement, replacement and displacements of solids, liquids and gases, toxic, inert, past or ongoing, in all sorts of different directions and at irregular speeds. These in turn have shaped and still do shape bodies of land and violently mark bodies of people in perceivable and sometimes imperceptible ways (Yusoff 2018).

As our contributions illustrate, all Critical Zones are of intense human activity. Re-casting landscapes, creating voids and heaps, redirecting rivers, draining wetlands, and capturing carbon from above or heat from below at unprecedented rates repeat the same gestures: of extraction, and its counterpart: dumping. These approaches frame the irresolvable tension between the environment as a 'resource' to exploit, focusing on its potential value, and the physical materiality of matter and the social cost of its movement.

2 Sticking with Holes and their Movements

Perhaps not surprisingly an interest in the movement of matter implies an omnipresence of holes, be they cracks, cervices, gaps, or pits. The volumetric landscapes of Critical Zones that this issue assembles include those marked by craters left by a sink hole, by active and dormant quarries, lakes and lagoons, burial sites for chemicals and carbon. Yet despite their omnipresence and (historical) colourfulness, as Martin Siegler points out, holes often go unnoted. Although often when dealing with extraction their prominence is much more significant than the amount of matter extracted. "Almost every object in our daily lives – from mobile phones to skyscrapers – requires the excavation of holes and the production of 'negative space'" (Siegler 2024, 59). Often these "negative spaces" (Weibel 2021) are far larger than the positive objects obtained from them. Massive heaps of waste and dirt are created in the extraction of comparatively small raw materials (Siegler 2024, 59).

Raw materials above ground, the production of 'negative space' below: their co-constituency demonstrates the cyclical nature of extraction. In fact, extraction is rarely an end point. In *Reciprocal Landscapes* Jane Hutton points out that even when the connection between the place of extraction and consumption are blurred by the absence of a visible trace, the connections are more than binary (Hutton 2019). The example of the history of guano fertilizer, extracted from deposits of seabird excrement from the Chinca islands in Peru is striking because the guano changes the composition of the soil, becoming mineral and then assimilated by plants. The input of nitrogen, phosphate and potassium affects plant growth, but the guano, once applied as fertilizer is not visible and cannot be isolated

again. The guano does not return underground in a neat cycle. It may be removed from the ground in one place and assimilated by the ground, elsewhere. In the case that Hutton unfolds it is assimilated in Central Park. It eats itself.

Moreover, the formal connection between Peru and New York enrolls unequal exchanges based on colonial debt that have shaped these connections. Notably with the forced laborers from Chinese ports that took off where the abolition of slavery in Peru and England left an opening and the labor conditions of the miners in the Chincha islands mid-nineteenth century were particularly tough. The increased value of (fertilized) land can also be extracted again. And this happens sometimes in unexpected ways. Take as a poignant example that deals an increase in value on the back of a depletion: Freshkill, a park that was developed on Staten Island, New York on top of a former landfill site (Taïeb 2019). Or as the Ilse Lake visited during the workshop, that went from being a quarry to a leisure lake, the holes left by extraction can become a resource or an unpredictable ecosystem (Ureta, Flores 2022). In both cases, the competing logics of urbanization and extraction meet in unexpected ways, above a filled-up hole.

Cracks, holes, cervices, or gaps hold together many of the threads that the contributions to this special issue offer. They are all the result of time and movement. They may be made from above or from below, cracks may be intentional: made with handheld tools or large-scale machinery, cracks might be accidental, they can be corporate, artistic, colonial or even pre-colonial, cracks can be overlooked, others are hard to miss. The intention of this special issue is not to characterised them nor to be exhaustive in dealing with cracks, but rather to pluralise. Our contributions illustrate a great variety even of otherwise similar coal pits and demonstrate that even though the underground is prey to ongoing extraction and dumping, it is far from a passive container. The power of the underground persists for example in the difficulty to access it, despite its presence; with its variability, and therefore the impossibility to generalise about its characteristics but also with its capacity to bite back. In one of the pieces, again but differently to the example of guano in Central Park, with the capacity to eat itself ("to gobble great mouthfuls of its own surface" in Müller, this issue).

In many of the contributions of this special issue – in some more explicitly than others – holes are manifest, be they literal or conceptual holes: sink holes, holes in the market, holes in basalt rock that promise to be filled with carbon in the near distant future or others still that have gradually filled with rain and groundwater over time. Sticking with the holes in this context highlights the ever-unfinished work of extraction and its remediation; it also illustrates the ongoing interplay between forces above and below ground. Importantly then, cracks are neither vertical nor horizontal. Nor predicable or stagnant. The Critical Zones is never still and binaries are troubles.

3 On Interdisciplinarity and Multimediality

Compiled with contributions from architects, art historians, anthropologists, cultural theorists, film makers, historians, photographers, sound artists, visual artists, "Cracking the Surface" is an interdisciplinary and multimedial endeavor that studies flows between above and below ground through a volumetric lens. Three of the papers bring together more than one author from different disciplines. The discussions raised by the issue are therefore cross disciplinary, as mirrored in the separation between above and below ground that this issue seeks to question, rather than the question of disciplinary boundaries that divide. Herein lies the capacity of this issue to shed light on the constant shaping and reshaping of the surface and its cracks, both rapidly and slowly. They are an invitation to look beyond the cases included here.

The wide range of the contributions from different disciplinary starting points, also offer a wide range of geographical starting points: from small towns and even erased villages, in Germany, to occidental urban and historical centres such as Brussels and Venice; but also, Nairobi and its periphery; a sunny state suburb of the American east coast; the Danish west coast and the digital 'virtual' space of fintech companies. The coal, building materials, urban fabric, chemical residues, ad carbon, are moved by machines, speculation, government led, demand driven, animals, gradual, unexpected or even the result of collapse. Together they depict critical zones that are dense, full of pipes, chemicals, rock, bodies of water, roots, gaps, cracks, demands, protests and workers.

Given that the ground is never neatly sealed, the authors offer ways to grasp movement: following a cormorant, a drop of water, server spaces, open pit mines or building bricks. Be they minuscule or large, the movements are what challenge the usual representations of the ground. Maps the historians work with and sections diagrams the geologists work with do not make these movements tangible, provoking a quest for more suitable modes of representation. In response, this issue is full of multimediality: images, also a sound piece and an animation that were proposed by the authors for this issue.

This propositional approach of working though different media is a starting point, not an end point. It seeks dialogue and discussion. This again rejoins the critical zonists in their question of how to handle the environment conceptually when it is being so massively mishandled by politics of extraction, dumping, draining, and pumping. Latour's work on the Critical Zones puts an emphasis on the double characteristic of the Critical Zone. It is at once unambiguous and approximate. As such, it has the quality of an oxymoron. It has the impetus of an urgent cry for attention to the planetary 'critical' fragility, all while remaining explicitly vague about the precise location of the 'zone'

(Latour, Wiebel 2020, 2). The juxtaposition of the two, highlights a binary quality in constant resonance. But 'critical' also has the vocation to question already established knowledge practices. The conceptual work therefore cannot be separated from the practical workings of underground mines, burial sites and sink holes and the proposal to bring together different disciplinary and methodological engagements with the movement of matter, seeks to bridge this gap, again and again.

4 Contributions

"Notes from the Demolition Edge" by cultural theorist, Kris Decker, is a first-person account that opens the special issue with a piece about a heavily mediatised climate protest against the expansion of a coal mine in the west of Germany where the village of Lüzerath once stood. Getting stuck in the mud with activists the author reports on the epistemological impossibility of relating a field site in writing. This is especially poignant and urgent when the place being described no longer exists, physically. What persists are the memories, the activists, the bigger picture of climate politics, some field notes. By astutely piecing together the bigger picture of the movement against the speed expansion of the mine, this text consolidates what it takes to write *up* the burial of a village. Observing a site from the precipice of a crater that has swallowed up Lüzerath, leads the author to slow down and dissects the habitual gestures of fieldwork to the point of irrecognition. This attempt to make sense of what comes up and what goes down, and what resists this vertical tug in the face of the bucket wheel excavator. Decker begs the question of what might eventually halt this excavator, the heaviest land-based vehicle ever built, a continuous digging machine that surface mines lignite. In this way Deckers work seems to join the protest.

"Thinking with Gaps between Coal and Post Coal in an Eastern German Mining District" by anthropologist Felix Schiedlowski begins precisely in a contrasting context in which mining of coal – at the other end of Germany – is destined to stop. This imminent interruption of the principal industry in the region is conceptualised as a temporal gap, embracing the spatial gap left in the landscape by close to a century of extraction. The linearity of both time and landscapes are disrupted and disoriented by the extractive industry and its encroaching end. Besides the precipice of another crater that is evoked in this piece, this article focuses on the many gaps in the landscape, both present and absent, and all the results of mining coal and its consequences in Profen and in Vereinigtes Schleenhain, in the east of Germany. The former open cast pits and the sinkholes the mining gives way to remain either open, overgrown, back filled

with mining waste or filled with water until they become lakes. The historical moment of transition in which this piece is situated grants gaps their political quality. They are not static, there is always space for change and movement, making space for conceptual analysis too. Gaps are good for thinking through, but this is not without far reaching consequences. These are not easily resolved gaps. Temporally, the beginning of the end of coal extraction is marked by German reunification, but the absolute end of coal extraction remains an enigma that enrols, commissions, funds, discussions about climate change and plans for an energy transition, the loss of jobs and homes. Though the piece begins with holes it doesn't get stuck in them.

The holes get even more unpredictable in Simone M. Müller's contribution "When the Ground Drops. Sinkholes and Scales in History". One sinkhole in particular is at the epicentre of this contribution. In Winter Park, a suburb of Orlando, Florida at 4 am in 1981 the earth gave way. The historical piece retraces how a sink hole, 107 meter wide and 30 meters deep, made headline local news at the time for the damage it caused. Into its vast diameter, the hole drew in a house, and the rear part of a car repair shop. The event triggers the formation of a Sinkhole science, institute and database in Florida. Dramatic as it is, the event, marks a turning point, but the author argues: it is not a one off. By focusing on the interplay between the above ground pressures of heavy urbanisation and extensive ground water extraction that weigh on the voids of the karstic environment that characterise the area, the sink hole reveals itself as particularly eloquent in articulating a dangerous liaison between the above and below ground in Winter Park and this not without engaging with expressions of environmental injustices. The conclusions can therefore be read as far reaching in the conceptual work of grasping scales of time, place and space, volumetrically. The geological event of significant magnitude comes to light as a geo-social formation of the Anthropocene that Clark and Yussof (2017) have described as opening up a deeper understanding of social worlds *and* geological strata.

Geological interest in the underground is also not isolated in "Excavation / Elevation: Above and below ground in Nairobi" by Constance Smith and James Muriuki. This collaborative piece by an anthropologist and a photographer depicts with words and writes with images on the cultures of construction in the context of urban transformation in Nairobi. These transformations are more than double, building up requires a digging down to cut the stone for constructions but what is built up also comes down when buildings collapse and host new urban ecologies. All of these movements are particularly acute in a city that is rapidly being developed by land speculation projects. These underpin the new high-rise skyline and their low-rise quarry pit counterparts. The hast to develop urban

fabric gives way to new architectures but also new fragilities: constructions stall, cracks emerge, buildings topple. These two tendencies fit neatly in the picture of Anthropocene as an accelerated human led geological force that modifies mineral horizons. But the Anthropocene is not only about rocks and humans in this piece. Smith and Muriki's collaboration also makes way for the more than human and the in-between and fleeting moments that do not necessarily make it into the geological record.

"Sensing a Lagoon: Distance, Care and Cormorants", Noemi Quagliati's contribution to the special issue, takes a deeper dive into multispecies thinking with the wings of a cormorant. The world-famous Venetian Lagoon, inhabited by a population of cormorants, comes to light in this piece as a fragile ecosystem. The lagoonscapes fragility enrols remote sensing technologies that the author proposes to view as harnessing attachments, rather than hostile and detached view from above to monitor and manage the bodies of water in Venice. Of all the movements a lagoon invites – of winds, of tides, of boats, of land masses, of rising sea levels and of tourists, the cormorants guide the way with their mastery of the sun cycle and the wind, the lagoon and its above and below water infrastructure. The ripple effects of the bird's incursion into the watery world are many: cormorants are known to be culled on fish farms, despite being a protected species, they are misunderstood as an invasive species and at best as a nuisance by many. Historically, the cormorant is symbolically negatively loaded and yet surprisingly then, they are used as a symbol of resistance against extractive tourism on contemporary posters. This array of relations to the cormorant is topped off by the authors' decision to make of this bird their conceptual guide. Cormorants' necessity to break the surface of the water to search for food, make concrete the connections between above and below that are central to this special issue and thereby unmake the conceptual divide between surface and subsurface that persist in dichotomous interpretations of the environment as seen either from above or from below. And furthermore, although these birds' behaviours conflict with some human interests, in this piece they invite a welcome oblique stance on the truly vertical: a cormorant-vertical instead!

Making a jump from a body of water to ground water to crack the surface, "Subterranean Reverberations and the Horror of the Chemical Sublime" by Caroline Ektanker focuses on the ongoing chemical presence in the industrial twin-town of Bitterfeld-Wolfen in former East Germany. The author sets the scene: former mining pits have been filled to form lakes and in the backdrop factory chimneys have been removed. The result is a visual erasing of the history of mining and the Agfa chemical plant that came to replace the coal industry in Bitterfeld-Wolfen. But this erasure is only skin deep. The connection with the industrial past lies low and is surfaced from the

watery underground by the author who lends special attention to what a buried soundscape can tell that a visible landscape cannot. The proposal of this piece is to invert the hierarchy of the senses: sound before sight. Sound is rendered capable of making connections between the above and the below ground where the visual cannot. An even more heightened sense of sound is granted by working with a sound engineer and contact microphones to reveal the invisible but relentless sound of the workings of a pumping system that was installed to connect wells and filtration units to attempt to remediate the ground water. The industrial past is far from erased from below the surface where remediation remains unfinished, the pollution uncontained. A complex system of pumps churn on. The humm, the hiss, the vibrations captured, whisper the lasting legacy of pollution and the fiction of containing it. The concept of 'transmediation' is mobilized by the author to contrast the remediation attempts on site. The change in prefix signals a shift towards the impossibility of a return to a prior state of purity, a constant state of movement. In this piece it is precisely the microscopes that capture sounds have the capacity to evoke the movement of water and the accumulation of chemicals it contains. In this way the ground is not only seeped in chemicals but also leaking sounds and stories about past. The focus on the sounds of the pumping system ironically amplifies what is not seen nor heard, what is not resolved by bringing to the fore the ambiguities of remediation, precisely what the system installed claims to achieve. Sound vibrations form relations between subjects and objects, bodies and things and lend themselves to a more subversive critique of global networks of extraction and contamination acting at a scale and rate generally imperceptible to the human senses.

Sound is also central in "Translucence: Some Notations on Sediments, Amber, Toxic Chemicals, and the Possibility of Returns", a two-fold contribution by the duo of historian and anthropologist Sebastian Lundsteen and sound artist Korana Jelača. Readers are invited to listen to a sound piece before, after or while reading to delve deeper into the noises of the underground off the coastal stretch of Denmark. The written piece follows the son of an environmental activist from Harboøre Tange. Bjarne, a 70-something-old, retired fisherman, took on his father's hobby of collecting and polishing amber. They are among many amateurs that glean this translucent 'northern gold' from the beaches. The surface of the amber must be polished for it to shine. The surface in this piece is permeable both to these enigmatic fossils, but also to toxicity. Also a former Cheminova chemical plant is buried in Harboøre Tange since 1962. This pesticide producing plant dumped vast amounts of chemicals underground with ongoing effects. These two submerged entities are of a strikingly different kind. But the translucent quality of amber is reminiscent of the opacity of access to information about the submergence of

the chemical depot too. Bringing together amber and toxicity in this text is also true to Bjarne's father biography. Rav-Aage, became renowned for his work mobilizing fishermen and local communities to protest the presence of the chemical plant. Father like son, Bjarne takes on his father's struggle too. He is involved in signalling the environmental injustices of lasting toxicity of the deposited waste, that much like in Bitterfeld-Wolfen, is far from contained! Amber, like toxins are moved by stormy weather. The stir can surface them, making it more likely to ascertain them. But the coastline like the surface of an unpolished amber, and sounds tell a story about time, existence, desirable and undesirable futures, and pasts.

"Countering Big Tech's Gaps: Queer Porosity and Intra-Solidarity Between Above and Below the Surface" is very much situated in the contemporary now. This is a co-authored piece by Jara Rocha, Helen Pritchard, Femke Snelting, Miriam Aouragh and Seda Gürse that are all members of TITiPI (The Institute of Technology in the Public Interest). TITiPI, that was founded in March 2020, as a temporary institution capable to respond to and resist the "inequitable impact of complex global technology regimes and infrastructures" (Rocha et al., in this issue). This contribution is grounded in queer theory and builds up on 'disobedient action research practices' of the collective in which the authors propose counter narratives of the underground to oppose big tech proponents of carbon dioxide removal technologies that claim to secure big business as usual for multinational corporations. In this written piece, and its accompanying animation made especially for this issue, the focus is on 'gaps' in knowledge and the underground that are exploited by the profit company owned by tech giants Frontier Climate. It is therefore not what is removed but what is placed in 'gaps' in basalt rock, under the subsurface that is in question. In particular, in Nairobi, the Kenyan Rift Valley projected as the New Carbon Valley Park, a carbon capture hub or a concretisation market forces, industries demands and profit margins neo-colonial global relations at work. Tending towards crafting counter imaginaries of the subsurface as a gap to fill, the authors draw on a body of queer poetry in particular. The queer poetics find their way into the textual animation that accompanies the article. Shapes spin, bright colours flash and text scrolls like the lyrics of a song protesting the conquest of the underground for carbon dumping, accompanying the urgent tone of this work.

The picture essay "Rotor: Entangled Matter" is by and about a collective too. Rotor is based in Brussels, Belgium and active in the physical work of salvaging construction material for re-use in an urban context in which office blocks are regally revamped, producing a lot of construction waste. This hands-on engagement with the materiality of construction informs an ongoing conceptual enquiry into the flows of matter. The cycles of where materials come from

and go to are rarely straight forward. A series of telling show cases form the backbone of this piece. They are a selection of a larger series of cases initially put together for an exhibition held at Bozar, in Brussels from October 2024 to January 2025. The images in this piece are in fact screenshots of videos entitled *Transmutation* that were showcased in the exhibition and compiled by Bêka & Lemoine, in collaboration with Rotor in different site of material production, transformation and re(use) in a radius of 200 km around Brussels. These depict how various construction materials enrol people's lives, changing economic interests, and environmental concerns, signalling the specificity of the questions that the materials of our built environments pose. An interest for the particularity of each material and its pathway from the underground, often to return to the underground as waste, is not simply for curiosities sake. Rotor, that is both the subject and author of this exhibition and article, is at the brink between conceptual and technical work that seeks to address the practical adjustments possible and necessary to lessen the environmental burden of the construction industry, responsible for no less than 35% of the EU total waste generation. The selection of three quirky sites of extraction, re-extraction and storage for reuse, give the propositional work that Rotor does an ironic undertone, solutions are never as straightforward as they seem in the messy entanglements of material flows. The crisp images and sharp captions make this very clear.

Side by side and all-in-all, "Cracking the Surface" emerges as encapsulating many different scales, and actors, in diverse contexts, historically, and geographically. The question of what constitutes an appropriate conceptual apparatus to address the depth of a surface sticks to the different terrains the authors' contributions report on. So much cracking renders the surface almost impalpable, and its role as a neat separation between above and below ground is averted. The tree incidentally figures across the contributions: a lone tree, a tree as witness, a tree eaten by a sinkhole, a plantation, and even a lack of trees and a tree-like structure in the Venice lagoon. The tree has a similar capacity to divert attention from the surface, sending roots and foliage into cracks in search for nutrients and light. A little like a diver in a lake that moves across the entire volume of the body water, a tree also does not grow in a single plane. A trees' growth is impacted by the waters it encounters, perhaps they are steeped in chemicals, rising from the water table to fill a former mining pit or sink hole or even water (with carbon) hypothetically injected into quartz rock. In each of the pieces of this special issue, attention to flows – not only of water – highlight that the stakes are often high to demonstrate control over these movements. Some flows should stop, some should start, but some stop and start, and some continue. Control too, is hardly ever clear cut nor neat.

e-ISSN 2785-2709

Acknowledgements

At the time of the first workshop no publication was intended but a regular meeting space for group discussions around texts of overlapping interest was set up. Those who contributed to the first workshop but are not among the authors of the special issue should be mentioned by name. The discussions on the main themes of this issue were lively and we would like to thank Martín Fonck, Irina Fedora, L. Sasha Gora, Bowen Gu, Jan Hansen, Karen Hudlet Vázquez, Elspeth Oppermann, for their precious input and Jörg Greiner from the diving school at the Ilse Lake too. We would also like to thank the Elite Network of Bavaria and the German Research Foundation (DFG) for their financial support as well as Annette Bayer, Sandra Hehlert-Friedrichs and Bram Van Cauwenberghe for their organizational support during our two verticality workshops. We would also like to express gratitude to all the peer reviewers who continued to nourish discussions from afar. Finally, this introduction has grown as an assemblage of thought-pieces, the full puzzle of which Penelope Harvey read with rigor and kindness. We would like to express our gratitude for her valuable feedback as well as her particularly quick turn-around.

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e-ISSN 2785-2709

Lagoonscapes
Vol. 5 – Num. 1 – June 2025

Notes from the Demolition Edge

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Abstract These notes gather the scenes of a single day around a coal mine. In the hinterlands of western Germany, thousands of protesters rallied in January 2023 to convey their opposition to the extension of the mine and etched the name of a village – Lützerath – into the collective memory of climate protests. These notes linger in the very moment of the village's passing and give way to the bewilderment of a peripatetic fieldworker thrown into the turmoil that flared up when the law arrived to disband what was left of a multi-year occupation, until its last devotees – two people barricaded in a self-dug tunnel – would have been dragged off. These notes are fragments on the conundrums of engaging with underground phenomena, on the fallibility of ideas of representation, and on the fragility of writing about conflicts over coal, climate, and communities.

Keywords Lützerath. Coal. Imaginary fieldwork. Climate activism. Diffraction.

Summary 1 Terrain. – 2 Field. – 3 Mud. – 4 Debris. – 5 Ground. – 6 Earth. – 7 Turf.

Edizioni Ca'Foscari

Peer review

Submitted 2025-03-24
Accepted 2025-05-13
Published 2025-07-21

Open access

Citation Decker, K. (2025). "Notes from the Demolition Edge". *Lagoonscapes*, 5(1), 25-34.

DOI 10.30687/LGSP/2785-2709/2025/01/001

One hope of conducting fieldwork in critical zones is to experience something more concrete and to hear, feel, smell, see something different than would be possible by sitting at a desk. To observe episodes of the climate crises out there holds the promise of compiling scenes, capturing speech acts, and becoming aware of things unfamiliar or surprising and letting them congeal into a coherent, cogent text.

But what happens when the protagonists and places to be observed are falling into disarray? When they are about to disappear? When taking note(s) gets out of hand? When the fabric of writing wears thin?

1 Terrain

Lützerath used to be a village in North Rhine-Westphalia. For much of its existence, the village "belonged to the municipality and parish of Immerath. Its postal code was 5141 until 1993, then 41812. Lützerath reached its largest population in 1970 with 105 people. In 2010, only 50, and at the beginning of 2021, 11 inhabitants still lived in the village".[1] Left uncounted in these figures are the climate activists who, since 2020, have positioned their bodies against the course of events. The activists occupied the brown coal village, living in houses left behind and building their own encampments. On 14 January 2023 – the last day of Lützerath's eviction –, the protest moved to the plots of farmland in front of Garzweiler II, the open-pit coal mine, vast and boundless. After Immerath, Holz, Spenrath, Pesch, Otzenrath, and Borschemich, the mine is about to swallow another village.

A few kilometers from the edge, Greta Thunberg is speaking on a stage, before a march of thousands will head on to join the protesters on the acres. Hand-painted banners abound. They read "The 1.5 degrees frontier runs through Lützerath", "Renewable energies not fossil fuel fantasies", "Lützi stays", and "Lützi lives".[2] For protesters of various denominations – from Ende Gelände and Fridays for Future to Menschenrecht vor Bergrecht and Alle Dörfer bleiben – the fall of Lützerath will leave a scar. It is a day likely to recast the history of climate politics in Germany, paving the way for another extension of the coal mine that will have set off unfathomable amounts of CO_2 by the time of its closure (or its depletion).[3]

1 That is the count reported in *Wikipedia* 2023. All translations by the author, unless otherwise stated.

2 Originally in German, the banners announce in bold letters: "Die 1,5°-Grenze verläuft vor Lützerath", "Erneuerbare Energien statt fossile Fantasien", "Lützi bleibt", and "Lützi lebt".

3 The former of which is said to take place in 2030, according to statements made by RWE Power AG (2023) that runs the mine.

Much of Lützerath's history comes to an end on that day which makes it into the pages of *The New York Times* (Schuetze 2023). The street signs in the area have already been changed; they don't recall the existence of the village. Simultaneously, another story picks up speed, one that turns Lützerath into many things at once: a symbol of a cleared protest (for the climate movements), a climate policy calamity (in terms of commitments to the Paris Agreement and its one-point-five-degree target), a terrain to be mined (for the bucket-wheel excavator), a component of a controversial plan (to fix the energy crisis after the Russian invasion of Ukraine), a question of identity (for the Green Party), an entrepreneurial stroke of luck (for RWE, whose corporate property the village became), and an epistemological quandary for me, the fieldworker.

2 Field

On my way to the demolition edge. Behind me wind turbines by the dozen. A few hundred meters in front of me the coalfield, below me the macerated earth, next to me protesters, all around police, helmeted, on horseback. Unfriendly weather up there. A gust. A protester of old age with a raincoat, reddish-orange, possibly a color from 1968. It flutters in the wind, as if its wearer were about to take off and announce the apocalypse.

In practice, doing fieldwork rarely means roaming over actual acres. Here in the hinterland, however, between the hamlets of Holzweiler and Keyenberg, the concept of fieldwork takes on an agricultural dimension that is missing in most ethnographic methods books.[4]

When the last crops were harvested on this Rhenish loess soil is impossible to determine. And I won't know what it is like to hold out for weeks, for months, or longer in a protest camp on a patch of soon-abandoned earth. This experience cannot be traced like an opinion or an argument, through a conversation or an interview; it is inscribed in the bodies; it is part of the activists' way of life that can be questioned and observed for a long time and yet remains untranslatable into a fieldnote.

Do numbers count? The bucket-wheel excavator, built in 1978, weighs twelve thousand eight hundred and forty tons and measures ninety-six meters in height. A protester measures between one meter forty and two meters, approximately. For every ten protest shouts there are about three police horses. Two courtrooms it saw, the

4 But see the stunning collection of papers by Leemann and Sutter (2023) who mull over fieldwork as it relates to agricultural practices.

complaint against the cession of land from farmer Eckardt Heukamp, an icon of the protests (Leue 2022), before being dismissed by the twenty-first senate of Münster's Higher Administrative Court (OVG Münster 2022).

3 Mud

This day is wretched. This day is dire. In nearly-bygone Lützerath, my desire for representing and recounting what happens wants to lie down in the mud. The idea of an "ethics of exhaustive recording" (Hoffmann 2018, 113) – taking note(s) of as much as you possibly can, with a chronicler's hand – is cast aside as quickly as the questions conceived at my desk before I arrived in the field. The literature I read on carbon cultures and extractivist landscapes: I forget about it. As raindrops dampen my notebook, I wish my observing gaze would fade and my interpretative inclination wither.

And you can't have them back so easily. There are moments of research and moments of writing that, for reasons to be found or not, resist being integrated into the logics of scholarly text production. Notes of whichsoever genre – be they more provisional like fieldnotes or more postscriptal, essayistic – might not overcome the perplexity and complexity of Lützerath's passing in favor of a coherent argument, a comparative analysis, a conclusive account.

If research into the public lives of climate issues is thought of as a quest for empirically unearthing how people make sense of, position themselves to, enact, and perform the climate crisis, then the demolition edge is a tough place to be. When smoke petards go off, clouds settle in, and violence flares up, the very notion of 'empirical' gets obfuscated. The data (so-called) is elusive. Nothing is for the taking here. Even "rubber boots methods" (Bubandt, Andersen, Cypher 2022, 7-12) are on the cusp of going phut.

I am not among the vanguard crowds that are being hit hard nor do I run a risk of being arrested. Still, sensing scenes of resistance troubles my notion of analytical distance, of the ways of becoming part of a field and at the same time imagining myself as its observer. That participant observation does something to its so-called subject matter, shapes it (through the choice of a perspective, a mode of description) and that, vice versa, the events in the field affect the ways and means of observing is nothing new. But what follows epistemologically from the shifts of perspective and position that I experience out there on the demolition edge?

Does being affected by the climatic – which is to say: the cultural – consequences of coal mining call for a normative standpoint, a committed judgment? Can there be such a thing as a neutral position towards the epistemic object? At what level of

involvement does this so-called object become something else? What problems of positionality arise when analytically approaching contemporary forms of climate protests which are in constant flux? Where could the fieldworker's position be if it is neither ostentatiously critical nor naively affirmative? On this side or beyond the climate movements? On their fringes, in their midst, apart from them? Or do I have to wait until climate activism at the coal mine becomes history?

4 Debris

Just a few days past the eviction in January 2023, the protests – and the infrastructure they deployed – are already weathering away. Lützerath's "protest architecture", which consisted of tripods, rope constructions, tree houses, and other sylvan designs, has been demolished; only "debris in the mud" is left (Simon 2023). And Eckardt Heukamp's farm, eventually sold to the coal mining company, has fallen.[5]

Prior to the big day, the Deutsches Architekturmuseum had tried to preserve one of the camp's dwellings. Thanks to a loan agreement concluded with the residents of a hut, the curation team had planned for *rotkoehlchen* (the dwelling's name) to be transported to an exhibition in Frankfurt. This did not stop the demolition work from going ahead, though, and the ambition of preserving cultural artifacts from evanescence came to nothing.[6]

As an object, the hut did not make it to the museum, but the protests did (Elser et al. 2023, 288-307). They prevail through posters, through stories of those who were there, through photographs – so many of them that it might require the work of several curators to process and interpret them. On one hand, there are professional press photographs published in newspapers and magazines. On the other, there are scores of photos circulating on social media, among them Marius Michusch's shot of a bucket-wheel excavator which, as the art historian Verena Straub (2023, 80) remarks, "appeared almost surreal under dazzling lights [...], reminiscent of dystopian scenes from *Star Wars* or other works of science fiction". This photograph made its way through virtual channels countless times (ARTE 2023),

5 Already by 2022, more than 80 per cent of the residents in the perimeter of the Garzweiler mine settled with the company, the journalist Alina Saha (2022, 4) notes in a reportage on everyday aspects of "living at the edge".

6 Likewise, Lützerath's remarkable tree houses remained impossible museum objects, "without a corresponding ceiling height, without a corresponding tree" in the exhibition space, states Oliver Elser, curator in charge of *ProtestArchitecture: Barricades, Camps, Superglue*, on air with Deutschlandfunk Kultur (2023).

juxtaposed to other footage produced by the people on site who documented their own practice, continuously and digitally.[7]

The protesters' videos, feeds, news, and posts are research material in their own right. Scrutinizing this material usually takes place in front of the screen, in the office, and must therefore do without the stench of smoke petards. When a field is explored virtually, there is no standing around, no wandering, no waiting, no spontaneous exchanges of words. The weather loses its meaning. Likewise, there is no more cleaning your boots of field debris (and no more contemplative moments that come with that practice).

5 Ground

On the flip side of fieldwork romanticism, though, are the expectations enshrined into a spontaneous methodology that declares every moment of being out there a high-yielding data collection exercise and conceives of fieldwork as a process which – minus assessable disruptive factors – moves routinely and confidently from observation to description. Ethnographic writing – be it in the mode of "writing down, writing over, or writing up" (Clifford 1990, 68) – runs the risk of becoming a thoroughly technologized practice that unerringly paves the way to future theses and arguments, by dint of placing "the vertigo of notation" (Barthes 1989, 145) on solid ground.

In contrast, I understand my notes to be an archive of ambiguity, of hesitation, of astonishment, all of which were present during my observational practice and slowed that practice down. As part of a research process that cannot be sure of its epistemic things, taking note(s) in and beyond that mess called the field becomes an insecure and "open-ended arrangement" (Rheinberger 2006, 354) that confronts my science studies interests with untried questions.[8]

For example, questions to do with activist thought styles that give shape to scientifically saturated scenarios and planetary futures – one-point-five-degree futures that circulate from sites of protest into political, academic, artistic contexts and become inscribed into ways of life, far beyond the climate movements. Does the end of Lützerath change how these futures are negotiated and

7 How did the images that circulated from the protests affect debates in the spheres where they were taken up? It is short-sighted to simply consider them as powerful, Straub (2023, 88) holds, since the images' "political effectiveness is dissipated in conflicts of interpretation, dissolved under several layers of irony".

8 Rheinberger's (2006, 350) context is the laboratory, where all sorts of "notes formulated into the impure, scribbles and overwritten protocols" are being produced. How might the constitution of fieldnotes compare to the everyday "acts of writing" (Hoffmann 2018, 9) that occur inside the lab?

thought about? I cannot say, since this is a question too large in scale for these notes. What Lützerath does as a discursive event cannot be measured while standing on the ground. It remains below the threshold of the palpable. The same applies to the matter that once ignited the conflict over Lützerath: the coal, down there in the earth.

6 Earth

I know – everyone knows – that there is coal to be extracted from that crater, even when it is impossible to see or sense this matter. I cannot – and do not want to – touch the matter with my hands. Neither can I smell it nor walk on it. The open-pit mine lies protected behind a hefty fence. From there, protesters can look down into a vast terrain where the process of excavating, transporting, and washing coal begins. The crater, preternatural in its extension, is a critical zone that remains distant. If I endeavored to enter it, the earth below me might become instable. I would tumble and fall from the demolition edge like from a cliff at the end of the world. Are there activists who have dared to rappel down from here? What would it feel like to have the disputed earth under your feet?

The inaccessible, the intangible, the barely manifest, the untranslatable, the unnameable, the inconspicuous, the disappearing. Plodding my way through the open field that faces the mine leaves me with a plethora of phenomena beyond grasp, beyond sight, beyond reach, beyond touch, beyond experience.

In that sense, writing notes from the demolition edge is an imaginary practice.

This practice could be thought of as part empirical, part fictional – very much in a *I swear I saw this*-kind-of-way (Taussig 2011). It is neither entirely a product of the mind nor is it simply derivative of the things and events out there. It is filled with sensory experience yet confronted with an interpretative void. It is as much in-between mind and matter as my fieldwork notebook, this "ancillary organ" (137) that mixes "raw material of observation with reverie" (xi) and "plots a course between chance and story" (137).

Fieldwork on conflicts over climate, coal, and community can steer away from extracting useful snippets from those working their butts off to construct a solid empirical argument. Instead, my fieldwork goes astray in the thick of things. It twirls as in a derwish of human and non-human agency (including the landscape and the weather) that alters the observer and the observed so thoroughly that a distinction between the two becomes hard to uphold.[9] I do not

9 Dancing agency is of Andrew Pickering's (1995) making.

find – nor do I search for – a vantage point from above. My gaze is "diffracted" (Haraway 1992, 318), the attention diverted. I have given up on that trickery of a bird's eye perspective.[10]

7 Turf

Standing at the demolition edge, with the crater up front and CO_2 curves on the horizon, I picture how extractivism is something other than a catchy, glossy vocable. Not least the extractivism that sometimes imposes itself on conducting fieldwork: the more material you amass and the deeper you go, the more you will know. No. Shifting the attention from horizontal to vertical matters may be just another move in an "age-old aesthetic of "representation'" (Barthes 1989, 148) that has exhausted itself. En attendant, my means for describing, designating, deciphering, or depicting the vertical sphere remain as limited as those of any practitioner out there, any activist, any journalist, any bucket-wheel driver, any photographer, any police person, any note-taker from close or afar.

Yet what happens on the terrain is that neat distinctions become messy. What exactly remains at the surface, what reaches deeper? Where (and how) to locate that line – is it a line? – between low and high, depth and surface, earth and atmosphere, ground and air, past and present? How many layers of meaning, politics, bodies, dramas, livelihoods, worries, biographies, hopes – they reach far into the history of industrialization, the history of a coal mining region, and the history of climate activism – will archeologists bring to the surface if Lützerath were to be turned into an excavation site?

I am not sure any science can help in that regard. Less so when trying to imagine that in under a decade, the coal mine will have pulverized all sorts of earthly evidence, which makes it hard for future archeologists to do their work. But other traces are plenty. For all its oblivions, the archive is stocked up.

So I decamp, dour, moving like a coal country kid past this scarred landscape that used to be the activists' turf back in the day.

10 A trickery as in Donna Haraway's notion of the "god trick of seeing everything from nowhere" which Haraway (1988, 581) connects to an "ideology of direct, devouring, generative, and unrestricted vision" (582).

Acknowledgments

I extend thanks to Barbara Preisig for pointing my nose to Lützerath in the first place, commenting critically on this text, and sharing thoughts around climate activism (many, over time). I am grateful to Livia Cahn for shrewd remarks and the participants of the Augsburg workshops for the exchange. Connie Smith brought up striking points on a draft version. Two anonymous reviewers shared their views. Conversations on matters of writing with Christoph Hoffmann, L. Sasha Gora, and Nora Wicki left a mark – *merci*. As well to the Institute of Advanced Study in the Humanities in Essen, Germany, for the fellowship through which this piece originated. Last but far from least, thanks to Eric Hounshell who cared for proof-reading.

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e-ISSN 2785-2709

Lagoonscapes
Vol. 5 – Num. 1 – June 2025

Thinking with Gaps between Coal and Post-Coal in an Eastern German Mining District

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Abstract By the mid-2030s, the Central German Mining District in eastern Germany is expected to see the end of brown coal mining. Drawing on ethnographic fieldwork, this article explores how the anticipated coal phase-out is entangled with the legacy of the post-socialist period following German reunification. It shows how these overlapping and often conflicting temporalities shape present-day life in the region. Phasing out coal is framed as progress toward a better future and as a corrective to the disruptions triggered by reunification. In this temporal configuration, the present emerges as a time of transformation. I conceptualise this present as a gap – a temporal and spatial condition shaped by the simultaneous presence of coal pasts and post-coal futures. The concept of the gap helps to reveal how disruptions and past-future entanglements in time structure the everyday experiences of those living in the Central German Mining District.

Keywords Coal mining. Energy transition. Eastern Germany. Gaps. Time.

Edizioni Ca'Foscari

Peer review

Submitted 2025-03-21
Accepted 2025-05-21
Published 2025-07-21

Citation Schiedlowski, F. (2025). "Thinking with Gaps between Coal and Post-Coal in an Eastern German Mining District". *Lagoonscapes*, 5(1), 35-58.

DOI 10.30687/LGSP/2785-2709/2025/01/002

1 Introduction

Looking out over the open-cast brown coal mine in Profen reveals the current state of the coal industry.[1] Massive excavators move through layers of sand, soil, and eventually coal, cutting a deep scar into the landscape. Not visible, however, are the villages that had to be erased from the map to allow for the expansion of the mine. Likewise, the ongoing debates surrounding climate change and the energy transition, which increasingly portray coal and its extraction as outdated, remain invisible. The long-standing economic significance of coal and the pride of generations of miners are also hidden from view.[2] A complex interplay of pride, loss, and transformation marks the history of the Profen mining site. However, when one looks into the pit today, these narratives do not immediately reveal themselves. What stands out instead is the absence, an immense area of lost land. The land appears to be missing, a gap between what was and what is to come – a gap in the landscape.

The open-cast mine becomes a break in the terrain, separating a coal-fueled past from a future shaped by uncertainty in the post-fossil era. This break interrupts the continuity of the surrounding landscape. While the terrain in the mining region is largely flat, with only gentle rises that gradually level out again, the mine presents a stark contrast. It cuts deep into the ground, disturbing the layers of soil and unsettling the flow of the land. For over 80 years, coal that is 20 to 40 million years old has been mined at depths of up to 100 metres, which is then quickly transformed into energy for the present (MIBRAG 2025). The resulting CO_2, released into the atmosphere, will pose a problem for humankind for a long time to come.

Coal mining in this region used to be on a massive scale, but now, the region anticipates a definite phase-out of coal in the not-too-distant future. The Profen mine was opened in 1941. Since then, more and more land has been swallowed by the expanding mine as the demand for coal has grown. Coal mining in Profen is set to end by the mid-2030s. In the present, coal mining is still active, but industry and society are caught in a time of transition towards post-coal. In this paper, I ask how the transition to become post-coal is challenged by the temporal relationship between past, present and future.

1 Although the technically correct term is 'lignite', this paper uses the term '(brown) coal' to emphasise its identity as a type of coal. The term 'lignite' does not linguistically convey this identity, and in the Central German Mining District, brown coal is not regarded as less valuable than hard coal.

2 This article is based on ethnographic fieldwork conducted in the Central German Mining District, with the principal phase of data collection carried out between spring 2020 and autumn 2021. All quotations from interviews and other fieldwork activities have been translated by the Author from German into English for this publication.

The open-cast mines Profen and Vereinigtes Schleenhain, located nearby, serve as the physical and empirical starting points for this paper. The Central German Mining District spans across southern Saxony-Anhalt and northern Saxony in eastern Germany. Berlin is approximately 200 kilometres north. The major cities of Halle and Leipzig are located in the centre of the mining district, but have long been independent of the coal industry. The town of Hohenmölsen, situated between Halle and Leipzig, is quite distinct. Many residents here are employed in the mining industry, and the Profen and Vereinigtes Schleenhain open-cast mines are only 16 and 27 kilometres away. Some smaller municipalities are located even closer to the open-cast mine. The town of Deutzen, in the south of Leipzig, is situated directly on the edge of the Vereingtes Schleenhain open-cast mine. The village of Großgrimma is right inside the Profen open-cast mine. The three locations are at the empirical center of this article. All three places have been shaped by their physical closeness to the open-cast mine. Großgrimma, in particular, was not just influenced by the mine but entirely erased by it.

The expansion of the Profen open-cast mine destroyed the village of Großgrimma. Großgrimma was the last of 15 villages devastated since 1947 for the expansion of the mining sites Profen and Pirkau (Recarbo 2025).[3] The village was relocated in 1998. Großgrimma can no longer be seen, yet the place is anything but absent. The coal underneath Großgrimma has 'not yet' been mined. Whilst all houses have long been demolished, one old oak tree still stands, surrounded by dirt and dust from the encroaching mining site. The oak tree is huge, majestic, and several hundred years old, with an enormous canopy. Today, the oak tree seems to be out of place in this otherwise unpopulated environment. The tree rises into the air, in a place that has disappeared into the depths and provokes conversations about a village that has long since ceased to exist.

This article explores how the transition to a post-coal future is complicated by disrupted relationships between past, present, and future – a disruption caused, in part, by the physical displacement of matter as coal is extracted from underground and brought to the surface. To explore this question, I use the former village of Großgrimma as an ethnographic anchor. Once cleared and resettled in the name of coal mining, the village persists through stories, memories, and symbolic elements such as its old oak tree. Together with material from Deutzen and Hohenmölsen, these narratives help illuminate how the past continues to shape the present in the Central

3 A total of 53,000 people had to give up their homes because of mining in the Central German Mining District, and 140 villages had to be abandoned for the coal that lay beneath them (Berkner 2021, 22).

e-ISSN 2785-2709

German Mining District. Based on ethnographic research, the article examines how coal mining disturbs linear notions of time, creating a present marked by temporal and spatial gaps.

The tree is of central importance to this article, as it forms the basis for my understanding of verticality and, ultimately, the 'gap' that emerges from the particular nature of open-cast mining. In the context of underground mining, themes of danger and darkness are often explored in both the social sciences and cultural discourse. John Berger described the atmosphere of an English coal mine in the 1980s as follows: "At pit bottom, the atmosphere is not unlike a ship's engine room. There's no sense of the nature of the earth you're in and under" (John Berger, in Overton, Harle 2024, 28). Rachel Squire and Klaus Dodds speak of "emotive, embodied, and affective responses with depth, volume, pressures, darkness, cold, heat" in subterranean settings (2020, 7). Sabine Luning and Robert Pijpers also describe this dialectic of seeing and not-seeing in their research on underground gold mining in Ghana. They speak of "visible witnesses of unseen extractive practices underground" (2022, 17) and emphasise the importance of vision for the production of knowledge, even in seemingly invisible fields such as underground extraction sites (Luning, Pijpers 2022, 20).

These conditions, however, are not found in open-cast mining, where extractive activities are always visible and in constant dialogue with the world above ground. Gigantic excavators first dig down to the coal-bearing layers, then begin extracting the coal itself. The open-cast mine has its own infrastructure, designed to transport coal and overburden, as well as to make the mining site accessible. The overburden is initially deposited outside the mine and later backfilled into the pit. This process of dumping, along with the variable nature of coal deposits – sometimes in long seams, sometimes in deep troughs – creates a rugged and barren landscape inside the mine. Looking upward is always possible; the sky is visible. Here, I draw on Sabine Luning's proposal to apply a "vertical view" (2022, 185), connected to the "capacity to see or not see" (Luning 2022, 187). In open-cast mining, the view is directed downward toward the coal, but it always remains connected to the surface environment, which establishes a constant connection between surface and depth. I draw a connection between this vertical relationship and the temporal dimension in Daniel Knight's notion of vertigo, defined as "intense confusion and temporal disorientation where people interrogate their usually unquestioned relationship to pasts and futures" (2022, 37). The ever-present vertical perspective, directed toward coal, remains tethered to horizontal, linear understandings of time (Knight 2022, 39, 42), producing a tension between temporal continuity and spatial rupture.

This teetering between below and above ground, in my analysis, translates into a teetering between past and future in the present.

In this article, the gap represents the space of the present. It is both a rupture – visible in the landscape and in the temporal structure of the region – and a site of connection. The disruption creates disorientation, but it also opens up room for dialogue. The present becomes a space for meaningful discussion about the past and future of the Central German Mining District.

In this paper, I treat the spatial gap in the landscape as an analytical device – one that helps to identify gaps in the present of a 'not yet' post-coal mining region. I use the figure of the gap to examine how the Central German Mining District seeks to move beyond coal without moving beyond its industrial identity; how it aims to end coal as an economic activity, yet retain coal as a cultural and historical reference point; and how it attempts to align with the green energy transition while holding on to its past. I draw on anthropological theories of time in extractive contexts (D'Angelo, Pijpers 2018; Irvine 2014; Palsson, Swanson 2016) as well as on research about processes and effects of becoming post-coal and post-industrial (Stewart 1996; Raffles 2020; Halvksz 2008; Dahlgren 2022; and others) to demonstrate how absences and disconnections are familiar phenomena in coal-affected regions, thereby contextualising my analysis of gaps. I show how ruptures and disconnections define the present of the Central German Mining District in a time of transformation.

In the first section that follows, I examine the temporal structure of the region, focusing on two key moments: 1989/90, marking the period around German reunification, and 2038, the planned end of coal mining. These two points in time frame a temporal gap that shapes how the present is experienced. The next section translates this temporal gap into its physical crystallisation point by showing how it becomes inscribed into the landscape through mining activity and the open-cast operation itself. In a subsequent ethnographic chapter, I bring together the temporal and spatial dimensions of this gap. There, I explore how space, time, and the present – conceived as a form of in-betweenness – manifest in the everyday lives of people in the mining district. The article concludes with broader reflections on the present as a temporal and spatial gap.

Figure 1 View of the Profen open-cast mine: excavator and bird stickers on the excursion bus of the coal company. Photo taken by the Author on 7 September 2021

e-ISSN 2785-2709

2 Becoming Post-Coal

The Central German Mining District is undergoing a transformation to finally become post-coal. In June 2018, the German government established an external advisory commission to develop social and economic conditions for a definitive coal phase-out in the country. Whilst the government agreed that the German green energy transition and fight against climate change demands the end of coal consumption, the framework of such a phase-out was debated heavily. The commission consisted of experts, stakeholders and activists involved in the energy transition and coal phase-out (Hermwille, Kiyar 2022, 21 f.). Their task was to strike a balance between demands for a very early coal phase-out, in the interest of climate action, and a very late exit, in the interest of energy supply and the economic stability of the coal regions (Statitisches Bundesamt 2024; Fraunhofer ISE 2019). After eight months of negotiations, the commission published its final document in January 2019. Essentially, the commission insisted on a gradual phase-out of coal, which will be completed by 2038 at the latest. Secondly, this coal phase-out should not come at the expense of the economic structure in the German coal regions, which is why the coal regions should be provided with 40 billion euros in structural funds (Kommission Wachstum, Strukturwandel und Beschäftigung 2019). This ongoing, slow, yet final farewell to coal and the parallel investment in the mining districts is referred to as *Strukturwandel* (structural change), a fair transition into the post-coal future.

Although the recommendations from the commission were not legally binding, in July 2020, the German Bundestag approved all major points from the final report. Since then, what holds true for the Central German Mining District also applies to the Rhenish and Lusatian mining areas, the two other active German brown coal mining districts. The present is marked by a period of *Strukturwandel* in which these regions are expected to transform into a post-coal future by 2038. The present became an undefined space, which, regarding one high-ranking civil servant responsible for implementing the coal exit, should enable the "transition to a different comfort zone". Today's coal mining industry is still operating, but the post-coal industry does not yet exist. The "decline of the old parallel world will only begin in ten years", the civil servant told me.[4] The present evokes a mix of hope and uncertainty about the post-coal future envisioned for 2038 – the promise of well-paid industrial jobs in carbon-neutral markets, as well as the protection and enhancement of the mining

4 Interview, 2020-05-25. Interview conducted by the Author with a senior civil servant involved in the *Strukturwandel* efforts in the federal state of Saxony-Anhalt. The interview took place in Halle.

e-ISSN 2785-2709

district as a region worth living in – while simultaneously building bridges to the region's post-socialist past.

Until October 1990, the Central German Mining District was located in the German Democratic Republic (GDR). After the Peaceful Revolution of 1989, Germany achieved unification in 1990, ushering in years of political, social, and economic alignment with the West German model. While unification was legally achieved in 1990, social, economic, cultural, and political integration proved to be a much longer and more complex process. Rapidly introduced economic reforms were intended to harmonise living conditions in the East with those in the West (Ther 2019, 75), but those reforms took quite some time (Paqué 2021, 112 f.). It is therefore challenging to define an endpoint for the social and political unity of Germany, likely because this endpoint has not been reached and may never be attainable (Mau 2024, 37; Pates, Leser 2021, 48). The transition from East to West Germany meant a shift from socialism to capitalism, from an economy of scarcity to one of consumer overproduction, from political restriction to freedom – but for many, it also meant a shift from industrial labor to mass unemployment. The historian Philipp Ther describes how this change meant an unprecedented economic collapse for East Germany and a *Schocktherapie*, shock therapy (2019, 88).

The effects triggered by the fall of communism were pervasive and occurred with dizzying speed. To this day, the post-socialist transformation continues to shape understandings of time in eastern Germany, particularly when discussing events before or after reunification (*vor oder nach der Wende*) (Ringel 2022, 8). For the Central German Mining District, the difference between before and after reunification can be expressed in figures: 20 power stations and 15 mining sites were in operation in 1989 (MIBRAG 2019, 3), along with 59,815 workers (Statistik der Kohlewirtschaft e.V. 2022). Within just a few months, in 1990 this figure fell to 46,796 workers and again to 6,675 workers in 1995 (Statistik der Kohlewirtschaft e.V. 2022). Although these figures should be seen in relation to the negative population trend in the region, it must be emphasised that the decline was not slow, but rather a dramatic collapse within a few months and years. Today, three active mining sites, three power stations, and 1,781 workers remain (Statistik der Kohlewirtschaft e.V. 2022). During a guided tour through the Profen open-cast mine, one of the tour guides – who enables school groups, and members of the public to gain an inside view of the mining site – reflected on the political and social upheavals of the time. For many, he explained, the political transition was something they managed to adapt to; economically, however, particularly in terms of finding new employment, the shift proved far more difficult for most workers. Recalling the suddenness

of the transformation, he described it in stark terms: "In the evening, when you go to bed, you are still red; when you get up, you are black".

Behind this statement lies the profound transformation from life under socialism to life under capitalism. It implies a certain passivity among those involved, an effect that can also be attributed to the intensity and rapid pace of this upheaval. The notion of an overnight transformation reflects the temporal division commonly referred to in German as *die Wende* – a clear demarcation between the 'before' and 'after' of the Peaceful Revolution and reunification. Although the events of the East German *Wende* took place more than 35 years ago and are therefore clearly part of the region's past, they retain the power to frame the pre-*Wende* period as a seemingly closed chapter in history, clearly set apart from what followed. In contrast, the effects of the post-reunification period remain present and are continuously reflected upon and addressed in contemporary discourse – for example, by the tour guide at the Profen mining site.

1989 marks one edge of the gap in the temporal logic of the region. With the project of *Strukturwandel*, the other edge appears in 2038. During my research, it became clear that both energy transition practitioners and local residents near the coal industry often associated the envisioned post-coal future of 2038 with the legacy of the 1989 Wende; particularly with its negative afterlife, meaning the lasting economic and social disruptions that followed reunification. A resident of Deutzen, a mining village discussed in the next section, expressed scepticism about the promises of *Strukturwandel*, saying that these were "exactly the kind of dreams" widely spread after reunification.[5] I use this quote to illustrate that the transformation into the 2038 future is linked to the legacy of the 1989 past. As an anthropologist, I am concerned with the space in between, the present, which in this process of *Strukturwandel* became undefined; 'no more' 1989 but 'not yet' 2038.

The inhabitants of the Central German mining district must endure and make sense of a present that is encapsulated between the seemingly stable pillars of 1989 and 2038. The sociologist Till Hilmar described the 1990s in eastern Germany as a time of "great enthusiasm" yet also "a time of rupturing economic change". Consequently, Hilmar sees the "need for healing narratives, for cultural scripts that can help restore peoples' sense of dignity and deservingness in market society" (2023, 302). The political process of *Strukturwandel* might allow for such healing narratives in the present, enabling the past and the future to coexist and be acknowledged. However, this reconciliation attempt can only be initiated because past and future stand in such closeness within the

5 Cited at a meeting of the local council in Deutzen on 2020-10-21.

post-coal transformation. This closeness, in turn, becomes possible because the present is perceived as the time in between. I describe this condition of inbetweenness in the words of Kathleen Stewart: "where things are neither fully present nor absent but linger and echo in a simultaneous lack/excess" (1996, 67). For such a condition of inbetweenness, Hugh Raffles offers the term "unconformities", describing them as "holes in time that are also fissures in feeling, knowledge, and understanding; holes that relentlessly draw in human investigation and imagination yet refuse to conform" (2020, 6). Raffles locates these unconformities in layers of rock and soil; from these engagements with the materials beneath the earth, he speaks of disorders in the present that, in turn, generate new temporal meanings.

Both Raffles and Stewart refer to phenomena rooted in vertical extractivist practices – Raffles through interactions with diverse geological formations, and Stewart through coal mining in West Virginia. It is no coincidence that such temporal entanglements occur in a mining district. The vertical practice of breaking open the horizontal landscape also disrupts the linear conception of time as a sequence of past, present, and future. In the Central German Mining District, the temporal markers of the pre-turn past of 1989 and the post-coal future of 2038 form an echo within the present. This echo becomes ethnographically tangible and can be rendered in its effects through the spatial manifestation of the gap as a vertical intervention in the landscape. Mining operations, as Jamon Halvaksz writes, "point to time as subjective experiences". Mines possess a physical presence that "folds the past into the present" and, through their aesthetic qualities, have the capacity to transform the landscape (2008, 22). Lorenzo D'Angelo and Robert J. Pijpers discuss "various material and immaterial inscriptions and materialisations of past, present, and future dynamics" in mining regions, and accordingly call for an analysis of the "dynamics of extraction itself" within a temporal framework (2018, 217).

Regardless of the industry's current activity, life in the rhythm of coal requires confronting a post-coal future. Huw Beynon and Ray Hudson describe the decline of the mining industry in the United Kingdom, noting that since the mines have closed, things have changed for the worse (2021, 251). They argue that mining areas have long been defined and marked as distinct, separate places (Beynon, Hudson 2021, 15, 64). In the name of the coal miners in Wyoming in the US, Jessica Smith asks: "What happens when gifts are no longer desired by the receiver?" (2019, 99). When Hugh Raffles mentioned that the era of coal in Spitsbergen might be coming to an end, those sympathetic to the resource interrupted to ask, "Is it?" (2020, 155). Reflecting on Australia's vast coal mining industry, Thomas Hylland Eriksen noted that "quitting is hard" (2016, 37). Also writing about

Australia, Kari Dahlgren describes how the end of coal mining leaves behind voids, which she translates into a symbol of emptied open-cast mines in Australia's Hunter Valley. In her work, final voids are understood as a "permanent scar on the landscape", a "reminder of destruction and loss", and a "metonym of the emptied futures that characterise the contemporary moment" (2022, 538). From this image of the landscape, Dahlgren notes, emerges not only a sense of loss but also potentials for future development (Dahlgren 2022, 550 f.).

The Australian voids correspond closely to the gaps identified in the Central German Mining District. In both Australia and eastern Germany, the tension between an active and declining mining industry has produced a coexistence of presence and absence, past and future – made visible in the landscape through the remains and realities of open-cast mining. In Germany, however, mining companies are legally obligated to restore land scarred by extraction. When this was no longer possible following the political transformation and the bankruptcy of the mining combines of the socialist planned economy, a government-funded agency assumed responsibility for eliminating the resulting voids. While Dahlgren acknowledges that such voids "can also serve as a base for potentiality" (538), she primarily emphasises their destructiveness (546), and vulnerability to false hopes – "for the void is most cheaply filled with false promises" (Dahlgren 2022, 552). A sense of emptiness permeates both the void and the gap, echoing Dzenovska's framing of the concept as a demographic and socio-political phenomenon in rural Latvia (2020). However, the idea of the gap as a lens for the present goes beyond emptiness and destruction. In contrast, by using the gap as a lens for the Central German Mining District, I aim to shift the focus from emptiness to coexistence – to the layered temporalities embedded in the local mining history and their ongoing negotiation (Luning 2018, 283). The following section addresses this very demand, demonstrating how this temporal setting, and the present as a gap, are inscribed into the landscape of the Central German Mining District.

3 Cracking Histories and Futures of Coal

The surface of the Central German Mining District has been cracked multiple times, and the landscape is full of gaps. However, most of those gaps have not endured; instead, they have been deliberately filled or flooded as part of landscape transformation efforts. Occasionally, sinkholes appear as legacies of deep brown coal mining, which was replaced by open-cast operations in the early twentieth century. With the advent of large-scale open-cast mining equipment, this dangerous and costly form of extraction became obsolete (Baumert 2023, 131; Berkner 2016, 287). Today, those sinkholes have

grown over and are filled with vegetation. The fact that these are former open-cast mines is often no longer apparent. The process of landscape change after mining is most noticeable where mines became lakes (Pampus 2024, 87 f.). Initially, this transformation occurred by accident. Once the coal was extracted, the mining sites of the early twentieth century were left abandoned, and slowly, the groundwater rose until a deserted gap in the landscape turned into a lake. The danger of landslides was a significant concern during the second wave of turning abandoned open-cast mines into lakes. After German unity and the sudden decline of the mining industry, as well as after decades of resource exploitation, hard labour, and environmental damage, there was a need to restore the land.

In contrast to nineteenth-century mining operations, giant excavators have been consuming the land and soil, creating gaps of unprecedented size and scale. Whilst occasionally an industrial afterlife for those sites was achieved, the public mood was to have the sacrifices of coal mining followed by the beauty of a lake. Filling up the gaps with groundwater and river water was a lengthy process, and preparing the ground and the embankments was challenging. Eventually, however, a former mining area turned into a land of lakes (Regionaler Planungsverband Westsachsen 2019). Many gaps of the past have been filled, and verticality seemingly reasserted. While the rupture of the surface has been covered, now those lakes mark the landscape, as the lingering trace of an era that has ended, no longer constituting a present condition but rather a historical phase. These ongoing processes become especially tangible in Profen, a site where the gap has not yet been reclaimed, and where extractive presence still shapes the land.

A lorry converted into a bus takes visitors into the open-cast mine, deeper and deeper along dusty paths. At first, the coal is barely visible; instead, the eye is drawn to shades of grey and yellow. In the depths of the mine, layers of earth reveal themselves through shifting tones – muted greys, dusty browns, deep blacks, and ochre yellows – each marking a transition from loess and gravel to sand, clay, and finally the dark seam of brown coal. Toward the slopes and the rehabilitated edges of the mine, shades of green start to blend into the scene. The journey continues deeper into the mine, until the vehicle comes to a stop on a coal-covered surface. To the left, the exposed coal seam cuts through the terrain; behind, a conveyor system transports the coal away; and to the right stands a gigantic excavator. Several metres below ground level, the coal underfoot is millions of years old. The excavator looms nearby, immense and unsettling in its scale.

Figure 2 Profen mining site, a gap in the landscape of the Central German Mining District. Photo taken by the Author on 9 May 2020

Nevertheless, the atmosphere is peaceful. The excavator is not in operation at the moment; otherwise, we would not be able to get so close. There is only some mining noise in the background. The clear view of the sky disguises how deep we have travelled into the open-cast mine. Our guide, whom I introduced earlier, put it this way: "We have been travelling into a 20-million-year-old underground". 60 people work in open-cast mining per shift, in four shifts, which means 240 workers in the Profen mine, plus the same number in Vereinigtes Schleenhain. So, around 500 people who work in the coal industry and call themselves miners. Throughout his tours, the guide offers sharp and often nuanced reflections on the state and future of the mining district. About the coal, the guide said, "Inside here is the sun that created the coal, and when we burn the coal, we set the sun free again". With this metaphor, he subtly questioned the energy transition, implying that coal might not be more harmful than solar energy. During another tour a few weeks later, he described the Central German Mining District as 'not yet' post-coal but 'no more' truly dependent on coal either, calling it "the last remnant of what used to be a large mining district", a remark that implicitly devalues a still-functioning mining industry and, by extension, the entire region.

The decline of the mining industry is one legacy of German reunification, yet the continued existence of parts of the industry is another side of that legacy. In southern Saxony-Anhalt and northern Saxony, industry continues to play a major role, with the chemical sector, though considerably downsized after German unification,

deemed suitable for privatisation (Mühlhaus 2020), alongside active coal mining operations. Moreover, the decline of the mining industry did not begin in 1989. The height of coal mining in the Central German Mining District was in 1963, when the region produced 145,500 million tons of coal, making it the most important German mining district (Statistik der Kohlenwirtschaft e.V. s.d.). Thereafter, production numbers fluctuated but never regained those heights.

The understanding of coal and mining as matters of the past is not only inscribed in the landscape, but also reflected in the everyday realities of the region. A campaign sticker from the environmentalist group *Ende Gelände* (a movement that has been protesting against fossil fuels by disrupting and blocking open-cast mines since 2015) proclaimed that "Coal is so nineteenth century".[6] Meanwhile, "Ideas are the new Coal" was the campaign slogan of a *Strukturwandel* innovation hub.[7] At a discussion forum on the future of *Strukturwandel* in the small village of Deutzen, an elderly gentleman reminisced about the past, saying that coal was "the engine here in the region", "coal has reigned, let me put it that way".[8] For him, as for many of my interlocutors, it was important to locate coal in the past and pinpoint its decline in the subsequent years of the German post-*Wende* period. The gentleman said he could mention 30 things off the top of his head that have improved after reunification. Nevertheless, he mainly lamented the loss since reunification: "Deutzen had everything, schools, kindergartens, after-school care centres, churches, a cultural centre. And nothing is left of all these, except a nice ice cream parlour".

The landscape of the Central German Mining District is shaped by centuries of extraction. For generations, mining activities have broken through the earth, creating a vertical connection to the region's underground resources – copper shale, hard coal, and above all, brown coal. Until well into the 2030s, the southern part of the district remains shaped by active open-cast mining. Here, past and future collide – both present, both inscribed into the landscape. The example of Deutzen makes this temporal entanglement especially tangible. At the public event on the region's future, the older man drew an analogy that reached back to the hopes and sacrifices of the post-reunification years. His perspective underscored how today's transformation is inseparable from the personal and collective commitments made in the 1990s. Fittingly, the discussion took place in the Catholic Church of Deutzen, built in the early twentieth century for migrant miners in an otherwise largely non-religious region. Just a few hundred meters away lies mining site Vereinigtes Schleenhain – one of the district's

6 Halle, 2020-11.

7 Zeitz, 2021-08.

8 2020-07-22.

e-ISSN 2785-2709

last remaining open-cast mines. In places like this, where the cracking of the surface is still ongoing, the landscape itself is absent. It is here that the collision of past and future most clearly defines the present of a mining district in transformation.

In the Central German Mining District, the vertical perspective into the ground opens only where mining is still active. This is crucial, as it directly links the phenomenon of temporal confusion to ongoing mining activity and marks this moment as a transitional phase: once the coal is exhausted, the hole will be filled. For now, however, it enables an engagement with both past and future. In this sense, the open-cast mines also correspond to what Alice Mah describes as post-industrial sites that have "yet to be transformed" (2012, 6). Here too, "violent tensions between the past, present, and future" emerge (Mah 2012, 69), yet not after but during the ongoing operations of industry. The following section examines ethnographically how this physical and temporal gap creates multitemporal perspectives on the region – perspectives that emerge not despite, but because of, its fractured surface.

4 Großgrimma: What is Left of a Place that No Longer Exists?

From the edge of the Profen mine, where the surface fractures begin, the path now leads down, closer to the processes unfolding below. Standing within mining site Profen, past and future can hardly be separated, and the old oak tree seems to confirm this temporal duplicity. It stands grand and looks marvellous. The tree itself would probably impress in most other urban or rural settings. However, mining site Profen, now home to the oak tree, is neither urban nor rural. The tree is surrounded by dust and dirt, yet it was once part of the physical infrastructure of the village Großgrimma. The devastation of Großgrimma began in 1995 and ended in 1998. Today, the boundaries of the village form part of the final section of the Profen mining site where coal is yet to be excavated. Since the 1930s, large-scale open-cast mines have been established in the region. In 1941, the Profen Sachsenfeld open-cast mine was opened (Regionaler Planungsverband Westsachsen 2000, 22 f.). Today, the land has been cleared of nearly all remaining human life, and preparations for the hunt for coal are soon to begin, before such mining operations are expected to end here and in Germany in the mid-2030s. As the excavators have not yet moved into this part of the open-cast mine, the oak tree still stands.[9]

9 Locally, the oak is known as the oak of Grunau, a former district of Großgrimma. For simplicity, this article refers to it as the oak of Großgrimma (Recarbo 2015).

Until today, the resettlement of Großgrimma is remembered and discussed as a story of success, particularly in Hohenmölsen, the town that became home to most of Großgrimma's former residents. For the inhabitants of Großgrimma, the survival of mining in this part of the Central German Mining District after reunification meant that their village had no future. When they learned, however, that it would take at least another thirty years until the coal underneath the village would be mined, they collectively decided to negotiate an early resettlement with the mining company. They chose change in the present over passively awaiting future destruction – a choice often framed as such by those involved in the resettlement process. The resettlement history of Großgrimma was indeed rather special. Earlier resettlements occurred during the GDR era, and they benefited the resettled people very little. Only a few of the high-rise buildings common in the former GDR stand in Hohenmölsen today, but those that do were used to resettle entire villages that had been relocated before reunification. The resettlement of the 800 residents of Großgrimma was mandatory as well. Eventually, people would have to give up their village. However, the relocation took place post-reunification. In a democratic state, many things were negotiable, and the compensations offered were decent. The resettlement is estimated to have cost the coal company MIBRAG nearly 100 million euros, with an additional 10 million euros provided by public authorities (Schierholz 2023). Anyone who had to give up their flat, house or land received a brand-new replacement or financial compensation. For the replacement buildings, a new settlement was established in Hohenmölsen, located *am Südhang*, a slope with a view over the surrounding countryside. Alongside the new housing estate, a new public square – the Square of the Miner – was also established in Hohenmölsen, featuring a community centre, a hotel, and a school with a sports hall. These investments are highly valuable for this relatively small rural municipality and vividly illustrate, in one place, how mining has both caused suffering and generated prosperity.

The resettlement took place after German reunification, but long before the major public debates around climate change and the coal phase-out became prominent. At the time, few questioned whether the demolition of Großgrimma was necessary to access the coal beneath it. Today, the unity between the village's former residents, local political figures, and the coal industry is often praised, especially by those dedicated to preserving the heritage of Großgrimma. The coal industry was not only involved financially in supporting the new beginnings of Großgrimma's residents in Hohenmölsen. Additionally, the mining company MIBRAG agreed to cover the costs of relocating the church in Großgrimma. The idea was later deemed unnecessary by most of the actors involved and was eventually dismissed. Instead, the money promised for the relocation

of the church was used to establish the *Kulturstiftung Hohenmölsen* heritage foundation, which commemorates the village of Großgrimma and preserves its memory and history to the present day. The loss of Großgrimma was a consequence of the coal industry, as was the new start in Hohenmölsen. You give, and you take; that is the way things are here with coal, as Cordula from the *Kulturstiftung Hohenmölsen* said to me: "The whole region depends on it; you live with it".[10] On another occasion, the mayor of Hohenmölsen, Andy Haugk, has put it in very similar terms: "The closer people live to the open-cast mine, the more relaxed they are about the issue of coal". Not only jobs but also social infrastructure exist thanks to mining. Moreover, concerning the villages that had to be devastated, the mayor was convinced: "People knew that". "We are at peace with coal mining".[11]

Figure 3 Formerly Großgrimma: old oak tree in the foreground, mining preparatory work in the background. Photo taken by the Author on 25 September 2023

The quotes by Cordula and the mayor exemplify the positive mood surrounding the resettlement of Großgrimma. Whilst coal might take land, a village, and a home, it also provides labour, pride, and wealth – the ever-true reciprocity of coal, which those living close to the mines know only too well. In the summer of 2023, a ceremony

10 Name changed. Interview conducted in Halle, 2020-03-10.

11 Interview conducted in Hohenmölsen, 2020-06-16.

e-ISSN 2785-2709

marking the 25th anniversary of the resettlement process was held at the community centre in Hohenmölsen, to which former residents and those involved in the resettlement were invited. At the event, the resettlement was praised as a voluntary act carried out in the service of the common good and "without any externally visible conflict", as one speaker remarked. The mood of the event was cheerful and celebratory, with local children singing the *Steigerlied*, the German miner's anthem – a symbolic act connecting present generations to their mining heritage. The sharing of anecdotes and communal meals fostered a sense of continuity and belonging, even though the village of Großgrimma itself no longer exists.

This celebration was meant to show that Großgrimma belongs to the past, but the memory of the place is kept alive. In this way, Großgrimma continues to live on in Hohenmölsen despite the presence of coal. Conversely, Hohenmölsen lives from and with coal. The narrative of the resettlement of Großgrimma as a difficult but collective and ultimately successful undertaking is intended to highlight this harmony of living with coal. The sacrifices made by generations living with and from coal are often framed as worthwhile. Indeed, especially in Hohenmölsen, the Profen open-cast mine and the resettlement of Großgrimma have contributed to creating a solid social infrastructure for the town. Yet, this narrative coexists with enduring tensions – the impact on the landscape, loss of homeland, and the vast amounts of CO_2 emitted by coal power generation temper the sense of triumph. The acknowledgment that these sacrifices have "paid off" thus encapsulates both gratitude and pragmatic acceptance.

Still, the past occasionally interrupted the celebration. When a former resident of Großgrimma was asked whether she now, after 25 years, feels at home in Hohenmölsen, she confidently replied, "Oh yes, we feel at home in Hohenmölsen, but sometimes we still think of our *heimat*". This ambivalence becomes even more apparent in the town church of Hohenmölsen.[12] In front of the church, the bell from the former church in Großgrimma is displayed; inside, a memorial space has been created with wooden plaques commemorating all the churches lost to resettlement in and around Hohenmölsen. I am visiting the church as part of an event organised by the *Kulturstiftung Hohenmölsen*, with the event focusing on remembering the abandonment of Großgrimma and the relocation of its residents. A local church representative offers a brief introduction to the building before turning to the history of mining-induced relocations – the reason for our gathering. A former local politician involved in the

12 Discussion forum at St Peter's Town Church in Hohenmölsen as part of the Summer Academy of the *Kulturstiftung Hohenmölsen*, 2020-09-15.

resettlement of Großgrimma and a former resident of the village share their memories of the process.

The resettlement story has been presented as a model case, featuring sincere community participation, active support from both the municipality and the mining company, substantial financial compensation, and an overall improvement in living standards for those affected. And yet, in the pale light of the church interior, cracks begin to show in the polished narrative – another story, quieter but no less present, begins to emerge. It surfaces as the former resident, a teacher at the local grammar school, takes the floor. She recounted the familiar story of a hard but fair resettlement. Long after she had left Großgrimma, the village was slowly dismantled. Every day, less remained visible. The complete disappearance of the village was accepted and anticipated. However, from one day to the next, the church was demolished, and the loss of this landmark weighed heavily on her. That memory interrupted her previously light-hearted speech; her voice faltered and tears welled up. Later, she regained composure, but for a brief moment, the past forced its way into the present. Her account does not contradict the official narrative of peaceful resettlement, but it complicates it. "I probably would never have stayed there anyway", the teacher reflected. The resettlement was a success, yet the sense of a lost homeland remains.

This interplay of memory, loss, and enduring presence finds its material counterpart just a few kilometers away at the former site of Großgrimma, now part of the active Profen open-cast mine. "This was my childhood", said the mayor. The place evokes memories, and the old oak tree brings them to life. I asked the mayor of Hohenmölsen if he could still orient himself in this unreal and vanished landscape. "Yes, by this oak tree" was his response. To me, the oak tree was as fascinating as it was disturbing, since it evoked a distant past in the present. Moreover, the oak tree and the surrounding mining site also provoked an equally absent future. The apparent near future was to see the oak tree's end, as excavators approached to mine the coal beneath it. However, temporal scales do not always align. The tree could, in theory, become coal – through the process of carbonisation. But this transformation, from wood to peat to brown coal and to hard coal, would take millions of years.

Anthropologist Richard Irvine urges us "to find ways of understanding the interrelationship between human and geological temporalities" (2014, 170). D'Angelo and Pijper similarly highlight the environmental consequences of extractivism as both are rooted in deep time and extend far into the future (2018, 216). And Palsson and Swanson call for attention to "articulations of biographies and processes in the longue durée" (2016, 165). Yet even this longue durée manifests in the present. When visiting the Profen mine, the tour guide spoke of descending into "millions of years of history". A coal industry

representative once jokingly called coal a "renewable resource". All these examples, I argue, reveal how deep time is mobilised in the present. Even the deepest past only becomes meaningful through its articulation in the present.

In this present, coal mining remains active, yet the sacrifices of past mining and the uncertainties of a post-coal future heavily shape the present. "There is not too much more to coal",[13] I have heard from a community representative in Deutzen. He was expressing the sense that coal is losing its significance and value, despite the open-cast mine still being active in the direct neighbourhood. An employee representative at the coal mining company said that his company is "in its core business, a run-down company".[14] Meanwhile, another employee representative summarised, "If you come up with projects that have the word *coal* written on them, you can turn around on your heel and leave".[15] These statements highlight the temporal complexity in which the Central German Mining District finds itself: a present defined by coal that fades into the background, overshadowed by the legacy of its past and the uncertainties of its future. Coal mining is thus a subject that shapes the past, present, and future of the region. However, through the lens of what is first a landscape phenomenon and ultimately a temporal one, this perspective shifts. In the depths of the open-cast mine, by the towering, ancient oak tree, it becomes clear how past and future coexist within the present. As the examples from Hohenmölsen and Deutzen have shown, glimpses of the past and projections of the future come into focus. This projection occurs, on the one hand, at the expense of the present itself; yet, on the other hand, it establishes a dialogue between the coal-related past and the post-coal future.

5 Conclusion: Gaps as a Prism for the Present

In this article, I have referred to gaps as physical phenomena in the landscape that translate into temporal phenomena; defining life in the Central German Mining District on its path toward a post-coal future. Located between a past defined by socialist modernity and fossil economies on the one side and a post-fossil energy landscape and society on the other, the present becomes a gap. Kathleen Stewart captured this relationship between past and future in her ethnography about the Appalachian region in the US, likewise a region defined by the legacy of coal mining: "The past, like the future,

13 Cited at a meeting of the local council in Deutzen on 2020-10-21.

14 Cited during an excursion to the Profen open-cast mine, 2021-09-07.

15 Cited at a closed event of the Rosa Luxemburg Foundation in Hohenmölsen, 2020-10-27.

comes and goes, drifting in and out of vision, but it haunts things until there is no telling what might happen and what people might do" (1996, 116). Consistently throughout her book, Stewart points to gaps as an undefined yet influential figure to describe this rugged relationship between what was, what is and what will come: "Imagine a world that dwells in the space of the gap, in a logic of negotiation, surprise, contingency, roadblock, and perpetual incompletion" (Stewart 1996, 17).

I argue that this logic is, first of all, of a temporal nature. I build upon the making and unmaking of temporal orientation in the present because the time of resource extraction is manifold (D'Angelo, Pijpers 2018, 216). Coal mining occurs in the present, but it also creates opportunities for the past and the future to intervene in the present. For the Central German Mining District, tales of the past and future promises are visible as a present disorientation. They become a disruption in the order of time and this disruption must be regarded as a disorientation that discloses and, therefore, defines the present and has practical implications for everyday life in the Central German Mining District. I have illustrated the implications of this disorientation through ethnographic vignettes from within and near the open-cast mines of the mining district.

This disorientation, illustrated by the concept of the gap, only applies to communities that live near and are characterised by coal mining. The gap, therefore, is not all-encompassing. It is a condition to be seen or unseen, referred to or ignored, embraced or endured. Active coal mining in the Central German Mining District is now limited to only a few locations. Beyond these sites, open-cast operations are barely visible, and the end of coal extraction is foreseeable. At the same time, the entanglement of multiple temporalities remains relevant, though it must be understood in relation to broader regional dynamics. Other employers now exist in and around Hohenmölsen; the town has absorbed the loss of Großgrimma. In nearby Deutzen, however, the decline of the coal industry is felt so strongly that the community, despite its geographic proximity to the mining areas, has distanced itself from coal altogether. This dialectic is not only visible in how people imagine a post-coal future but also in how they relate to the post-reunification past. The legacy of German reunification lingers like a background noise in the present – still relevant, and frequently a subject of political debate. Yet it is just one factor among many, perceived locally as more or less significant depending on the context. The condition of the gap can therefore be activated or ignored – both by actors in the field who seek to recalibrate the relationship between past, present, and future, and as an analytical lens through which to understand the present.

Gaps act as an inherent logic, a potential backdrop in everyday life in the mining region. Gaps, therefore, are always full of meaning and

should therefore not be closed but endured (Fortun 2012, 452, 458). The aim of this article was to illustrate the significance and present-day nature of the gap for the Central German Mining District. I have argued for a reading of a mining site beyond its use for coal mining. I have argued that the mining site marks an absence, land missing, a gap in between. The gap brings future potentials and past legacies into conversation; in the present, it allows for the past and future to coexist. As much as the gap disrupts, it connects the streamline of history, and thus enables a dialogue between the end of the coal mining industry and the post-coal future.

The gap becomes a depiction of a present in transformation. To think with and through gaps is to break with horizontal readings of my field. In this paper, I have focused on how the anticipated end of coal mining is shaping the Central German Mining District. However, I did not focus so much on coal pasts and post-coal futures. Instead, the idea and physical reality of the gap helped to uncover how those coal pasts and (post-)coal futures shape the present of the Central German Mining District. Without visible gaps in the landscape, it is harder to have a dialogue between past, present, and future. The gap represents a space of possibility in which past, present and future enter into dialogue with each other. However, as I have shown, the gap can also mean that both past and future overshadow the present.

This paper is a quest to take gaps into account and take the disorientation they produce seriously – especially but not exclusively in times of the green transformation. To face the future as a time of becoming post-coal can provoke or foreclose debates about the past. In the present, those contradictions and misplacements are spelt out. The paper aimed to identify, understand, and address gaps in the social life of a *not yet* post-mining region, as gaps are a powerful reality in the present Central German Mining District.

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e-ISSN 2785-2709

Lagoonscapes
Vol. 5 – Num. 1 – June 2025

Excavation | Elevation: Above and Below Ground in Nairobi

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Abstract A practice-led collaboration between James Muriuki and Constance Smith, "Excavation | Elevation" examines the excavations and extractions that make high-rise architecture possible. Focusing on the socio-geologies of Nairobi, it follows the city's urban transformation above and below ground. As fields become tower blocks, excavation and extraction, quarrying and land speculation underpin new high-rise skylines. But horizons can be fragile: buildings collapse and construction sites play host to new urban ecologies, as the underneath and the surface shape each other.

Keywords Nairobi. Construction. High-rise housing. Urban anthropology. Extraction.

Summary 1 Extraction. – 2 Collapse. – 3 Unruly Depths.

Edizioni Ca'Foscari

Peer review

Submitted 2025-04-11
Accepted 2025-07-10
Published 2025-07-21

Open access

Citation Muriuki, J.; Smith, C. (2025). "Excavation | Elevation: Above and Below Ground in Nairobi". *Lagoonscapes*, 5(1), 59-90.

DOI 10.30687/LGSP/2785-2709/2025/01/003

"To build up, you must dig down", said Patrick, a *fundi*, or skilled labourer, on one of Nairobi's innumerable construction sites. Showing us the deep foundations for the current building he was employed on, he gestured down into the cavity. "Down there, that's where it starts". All around Nairobi, *shambas* (fields) are becoming *ghorofas* (high-rises). The city is in the middle of a construction boom that is radically reconfiguring the urban skyline. Excavation and extraction, quarrying and land speculation underpin Nairobi's new passion for verticality. Patrick's simple words lingered in our minds long after the encounter, eventually inspiring the title for this project: *Excavation | Elevation*. With his words in mind, our engagements with diverse sites of urban transformation in Nairobi – with mushrooming high-rise buildings, with the quarries where building stone is sourced, with sites of building collapse and of prestige development – revealed themselves as interconnected not only materially but volumetrically. We began to see how the underneath of the city and its surface were shaping each other.

Patrick's comments drew our attention to the geological manipulations that underpin urban transformation, exposing how urban skylines rely on exchanges and flows between the above ground and the underneath. These exchanges, circulations and accumulations of earthly matter evoke what Latour (2020, 3) called the "critical zone": movements through the semi-permeable "thin skin of the living earth". Though porous and leaky, the critical zone is not totally free-flowing. Conditioned by geology and climate, interchanges across rock, soil, water and air are also intimately shaped by above ground politics, social life, technology and forms of knowledge production that render the underneath knowable in certain ways (Ballestero 2019). In such ways, the critical zone conditions and enables human and nonhuman worlds that emerge from it, and vice versa. This is what Clark and Yusoff (2017) point to with their conceptualisation of "geosocial formations". Highlighting the multivalency of *formation* as both geological and social, process and outcome, they posit that "thinking the becomings of earth and society together might help us probe the richly layered formations we have inherited for the overlooked, marginalized or as yet unactualized geosocial possibilities murmuring within them" (Clark, Yusoff 2017, 6).

Inspired by this approach, in this essay of word and image we follow Latour's invitation to become 'critical zonists'. Moving from sites of excavation into new vertical neighbourhoods and down into the city's underneath, we attempt to permeate Nairobi's shifting landscapes of buildings, planning and infrastructure, examining the materiality of anticipating the future in a rapidly transforming city. We found that in Nairobi, 'geosocial formations' are not simply of academic interest, but under scrutiny by all kinds of actors, from construction workers to residents. From this perspective, Patrick is also a 'critical zonist' in

the way that his very straightforward comment nevertheless revealed a mode of thinking that moved through the earth's surface, seeking to know its possibilities and limitations.

This collaborative project between artist and anthropologist has been in process since early 2022. In addition to publications, the project has to date encompassed two exhibitions, two short films, and a series of public talks, workshops and interventions.[1] Although we work in different media, with Smith taking the lead on the writing and Muriuki undertaking the photography and visual components, the fieldwork – including interviews, site visits, visual research methods and observations – has been undertaken together. This has taken us to diverse areas of Nairobi, from stone quarries to construction sites, from exclusive high-rises to dense tenement housing, from sites of building failure to salvage economies of scrap. The project aims to link together the extractions of construction material – the unmaking of the underground in order to build the above ground – with the extractive political economies that drive urban property regimes in both cities. This is part of a larger project led by Smith tracing how, within such conditions, urban residents live with and alongside precarious architecture and failed buildings, and how the material unreliability of their homes drive debates about (im) moral economies and public (mis)trust, generating calls for not only the politics, but the very fabric of cities, to be unmade and rebuilt along more equitable lines (Smith 2023b; 2023a). In this piece, we seek to bring word and image together on an equal footing, to develop an open-ended engagement with the terrain of Nairobi. Rather than images illustrating the text, or the text explaining the images, we intend for one to illuminate the other, evoking qualities of presence and feeling: a way of engaging with the city that is not simply about representation, but which attempts to foreground the material, tactile and affective.

1 See the project website `https://www.highriselandscapes.org/` for more information, including exhibition installations and to view the films.

1 Extraction

"The city is coming this way, and it is us who are making it", said a quarry foreman by the name of Maina. His face crusted with grey dust, he gestured to the vast hole behind him, where tiny ants of men moved behind a toy-sized engine with a spinning blade fitted to its rear. The engine traced slow lines across the ground, slicing the land into a descending grid, the men threw the cut blocks of stone on to the back of a lorry. Like a cavity burrowing into a tooth, the quarry was gradually eating away at the green hillside. In this region of Kenya better known for the pineapple plantations of Del Monte than for its urban influence, Maina nevertheless saw himself as a city-maker, feeding Nairobi's hunger stone by stone.

Over the past decade, Nairobi City authorities have been re-imagining Nairobi as a 'world-class' city of spectacular infrastructure and gleaming high-rises, inspired by neoliberal models of urban development in cities like Dubai and Kuala Lumpur. Increasingly a destination for global capital, Nairobi's real estate sector has exploded in recent years, following a trajectory that has been described as a "real estate frontier" (Gillespie 2020). Land and housing are increasingly commodified with land values rising steeply. Although Nairobi continues to grow horizontally, one consequence of rapid urbanisation is that land values have been increasing exponentially. This has meant the real estate market has started to build upwards: in wealthier neighbourhoods family villas have been sold off to developers and high-end apartment blocks constructed in their place. Construction continues at such a pace it is dizzying: the city shapeshifts from one month to the next. Meanwhile, in Nairobi's majority neighbourhoods, corrugated iron shacks known as *mabatis* are being replaced by multi-story rental tenement blocks, resulting in the verticalization of housing and high levels of urban densification (Huchzermeyer 2011). This is part of an urban property boom that is generating new geographies of rentier capitalism in the city (Gillespie, Mwau 2024). Urban life is both literally and metaphorically unstable, as rapid urban financialization brings challenges of social and economic precarity. But the city has also been rocked by ongoing spate of shocking building collapses, revealing the extensive architectural precarity in which many Nairobians dwell, even as new towers soar overhead. The city tilts with the unsettling of ground (Elyachar 2022).

When he described himself as city-maker, we were struck by Maina's sense of agency in a city that is growing so fast along so many different trajectories, that it is often spoken of in public debate as 'out of control', and where popular majorities are often presumed to be victims rather than active participants of urban development. Indeed, scholarly approaches to African cities such as Nairobi have until recently emphasised the failures of urban systems, planning and politics, and the forms of abjection and marginality this has produced (see e.g. Guma 2022; Nuttall, Mbembe

2008 for a discussion of such perspectives). Against this narrative, social collaboration, improvisation and agency have emerged as important corrective themes for understanding the nuanced ways in which lives can flourish in African cities (Simone 2004; Simone, Pieterse 2017; De Boeck 2012). Yet cities make people as much as people make cities: processes of accretion and subtraction, construction and dispossession, wasting and renewal, influence city formations – both social and material (Smith 2019). In Nairobi, like cities elsewhere, substances and resources, technologies and things, human and non-human bodies are entangled in the becoming and (re)making of the city itself. The quarry where Maina works is one such site of entanglement; a geosocial formation from which the literal building blocks of the city are cut, but which simultaneously shapes the lives of those who live and work there.

Maina's words reminded us that much of the stone, as well as the sand and hardcore used in concrete, that builds Nairobi is not imported but quarried from the city's hinterlands. As Nairobi grows, the distance between the quarry and the city shrinks. As Maina put it, "the city is coming this way". This is an ambivalent observation: on the one hand, it alludes to the promise of urban development and a sense of agency over it, spoken with a sense of pride by Maina and his colleagues when they said, "it is us who are making it". But the approaching city is also understood as a potential threat, affecting their future livelihoods. Nairobi's expanding urban fringe has often heralded rising peri-urban land prices, conflicts over land use and tenser relations with adjoining communities. One landscape, one set of lives, are built through the unbuilding of others. This is what Neil Brenner (2013) pointed to with his conceptualisation of planetary urbanism: there is no place unmodified by urbanization. Where does an urban agglomeration begin and end? Should it not include the planetary infrastructure on which it depends? The planet is also "an agent in the process [of urbanization] as well as its expression and residuum" (Labban 2019, 41).

Where a quarry is located is decided not only by prospecting for desirable geologies, but by other porous, opaque interactions across the critical zone, in which topography and politics come together. The ambiguity of land ownership, of extraction rights and of claims that can be made to territory are fundamental to the geosocial formation of the quarry: it is the very lack of clarity that enables semi-licit quarries such as this to emerge. The politicisation of, and conflict over, land is an old story in Kenya, from the dispossession of vast tracts of the country by settler colonials, to a failure of redistribution following independence, the allocation of land as political reward and innumerable ongoing disputes over titles, boundaries and inheritance (Manji 2020; Boone 2012; Berman, Lonsdale 1992). The quarry where Maina works is on land with a complex and opaque history of allocation and re-leasing. There is an ongoing dispute over control of the land between public agencies and the Salvation Army, which has been a powerful landholder

e-ISSN 2785-2709

in Kenya since the colonial period. The church has accused the county government of intimidation, while county authorities have responded in kind (Ciuri 2024). At the same time, hundreds of acres of the area have been exploited for quarrying by parties the church claims the land was never leased to, a case that has been full of accusations and counter-accusations, and which was eventually dismissed by the Environment and Land Court (Cece 2020). It is this porosity and opacity that has enabled the quarrying to continue at pace and scale, machinations and extractions going underground in both senses of the word.

Ultimately, the very success of the quarry as a source of affordable urban materials for making the city renders its future uncertain: the site of Maina's quarry may be swallowed up by Nairobi's growth. There is a repetitive temporality here in the relation between quarry and city: across Nairobi's history, quarries have been absorbed into urban space. The local extraction of stone for urban construction dates back to Nairobi's earliest days as a colonial staging post on the East African Railway. What is now known as Quarry Road was in the 1920s an outlying track that led to the first peri-urban quarry. It was long ago engulfed by urban development, and today, one would describe it as just near the city centre. 'Kware', meanwhile, is a Sheng word that appears in neighbourhoods all over Nairobi, indexing sites where stone extraction does, or did, occur. Many of these excavations have been backfilled, and even have new buildings precariously constructed on top of them. In the fringe settlement of Gataka, for example, south of the city, a redundant quarry now has a large church situated within it and further buildings constructed on stilts around its edge. Such sites are frequently flooded during Nairobi's regular heavy rains, when rivers, streams, and drainage channels swell and overflow with increasing unpredictability. Such volumetric processes move within and across the critical zone, further troubling any sense of boundary between surface and underneath. Just as stones are raised from the rock upwards for construction, so other materials move below surface level. Flooding blurs the surface, as built form is displaced, leaks or sinks.

Though Maina and his colleagues describe themselves as city-makers, it is partly bluster. They are acutely aware that despite the quarry's vast physical presence, it is also precarious – politically, topographically, and temporally. Their sense of pride is also ambivalent, bound up in their awareness of Nairobi's murky politics and intensifying inequality. As Andrea Marston (2021) has shown in reference to mining in Bolivia, in extractivist economies it is not just rocks that are differentially valued but people too. The quarry, through its labouring practices, produces quarryworkers as stratified subjects, even as they might dream the city otherwise. This sensibility becomes more acute as we follow the trucks from the quarry and into a construction industry that simultaneously is producing a high-rise real estate boom and deep urban precarity.


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2 Collapse

Following the stone blocks cut from the quarry into the city, most truckloads go into the construction of low quality, but highly profitable, tenement rental units which now dominate low-income Nairobi. These tenement neighbourhoods are built at extremely high density with little regard for regulations and planning, generating vertical neighbourhoods of structurally precarious architecture, in areas that were already lacking in basic services, such as running water, sewerage, or adequate electricity (Mwau, Sverdlik 2020; Huchzermeyer 2011). It is these neighbourhoods that have borne the brunt of a series of building collapses occurring at a rate of four or five a year. In the rush to build, outrageous shortcuts are being taken. Sometimes the steel rebar is too small to cope with the size of the building, sometimes the concrete is diluted with too much sand, sometimes the excavated foundations are too shallow or are dug too close together, undermining the stability of the adjacent building. As the costs of construction materials continues to spiral globally, further shortcuts are being made by developers to recoup their investments. Collapsed buildings are part of wider dynamic of opportunist property speculation that we have elsewhere conceptualized as 'grey development': an opaque assemblage connecting the above and below ground: inadequate foundations, poor quality building materials, regulatory inadequacy and an illicit construction industry that drives a particularly aggressive form of residential capitalism (Smith 2020).

The precarity of Nairobi's housing reveals itself not just in the crisis of building collapse, but in forms of collapse at a wider, even planetary, scale (Arboleda 2020). The manipulation and extraction of geological materials – quarrying stone and sand, the excavation of vast quantities of earth for foundations, and a globally escalating concrete industry – underpin Nairobi's high-rise urbanism, linking the acute temporalities of collapse to the geosocial formations of the Anthropocene (Clark, Yusoff 2017). The carbon footprint of concrete makes it one of the worst contributors to anthropogenic climate change, which in turn is understood to be intensifying extreme weather events in Kenya and raising flood risks (Kiptum et al. 2023). Powerful seasonal flooding in Nairobi can literally undermine the foundations of tenement buildings and makes building failure more likely – indeed, most of the collapses happen in Nairobi's rainy season (Fontein et al. 2024, ch. 1).

Building collapses are moments of violent rupture, but they are deeply connected to long urban histories of extraction and dispossession as well as exclusionary futures. In 2022, an apartment block collapsed in Kinoo, a neighbourhood on Nairobi's western fringe. The building failed in the latter stages of its construction – apartments

had been pre-leased, but the building not yet completed. One Kinoo resident, Paul, tells us he would never live in a building more than three floors high in this area, it is too dangerous. Walking around, we start to see tilting tower blocks, their cuboid forms listing towards or away from each other. We are unsure if this is evidence to back up his words, or if our imaginations are going into overdrive: once you start looking for fragile buildings, you see them everywhere.

In this area of Nairobi's edge, apartment blocks are popping up via a dynamic land market in which local owners of small plots of land are selling to Nairobi property developers. Paul saw the collapse of apartment blocks as linked not only to the murky speculations of grey development but also to a fragile underground, revealing himself to be another critical zonist. What he described to us as 'seasonal rivers' flow through the area, some remaining entirely underground, some surfacing occasionally. The watery underneath is more akin to an aquifer and is much less defined than the word river implies (Ballestero 2019). The landscape is threaded with a porous network of rivulets, fissures, and channels through which rainfall soaks, groundwater swells and the seasonal surges of nearby rivers drain. When apartment blocks are constructed in this area, foundations are excavated and filled, but shortcuts are often taken, Paul told us. The foundations are not deep enough, large enough, or reinforced enough to cope with this friable underground. Instead of bedrock, they encounter the terrain of these seasonal rivers, whose underground waterways are sometimes fluid, sometimes dry: the streams and rivulets pulse with heavy rainfall or dehydrate in times of drought. Cumulatively, this destabilises a building's foundations, ultimately causing it to tilt and list, and even collapse.

For Paul, who was born in Kinoo, the crumbly, uncertain underneath is something that, although it cannot be seen, is somehow known at a visceral level. He knows not to trust it, a knowledge made clear in his commitment to remain living at ground level. But the uncertainty of the underneath is also changing character – its unpredictability taking on new aspects across the critical zone. Kenya's struggles with prolonged drought and with severe flooding have made international headlines in recent years as the effects of the climate crisis disrupt historical patterns of seasonal rainfall. There are other changes too. At the edge of Kinoo, Paul takes us to a waterpool where he used to play with friends when they were kids. Down in a steep valley, a stream gushes from the hillside, flattening out into a pool as the terrain levels out. "It used to be clean", he remarked, raising his arms and dropping them despondently. There is rubbish, mostly plastic waste, caught up in the fringes of the stream, the huge green elephant ears of arrowroot plants – *nduma* – erupting through a plastic bag. Building collapse is occurring amid a wider landscape of toxic flows across the area's surfaces. The flattish areas to the sides of the

stream are now cultivated, and fertiliser use is common. "The water now is contaminated" Paul tells us, not just from agrichemicals but from seepage and runoff from the many construction sites all around, "Children can't swim here anymore".

Back in Kinoo at the site of collapse, James and I stand with another local, Josephat, at the edge of the concrete debris and mutilated steel. Gazing at the rubble, Josephat explained that he had been going to rent an apartment for himself and his wife, but the building collapsed before construction was finished.

> This city – even you can't know where you are living. Any time, it can just collapse. […] And politicians they don't care, they only think of their stomachs. Now where do we go? For us *wananchi* (ordinary citizens), Nairobi is a death trap.

In addition to the faults of individual buildings and topographical uncertainty, Paul and Josephat's explanations pointed to the political economy of construction in Nairobi, and how precarious skylines are embedded in the wider landscape of a chronic housing crisis: since the colonial era, housing in Nairobi has failed to keep pace with the rate of urbanization, resulting in serious overcrowding. Today, roughly 60 percent of the city's population lives on just 6 percent of its land.[2] These inequities are entrenched and compounded by forms of spatial authority and infrastructural injustices that have their roots in colonial urban governance and through which arrangements of urban marginalization and dispossession persist (Kimari 2021). In Nairobi as in many African cities, planning policies and building regulations are anti-poor in the sense that they exclude low-income groups from security of tenure, quality housing, or access to services (Watson 2009).

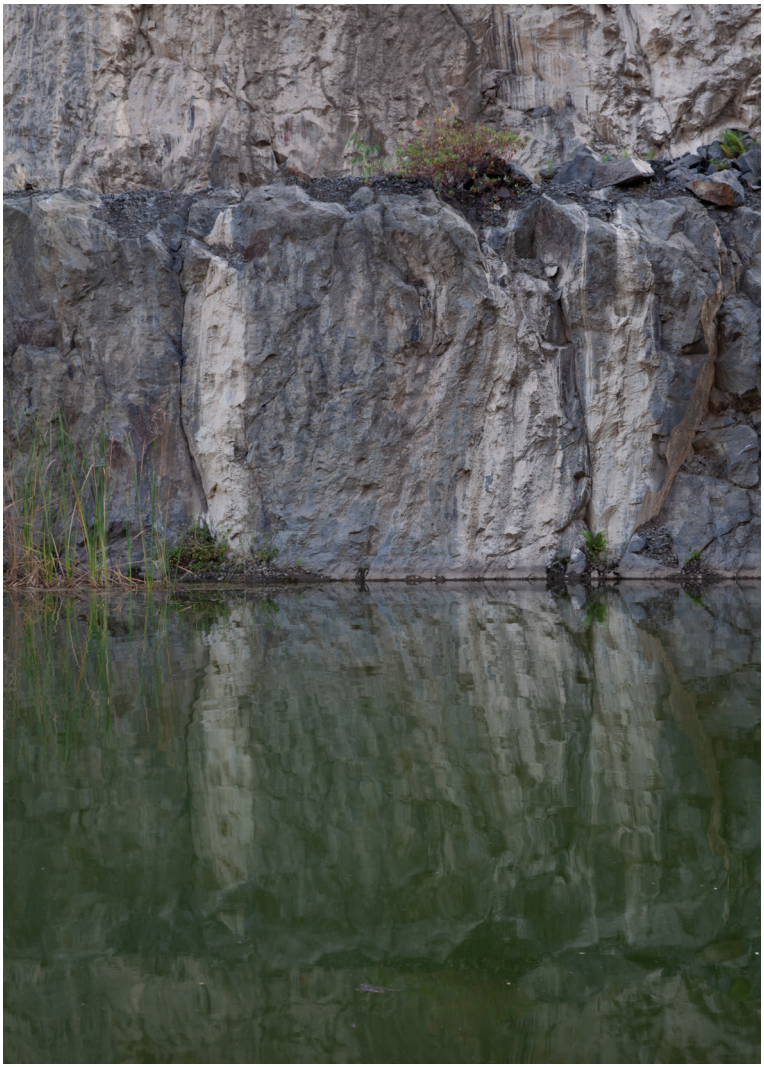
The property sector is marked by a "revolving door" between politics and business, implicating politicians in land acquisitions, procurement and contracting, as well as in the extraction of profit (Pitcher 2017). For example, when the current President, William Ruto, was Vice-President in the previous administration, a property development company in which he was an investor was linked to a land-grabbing scandal when a primary school playground was seized for the construction of a hotel car park (Fontein et al. 2024, ch. 1). Though that case received more public critique than usual, it was far from unique. A former government flagship megaproject to build a 'world-class' high-rise techno-city on the fringes of Nairobi was rife with accusations of bid rigging, profiteering, procurement scandals,

2 "Urban Pathways – Kenya, Nairobi". *Urban Pathways*, 2019. https://kippra.or.ke/strengthening-the-upgrading-programmes-of-informal-settlements-in-nairobi-2/.

and other irregularities involving local senators and government ministers (Mulupi 2012). In such ways, the promise of Nairobi as a future global city is shown to be superficial: the surface of the vision may be of gleaming high-rises, but these promises are often illusory, riven with forms of deception and public mistrust, and sometimes hiding a dangerous precarity underneath (Smith 2023b).

In a city riven by immoral economies of housing, ecological breakdown, and derelictions of political care, we can see how for tenants of precarious buildings such as Josephat, flows and exchanges across the critical zone are understood not so much in terms of making urban life, but its 'unmaking'. The city tilts, grounds are unsettled, what should be below is surfaced in moments of violent and shocking rupture that have their roots in a slower, but nonetheless extractive, urban political economy, and an even slower breakdown of subsurface geologies. Down there, that's where it starts.

In such ways, the high-rise construction boom links the above ground to the underneath, as geosocial formation. The illusory promises of spectacular development and the hidden operations of the property sector require attending to the metaphorical possibilities of the critical zone as well as the material: attempts to think vertically through deception and opacity as we try to navigate an urban world that is not all it seems from the surface. In many ways, the infrastructures that appear on the ground *are* just the surface: their linkages to what is going on underneath remain opaque, though the network is understood to be powerful. In this subterranean politics, the earthworks of the diggers that excavate a building's foundations echo the workings of capital. As Xavier Garnier has astutely put it, "money is the great 'digger' in the neoliberal regime", while corruption "undermines social institutions… until it provokes local collapses" (Garnier 2021, 141).



3 Unruly Depths

In the financial and corporate hub of Nairobi's Upper Hill neighbourhood, is a site of neoliberal digging *par excellence*. In 2017, this was the setting for what was envisaged as the tallest building in Africa: a 300metre double skyscraper named The Pinnacle. Architectural renderings on billboards and promotional materials showed a birds-eye view of a gleaming edifice of glass and steel, soaring over the city with downtown Nairobi barely visible in the background. Led by a Dubai-based developer with partners from across three continents, the project was officially launched by then-President Uhuru Kenyatta and the foundations were excavated, generating a huge crater in the hillside. But by the end of 2017 the project was tied up in a complicated lawsuit with conflicting claims of land ownership and misuse of the site involving several project partners (Wasuna 2019). The case is still unresolved, and the project is dormant: the sound of machines has fallen silent, replaced with birdsong and rustling grasses. The planned tallest building in Africa remains the deepest hole in Nairobi.

Over the course of 2022, James and I made several visits to what we began to call the Upper Hill Hole, fascinated by its scale, but also by the incursion of plants, wildlife and unpermitted people. The hole is now filled with water, and creepers, grasses and wildflowers cover its banks. The suspension of construction did not mean the site was inactive – far from it. We sat and watched the flight of three kingfishers swooping across the water's surface, before they perched on the metal trusses on the foundation walls. Ducks swam beneath, house martins nested, and there are even fish in the watery depths. Nairobi is a city with a fraught history of destroying its green spaces, and the politics of environmental activism has been met with some brutal pushbacks, as attested by the 1980s Greenbelt Movement led by Nobel Peace Prize winner Wangari Maathai. And yet here, under cover of what on the outside was meant to be one of the largest infrastructural projects ever in Nairobi, was now the city's only urban lake. It was playing host to new, unexpected ecologies, including the human.

On one visit we encountered Jeremiah, when he appeared to chop wood at the top of the crater. The wood was to feed the fire on which he was brewing tea to sell to workers employed on constructing a new highway adjacent to the site. The hole was a Godsend, he said. His tiny café had no permanent structures, instead he used wooden planks propped up on building stones for benches, while a shelter was rigged up from old plastic sacking salvaged from the same highway project. He had made a small entryway into the Pinnacle site by unfixing one of the corrugated iron panels, and, at the end of every day, disassembled his café and stored it inside the fence. He sometimes slept there too, under a tarpaulin.

The Upper Hill Hole is an example of what Bettina Stoetzer (2018) has called a ruderal ecology. She writes:

> The term 'ruderal' comes from 'rudus', the Latin term for rubble. A common term in ecology, it refers to communities that emerge spontaneously in disturbed environments usually considered hostile to life: the cracks of sidewalks, the spaces alongside train tracks and roads, industrial sites. (2018, 298)

or, in this case, the abandoned foundations of a skyscraper. Neither wild nor domesticated, ruderal ecologies are best described as unruly: they offer insight not only into nonhuman urban life but "the broader, unintended ecologies of human-built structures and the multispecies worlds of which they become part" (2018, 298).

This unruliness is an important aspect of Nairobi's geosocial formations. It draws attention to the city's urban churn, and the way in which materials, substances and more-than-human actors reconfigure infrastructural and developmental imaginations. This unruliness can reshuffle and realign urban formations in ways which draw attention to the unpredictable potentialities of the critical zone. Contemplating the hole's hidden depths, we began to wonder, what is the difference between this hole that was excavated for the Pinnacle, and the hole that is the quarry where Maina works? Both were sites of extraction – of labour and materials – indexing the inequities of Nairobi's growth in different ways. Both quarry and foundation held within them the potential to become something else – that is, a tower. One by being the site from which building stones were sourced and the other as the place where a skyscraper's concrete foundations would be poured. Both were entangled in the complex temporalities, socialities and materialities of Nairobi's constant flux. As geosocial formations, they prefigured the silhouettes of high-rise transformation whilst also manifesting its frailties, breakdowns and hollow promises.

This returns us to Patrick's words: "To build up, you must dig down". Rather than taking the city at face value, we have tried to dig under its surface, to think across its critical zone. We juxtapose the physical extractions of quarries and foundations with materialities of property-driven extractivism: the way that the political economy of housing is fundamentally entangled with the materialities and substances of Nairobi's urban landscapes, and how opaque property speculation is radically reshaping the city. When collapse occurs, we see below the urban surface to what is hidden underneath. Lives as well as buildings are unmade in an instant and promises of a 'world-class' future city are revealed to be hollow.

Sat on the banks of the hole in Upper Hill, we watched the birds diving beneath the water's surface. The hole's unruly ecology

seemed also to point to the hubris of humans' city-making projects. The subterranean excavations reinforced how frighteningly easy it is to interfere in the critical zone, in the "thin skin of the living earth" (Latour 2020, 3). But also, how surprisingly quickly the more-than-human world can reconfigure formations such as construction sites into alternative assemblages. Nairobi's persistent social and infrastructural injustices, materialised by grey development and its collapses, as well as its long histories of extraction, will of course take much more than unruly plant life to repair. But perhaps the interrupted excavations of the hole and its unplanned ecological incursions can offer a temporary refuge from the city's incessant construction work, a gap in which to reflect on the forms of power at stake in shaping which lives thrive in the disturbed landscapes of our cities.

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e-ISSN 2785-2709

Lagoonscapes
Vol. 5 – Num. 1 – June 2025

Sensing a Lagoon: Distance, Care, and Cormorants

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Abstract By questioning the dichotomy between epistemology 'from above' and 'from below', this article presents a multidimensional and multisensory analysis of the Venetian Lagoon ecosystem. It first investigates remote sensing techniques applied to Venetian coastal management, artisanal fishery, and archaeology, tracing the evolution of environmental remote sensing through the work of geographer Evelyn L. Pruitt, who coined the term. The focus then shifts to the cormorants inhabiting the lagoon, whose movement between air and water in search of food – sparking conflicts with fish farmers and anglers – reframes the divide between the world above and the one below the water's surface, offering a more-than-human perspective on the so-called vertical turn.

Keywords Venetian Lagoon. History of Remote Sensing of the Environment. Vertical Turn in Visual Culture. Cormorants (*Phalacrocorax carbo sinensis*). Multispecies Relations.

Edizioni Ca'Foscari

Peer review

Submitted 2025-03-24
Accepted 2025-05-30
Published 2025-07-21

Open access

Citation Quagliati, N. (2025). "Sensing a Lagoon: Distance, Care, and Cormorants". *Lagoonscapes*, 5(1), 91-120.

DOI 10.30687/LGSP/2785-2709/2025/01/004

1 Introduction

A flock of cormorants perches on a wooden structure rising from the lagoon waters near Ponte della Libertà, the bridge that links Venice to the mainland. In winter, their regular presence in this area is marked by the white excrements staining the upper poles. Yet, this detail does not take away from my fascination with their elegant presence and choreographic arrangement, which follows the geometry of the human-made structure, forming a small square within a larger rectangle **[fig. 1a-b]**. The sinuous bodies of the cormorants, their metallic black and bronze plumage visible in the classical spread-wing posture, punctuate the lagoon landscape. Mysterious and disquieting, they appear as the living counterparts to the symbolic birds carved into the *patere*, the ornamental bas-relief discs that adorn Venetian palaces.[1]

Figure 1a Cormorants perch on the infrastructure, marking the locations of methane gas valves in the Venetian Lagoon waters near Ponte della Libertà, December 2024. Photo by the Author

1 In Venetian religious and civil architecture, a *patera* is a bas-relief disc, typically carved in Istrian stone or marble and commonly used between the eleventh and fourteenth centuries to adorn medieval buildings with depictions of animals that carry moral or allegorical meanings. On Venetian *patere* and medieval bestiaries, see Marzemin 1937 and Riccioni 2019.

Figure 1b Detail of cormorants perching on infrastructure in Venice. Photo by the Author

The poses and behaviour of these animals, which have become increasingly pervasive in the Venetian Lagoon, not only reveal unexpected aspects of the lagoon's avifauna but also draws attention to the human infrastructure that the birds have appropriated. The wooden and metal poles on which they perch are protective structures designed to alert passing boats to the presence of methane gas valves in the water. This intricate network of underwater pipes – delivering gas, drinking water, and electricity to the lagoon's islands – is signalled by cylindrical pillars topped with spherical markers. Each sphere displays a letter that denotes the hidden element for which it stands: 'M' for methane, 'E' for electricity, and 'A' for aqueduct. Solitary cormorants can often be seen perched atop these metallic spheres, reminiscent of the celestial and terrestrial globes housed in the Doge's Palace.[2] Beneath them, traffic signs warn: "no mooring and anchoring". Given that the average depth of the Venetian Lagoon is only approximately 1.2 meters, boats must navigate along designated waterways marked by *briccole* – clusters of large larchwood poles bound together.[3] These typical elements of Adriatic lagoons not only guide navigation but also serve as daytime roosts for birds. Thus, on the one hand, specific features of the landscape reveal the otherwise

2 On the geographical maps and globes of the 'Scudo' Room in Venice Doge's Palace, see Gallo 1943. On the history of terrestrial and celestial globes, see Stevenson 1921.

3 In 2018, a boat collided with a steel pipeline of the aqueduct, causing significant damage and cutting off water supply to part of Venice (*Il Gazzettino* 2018b).

e-ISSN 2785-2709

hidden human infrastructure, visible only during construction or maintenance work.[4] On the other hand, what happens underwater directly influences the aesthetic experience of the landscape.[5]

This article explores two distinct ways of experiencing the Venetian Lagoon, both of which rely on distant perspectives to approach what lies beneath the water's surface. The first section examines the application of remote sensing techniques in the context of the lagoon environment, focusing on coastal management, artisanal fishery, and archaeology. These case studies provide a foundation for reflecting on the concept of remote sensing and tracing its evolution through the writings of Evelyn L. Pruitt, the geographer who coined the term 'remote sensing' while working on coastal erosion at the United States Office of Naval Research (ONR).[6] The first part of the paper concludes by addressing the trend in the humanities to contrast 'epistemology from above' with 'epistemology from below', while also proposing more nuanced and less dichotomous interpretations.

The second part of the essay shifts to a different perspective on remote sensing by seeking to understand how cormorants experience the lagoonscape.[7] Human understanding of animal behaviour often relies on remote observation, facilitated by optical tools such as binoculars and cameras that extend human vision. This observational approach is particularly useful for getting close to cormorants, which remain mostly silent in the Venetian Lagoon, producing resonant, guttural, and purring calls only at their Northern European nesting sites. The use of zooming instruments also enables a detailed description of the birds' ability to 'crack the water surface' while diving for food – often causing conflicts with fishermen. This behaviour offers a way to interpret the vertical turn analysed in this issue through a more-than-human lens.

By presenting studies in which remote sensing and distanced sight are not equated with detached mastery or transcendent power, but instead reflect a search for intimate environmental connection and care for the more-than-human, this article contributes to embodying

4 Venice's first aqueduct, built in 1884, is currently being replaced and can be seen when arriving in Venice via the Ponte della Libertà bridge.

5 On landscape semiotics, see Turri 2014.

6 Pruitt is commonly credited with coining the term 'remote sensing', though she notes that her main assistant, Walter Bailey, also contributed to shaping the concept (Pruitt 1979, 106; Walker 2006, 436).

7 The Venetian Lagoon is home to three species of seabirds from the Phalacrocoracidae (cormorant) family. The European Shag (*Gulosus aristotelis*) is present in small numbers, while the Pygmy Cormorant (*Microcarbo pygmaeus*) and the Great Cormorant (*Phalacrocorax carbo sinensis*) are present in substantial numbers during the wintering period. The data in this article specifically refer to the Great Cormorant (*Phalacrocorax carbo sinensis*). For an updated summary of the presence of the Pygmy Cormorant in the northern Adriatic, see Volponi 2024.

the view from above (Bellacasa 2017; Baldacci 2023). It highlights the interconnections between micro and macro, atmosphere and hydrosphere, and human and non-human, while challenging the horizon line imposed by Western visual traditions in the representation of places (Haraway 2001; Amad 2012; Quagliati 2024).

2 Remote Sensing of Coastal Environments

In 2005, the journal *Zeitschrift für Geomorphologie* published a supplementary issue on *Coasts under Stress*, which started with Paolo Ciavola's article "Sediment Resuspension in the Lagoon of Venice: Short-term Observations of Natural and Anthropogenic Processes" and ended with Harley Jesse Walker's "Evelyn L. Pruitt and Coastal Science", a tribute to the memory of the late Director of the Geography Branch of the ONR. A review of these two pieces provides a valuable introduction to key aspects of lagoon ecosystems and highlights the impact of industrialisation on the Venetian environment over the past century. Additionally, it offers an opportunity to discuss the crucial role of remote sensing in the management and preservation of coastal zones (Psuty, Sherman, Meyer-Arendt 2005).

Paolo Ciavola's research focuses on sedimentation dynamics in coastal lagoons through the analysis of waves, currents, and tides, as well as considering the impact of vessel traffic. In the 2005 article, the author details the underwater measurements conducted with a Remote Unit for Nearshore Transport Investigation (a small benthic lander) positioned on the lagoon bed next to the Malamocco-Marghera canal (Ciavola 2005). This shipping waterway, utilised by cargo ships, oil tankers, and cruise liners heading to the Marghera commercial and industrial port, is one of three inlets connecting the shallow, enclosed waters of the Venetian Lagoon to the Adriatic Sea.[8] Venetians often refer to it as *Canale dei petroli* (Petroleum Canal) because it was excavated to a depth of 14 meters in 1968 to facilitate oil traffic toward the factories of Porto Marghera – one of Europe's largest and most polluted petrochemical complexes located on the lagoon's eaves (Fabbri 2003; Casson 2007; Iovino 2016). The material excavated from Canale dei petroli was used to create artificial islands (*casse di colmata*) for the development of Porto Marghera's third industrial area. With the enactment of the 1973 Special Law for Venice (Legge 171/1973, Interventi per la salvaguardia di Venezia),

8 After years of protests by residents against the passage of cruise ships through the Giudecca Canal in Venice's historic city centre – citing damage to Venice's ecosystem and cultural heritage – the national government announced in 2021 that cruise ships would be rerouted, along with cargo ships and oil tankers, through the Malamocco-Marghera Canal (Testa 2011; Tattara 2014; Guaraldo 2021).

the reclamation was halted. By that time, however, approximately 20 million cubic meters of material had already been deposited.[9]

In Ciavola's experiment, sensors 'observed' natural and anthropogenic mechanisms driving sediment fluxes over a 16-hour period. Sensing, studying, and understanding the lagoon's waters have been vital since the time of the Republic of Venice (697-1797), which regarded the lagoon as its natural defensive wall. In mapping the lagoon environment, Venice's rich cartographic tradition reflects sustained efforts to preserve its 'breath' – the dynamic interchange between fluvial and saline waters. The lagoon "breathes with the moon", as the tides cause the waters to rhythmically rise and fall every six hours in an endless cycle (Bevilacqua 2000, 29; Iovino 2016, 50). The gravitational influence of celestial bodies on the lagoon's tides was already schematised in 1560 in Cristoforo Sabbadino's remarkable drawing, *Figura Lunare* **[fig. 2]** (Anselmi 2000), which illustrated the relationship between lunar phases and flood and ebb currents (*flusso e riflusso*).[10]

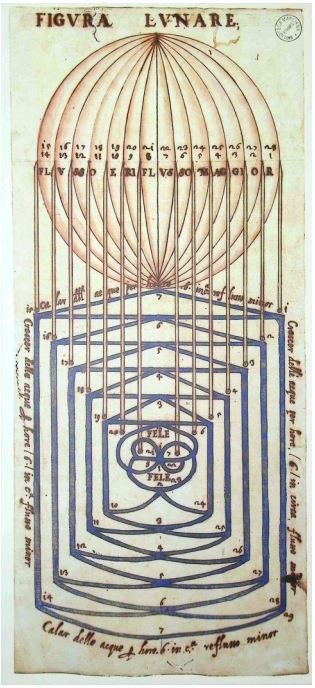

Figure 2
Cristoforo Sabbadino, *Figura Lunare*. 1560.
36 × 35.5 cm. Venice, Biblioteca Marciana BANCO 0004.257 (Anselmi 2000)

9 Today, the reclaimed areas have evolved into vital biotopes, providing essential habitats for a diverse array of bird species (Rallo 1978).

10 I am grateful to Chiara Famengo for introducing me to Cristoforo Sabbadino's *Figura Lunare*.

Sabbadino, a prominent hydraulic engineer for the Republic's Magistrates of the Waters, championed a transformative intervention in the lagoon's hydrology (Sabbadino 2011; cf. also Omodeo 2022a). He proposed diverting the major river deltas away from the lagoon to prevent fluvial sedimentation from reducing the water surface. The sediments would first clog the canals and, ultimately, turn the lagoon into dry land. Today, the challenges faced by the Venetian Lagoon are quite the opposite from what they were in the past, as danger no longer comes from the rivers, but from the sea: subsidence – resulting from groundwater extraction during the development of the industrial area of Marghera – and eustatism – the rise in sea levels caused by global climate change – could gradually transform the Venetian Lagoon into a gulf. The increasing frequency of exceptional tide peaks, known as *aqua granda*, prompted the development of the controversial MOSE project (an acronym for 'Modulo Sperimentale Elettro-Meccanico', or Experimental Electromechanical Module).[11] First made operational in 2020, this mechanical system of mobile barriers, installed on the seafloor at the lagoon's inlets (invisible when not activated), is designed – according to its proponents – to 'defend' and 'save' Venice from the sea by temporarily separating the lagoon waters from those of the Adriatic.[12] The name of the system itself references the biblical figure Moses (Mosè in Italian), who famously parted the Red Sea. However, questions remain unanswered about how this temporary separation from the source of risk – rising sea levels – will further transform Venice's amphibious character and its delicate relationship with the lagoon (Fabian, Centis 2022).

Paolo Ciavola's paper for the volume *Coasts under Stress* provided me with an opportunity to explore aspects of hydrodynamics and the geomorphological features of coastal lagoons, while contextualizing how Venetian environments are continuously monitored today and how they have been understood and managed in the past. Additionally, the paper highlights the scientific applications of remote sensing technologies (in this case, an observational platform on the seabed) for collecting data on dynamic underwater transformations.

While not directly concerned with the Venetian Lagoon, the concluding article of the supplementary issue of the *Zeitschrift*

11 The unprecedented flood of November 1966, which submerged Venice, Chioggia, and other built-up areas, led to the development of the MOSE project (De Zolt et al. 2006; Cavaleri et al. 2020). For insights into the history and future of MOSE and its impact on the lagoon ecosystem, see Fersuoch 2015; Del Bello 2018; Lionello et al. 2021.

12 MOSE is not the first attempt to protect the lagoon city from rising waters. In 1716, the Republic of Venice constructed the Murazzi, a long defensive breakwater made of white Istrian stone, designed by Vincenzo Maria Coronelli. Standing 4.5 meters above sea level, it stretches along the islands of Lido and Pellestrina up to Ca' Roman and the Sottomarina coast (Grillo 1989).

für Geomorphologie, titled "Evelyn L. Pruitt and Coastal Science", gives a broader perspective on the historical development of remote sensing and its applications in coastal research (Walker 2005). The *in memoriam* tribute, written by geographer Harley Jesse Walker, highlights Pruitt's pivotal contributions as Director of the Geography Branch of the ONR. It also discusses her instrumental role, alongside Richard J. Russell, in founding the Coastal Studies Institute at Louisiana State University, which significantly advanced coastal and marine science (Roberts, Coleman, Walker 2014). Similar to Ciavola's interests, the projects supervised by Pruitt investigated, among other topics, process sedimentology, coastal erosion, tidal flats, wave dynamics, and air-sea-land interactions. The innovation introduced by Pruitt and the ONR team in the 1960s tackled coastal research through the use of remote sensing. This approach went beyond traditional on-site observations and surveys, incorporating aerial photography and satellite imaging – technologies that became increasingly accessible after WWII – to identify distinct units that characterised deltas and marshlands (Walker 2005, 215).

In the post-war period, remote sensing was a new term, but not a new science. Broadly defined, remote sensing refers to the process of acquiring information about objects without making physical contact with them. Astronomy, for example, has always relied on the ability to sense from a distance (Clerke 1888). However, the advent of aviation shifted the perspective from turning eyes to the sky to looking down at the Earth. Moreover, the World Wars boosted aerial photoreconnaissance, establishing photo-interpretation as a recognised discipline that provided significant support to scientific research. The term 'remote sensing' started to be used by the scientists of the ONR to refer to the gathering and processing of information about the Earth's environment, particularly its natural resources (Simonett 1983, 1). Pruitt discussed the term's genealogy in a piece on the ONR geography programme:

> The term 'photograph' was too limited because it did not cover the regions in the electromagnetic spectrum beyond the 'visible' range, and it was in these nonvisible frequencies that the future of interpretation seemed to lie. 'Aerial' was also too limited in view of the potential for seeing the earth from space. A new term was needed, so 'remote sensing' was invented, and I am generally credited as its coiner. (Pruitt 1979, 106)

Pruitt's work at the Geography Branch highlights how, although remote sensing technology emerged from military-funded research during the Cold War, its conceptual underpinnings – unlike those of aerial photography – are grounded in environmental science, with a particular focus on water resource assessment and coastal

management. One of the earliest educational books on remote sensing, written by geologist Joseph Lintz and geographer David S. Simonett in 1976, highlights its application to lagoons, with a specific focus on the Venetian Lagoon. The authors underscore the role of remote sensing in identifying and quantifying environmental degradation, particularly the impact of large industrial complexes on artistic, cultural, and sociological centres. They argue that such data collection is crucial for developing regulatory, planning, and preventive strategies to safeguard these valuable sites (Linz, Simonett 1976, 576).

Monitoring, management, and control are often considered the primary objectives of remote sensing. However, a series of ONR-sponsored events showcasing the emerging field also underscored the limitations of human sensory perception and the challenges of interpreting non-human temporal and spatial scales. This was evident in the first symposium on remote sensing of the environment, held in February 1962 at the University of Michigan (see *Proceedings of the First Symposium on Remote Sensing of Environment* 1962). At this event, the application of remote sensing to various Earth science fields was introduced, alongside a comparison between machine sensors and human senses. The symposium proceeding explains that sight and hearing rely on the sensing of radiant energy, effectively making them remote sensors, whereas touch, taste, and smell depend on the transport of matter and require proximity to the source. In this perspective, as Haraway suggested (1991), the Western technoscientific gaze implicitly enforces a normative hierarchy, privileging the 'observational' senses as powerful while deeming the others 'clumsy'.

However, Gwynn H. Suits, head of the Infrared Laboratory at the University of Michigan, also addressed the limitations of human remote sensors during his welcome speech at the first remote sensing symposium: "Almost all of the turmoil of the earth is below the hearing range of our ears. Still, hearing covers about 10 octaves while sight covers barely one". Referring to electromagnetic radiation beyond the visible spectrum – such as radio waves, microwaves, and infrared – he added:

> We are still creatures of the sea in many ways. Ancient sea water still flows in our veins and fills our eyes. This water is largely opaque to all electromagnetic radiation save those with wavelengths between .35 and .7 microns and of course the gamma rays which penetrate practically everything anyway. (Suits 1962, 2)

The intimate relationship between fluids within and outside the human body underscores the continuum between humans and the environment. Additionally, the quotation above emphasises the

significance of interpretative processes, particularly rendering methods, in analysing satellite imagery captured in the non-visible portions of the electromagnetic spectrum **[fig. 3]**. Scientists engage in a continuous process of translating data into visual representations. When interpreting remote sensing data, key features include scale, colour, tone, pattern, shape, and texture. Focusing on the last feature, Andrea Ballestero suggests understanding remote sensing as a way of "touching with light". By doing so, she challenges the dichotomy between touch as proximate and vision as detached, seeking to move beyond the ocularcentrism ingrained in Western societies (Ballestero 2019).

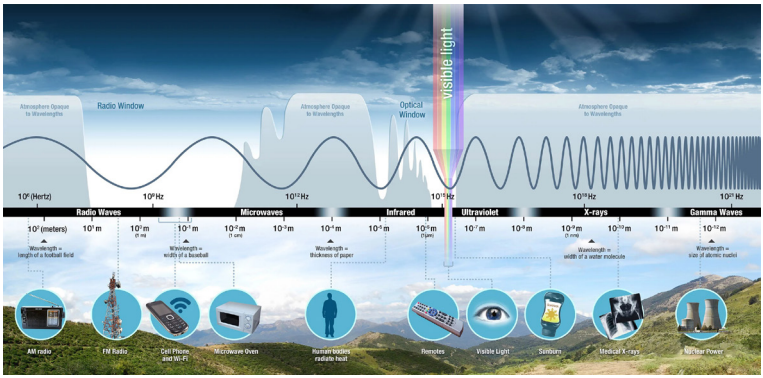

Figure 3 NASA Science Mission Directorate, *Introduction to the Electromagnetic Spectrum*. 2010. http://science.nasa.gov/ems/01_intro

Another significant dichotomy that has emerged within the environmental humanities in recent years is the contrast between 'histories from above' and 'histories from below' (Morrissey, Wilson 2016; Dawson 2024).[13] In visual studies, this polarisation is often framed as associating 'the view from above' with a cold, detached, and predatory gaze emblematic of military and capitalistic technoscience (Cuevas 2022; Levy 2023). Conversely, 'the view from below' is interpreted as a tender gaze – an ethical approach to addressing social injustices and fostering an emotional connection with the more-than-human world (Cormican, Marston William 2021). Yet, might it be possible to explore the connections between above and below the water's surface, rather

13 A broader overview of the development of 'history from below', including the influence of E.P. Thompson and Eric Hobsbawm, can be found in Bhattacharya 1983. On subalternity under colonialism and neoliberal globalisation through a feminist lens, see Spivak 2010. On 'knowledge from below' in early-modern Venice hydroculture, see Omodeo 2022b.

than reinforcing their opposition?[14] Writing about wetlands requires recognising the inherent interdependence of water, earth, and air. The Scirocco wind drives water over the salt marshes, temporarily submerging them, only for halophytic vegetation to emerge as the tide recedes. Understanding the natural mutations of these environments fosters a perspective centred on relationships, underscoring the fluid interplay of elements over rigid boundaries (cf. Gruppuso 2022).

Following Ballestero's line of research, the present article focuses on case studies where remoteness is not equated with detachment but instead becomes a synonym for environmental and more-than-human care. For example, a 2001 guide on good fishing practices and biodiversity protection in the Venetian Lagoon states: "To describe this complexity, the following satellite image is useful, allowing us to grasp at a glance the variety of environments that make up the 'mosaic' of the Venice Lagoon" (Franzoi et al. 2021) **[fig. 4]**.[15] Projects that merge the expertise of Venetian artisanal fishers with the work of scientists – who monitor key water parameters on-site and analyse high-resolution satellite images – demonstrate that an exchange of diverse knowledge systems can foster the sustainable use of lagoon resources while preserving biodiversity.

I would like to conclude this first part of the article with one final example of the interplay between underground, underwater, aerial, and outer space perspectives. Since the advancement of aviation and photoreconnaissance during World War I, archaeologists have supplemented on-the-ground survey inspection with aerial and, later, satellite imagery (Crawford, Keiller 1928; Forte, Campana 2016). Remote sensing and geophysical methods – including multispectral aerial and satellite images, magnetic gradiometry, electrical resistivity, ground-penetrating radar, and frequency domain electromagnetics – have been used to investigate the archaeology of Altinum, a Roman city along the inner margin of the Venice Lagoon. The city was abandoned between the sixth and seventh centuries AD as its inhabitants fled warfare and instability, seeking refuge on the lagoon island of Torcello. The ancient city, now farmland reclaimed between the nineteenth and early twentieth centuries, has remained largely undisturbed, as it was never buried under medieval or modern infrastructure, thereby preserving its archaeological record. This allowed non-invasive remote sensing techniques to reveal the *forma urbis* of Altinum, including key structures such as its theatres, temple, and forum (Mozzi et al. 2016).

14 This dichotomy between view 'from above' and 'from below' has been challenged by the approach of Forensic Architecture, which subverts the use of remote sensing instruments from a policing and monitoring apparatus to a tool for documenting human rights violations and environmental crimes (Weizman 2017).

15 All non-English quotations in this article have been translated by the Author.

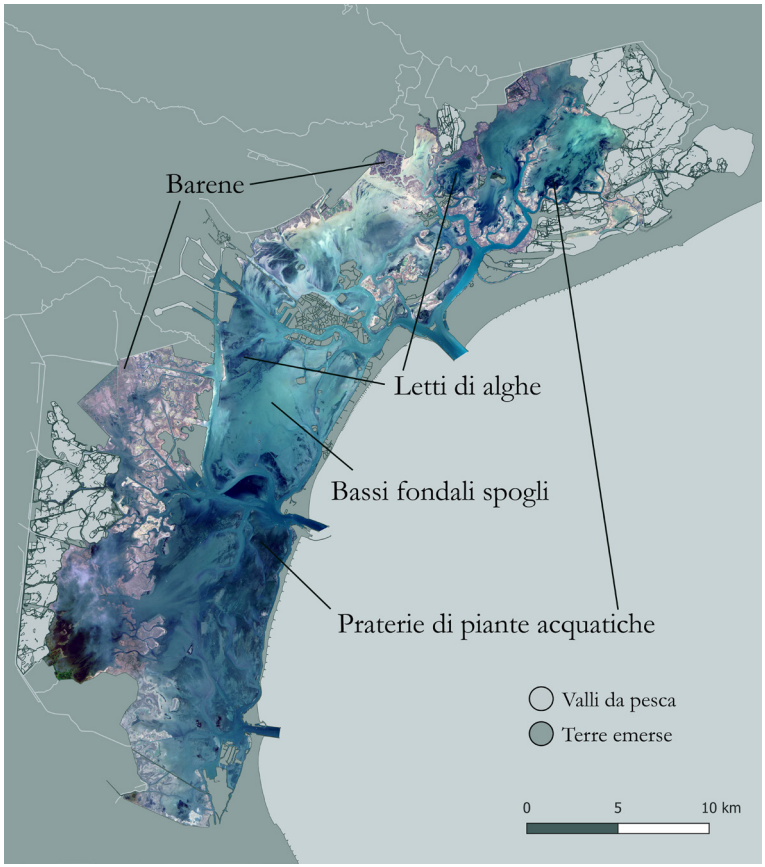

Figure 4 Satellite image of the Venetian Lagoon recorded during a low tide phase, spring 2020. Image used in the project *Assessment and Improvement of the Degree of Environmental Sustainability of Artisanal Fishery in the Natura 2000 Sites of the Venetian Lagoon*, funded by PO FEAMP 2014-2020 (Franzoi et al. 2021, 18)

The Venetian Lagoon also includes submerged archaeological sites. *Panorami sommersi. Le origini di Venezia* (Submerged Panoramas. The Origins of Venice) is a 2022 documentary showcasing these submerged Roman-era sites, first uncovered through the pioneering research of Ernesto 'Tito' Canal and more recently studied by archaeologists from Ca' Foscari University of Venice. A lagoon environment expert, Canal located stones accidentally found by fishermen in their nets. Buried under deposits of clay, silt, and sand, and submerged in water, traces of Roman structures on the lagoon floor were initially detected using probes, hand coring, and an echosounder **[fig. 5]**. With these tools penetrating the lagoon's stratigraphy, Canal could perceive what lay beneath the water's surface and reconstruct the Roman

city by remotely 'touching' the lagoon floor (using steel probes or acoustic waves). To verify his findings, he collaborated with divers, whose underwater movements are shown in the documentary, revealing more-than-human life and human-made infrastructures **[fig. 6]**. Due to the scarce light in the lagoon's waters, where visibility ranges from half a meter to one meter, "one sees by touching, gets moved by touching". The archaeological work depends heavily on atmospheric conditions and the state of the sea: "On certain days, there are currents on the lagoon floor that differ from those on the surface. These currents move the fine and very mobile sediments on the lagoon floor, and you find yourself in total darkness in the final meter [of diving]" (Gottardello 2022).

In the last decade, a new approach to spatial complexity has encouraged a shift toward a volumetric understanding of environments – one that moves beyond the two-dimensional horizontal surface, long dominant in geographic studies (Elden 2013). This shift becomes especially evident in the search for submerged archaeological data in the lagoon, where even volumetric thinking proves insufficient. Fully engaging with the voluminous materiality of this place demands a dynamic interplay among remote sensing technologies, embodied perception, and the more-than-human landscape – together revealing a spatial experience that is deeply layered, entangled, and immersive.

Figure 5 Self-taught archaeologist Ernesto Canal conducting hand coring in the 1980s to detect Roman remains in the lagoon waters. Historical footage featured in Samuele Gottardello's documentary *Panorami sommersi: le origini di Venezia*, 2022, 10′22″

e-ISSN 2785-2709

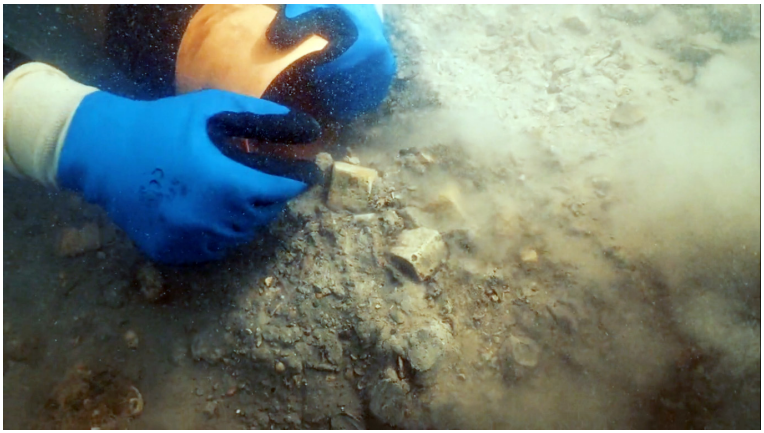

Figure 6 A diver exploring an underwater archaeological site in Venice. Samuele Gottardello, *Panorami sommersi: le origini di Venezia*, 2022, 32′54″

3 Sensing a Lagoon Through the Cormorant Dimension

Laguna. Conservazione di un ecosistema (Lagoon. Conservation of an Ecosystem) was a 1984 exhibition organised at Palazzo Grassi by the Venetian section of the World Wide Fund for Nature (WWF), with the support of the city Department for the Environment. The initiative aimed to promote environmental protection after the almost irreversible degradation of the lagoon's natural resources caused by reclamation, industrial settlements, pollution, and poaching. According to Italy's WWF president, Fulco Pratesi, the exhibition

> [was] meant to convey how Venice is not a jewel dropped from other galaxies into an entirely foreign, detached environment. It demonstrates how the St. Mark's Basilica and Procuracies, the typical Venetian narrow streets and small squares are nothing but a skilful and perfect extension of reeds and salt marshes, mudflats and sandbanks. (Rallo, Semenzato 1984, 7)

The exhibition also launched the idea of establishing a national park, modelled on those of the Danube Delta, Camargue, and Doñana, to preserve Italy's largest wetland. Although the city administration revoked the scaled-down version of the park in 2016, which was intended to protect only the northern lagoon, the 1984 initiative remains a key reference as the first exhibition to raise public awareness of the lagoon's ecosystem through scientific popularisation.

Designed for a non-specialist audience, Cristiano Zentilini's illustrations, featured in the exhibition, are particularly relevant to

the theme of this article **[fig. 7]**. One horizontal drawing schematically represents the lagoon ecosystem and its food chain:

> The lagoon environment is characterised by highly variable and challenging physico-chemical conditions for the survival of organisms. However, the high concentration of nutrients allows for significant growth of phytoplankton, and consequently zooplankton: the primary source for increasingly complex food chains. (Rallo, Semenzato 1984, 86)

Using fine arrows, the illustrator meticulously maps the interactions among underwater organisms and their links to animals above the water's surface. A wooden mooring pole, or *palina*, anchored in the lagoon bed, serves as a substrate for oysters and mussels underwater. Above the waterline, it becomes a perch for seabirds like cormorants, apex predators that primarily feed on mullets, flounders, sand smelts, and gobies.

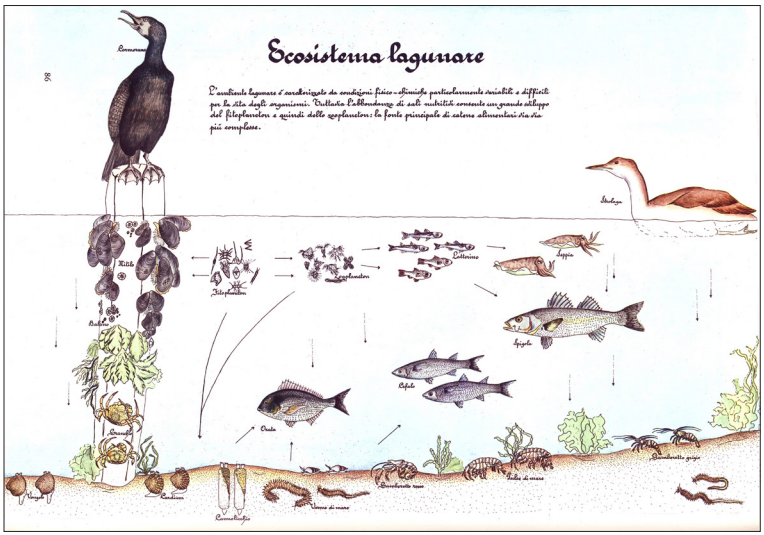

Figure 7 Cristiano Zentilini, *Lagoon Ecosystem*. Illustration from the exhibition *Laguna, conservazione di un ecosistema*, 1984. Venice, Biblioteca Marciana MOSTRE VE 0117 (Rallo, Semenzato 1984, 86)

Great Cormorants (*Phalacrocorax carbo sinensis*) appear in many of the illustrations included in the exhibition catalogue. From a contemporary perspective, their inclusion seems unsurprising, given how common it is to spot these birds in the lagoon today. However, naturalists of the past regarded the *corvo marin*, literally 'sea raven', or *marangòn* (as the cormorant was known in nineteenth-century

dialect) as a rare presence in the lagoon, observed almost exclusively during the winter months.[16] This trend continued until the mid-twentieth century, by which time cormorants had nearly vanished from most European countries due to human persecution, chemical pollution in fish (DDT and PCB), and habitat destruction.

Although conflicts between humans and cormorants often arose from competition for fish, these birds were also hunted purely for 'sport', as their meat was not prized for consumption.[17] Arthur Conan Doyle's 1881 article "After Cormorants with a Camera", published in the *British Journal of Photography*, provides a vivid account of such recreational killing on the Isle of May (Stiegler 2024, 19-24). Doyle describes a trip aimed at appropriating wild nature through a dual form of shooting: killing as many "fine, old, pre-Adamite cormorants 'with a most ancient and fish-like smell'" as possible while simultaneously photographing them in the moments of their death (Doyle 1881a, 533). By the end of the day, the hunters had killed "forty-three cormorants, nine rock pigeons, two mallets, a curlew, and a bo'sun gull" (Doyle 1881b, 545). All that remained of these birds were the photographs. In a markedly different vein, eight years after Doyle's publication, Florence Merriam Bailey's *Birds Through an Opera-Glass* was among the first field guides to promote the ethical study of avifauna, replacing the rifle with binoculars and cameras and once again 'touching with light' to observe and study birds in their natural habitats. Remote observation played a key role in the rise of bird protection societies and in a growing sensibility towards animal welfare (Lundquist et al. 2025).

Nevertheless, it was not until the 1960s that attitudes towards cormorants began to shift. To prevent cormorant extinction, protection measures were undertaken in Northern European nesting sites, and most countries subscribed to the European Community Bird Directive in 1979 (now Directive 2009/147/EC) that made it illegal to disturb, capture, or kill cormorants – except under derogation. These measures led to a conspicuous growth in breeding populations in the Netherlands, Denmark, Sweden, Germany, and Poland, with immediate repercussions also in the wintering sites of southern Europe and the Mediterranean (Cherubini, Manzi, Baccetti 1993). In 1988, the Italian National Wildlife Institute (Istituto Nazionale per la Fauna Selvatica, now ISPRA) published *Lo svernamento del Cormorano in Italia* (The Wintering of the Cormorant in Italy), the first national report documenting the increasing winter presence of these

16 Contarini 1847; A.P. Ninni 1866, 54; E. Ninni 1938; Bon, Richard, Semenzato 1993, 138.

17 Cf. the account by ornithologist Ettore Arrigoni degli Oddi of a cormorant shot in the Venetian Lagoon, which mentions the bird's unpleasant taste and strong fishy odour after being roasted (Arrigoni degli Oddi 1919).

aquatic birds. The study also pointed to major regional data gaps, including incomplete records for the Venetian Lagoon (Baccetti 1988). Regular censuses in the lagoon began in 1989, with evening counts conducted in January near known roosting sites. These recorded 580 individuals in 1989, rising to 4,601 in 2015, then stabilising over the past decade.[18] Nesting has been recorded in the Venice Lagoon since the late 1990s, despite most cormorants in the region being wintering individuals that migrate annually from Northern Europe, typically arriving in Venice between October and November and departing in March (Semenzato, Tiloca 1999, 129).

While scientists view the favourable conservation status of the species at the European level as a successful indicator certifying the health and fishiness of coastal stretches, many Venetian fish farmers and anglers still perceive these birds as an alarming threat, despite their now stable population (*Il Gazzettino* 2018a; cf. Wild 2012). The most significant damage is reported in the *valli da pesca*, traditional fish farms located along the lagoon's edges, where a distinctive form of aquaculture is practiced (Provincia di Venezia Assessorato 1997). To mitigate cormorant predation in these structures, commercial fishers began installing protective nets and received regional compensation for losses. Although the cormorant is protected under Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, selective culling has been authorised by the Italian Institute for Environmental Protection and Research (ISPRA) in fish farms starting since 1997 (see also Delibera Giunta Regionale del Veneto no. 2072 of 3 August 2001). However, these measures resulted in only a modest reduction in predation, with a recorded yearly decrease of just 13% in the month of December (Borgo et al. 2004).

Beyond the measurable damage, the cormorant has increasingly become a scapegoat for broader and more complex challenges facing the fishing industry, despite expert assessments suggesting that its impact is largely confined to areas with high fish densities (Raicaldo 2023).[19] The shift from a rare presence in the past to a common sight today has led people to mistakenly regard cormorants as an alien

18 For information on cormorant population trends in the Venetian Lagoon, see the annual reports by the International Waterbird Census, coordinated over the past decades by the Associazione Faunisti Veneti, available online at: `https://www.faunistiveneti.it/pubblicazioni/#1478699679065-38d7dc79-8a6f`. For data from the early years of the census in the lagoon, see Cherubini, Manzi, Baccetti 1993.

19 On the problems of the Venetian Lagoon's artisanal fisheries, see Silvestri, Pellizzato, Boatto 2006; Granzotto et al. 2001; Santana 2022.

invasive species.[20] There is a common belief among part of the fishing community that 'the cormorant is not ours', meaning that it is not an autochthonous species intimately rooted in the lagoon environment.[21]

This conviction, however, contrasts with Vittore Carpaccio's painting *Hunting on the Lagoon*, which natural and art historians consider a realistic depiction of the lagoon environment in the late 1400s **[fig. 8a]** (Dal Pozzolo 1999; Bon, Semenzato 2023).[22] The scene is set in a fishing and hunting valley, characterised by huts made of marsh reeds (*casoni*) and barriers designed to capture specific fish species during their migratory periods. The focus of the composition is on Venetian patricians engaged in hunting loons and grebes using bows equipped with clay bowls instead of arrows. The killing of inedible species with such unconventional tools could be interpreted as a form of challenging recreation, or, as some sources suggest, as a method to avoid damaging the birds' down feathers, which were used for garment stuffing (Bon, Semenzato 2024, 154). In the background, Carpaccio depicts a variety of waterbirds associated with the upper Adriatic species documented in written sources from the period. These include a heron perched on top of a building, a flock of waterfowl – likely geese – a crane, and gulls resting on the palisade. The painting also features an easily recognisable cormorant, perched in its characteristic semi-open wing posture on a pole driven into the water **[fig. 8b]**. Other cormorants are shown on the boats, possibly alluding to the fishing practice, common in Japan and China, where trained cormorants were used by anglers to catch fish – although this practice was rare in Europe (Beike 2012).

20 Cormorants, unlike African sacred ibises and blue crabs, were not introduced by humans in the Venetian Lagoon and are therefore not classified as an invasive alien species (Beike 2014). For the European Commission's definition and management of invasive alien species (IAS), see `https://environment.ec.europa.eu/topics/nature-and-biodiversity/invasive-alien-species_en`. The term has been critically examined by Colautti and MacIsaac (2004), Hettinger (2012), Inglis (2020), among others. For insights into how the public and experts perceive the relationship between the origin ('nativeness') of species and their behaviors and impacts ('invasiveness'), see Van der Wal et al. 2015.

21 I thank Eleonora Puliero for sharing an early preview of her ethnographic fieldwork conducted among fishermen.

22 The painting *Hunting on the Lagoon*, housed at the Getty Center in Los Angeles, is the upper portion of a larger vertical panel that was sawn apart before the nineteenth century. The lower portion, titled *Two Venetian Ladies*, is housed at the Museo Correr in Venice. For a reconstruction of the history of these two paintings, including the missing elements, their context of production, and the evolving interpretations by art historians over time, see Marcantoni 2008.

Figure 8a Vittore Carpaccio, *Hunting on the Lagoon*. Ca. 1490-95. Oil on panel, 75.6 × 63.8 cm. Los Angeles, Getty Center, Museum North Pavilion, Gallery N204

Figure 8b
Detail of Vittore Carpaccio's *Hunting on the Lagoon*. Ca. 1490-95

e-ISSN 2785-2709

Despite the constantly evolving nature of species distribution, the symbolic representation of the Western cormorant has largely remained negative throughout history. Over the centuries, cormorants have been associated with the devil, death, and bad omens, later evolving into a symbol of greed (Wild 2012; King 2013; Wires 2014). Their ability to catch fish swiftly has contributed to the perception of an insatiable appetite and inherently selfish nature – a view that partially persists today and is reinforced by their occasional cooperative hunting behaviour.

Biologically, however, the cormorant is a remarkable example of evolutionary adaptation. These birds are exceptional divers, chasing fish underwater with powerful propulsion from their webbed feet **[fig. 9]**. Unlike most birds, they can move their aquamarine eyes, which are shielded by a transparent nictitating membrane that enhances their underwater vision. The hooked tip of their upper bill helps them grasp prey effectively. To increase their speed while diving, their wings are relatively short, imposing high energy costs during flight, and their feathers are less water-repellent than those of other waterbirds, such as ducks. This is why they are often seen standing with their wings spread open to dry toward the sun. In the past, this striking appearance, marked by a glossy black plumage, has evoked images of crucifixions and contributed to enduring symbolic associations with darkness and the ominous.

Figure 9 A European Shag (*Gulosus aristotelis*) swimming underwater in search of prey in Trieste, August 2020. In the Venetian Lagoon, poor water clarity makes observing Great Cormorants diving extremely difficult. Photo by the Author

These physical traits may shed light on the origin of the Venetian name for the cormorant, *marangone*, which derives from the Latin *mergere*, meaning 'to immerse' or 'to dive'. Interestingly, this etymology has long been linked, probably mistakenly, with the *marangoni*, the skilled naval carpenters of the Venetian Arsenal active since the fourteenth century, who were known for their ability to repair ships, sometimes even below the waterline (Schmitt 2008). Despite such evocative associations, the cormorant has long remained culturally marginal. In poetry, the cormorant stands in stark contrast to Coleridge's and Baudelaire's albatross, and in fiction, it lacks an equivalent to Bach's *Jonathan Livingston Seagull* (Coleridge 1798; Baudelaire 1861; Bach 1970).

In recent years, however, the artistic and cultural spheres have shown a growing interest in this species, particularly in Northern Europe. In these regions, cormorants often nest in colonies on isolated islands, where the vegetation dies off after a few years due to guano accumulation. From a human perspective, these stark, barren landscapes stand out as scars in the otherwise verdant Nordic scenery. This tension between natural processes and cultural perception is explored in *Chorus sinensis*, an audiovisual choral piece dedicated to the Great Cormorant. Created between 2019 and 2022 in the coastal areas of the Bothnian Sea and Archipelago, where human and seabird territories intersect **[fig. 10]** (Taipale, Eerala, Naukkarinen 2021), the project acknowledges the bird's historically negative portrayal, as described by Karoliina Lummaa:

> A big blackguard of a bird that depletes fisheries and, with its droppings, brings death to verdant places pleasing to the human eye. […] Black bird, white droppings; a black-and-white image of a bird. […] That is what it looks like when you regard the bird and its nature from on high, scanning for signs of nuisance and disorder. (Lummaa 2021)

Figure 10 Jan Eerala, frame from *Chorus sinensis*, 2021. The Conference of the Birds project: Finland Nest, Pohjankalliot, Bothnian Sea. https://theconferenceofthebirds.net/finland/

The work poses a series of questions: Can other narratives and representations of the Great Cormorant emerge? Is this bird worthy of a human song? Can there be poetry about a bird that never sings, one often deemed a nuisance? What will be the Great Cormorant's story in the future? Inspired by the guttural sounds produced by cormorants at their breeding colonies – an aspect rarely explored in artistic compositions for a species largely considered silent – a composer, an audiovisual artist, a curator, a literary scholar, a costume designer, and singers collaborate to give voice to these birds. Their choral performances took place on Pohjankalliot, a rocky island that serves as a habitat for cormorants and other seabirds. *Chorus Sinensis* suggests that moving beyond the human-animal conflict when considering cormorants may open new ways of perceiving coastal environments and provide alternative tools for ethical engagement with the environmental crisis.

Cormorants have gradually become iconic elements of the Venetian lagoonscape. Over the past few years, their image has begun appearing on t-shirts and bags in sustainable fashion shops, on leaflets from Ca' Foscari University's Research Institute for Green and Blue Growth, and on posters as a symbol of resistance against extractive tourism **[fig. 11]**. While some fish farmers still perceive their ability to break the water's surface as a threat, a shift in public perception toward cormorants in Venice is becoming evident. Rather than being interpreted as an invasion, their presence acts as a lens for understanding the lagoon's dynamics, opening up unexpected perspectives. As noted earlier, their perching behaviour brings attention to submerged human infrastructures, while their activity above and below the water offers clues about aquatic life and the health of the lagoon. When they spread their wings to dry, they indicate the sun's position and the direction of the wind. Tracking their movements across the lagoon leads us from the inlets where the MOSE system is installed to their night roosts, which they share with other species – whether in the trees of fish-farming areas in the northern lagoon, on the transmission towers of the industrial zone, or in the abandoned clay quarries of the hinterland, now converted into protected oases. Following their migratory routes to breeding sites further reveals the intricate ecological networks linking the Mediterranean coasts and lagoons with those of Northern Europe. Their historical near-extinction serves as a stark reminder of the devastating effects of chemical pollution on the environment and the contemptuous human attitude towards animals. Finally, their mastery of both air and water currents suggests a way to rethink the conceptual divide between the world above and the world below the water's surface.

Figure 11
Marta Sottoriva, poster for a demonstration against big ships organised by Comitato NoGrandiNavi and supported by Collettivo Universitario Liberi Saperi Critici Venezia, April 2024. Photo by the Author

4 Conclusions: Towards a More-than-Human Vertical Turn

The preceding two sections have examined ways of sensing the Venetian Lagoon from a distance: the first presents a number of remote sensing technologies used to understand this coastal environment, while the second engages with the movements, behaviours, and habits of cormorants. Although these two approaches may initially appear unrelated, both are challenged by the visual limitations imposed by the lagoon's waters **[fig. 12]**. Despite their differences, both sections ultimately address the lagoon's inherent opaqueness (cf. Glissant 1997) and emphasise the interdependence of visible and hidden layers of the lagoon ecosystem as well as the porous boundary between above and below. Whether through satellite imaging or birdwatching, either approach attempts to move beyond the notion of 'close-up at a distance' and clear telescopic vision. The analysis of remote sensing exposes the limitations of human sight, while the attempt to approach the lagoon from the perspective of the cormorant shifts the focus away from managing a so-called 'problematic' species toward cultivating a deeper curiosity – one that echoes Jacques Derrida's reflections in *The Animal That Therefore I Am* and enables a reinterpretation of the 'vertical turn' (cf. also Despret 2021).

Historically, the concept of vertical space has come to the fore with the development of aerial ascent in the eighteenth century and to new building techniques that, by the end of the nineteenth century, metaphorically 'scraped the sky'. The challenge of producing vertical aerial photographs, perfectly perpendicular to the Earth's

surface – valued for their measurability – was initially driven by military needs in the early twentieth century and later applied across various fields of knowledge. The space race further expanded the notion of verticality, but it was the war on terror at the beginning of the twenty-first century that prompted a critical analysis of satellites and drones as instruments of imperial hegemony. This phase also opened up recognition of the underground as a hidden space of tunnels, infrastructure, and exploited natural resources natural resources, prompting a reformulation of vertical space as extending from orbit to the Earth's depths.[23] At the same time, the space below the Earth's surface gained increasing significance within the environmental humanities, driven by the search for evidence of a new geological epoch, unofficially called the Anthropocene.

Figure 12 The moment a cormorant breaks the water's surface in the lagoon waters in front of Pellestrina, sunset, February 2025. Photo by the Author

Within a history of verticality shaped by human power dynamics, this article has tried to imagine a more-than-human, non-graspable vertical space – one that may not even be truly vertical, but oblique, steady, wet, dry, fishy, metallic, silent, guttural – like that of a cormorant. There are various ways to sense the lagoon: with feet, hands, nose, ears, mouth, and eyes, as Tiziano Scarpa writes in

23 For a comprehensive overview of the approaches to verticality summarised in this paragraph, see the bibliography in the introduction of Sandoz and Weber (2022) and Kurgan (2013).

his "sensual guide" *Venice is a Fish* (2009). It can also be imagined through non-human senses, as Carlos Casas suggested in the exhibition *Bestiari* (2024).[24] The lagoon can even be sensed from a distance – not as a sign of detachment, but as an expression of care.

Acknowledgements

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement no. 945361. The author wishes to thank the UNESCO Chair of Water Heritage and Sustainable Development and THE NEW INSTITUTE Centre for Environmental Humanities (NICHE) for their support. Valuable insights into lagoon avifauna were generously shared by Mauro Bon, Antonio Borgo, Giuseppe Cherubini, Francesca Coccon, Andriano Drago, Luca Mamprin, Giacomo Masato, Lucio Panzarin, Fabio Penzo, Marco Picone, Giampaolo Rallo, Alessandro Sartori, Massimo Semenzato, Raffaella Trabucco, and Stefano Volponi. The photographic component of this article was made possible thanks to Luca Mamprin's guided boat tour from the Venetian mainland to the LIPU nature reserve at Ca' Roman.

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24 Cf. *Bestiari* by Carlos Casas, a collateral event of the 60th Venice Biennale, curated by Filipa Ramos. Available at: https://www.e-flux.com/announcements/589447/carlos-casasbestiari/.

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e-ISSN 2785-2709

Lagoonscapes
Vol. 5 – Num. 1 – June 2025

Subterranean Reverberations and the Horror of the Chemical Sublime

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Abstract This article examines how the faint, persistent hum of groundwater pumps exposes the limits of industrial clean-up. Focused on efforts to manage groundwater contaminated by a century of coal-based chemical industrialization in Bitterfeld-Wolfen, it draws on sonic methods and the concept of transmediation to explore how sound and water unsettle the illusion of containment. Attuning to these peripheral vibrations offers a way of sensing pollution as ongoing, relational, and irreducible – within what the paper frames as a toxic common.

Keywords Toxicity. Transmediation. Legacy pollution. Sonic epistemologies. Remediation. Slow violence. Toxic commons.

Edizioni Ca'Foscari

Peer review

Submitted 2025-03-22
Accepted 2025-05-26
Published 2025-07-21

Citation Ektander, C. (2025). "Subterranean Reverberations and the Horror of the Chemical Sublime". *Lagoonscapes*, 5(1), 121-138.

DOI 10.30687/LGSP/2785-2709/2025/01/005

1 Introduction

Herr D, the groundwater engineer, pulls out a laminated map of the Bitterfeld-Wolfen superfund site, scaled at 1:1000. The map reveals a dense web of information: road networks, building outlines, property zones, and a patchwork of wells, overlaid with directional arrows indicating groundwater flows. Beneath it, a technicoloured blotch blooms across the page – pinks and purples at the centre marking zones of highest toxic concentration, fading into blues, greens, and yellows along its amorphous edge. As I follow Herr D's finger tracing the logic of hydrogeological, a low, persistent hum of pumps begins to invade my senses. The monotonous, mechanical drone conjures the strain of liquid forced through tightly regulated remediation conduits that pierce the surface, breaching the boundary between above and below ground. My attention drifts toward the chemical park that seems to hover – placeless – feeding into an expanding global circulation of chemical presences. I am reminded that the sound of strained pumps, like contaminated groundwater itself, resists both containment and easy representation. It leaks across thresholds, forging new relations and unsettling the spatial orderings upon which remediation depends.

The chemical-industrial twin-town Bitterfeld-Wolfen – once stigmatized as one of East Germany's mega-polluters – underwent a radical transformation after the fall of the Iron Curtain. To reintegrate the former socialist territory into a newly unified Germany, the federal government launched an ambitious remediation program[1] designed not only to erase the region's sensational pollution but also to pave the way for its transition back into a capitalist market economy (Chaney 2017, 157). The results were quickly discernible. Within a few years, the towering smokestacks and outdated Soviet factories were systematically demolished, causing the characteristic yellow-grey smog to dissipate from plain sight. The scoured landscape left behind by large-scale lignite extraction was gradually concealed, colonized by vegetation. The exhausted opencast mines flooded and

1 The *Ökologisches Großprojekt Bitterfeld-Wolfen* (ÖGP), launched in the early 1990s by the German Federal Ministry for the Environment, was one of the largest and most complex environmental remediation efforts in post-reunification Germany. Its goal was to address the extensive contamination of soil, groundwater, and surface waters caused by long-term coal-based chemical production. The project involved the coordination of federal and state agencies, private industry, and scientific institutions, focusing on the installation of large-scale groundwater remediation systems, containment structures, and legal frameworks to manage long-term liability. It also served as a model for remediation governance in other post-industrial regions. See: Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), *Ökologisches Großprojekt Bitterfeld-Wolfen: Abschlussbericht 2014*.

repurposed into picturesque lakes – designed as much to rehabilitate the land as to reframe its narrative (Maertens 2024, 1002-3). Others, having served as receptacles for industrial waste, were quietly sealed shut – capped, covered, and folded into the terrain. Industrial clean-up became both an impetus and a justification for the neoliberal reconstruction that the region was coerced to undertake, legitimizing the continued production and distribution of synthesised chemicals under the newly greenwashed identity of a chemical park.[2]

Yet, despite over three decades of remediation and its new, clean appearance, Bitterfeld-Wolfen's polluted past never truly disappeared. The toxic legacy of over a century of coal-based chemical industrialization – once as palpable as raucous sounds, noxious fumes, and thick yellow-grey smog – has instead shapeshifted into 200 million tons of heavily toxic groundwater laced with persistent organic pollutants such as chlorobenzene, DDT, and HCH (see Wycisk et al. 2013). To prevent its spread, an extensive 'pump and treat' system has been installed – an interconnected network of wells, pumps, pipelines, and filtration units. Paradoxically, this infrastructure, designed to contain toxicity, relies on the very act of circulation: contaminated groundwater must be continuously extracted, displaced, and processed to prevent it from migrating unchecked. The system's faint but unrelenting hum forms a peripheral, yet unsettling soundscape – an acoustic reminder of a strained containment belied by the restless mobility of the subsurface. Lundsteen describes such pumps as "a slow-motion mitigation process and a critical technology that works as a safeguard, transforming an urgent and intolerable chemical cataclysm into a long-term, gradual release" (Lundsteen 2024, 201).

The tension between the visible success of remediation and the ongoing persistence of contamination is difficult to reconcile. Toxicity regularly exceeds containment – spatially, epistemically, and aesthetically – through slippages, ambivalence, and persistent uncertainties that resist resolution (Liboiron et al. 2018; Boudia et al. 2018). Within environmental governance, remediation is largely shaped by a visual aesthetic regime – one that renders contamination invisible, ordered, and seemingly resolved, reinforcing the fiction

2 The Chemical Park Bitterfeld-Wolfen (*Chemiepark Bitterfeld-Wolfen*) was established in the 1990s as part of a broader effort to restructure and modernize the region's chemical industry after reunification. Built on the site of the former Chemiekombinat Bitterfeld, the park now hosts a mix of national and international firms operating within a shared infrastructure. Its business model – replicated in other post-industrial regions – relies on centralized services such as water treatment and energy supply, enabling companies to outsource environmental management and cut costs. Spatially, the park clusters production on selectively remediated land, avoiding areas deemed too contaminated or geologically unstable.

of containment. But containment does not operate solely through visuality. It is also legal – codified through property boundaries, liability exemptions, and threshold values – as well as sensory, privileging what can be seen over what is felt, heard, or smelled. Together, these regimes help make present or obscure the uneven distribution of toxicity.

Addressing this tension calls for alternative modes of sensing that move beyond the ocular. Unlike vision, which creates distance and reinforces a sensation of separation between above and below ground – here, figuratively, between past and present – other sensory practices and ways of knowing are better equipped to collapse such distinctions. Mignolo and Vázquez (2013) argue that modernity has structured perception around the primacy of vision, determining what is made perceptible while relegating the so-called 'lower' senses – hearing, smell, and touch – to the margins of legitimate knowledge. The pumping infrastructure, though inconspicuous and peripheral, produces a constant undertone that is both evocative and suggestive, drawing attention to what remediation seeks to obscure. Although the region's industrial legacy resists easy representation, it nonetheless continues to manifest through the pump's faint, yet emphatic murmurs.

Sound and acts of listening help to disrupt the modernist impulse to control and categorize by instead demanding relationality, attunement, and proximity (Kanngieser 2020, 442). In their text, Kanngieser argues that listening is not just an act of perception but an embodied and ethical practice – one that calls for situated engagement with place, history, and power. In response to this tension between surface and depth – and the limits of vision alone to account for a thick present – this paper homes in on the peripheral sound of pumps to trace their affective transmissions and analytic dimensions. It introduces 'transmediation' as a conceptual and methodological approach that draws on feminist technoscience, media studies, and artist research to explore how different aesthetic practices can help mediate what is sensed, known, and ultimately remembered.[3]

Where remediation is typically framed as a technical solution aimed at removing contaminants from air, soil, or water – and gestures, as the prefix *re-* suggests, toward a return to a prior state of purity – *trans*mediation signals something else. The prefix

3 A fuller articulation of *transmediation* as both theory and method – emerging at the intersection of feminist technoscience, media studies, and aesthetic practice – is developed in the author's dissertation, *Toxic Commons: Transmediating Permanent Pollution* (forthcoming, Bauhaus University Weimar, 2026). There, acts of transmediation are framed as epistemic devices that foreground so-called "inferior senses" – touch, smell, and sound – as a means of attuning to the often imperceptible, relational dimensions of toxicity and the conditions that contribute to an expanding *toxic commons*.

trans- implies movement across, over, and beyond, establishing pollution as ongoing, irreversible, and inherently contested. Clean-up is thus not a finite act but a continual negotiation – one that must constantly grapple with the question *cui bono?* For whom, where, when, and how is remediation enacted, and at what cost? Transmediation is not intended to negate or conflate the important work of technocratic remediation but rather works alongside it, drawing attention to the aspects that regularly fall outside its frame: fragmented histories, embodied exposures, and the unruly seepages of groundwater. It is only through situated and layered acts of translation and mediation that certain harms can be made known.

This article emerged from a 2022 field visit to several sites within ÖGP Bitterfeld-Wolfen, conducted together with sound technician Max Schneider and local remediation engineers. Through an artistic and ethnographic engagement with the site, listening became both method and analytic – and a way of attending to what usually falls outside public purview. Drawing on Chion's (1994) typology of listening, this approach engaged three interrelated modes: 'semantic listening', focused on the meaning of spoken content as it unfolded in conversations with local interlocutors; 'causal listening', oriented toward identifying the sources of specific sounds, ranging from passing cars and birdsong to the quiet hisses of the pumps; and 'reduced listening', which foregrounded the acoustic textures themselves – the hums, drones, and pulses – as aesthetic phenomena that transmit affect beyond informational content. Layering these modes enabled a situated sonic epistemology – one that brought into focus a different reading of Bitterfeld-Wolfen: not as a remediated landscape, but as an unsettled and still-unfolding toxic site. This emergent perspective challenges dominant narratives of successful clean-up and draws attention to the ambiguities of managing toxic legacy sites, highlighting the creative and ethical engagements they demand (Müller, Balayannis 2025, 70).

2 The Endless Murmur of Pumps

It is early February. Cold, grey and damp. We find Herr D pacing next to his company car at the parking lot behind the train station. We exchange politenesses and quickly retreat into the car to escape the raw weather. I intuitively take the front seat and the sound technician the backseat to accommodate his bulky sound equipment. Herr D – the main groundwater engineer at the regional remediation company Mitteldeutsche Sanierungs- und Entsorgungsgesellschaft mbH (MDSE) – signals a naive curiosity upon our arrival. It quickly becomes obvious that his work rarely warrants attention from the outside, especially not from people like us.

Whilst pursuing small talk, Herr D drives out of the train station parking lot, weaving his way through the outskirts of the historical town of Bitterfeld before heading northeast towards an industrial area that connects Bitterfeld with the town of Wolfen. We pass car dealers, printing companies and the odd *Imbiss* 'canteen'. At the dilapidated Bitterfeld Kulturpalast, we take a right and drive up along Parsevalstraße that splices straight through the former industrial grounds of the Chemiekombinat Bitterfeld (CKB)[4] – today operated by the Chemical Park. I have consumed numerous accounts of the sensational pollution at the height of socialist state rule but it takes a lot of imagination to conjure those impressions in the present: the colossal brick factories with rickety, leaking pipelines and towering smokestacks spewing out that infamous yellow grey smog that cemented Bitterfeld's reputation as "one of the dirtiest cities in Europe".[5] Today, the area is best described as a low-rise industrial sprawl interrupted by the odd, abandoned lot.

After reunification, the federal German government faced a major obstacle: the heavily contaminated underground posed serious risks to human and environmental health and deterred new business investment. In response, the state extended liability protections for legacy pollution and introduced a three-dimensional property regime. This framework ensured that the state assumed responsibility for pollution predating the cut-off date – 1 July 1990 – while enabling redevelopment and privatization of land without burdening new owners with remediation costs.[6] In practice, this means that the Chemical Park occupies only a thin surface layer – down to a depth of about 30 cm – while the toxic legacy beneath remains the responsibility of the state. The park itself is a spatial and legal construction that enables industrial activity to persist atop a polluted and unstable subsurface. Pipes weave together below and above ground, forming part of a controlled circulatory system that moves both contaminated groundwater through remediation infrastructure, as well as chemical intermediates between the chemical park's different companies and beyond. This network not only sustains the appearance of containment and efficiency

4 The Chemiekombinat Bitterfeld was one of the largest chemical production complexes in the German Democratic Republic (GDR), specializing in chlorine chemistry, synthetic materials, and pesticides. Its intensive manufacturing processes made it a cornerstone of the GDR's economy but also one of its most polluted industrial sites.

5 See, for instance, Monika Maron's novel *Flugasche* (1981), and the documentaries *Bitteres aus Bitterfeld* (1988) and *Sehnsucht nach Bitterfeld* (1993), all of which depict the region's industrial pollution in vivid detail during the late GDR period.

6 See "Landesanstalt für Altlastenfreistellung", Landesanstalt für Altlastenfreistellung des Landes Sachsen-Anhalt (LAF).

but also plugs the site into an expanding global circuit of chemical production, exchange, and flow.

The small settlement of Greppin approaches and Herr D pulls over and parks next to an inconspicuous pumping station connected to elevated pipelines that run along the main road. He leaves the motor humming and pulls out a pile of laminated A3 pages consisting of maps, sections and diagrams. He guides us through the plans and elevations and contours his technocratic gaze of the region's groundwater problem – one that is undeniably substantial. The sound technician and I listen attentively to Herr D' descriptions of the movement of the groundwater; the locations of underground wells and pumps; and where the two collude to prevent a further spread of the multicoloured toxic soup.

The pumping operates on a two-fold scheme, he explains: either it extracts dirty groundwater before it 'spills over' into clean water bodies or it salvages the incoming clean groundwater and displaces it above ground before it mixes and mingles with dirty. Due to excessive mining and the fundamental terraforming of the underground, the natural ground water table was rearranged. The pump and treat system is therefore designed to artificially regulate the groundwater table of the roughly 1,300 hectares of former industrial grounds into the unforeseeable future. Continuous pumping has become essential to prevent flooding, subsurface contamination, and the uncontrolled migration of legacy pollutants beyond the confines of the superfund site (Wycisk et al. 2013).

Herr D points to a series of pumps, strung like a string of pearls along the northeastern side of his map, near the location where we have parked. He explains that they were among the first pumps installed in the early 1990s, designed to protect the small village of Greppin from impending spills of legacy pollution from the adjacent industrial zone. The heavily contaminated groundwater naturally gravitates toward the Mulde River, which lies on the other side of the settlement. Without the pumps, groundwater levels would rise beneath the village, seeping into building foundations, dampening basements, and potentially causing the organophosphates pervasive in the groundwater to sublimate into a lethal gas.

A generative, yet toxic, bond between cheap and dirty brown coal and coal-based chemistry lies at the heart of Bitterfeld-Wolfen's dual reputation as a *Wirtschaftswunder* 'economic miracle' and *sensationally polluted place.* Shortly after the serendipitous discovery of lignite in the mid nineteenth century, Germany's chemical industry, spearheaded by Agfa, strategically resettled from Berlin. The abundant reserves of brown coal – combined with cheap land, labour, and a well-connected railway – drove a gradual yet violent terraforming of the landscape. The subsurface was torn open and systematically emptied of its bounty. The coal animated the chemical

industry that in turn expanded exponentially. Within a century, the region had transformed beyond recognition – from small-scale farmland to a chemical industrial hub populated by a dense fabric of coal-fired factories. The rhythmic clatter of machinery, the hiss of steam, and the churn of coal-fired factories merged and concentrated, echoing across a barren moonscape that surrounded it.

In the shadows of the prospering industrial growth, surplus chemical waste was routinely dumped into the exhausted open-cast mines to offer temporary redemption. These repositories of industrial sludge – that at times reached depths of up to 60 m – became a new subterranean medium through which the groundwater was then forced to flow and contributed to its severe chemical saturation. Above ground outdated factories would drip, leak and spill chemical intermediates that eventually seeped and leached into the ground and create three-dimensional plumes of chemical residues evidencing what was once present above ground, even though few records remain to confirm it.

After examining Herr D's map and forming an initial understanding of the complex groundwater problem, he suggests we inspect one of the pumps. We get out of the car and walk some meters down the road where we approach a 1 × 1.5 m green casing designed to blend with the surrounding landscape. He opens the case and reveals a modest metal infrastructure – a folded pipe with some simple measuring devices. It emits a dull hum with the occasional hiss. The sound is more pronounced without the casing, but it still folds into the wider, muffled soundscape of the chemical park – that indistinct blend of low-frequency sounds interrupted by the occasional passing truck. I get up close and lightly hold my hand against the metal pipe, sensing the pump's stubborn vibration as it runs through my body.

Herr D stresses the scale of the operation and the monumental task these pumps perform day in and day out even though it does not look like much from where we are standing. He waves his arms horizontally to gesture at the axis of pumps that punctuate the ground at an interval of roughly 10-15 m. The central challenge, according to him, is to keep the pumps running despite their propensity to clog up or corrode due to the abrasive chemical composition of the groundwater. Herr D explains that there have been investigations into the possibility of constructing an underground slurry wall that would hermetically seal Greppin from the impending pollution from the past. The saturation of groundwater is however so varied and unpredictable that there is till this day no uniform material able to tolerate the full range of potential threats. Besides, he adds, there are no machines available that would be able to produce a deep enough slit into the ground. Not even the most advanced mining equipment has that capacity.

Herr D has no problem admitting that the system is imperfect. He explains that the locations of the pumps were approximated using a combination of chore samples, GPR scans and geological records. There is also a portion of historical data and random water sampling that helped specify certain decisions. The data was translated into a three-dimensional model used to artificially regulate the groundwater flow by monitoring the performance of each individual pump in relation to the whole. The system responds to different variables and can project the effects of periods of sustained drought or calculate its capacity to withstand heavy rains or even a flood. The looming threat of intensifying local climate catastrophes are, however, no match. The system has very clear limitations, he admits.

Once extracted, the dirty groundwater is transported via elevated pipes to a purifying plant nearby where the most severe chemicals are expurgated with the help of coal filters. By the end of this process, only a tiny portion of the water will be deemed 'clean enough' to move on to the adjacent sewage treatment plant where it joins the regional grey and black water. At the sewage treatment plant, incoming dirty water is refined to meet legal threshold levels to the degree that it can be released into the Mulde river that snakes its way through the landscape on its journey to the North Sea. There is a clear threshold differentiating water that moves above and below ground. Alarmingly, Herr D explains that most of the filtered groundwater is returned to the ground after initial treatment, as it is still considered too polluted to meet the light of day. According to him, approximately two and a half million cubic meters of groundwater are displaced annually, and hundreds of tons of pollutants have already been recovered through the treatment process. Yet despite these efforts, he notes, the overall contamination levels have not decreased significantly. Perplexingly, the concentration of certain pollutants has even increased.

As I listen to Herr D speak, the robust figure of a 'pump and treat' system begins to weaken in my mind's eye. The sheer scale of contamination – 200 million metric tons of heavily toxic groundwater – makes it clear that depletion is an illusion. The orchestrated rerouting of water instead sustains the appearance of control, a present in which the groundwater *Blase* 'bubble' remains intact. The fact of the matter is that the groundwater will never be cleaned, nor will the problem ever be solved. Instead, the pumps are doomed to pump into the unforeseeable future, consuming endless amounts of energy and generating a humming stratum imperceptible to most human consciousness.

e-ISSN 2785-2709

3 Coming into Proximity to Antonie's Toxic Underbelly

We travel to another location on Herr D's map, to the southwestern edge of Antonie – a former coal mine that, like others of its kind, doubled up as a landfill and filled up with miscellaneous industrial waste during the last century. We have come to inspect the pumps that intercept incoming 'clean' groundwater before it collides with Antonie's toxic underbelly. With the fall of state socialism at the end of the 1980s, Antonie was sealed shut and remediated as part of the reparations fund. Her content is sensationally dirty, yet substantially under-documented and she is colloquially referred to as a *Sorgenkind* 'problem child' by local remediation experts. Predictions suggest that it contains roughly six million cubic metres of industrial waste – half of which is immensely toxic. The Helmholtz Centre for Environmental Research (UFZ) in Leipzig has recorded, among other things, 76,000 tonnes of HCH from lindane production, 48,000 tonnes of DDT sludge, 19,000 tonnes of hexachloroethane, 13,000 tonnes of chlorobenzene and 70,000 tonnes of sulphuric acid, which were illicitly dumped directly from railway tank wagons via hoses into the unprotected opencast mining pit during the GDR era.[7]

Standing next to the remediated landfill today, there are few visual clues that disclose what hides below the surface. The pit has been concealed by a carpet of greenery and its perimeter modestly demarcated by a fence. Public access on paved paths is restricted; only we are present on the premises. I look over onto a neat arrangement of landscaped retention pools that give off a soothing, trickling sound. The surface of the pools, that would otherwise reflect the grey February sky, are today unsettled by a light drizzle.

Together with Herr D and a mechanic from the MDSE, we climb down a shaft to get to an underground mechanical room that coordinates the salvaging of incoming groundwater and redirects it to the retention pools above ground. *Trockenlegen* 'drainage' is the central tenet of the pumping on the southwestern side of the superfund site. Containment, I begin to understand, is not a static barrier but an ongoing infrastructural effort – a mitigation strategy aimed at preventing the past from reasserting itself. As Hird (2013, 114) reminds us, landfills defy closure: the contents do not lie inert but seep, react, and mutate in ways that resist prediction. Even when kept dry, such sites harbour "unknown unknowns" – chemical reactions, microbial activity, and subterranean movement that

7 For more details, see the annual report of the Helmholtz Centre for Environmental Research (1998/1999), which includes Peter Popp's article "Das Bitterfelder Grundwasser – Ein gefährlicher Cocktail" (pp. 18-24), available at: `https://www.ufz.de/export/data/2/84245_018_024.pdf`.

continue to unfold beyond human perception or control. In this context, containment becomes speculative – an attempt to manage risks that will never be fully known.

As we step into the underground pump room, sound thickens – reverberating through the architecture and intensifying the pulse of translocating water. The sound technician moves methodically, affixing contact microphones to cold concrete walls, vibrating metal railings, piping and staircases. Unlike conventional microphones, which capture airborne sound, these devices extend human hearing into vibrations that evade human perception. Just as a seismograph detects tremors beyond the threshold of human sensation, contact microphones render the subterranean environment newly audible – though not in its entirety.

The sound engineer explains that contact microphones do not record water itself – water does not generate sound in this context. Instead, the microphones register the vibrations produced as water moves through the remediation infrastructure, pressing against pipes, valves, and metal casings. What we hear is not the water, but the resonance of its containment – the hum of compressed energy, the friction of liquid confined within narrow channels. An entire spectrum of sonic activity remains imperceptible: the seepage of moisture dispersing into sediment, and the slow diffusion of contaminants as they merge, react, and reassemble. These processes unfold in silence, slipping beyond the range of the microphones and the human ear alike, intuitively sensed but never fully grasped. The contact microphones pick up what I now feel: the overburdened machinery of containment peripheral to my senses now drawn into sharp proximity with my body. The quiet surface is turned on its head; what once seemed still now reveals itself as restless, always at work, never at ease.

4 The Fluid Movements of Sound and Water

Inspired by Andrea Ballestero's invitation to "exercise new figurations" that challenge dominant conceptions of the underground as static and inert, I make use of her spongy aquifers (Ballestero 2018) and voluminous plumes (Ballestero 2020) to recast the subsurface as a space full of dimension, obscurity, and unfolding relations (Hird 2016). When seen through the optics of watery movement, the underground can be understood as nothing but lively. Water is continuously shaped by its encounters with the varied granularity of the underground as it stakes out paths of least resistance; sieving through sandy sediments, dividing along stony crevices, or being temporarily immobilized by a clay surface or caught up in an oily resin.

Herr D's 2D map offers little fodder for imagining the tactility, temporality, and unruliness of the subsurface – qualities essential for understanding how contamination persists, disperses, and exceeds containment. According to his diagrams, water moves in simplified, straight lines and organizes along binary categories: above or below ground, dirty or clean. Definitions of clean and dirty, however, operate on a sliding scale of threshold values (Liboiron 2022, 58-9), and the legal perimeter of the superfund site is delineated by an arbitrary line that in no way reflects nor contains the problems of the past. Bodies of water are thereto neither singular nor stable. As Stacy Alaimo (2010) argues through the concept of *transcorporeality*, bodies – including bodies of water – are not closed systems but sites of constant exchange, where human, chemical, and environmental flows intermingle. Water can thus be understood at a molecular level or as a vast, moving mass, shifting in scale and composition depending on how it is encountered and framed.

Sound is often described in watery terms, moving in wave formations through different media – gas, liquid, or solid – each shaping its trajectory through absorption, reflection, or resonance. Unlike light, which can travel through a vacuum, sound depends on a medium to propagate, making it an inherently relational force. In open air, it moves slowly and dissipates over distance, much like the delayed rumble of thunder following a lightning bolt. In water, however, sound travels four times faster, allowing whales to communicate across vast expanses of ocean. Inside enclosed structures – such as a metal tube or a pump – sound reverberates, folding in on itself until it becomes unrecognizable from its source. As it moves through different materials it can create both proximity and distance – amplifying in some environments, dissipating in others, shaping what can be heard when and how, and by whom.

At its most rudimentary level, sound is a physical and neurological event – waves enter the cochlea, triggering a cascade of sensory processing in the auditory nervous system and the brain. Yet much of what sounds does, escapes our direct attention. Some frequencies are too high or too low for us to register, while others blend into the backdrop of everyday life, unnoticed through habituation. Whether actively perceived or not, sound remains omnipresent and promiscuous, leaking across boundaries and material thresholds. As Gallagher et al. (2016, 620) remind us, "Every space and place sounds and resounds, every living body and being vibrates, and every kind of material, object and surface has acoustic properties".

Sound is also transgressive, entering bodies without consent. Unlike vision, which we can control by simply closing our eyes, hearing remains involuntary – ears are always open, always receiving. Reflecting on the relationship between sound and the unconscious, Cox (2009) argues that sound is not merely a

representational phenomenon but operates at a deeper, vibrational level, shaping experience before it reaches cognition. He describes this as the "sonic unconscious" – a domain where sound bypasses rational interpretation and instead acts on the body, lodging itself beneath perception. Even when unheard, it lingers, shaping how we sense and respond to the present, attuning us to forces we may not immediately recognize but nonetheless feel.

I chat to Herr D and the mechanic whilst the sound technician is busy with his various recordings. We climb out of the shaft and into the open air, taking shelter under a provisional roof. Herr D is in his fifties and grew up in a village nearby. The mechanic is younger, I would guess somewhere in his early thirties. Their recollections of the past thus vary greatly in perspective. Herr D was trained in mining during the GDR in his early twenties and lived in the outskirts of Bitterfeld, close to an active coal mine. He clearly remembers the haunting high-pitched creaks that would echo throughout the night as the bucket wheel excavators scraped up the subsurface. He recounts the industrial soundscape as having been filled with *Kriechen* 'screeches' and *Geklapper* 'clatter' but that this changed drastically after reunification.

With the federal reintegration, jobs in mining became increasingly obsolete as East Germany fell under the stricter environmental laws of the unified German state. Reunification thus marked the beginning of a gradual phase-out of brown coal, driven by both legal mandates and economic restructuring (cf. Chaney 2017, 140-2). As large-scale coal extraction was scaled down, Herr D transitioned into remediation science, a shift he describes as less drastic than it might seem – both fields, after all, operate within the same logic. The mechanic grew up shortly after the region's restructuring and has therefore never experienced the haunting sounds of coal digger makes, nor does he carry the embodied memories of the troublesome heavy industry and the way it used to invade and hang heavy on the senses. The swishing of wind turbines has now replaced the rattle of the fossil regime.

Sound does not need to be consciously registered to affect us. A sudden bang hijacks the nervous system, triggering an immediate surge of adrenaline, while low-frequency vibrations – inaudible yet physically palpable – seep into the body over time, embedding themselves as unease. In Bitterfeld-Wolfen, the muffled, mechanical soundscape of remediation operates in this same register – an almost imperceptible pressure, a weight without origin. What strikes me the most are omissions.

As Herr D, the mechanic, and I stand huddled together, we drift into conversations about more-than-human ecologies and how they have been forced to adapt to the region's drastic transformations. As fossil extraction ceased and heavy machinery fell silent, ecological

processes gradually resumed. The pioneering forest that has recolonised the eastern side of the remediated open-cast coal mine Goitzche – today a scenic lake – has become a treasured sanctuary for birds and insects that were once driven away due to mass deforestation. Biodiversity has since then exploded exponentially and now also attracts human populations that spend their pastime in proximity to the soothing sound of rustling leaves and variations of chirps and trills. These sounds require no interpretation; they announce themselves as signs of life, of restoration, of an environment that can be perceived as whole.

Despite the visual coherence of Bitterfeld-Wolfen's remediated landscape – its scenic lakes, reforested areas, and absence of visible smog – my body registers a cognitive dissonance, as attunement to other faculties reveals a gap between what is seen, what is sensed, and what remains obscured. Above ground, pipes shuttle both contaminated groundwater toward treatment facilities and newly synthesized chemical intermediates between the various chemical companies of the chemical park. Below ground, a hidden infrastructure strains to contain legacy pollutants that remain restless, and unruly. These parallel networks of movement and control – visible and submerged – converge in a space where toxicity is managed but never resolved. The scale and invisibility of these flows evoke a quiet unease, a sense of vast chemical processes unfolding into eternity, unsettling the surface image of recovery and hinting at something vaster, more unstable, and unresolved.

What initially presented itself as coherent begins to unravel, pulled apart by the sonic undertow. As I continue to listen, I realize that Herr D and I are perceiving from very different vantage point. He carries embodied memories of past pollution that once defined everyday life here, allowing him to read the landscape with practiced familiarity and fill in the cognitive gaps. I, by contrast, struggle to make sense of what I hear and feel. The longer we speak however, the more my perception begins to shift and sharpen. The remediated lakes and the winding river Mulde cease to appear natural, revealing themselves instead as engineered bodies of water – controlled, contained, and artificial in both dimension and composition. I begin to grasp how they are hydrologically connected to sources beyond my immediate field of vision. From our exchange, I also learn how much legacy toxicity lies buried in the Mulde's alluvium. A single disturbance of these sediments could send shockwaves downstream, unleashing harm that might reverberate all the way to the North Sea. I pause, reflecting on the endless labour of the pumps and the relentless energy required to sustain the precarious illusion of clean-up. This energy demand, in turn, necessitates ever-deeper excavations – extracting from the earth to perpetuate the very system tasked with managing its harm.

To Herr D, working with the underground requires a certain humility – an acceptance that the truth will always be partial, that remediation is not a solution but an ongoing negotiation with the past. It is a form of speculative containment: a performative effort to manage the unmanageable, to maintain the appearance of control in the face of uncertainty. The act of monitoring and pumping, despite its limits, is just as much about keeping contamination from vanishing into forgetfulness, much like how landfills render waste invisible through infrastructure and regulation (Hird 2013, 106-7). Not all industrial wastelands are granted this attention; most drift into oblivion, their toxic legacies absorbed by the lands and bodies that surround them. Nixon (2011) argues that slow violence is not sensational but attritional. It unfolds beyond immediate perception, persisting at frequencies at the cusp of consciousness (Nixon 2011, 2). Without tools to render these lingering violences perceptible, they inevitably fade into obscurity.

5 Transmediating the Chemical Sublime

As we sit together in the sound studio back in Berlin and listen to the field recordings, something unexpected happens. The recordings of the pumps reveal an acoustic reality we had not fully perceived on site. My senses and cognition struggle to process the unfamiliar sounds, creating an atmosphere of eeriness. The contact microphones, attached to the metal pumps and filtered through the sound technician's software, have transformed the monotonous rhythm of water management into a carpet of metallic drones, punctuated by faint, swirl-like frequencies that evoke the distorted echoes of distant, terrified screams. The tone is dark. The pulse is propulsive. Metal, energy, and water have collapsed into a singular sonic presence – one that borders on the horrific.

Both Steininger (2018) and Engelhardt and Cinkevich (2023) evoke horror as central to the experience of chemical and infrastructural systems: for Steininger, a petrochemical sublime marked by awe and dread; for Engelhardt and Cinkevich, the slow pulse and generational suspense in which violence unfolds beyond the threshold of visibility. In Bitterfeld-Wolfen, this tension becomes palpable. Chemical companies float above ground, seemingly detached from the region's polluting past. Their gleaming infrastructure projects an uncanny illusion of order and purity, even as it continues to redistribute an invisible yet unceasing stream of chemicals that permeate and accumulate in land and bodies elsewhere. It is only when a pipe of contaminated water punctures the surface, leaking uncontainable sound, that the connection between above and below merges, and

their true scale and effect become disturbingly present. Water and chemical intermediates flow silently, pumps strain quietly

Remediation in Bitterfeld-Wolfen, rather than eliminating pollution, reinforces it through the profound interconnectedness of remediation infrastructures and ongoing chemical production. Publicly framed as environmental restoration, remediation actively sustains the industries it ostensibly regulates. The promise of a 'clean' environment paradoxically facilitates new extractions, additional toxicities, and the uncanny persistence of synthetic chemistry integrated into global supply chains. Chemicals prohibited in Europe are synthesized and discreetly exported, entering broader circulations and geographies, perpetuating harm in an expanding and ever-deepening toxic commons (Müller 2021).

If the toxic sublime resides in the affective tension between awe and dread, its sonic form might be precisely this: a presence at once monumental and elusive – quietly signalling an unresolved environmental legacy, where awe at infrastructural scale invokes horror. Yet this sonic sublime can be politically ambivalent: while it gestures to the scale and persistence of environmental harm, its abstraction and infrastructural grandeur risk naturalizing or aestheticizing toxicity. Rather than catalysing action, the soundscape may instead reinforce the perception that remediation is already underway – rendering the crisis audible but seemingly managed. Remediation thus functions as a mechanism of deferral – managing toxicity without resolving it.

To tinker with imaginaries of technological horror and chemical monstrosity is to explore new ways of confronting global networks of extraction and contamination – systems that operate at scales often imperceptible to human senses. The notion of a monstrous presence – partly visible, partly sensed – echoes the difficulty of apprehending the long-term consequences of industrial processes. The human faculties struggle to register the abstract casualties of slow violence, diffused across time, space, and bodies of all sorts. This is where transmediation asserts its force. It does not aim to restore or resolve, but to amplify. By working with silence, absence, and peripheral frequencies, transmediation makes perceptible what remediation conceals. The pump's barely audible hum becomes a signal: that contamination has not vanished, only receded from view. Against the visual rhetoric of restoration, transmediation attunes to a thick present in which nothing truly disappears, becoming a practice of staying with what remains.

Inspired by how stargazing in the dark of night stirs a longing to grasp complex planetary relations and their cosmic pull, delving into the subsurface similarly opens pathways into our collective fears, repressions, and desires for control. There is no 'away', no 'elsewhere' to which pollution can be relegated. Sound and water

move continuously through and between bodies, breaking down imagined boundaries – earth, skin, piping – that obscure their deep entanglement. Though often concealed, the subsurface inevitably reemerges, unsettling the illusion of containment. Thinking with water and sound reveals how they leak, cling, and reverberate across bodies, opening new ways of sensing and relating within an expanding toxic commons.

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e-ISSN 2785-2709

Lagoonscapes
Vol. 5 – Num. 1 – June 2025

Translucence
Some Notations on Sediments, Amber, Toxic Chemicals, and the Possibility of Returns

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Abstract The ongoing repercussions of a permanently and persistently polluted planet present a critical juncture that requires new analytical engagements. This article uses translucence as a conceptual vehicle to explore chemical pollution by comparing amber with a buried chemical waste depot. These two modes of submergence animate discussions about time, existence, desirable and undesirable futures, and pasts. Translucence – light passing through a semi-transparent object and thus becoming transformed – helps conceptualize epistemes that diffusively alter perspectives rather than being clear or opaque. The article combines text and sound (https://doi.org/10.30687/LGSP/2785-2709/2025/01/006/mmedia/001) to explore experiences of pollution and landscape across dual media interfaces.

Keywords Amber. Surfaces. Toxic chemicals. Translucence. Verticality.

Summary 1 Overture. – 2 Surfaces. – 3 Amber. – 4 Depot. – 5 Return. – 6 Depths.

Edizioni Ca'Foscari

Peer review

Submitted 2025-03-21
Accepted 2025-05-22
Published 2025-07-21

Open access

Citation Lundsteen, S.; Jelača, K. (2025). "Translucence. Some Notations on Sediments, Amber, Toxic Chemicals, and the Possibility of Returns". *Lagoonscapes*, 5(1), 139-158.

DOI 10.30687/LGSP/2785-2709/2025/01/006

1 Overture

Dear listener-reader/reader-listener,

this sound/text is conceived as a multisensory experience. You are invited to explore the sonic landscape by pressing play either before, during, or after immersing yourself in the textual universe.

The sonic piece entitled "Notations on Sediments", by sound artist Korana Jelača, is intended to be in direct conversation with the essay without being in competition with the words but rather adding to them while introducing subtleties to encourage the reader to further think of and question the larger context of ontology, altered landscapes, history, toxicity, and translucency. Hopefully, this allows your experience to weave in and out of the text. The sound is intended to convey a sense of isolation and distance which is present in towns and communities like Thyborøn. Landscapes that have been drastically transformed both by the elements, but even more so by industrialization, thus becoming discarded and undesirable non-places.[1]

Scholarship on chemical pollution has challenged conventional thinking; dissolving boundaries between subject and object, body and landscape, disrupting linear orthodox temporality, and questioning domains of perceptibility (Alaimo 2010; Müller, Nielsen 2022; Murphy 2006). This sound/article engages with these arguments 'performatively', by dissolving the barriers between listening and reading in a way that, like pollution, contaminates, transmits, and transforms the experience. Contamination and pollution are, however, not innocent encounters (Bond 2021; Reith-Hauberg 2024). The long-standing tendency to decontextualize and isolate chemical contaminants must be critically re-examined. And so, the intention behind the sound/text is to move towards a deeper form of relational thinking.[2]

The authors would like to extend a sincere thank you to the special issue editors, peer reviewers, Katy Overstreet, Jacob Mohr, and Jagtvej 69 for inspiration and guidance.

1 The artist works with field recordings, everyday objects, and materials to expose a certain lacking in our comprehension of our surroundings. The piece is composed using only concrete sounds, creating an opportunity to alter perceptions of the familiar.

2 As Deleuze and Guattari (2011) suggested, a text is a non-linear, non-hierarchical entity – it is a rhizome existing in relation to the "outside" of the text, as a plateau to use their (geological) term, that encompasses connections, flows, and interactions. In a similar, but less ambitious way, we wish to connect the text to surfaces, depths, fossils, chemical waste, sounds, and experiences. See also Lesley Green's (2020) *Rock, Water, Life*.

e-ISSN 2785-2709

While sound introduces a performative dimension, amber and a submerged toxic waste depot are brought into analytical focus to ask what kinds of histories, practices, reasonings, and habits have produced and shaped an industrially contaminated landscape. And, relatedly, what kinds of knowledge, practices, and relations either resist, counter, or offer alternatives to this dominant mode of reasoning? Following Charlotte Wrigley (2023, 5), who challenges the techno-scientific monopolization of underground knowledge by calling for the inclusion of more embodied epistemes, those that do not appear on maps or in models, this article introduces the concept of 'translucence' to critically reflect on knowledge/power, visual representation, verticality, and submerged chemical waste.

In optics, translucence denotes the state between transparency and opacity: as light passes through a substance, it is preserved but altered in the process (Gigilashvili et al. 2020). This quality is not only characteristic of amber but also invites reflection on the improbability of unmediated reality, and how epistemic regimes are shaped by ideals of clarity and purity (Shotwell 2016). Translucence, as a concept, critiques techno-scientific routines in which knowledge about chemicals is tied to visibility, objectivity, manageability, and certainty where outliers and distortion are often erased or ignored. Yet, the buried toxic waste has not complied with these epistemic frameworks. Instead, translucence introduces alternative ways of knowing a landscape that is shaped by flooding and storms but also hosts amber and a submerged depot. The article argues that dominant practices of boundary-making and reductive representations of the underground carry serious consequences. Still, figures like amber and translucency offer analytical potential emerging from thinking about, with, and through verticality.

Inspired by Overstreet and Sørensen's (2024, 3) methodology and epistemology – which assemble seemingly disparate stories to make sense of politically charged places, this article brings the landscape, its history, amber, and a subsurface depot into an analytical constellation. These serve as empirical touchstones that integrate ethnographic fieldwork, archival research, and artistic practice.

The original idea was to include sounds of amber and the transformations of it in the piece, but the focus eventually shifted to amber as an artifact, a symbol of human modification of our surroundings. Therefore, the artist chose to manipulate and record different objects made of wood, metal, plastic and glass, allowing them to intertwine with, pollute and alter the sounds of the wind

and the sea. In a sense, to acknowledge and replicate how human presence alters and manipulates the landscapes which it inhabits.[3]

The article unfolds through five curated encounters. It begins by situating the reader in the landscape offering a sense of place, milieu, and its inhabitants. A brief local and natural history of amber follows. From there, attention turns to the emergence and conditions surrounding the depot, before lingering on the probability of returns. The final section proposes a quiet closing, revisiting the concepts and their potential to prompt further reflection.

Now we welcome you to press play and begin exploring.

2 Surfaces

The horizon is filled with clouds of various sizes drifting with the wind. Swallowed up by a scenery so characteristic of this place and time of year, I find myself on the Danish West Coast in late October. I am walking along the beach near the small town of Thyborøn, placed at the very end of Harboøre Tange – a narrow sandy strip that separates the enclosed, brackish water of Limfjorden from Vesterhavet, the Danish name for the North Sea.

Here, the shoreline does not simply lie adjacent to Thyborøn; it forms a meeting point of two worlds – one urban, one marine – that gradually dissolve into each other, making it hard to distinguish where one ends and the other begins. The landscape is profoundly shaped by currents and tides, where the disruptive forces of storms and floods radically alter the boundaries above and below water. As Wilko Graf von Hardenberg and Martin Mahony (2020) argue, the perception of the sea's surface – its heights and depths as objects of knowledge – are fluid, relative, and historically contingent, shaped by evolving scientific interests and practices. In this sense, distinctions between beginnings and ends, surface and depth, and the shifting borders of land and water resist clear definition, fluctuating with perspective, which are especially prevalent in a moving landscape.

3 Among the sounds heard are bubble wrap, different metal and plastic parts used in building construction, carbonated water in a very thin glass and discarded plywood. Furthermore, the artist chose to use bird sounds recorded in urban parks which always have a backdrop of traffic or some other machinery, which can be heard if you listen carefully. In many years of using field recording the artist noticed that sounds like traffic, construction are almost always to be found in the distance of Danish beaches and forests and are often only drowned out by the sound of strong winds. Considering the topics at hand it seemed more relevant and appropriate to add urban nature to the mix. Panning and layering choices, in both recording and post-production are meant to aid in shifting and altering the readers/listeners perspectives and recognition, thus exploring the ideas of the organic vs. synthetic among other topics.

These processes of layering, upheaval, and settling are integrated into the very fabric and structure of Thyborøn, sedimented in its culture and history. The people living here, known for their toughness and tenacity, have similarly been shaped by the cyclical forces of nature which sustains life, yet in moments of volatile intensity, turns into life-taking violence (Rasmussen, Rasmussen 1972, 17-20).

In 1825 a relentless storm breached the sandy strip of Harboøre Tange which, until that defining moment, had connected the mainland with Northern Jutland and served as a terrestrial barrier between the fjord and the North Sea. The catastrophe, as one newspaper described it, became the most violent storm in over a century, claimed more than 800 lives and had long-lasting and long-lasting social, environmental, and economic repercussions (Poulsen 2019, 2-6).

Yet the storm in 1825 was not an isolated event. Repeated storms throughout the century widened the breach, deepening the water channels and carving out what is now known as the Thyborøn Canal. In 1868, a storm-induced flood was documented by an unnamed traveler who recounted the dramatic transformation of the landscape, from "once fertile meadows and dune-protected villages to a barren, gravel-filled plain" (Vestergaard Jensen 1973, 4). The wayfarer was fascinated by the local's determination to survive in a place where storms and floodings had taken everything from an area that had little. Despite enduring intense circumstances, the prospect of a deteriorating future caused by living in a hostile environment led several residents to move. By 1896, 20 houses, two cows, some sheep, and a few geese remained in the area around Thyborøn (Rasmussen, Rasmussen 1972, 87).

While poverty, absent infrastructure, a desolate topography, and treacherous surroundings did not make an attractive combination, Thyborøn did, in fact, see an increase in population and wealth from the turn of the century until the 1950s. The development was rooted in the seemingly catastrophic storm of 1825, which had created a canal, also brought attention to coastal protection facilities and construction of built infrastructure. Industrious and opportunistic individuals began building several breakwaters, a harbor, and a railroad which eventually led to an emerging industrialized fishing industry (88-9). The path of decline that seemed unavoidable became a favorable event of circumstances as the canal led to the construction of early logistical industrial infrastructure. The port of Thyborøn became one of the most important access points for commerce, placed at the intersection between Limfjorden to the North Sea. The storm of 1825 altered the area's reputation from the "coast of death" to "land of opportunities" indicating how disasters had devastating consequences for some, leading to a gradual abandonment, while the very same catastrophe became a profitable opportunity for others (Poulsen 2019, 29-30).

The coastal processes of tides and currents, storm and floodings, shaping the landscape for centuries, are still vital to understanding the

rhythms of life on Harboøre Tange. After a recent storm left the streets deserted, I was drawn the beach in its wake. I took the storm as a serendipitous event to become familiar with the local tradition of looking for amber, guided by a local woman.[4] Prior to my coastal undertaking, I had learned the tacit knowledge required for collecting amber from Bjarne, a 70-something-old, retired fisher who had dedicated much of his spare time to collecting and polishing amber. His knowledge comes from his father, affectionately known as Rav-Aage – 'Amber-Aage' in Danish –, a well-known figure in the community.

The same natural forces that devastate the coastline also bring amber ashore. But they also bring something more insidious.

Rav-Aage, also remembered as Denmark's first environmentalist, mobilized a large group of fishers against the pesticide producer, Cheminova, which had long been dumping vast quantities of toxic chemicals in the area. The contamination unfolded as a form of slow violence, its effects delayed, invisible, and ongoing (Nixon 2011; Lynge et al. 2021). Although Rav-Aage's activism was hailed as a success, Harboøre Tange remains the most contaminated area in Denmark, with three major sites of buried hazardous waste; one of them a chemical depot buried on the shoreline just a little south of Thyborøn (Andersen 2024). Bjarne has continued his father's struggle against living in a toxic environment, committing himself to a complete remediation of Harboøre Tange.

And just as the tides once brought opportunity through amber, storms and currents now return the buried toxic waste – once thought gone – reminding us that nothing in this landscape ever truly disappears. The coastal processes of tides and currents, storms and floodings, are also the same phenomena that returned the toxic waste which was thought as gone.

3 Amber

While spending time at Bjarne's house seeking to learn about the environmental injustices of long-term exposure to chemical pollution, amber sank into a stronger focus. The previous days of storms, which eventually led me to the beach, pushed our conversation to other places, like how and where to find amber. Amber is known as 'Northern Gold' because it is commonly found in Northern Europe. Their materiality as resin secreted by pine trees during the tertiary age, reveals a golden glow shining beneath an otherwise ordinary surface and distinguishes it from other types of fossils (Nationalmuseet). The currents and waves surface geological time, as the amber lies dormant for eons on the seabed until storms carry

4 The authors have chosen not to disclose her name.

the deep-time artifacts into the present. Storms unravel deep time providing the perfect occasion to look for the fossilized tree sap.

There are different ways of collecting amber; some people stand in the waves during a storm with handheld nets, while amber is also a common bycatch lifted from its dwelling as commercial fishing boats plow through the seabed. A third, and more common, less intensive, and low-key method, was the one Bjarne taught me: he instructed me to rummage through kelp, shells, and small pieces of wood across the coast, and not, as normally believed, among the stones and pebbles. Because of amber's density, it is found among lighter objects on the coast.

Gaining knowledge of amber through environmental storytelling, the urge to look for the golden pebbles collided with the serendipity of storms, which ultimately led me to inquire about an amber-finding excursion. Unfortunately, Bjarne was unable to join me as he suffers from a severe back injury because of an accident during his time as a commercial fisher in the North Sea. A tragic event that still renders him unable to walk for longer distances. And so, because of Bjarne's immobility a local woman who also had cultivated a remarkable knack for finding amber agreed to companion me. We fetched two sticks, useful tools for sticking and poking through the wet, sandy seaweed and pieces of driftwood lying scattered across the beach.

Finding amber is both a pastime and a traditional supplementary income for people living in Harboøre Tange. In the Northern parts of Europe, amber is a type of fossil whose cultural significance can hardly be understated; in Denmark, they were an important source of income and vital for trade in ancient times (Schnorr 2012; Brinch 2012). Amber is also believed to have healing capacities and has been used as valuable currency for trade, which is partly the reason why archeologists find them in far-flung corners of the world. They come in various colors; orange, red, brown, green, and black, each holding a captivating and shimmering presence, which has placed it among some of the most precious materials. The multiple and variegated nomenclatures used to describe amber; fossils, resins, succinite, and resinite, have given rise to much speculation as well as confusion. Originating from extinct forests causes a severance between source and redeposition adds additional layers to their perplexing presence. And ultimately, the fossilization processes where physical circumstances are as important as temporal spans, have given much cause to speculation in terms of how, when, and why amber is formed (Causey 2012). The enigma of amber prevails as being much studied but still not fully understood, even in areas of scientific inquiry.

Despite amber's persistence, as materializations of processes that have traveled through geological time, entered social and cultural time, becoming objects of scientific inquiry, they remain elusive objects. They illustrate how things, phenomena, and entities that might

appear well-known and even normal, have generated an abundance of knowledge, but are still shrouded in partial mysteries. As such, amber becomes objects that contain an aspect of not-knowing emerging as windows into unexplored aspects of the past and the present.

Today, amber still holds significance in the Northern Region as a desired status symbol with a mythological dimension, but also an attraction for tourists that flock to the Danish West Coast looking for fossilized resins. While some tourists are inclined to look for amber as an activity that resembles a lottery, some reports of finding massive chunks of amber sold for a good deal of money, most take finding amber as a sign of good luck and a small-scale surprise. My own motivation was to mimic Bjarne and Rav-Aage, getting a better understanding of the area in an embodied way while small-talking with my companion about the place and its history.

The coastline where I poked around looking for amber is directly linked to the subsumed chemical depot. The chemical depot, the landscape, amber and the shore connects to Cheminova and Thyborøn, but not in a straightforwardly and linearly way. Instead, it is best illustrated by lines drawn between material, synthetic, organic, temporal, spatial, social, political, scientific, social, economic, and more-than-human elements. While strains of new materialism claims that amber might hold a certain "thing-power", there is a very different other type of agency to the chemical depot which entails slow violence and the ongoing aftermath of toxic exposure (Bennett 2010; Murphy 2017; Frantzen, Bjerre 2020). However, amber and the chemical depot are subjected to, and a part of, the same rhythms and movements of the landscape, but belong to two very different epistemic regimes. The first belongs to a type of local knowledge where the sea returns what has been given, the other insists on containment through technological control and epistemological certainty. As we shall see, both are characterized by translucency as a type of epistemic murk (Taussig 1986, 121). As an analytic interface, translucency provides a critique of certain epistemic regimes whose claims of unmediated and unbiased objectivity have life-altering consequences, while also offers an opportunity to think otherwise.

During our shoreline scramble in pursuit of amber, I was reminded how Bjarne's relation to amber illustrates such an otherwise. In many ways, Bjarne and Rav-Aage symbolize an intergenerational history, by having traveled on similar paths but in different decades; they both spent a large part of their lives at sea, have a strong sense of justice, nurture a close relationship to, and knowledge about, their surroundings which is, among other things, shown through their appreciation of amber. When Rav-Aage passed away, Bjarne moved into his childhood home and took up his father's interest in collecting, polishing, and selling amber, as well as running a small amber museum inside his house.

When Bjarne was raised, knowledge and skills were passed on from generation to generation, as a type of practiced and learned heritage that differed from that in schools. The craft of finding and polishing amber into golden glowing aesthetic objects – is a skill that requires patience, as a practice involving a constant process of careful removal of the surface. Amber-polishing brings surfaces and depths into conversation, like residing beneath the earth's crust or placed on a seabed surface, hidden and forgotten until a storm brings it ashore where Bjarne would pick it up and carry it back home.

The subsequent scenes involve Bjarne slowly and steadily polish the surface, while gradually dissolving and revealing a radiant and glowing inner world, bringing another perspective, a translucent perspective, into existence as the light is altered when it passes through. The translucency of amber reveals the relationship between interiority and exteriority as processual and gradual, and about what might exist under a surface that has been deemed as impenetrable.

4 Depot

Amber and translucency tell a story not unlike that of chemicals and their toxic properties. They are unruly entities, continually attempting to be tamed, but nevertheless evades settled distinctions and fixed categories. They multiply, proliferate, and surface in unexpected places. They are, however, very different in their political, environmental, and social realities. Still, translucency and amber speak to the conditions and logic that shape these realities.

A well-known story about toxic chemicals is framed as industrial development. Traditional ways of living were subsumed by new businesses and factories, replacing former subsistence economies. These emerging industries signaled a new era defined by an accelerated scale and intensity – and one that forged radically different relationships with its surroundings.

In 1952 Cheminova established a factory just south of Thyborøn, producing organophosphate-based chemicals and mercury-based coating for the agricultural industry. Targeting the emerging global agrochemical market, the company quickly rose to become a prominent pesticide exporter. But their fast-growing business did not happen without consequences (Jørgensen et al. 1984, 13-14).[5]

Despite warnings from experts, willing local politicians granted Cheminova permits to dispose of wastewater (Miljøministeriet

5 Danske Ukrudtsmidler sendes til flere end 30 Lande 1956.

1981b, 1-10).[6] In the 1950s, the local political and juridical bodies consisted of businessmen, interested in bringing prosperity to a place that was perceived as underdeveloped (Den Store Danske).[7] Not unlike the cultural significance of amber, Cheminova represented wealth and status. As a result, Cheminova was allowed to dispose sewage on the coast between two dunes. A pipeline reaching across the sandy strip – from the east to the west – was not financially viable, making a sewage-filled truck the best cheap alternative.

However, yellow water flowed from the factory grounds, a synthetic smell inundated the area, and reports of spills from an overfilled truck driving haphazardly non-stop in all weather, were followed by reports of chemical exposure (Miljøministeriet 1981b, 79).[8]

These forms of pollution were often rationalized. They were framed as isolated incidents, incidental accidents, or the exaggerated complaints of a local population resisting the benefits of a benevolent company. But behind this rationalization lay a deeper tension: the dreamscape of synthetic modernity, enabled and sustained by exclusion, contamination, and selective visibility.

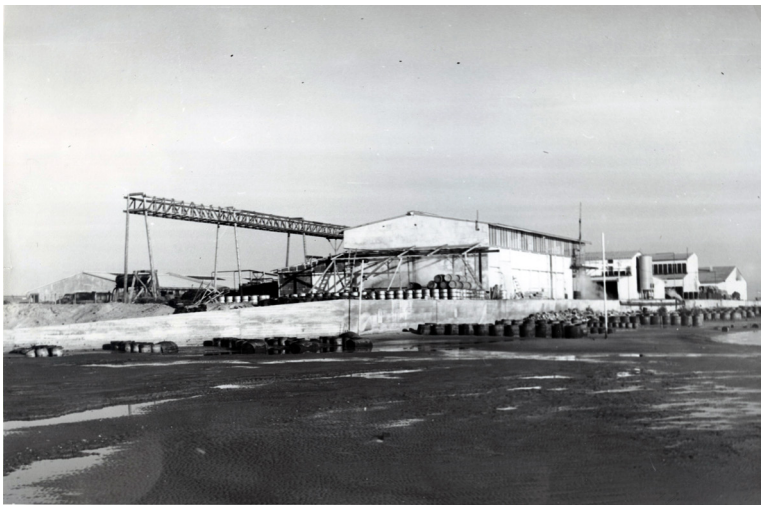

Figure 1 Cheminova's factory. Unknown photographer, ca. 1956. Harboøre, Lokalarkivet for Thyborøn-Harboøre-Engbjerg, B12999, www.arkiv.dk

6 Cheminova skal bygge Rensningsanlæg inden Nytaar – Landvæsenskommissionens Kendelse faldt efter bevæget Møde i Gaar 1952; Court Transcript of Negotiation Protocol 1952.

7 Cheminova Flytter Fra Maalev Til Landets Mest Øde Omraade 1952.

8 Rønland-Beboere Klager Til Politiet over Cheminova 1956.

e-ISSN 2785-2709

A few years later, the waste site became the optimal solution for dumping other types of externalities. In 1956 Cheminova filed for permission to extend their disposal agreements to include solid waste. A local representative from the coastal authorities reported how Cheminova's property had expanded because of buried solid chemical waste, including half-empty barrels and contaminated debris from the production.[9] Shocked by the scale and intensity of waste accumulation, the local authorities led by the Danish Coastal Protection Management, agreed to expand the permission as it posed the "least risk", especially considering the contamination of water consumed by the nearby residents and their livestock.[10] A tentative agreement for three years was turned the area into a dump site for chemical waste (Miljøministeriet 1981a, 77).

In 1958, when the agreement expired, Cheminova continued dumping waste between the dunes. By 1962, a storm had eroded one of the dunes facing the Sea and large parts of the liquid waste flowed into the sea, while the solid waste remained. Despite consistent reports from local fishers warning that Cheminova's waste management had deteriorated, the authorities nevertheless expressed surprise at the continual and illegal dumping. The storm led the local authorities to establish preventive measures, such as a fence around the dump site, a cautionary sign, and insisting on building a pipeline for sewage from the factory to the shoreline (Miljøministeriet 1981a, 52-3).

The dunes were rendered as blank spaces existing outside of Harboøre Tange. They were chosen as dumping sites based on a particular understanding of coastal dynamics, rendered as a "system", in which the sea's movement would naturally erase the waste (Andreasen 1983). This system imagined the coast as unidirectional; flowing away, absorbed, forgotten. It did not account for the return. The design excluded the possibility of reversal. Falling out of bureaucratic and technoscientific existence, the waste was assumed gone. Like amber, the toxic remnants of Cheminova became agents of environmental memory. They surfaced in response to weather and time, revealing the landscape's unwillingness to forget. Though subject to scientific categorization and bureaucratic oversight, the waste depot remained semi-visible – translucent, but not absent. It defied regulatory expectations, undermining narratives of disappearance, and became a haunting reminder of the region's entanglement with both industrial ambition and ecological vulnerability.

The storm of 1962 demonstrated the dangers of having an open pit for chemical waste, requiring the Coastal Authorities to cover

9 Report on inspection of Cheminova 1956.

10 Svendsen *Institutional Correspondance about the Prospect of a Landfill* 1956.

e-ISSN 2785-2709

the landfill with sand. Covering up the waste pit removed it from out of sight, and through the visual disappearance, it superficially and effectively removed the waste problem. This reasoning is closely associated with the ways in which specific properties are ascribed to the underground. The underground, Rosalind Williams notes, is intertwined with cultural imaginaries of industrialism and technology-induced desires for a complete mastery of nature (Williams 2008). Williams shows how the space beneath the surface was depicted as absent from time and life and consequently rendered it conquerable through technology.

Yet, like amber, the buried waste persists in silence, only to reappear through the very processes of storms, tides, shifting sands, that once helped conceal it. Both amber and toxic waste blur the lines between what is natural and what is industrial, what is past and what is present. They re-emerge as reminders that disappearance is rarely permanent and that the landscape itself stores memory – not only of life, but of violence.

The buried waste, much like amber, defied the desire for clean boundaries. It undermined the notion that harm can simply be hidden or managed through technological intervention. As translucent entities – both materially and metaphorically – they expose the porousness of containment, and the instability of the systems designed to suppress them. In this way, the underground does not erase.

Bureaucratically supported scientific investigations insisted on keeping the hazardous substance in its place. However, the chemical waste in its translucent state meant that it distorted otherwise transparent models of containment. The waste sedimented in some places but seeped and leaked into other places. It dripped and dissolved, percolated and erode, slouched and slided, and altogether escaped its confinement. And so, the submerged depot released its toxic contents out of the presumable confinement leading to the contamination that transgressed stratigraphies, revealing the circular motions of eco-systems. A leakage from the depot, contaminated a multitude of small sand eels, who were subsequently devoured by hungry terns, leading their polluted bodies to be scattered all over the area.[11]

Appalled by the radical environmental degradations and bureaucratic inertia, a group of local fishers, most prominently Rav-Aage decided to speak out against the factory's pollution, with Rav-Aage becoming one of the first publicly recognized environmentalists in Danish history.[12] Using his vernacular knowledge,

11 *Nye Problemer for Thyborøn-Fiskeriet* 1964

12 *Nye Problemer for Thyborøn-Fiskeriet* 1964; Lex Aage Hansen – ravsliber og miljøaktivist.

the same type of intimate relationship with the environment that earned him his amber-epithet, Rav-Aage identified and criticized those who claimed that the waste remained buried and isolated. It was the stench that first alarmed him and then the fish he caught that had blisters and white stains. They tasted like the rancid stench coming from the factory (Gade 1987). Drawing from his embodied history, he knew that toxic waste, like amber, surfaces after being tossed and turned by the sea. Its presence persisted beneath the surface, a slow and spectral force whose return was not just possible, but inevitable.

Successive storms accelerated the already vulnerable position of a buried depot subjected to coastal erosion, but it was institutional amnesia that unintentionally unearthed the chemical waste. The depot had been bureaucratically forgotten in 1971 when Coastal Authorities accidentally excavated the depot during shoreline maintenance. The reawakening of a forgotten chemical waste problem, catalyzed successive debates about the existence of the depot (Miljøministeriet 1981a, 125). Upon opening the depot, the waste did not appear as projected, the waste had mutated into a toxic substance described as "sticky and oily" (126). Cheminova either could not or did not want to provide information about what had been disposed, of and was ordered to exhume 1,260 tons of waste and re-deposit it on its new industrial complex adjacent to their former property. After the depot had been partially removed, a concrete lid was placed on top to solidify the boundaries between the surface and the depth in an effort to better contain the chemical waste.

The politics of containment also hinges on the stability of other natural elements. However, Vestkysten is notorious for its extreme weather – the very same conditions that return amber to land, unravelling time and toxic waste. Rav-Aage and the group of fishers turned environmentalists, nevertheless insisted that something was seeping from the depot. And that something was destroying the surrounding environment. It was, however, not only the seeping of toxic waste to all sides that concerned Rav-Aage, but the increasingly exposed position at urgent proximity to the seashore that became a primary apprehension (Gade 1987). The altered situation made the depot crawl into a different stratosphere, where the stakes had become higher. Coastal erosion had taken small pieces of land, while storms intensified the process, making the depot move increasingly closer to the shoreline. Time became an important factor, adding urgency to an already critical state. By the late 1970s, successive storms contrasted previous arguments concerning the depot's status as safe and secure. Through the course of five years, from 1978 to 1981, toxic waste leakage, storms, and the coast approximating the depot caused the media and politicians to question whether it was safely contained (Pedersen 1978; Kyrø 1981; Andreasen 1981).

Rav-Aage became an important figure in the demand for remediation of the submerged depot. He joined a group of young biologists and formed "Cheminova-Gruppen" a trans-regional, interdisciplinary, and intergenerational constellation committed to documenting the pollution coming from the depot (Østergaard, Madsen 2017). The group studied the swirl of epistemic murk flowing from the heart of Cheminova, as the management continually, and strategically, claimed none-awareness or provided imprecise and occasionally false information, upon inquiries into the status of the pollution. Ultimately, they demonstrated that the solid boundaries of the surface were, in fact, very porous. Their activism played a vital role in bringing the depot's dangers into public discourse and ultimately spurred political momentum for remediation. However, discrepancies between the materiality of the waste and its bureaucratic second life became a specter haunting the area and its inhabitants. The depot, not assumed to pose any danger, was challenged by the many cases of immediate and gradual exposure as well as immediate and long-term consequences (Kamstrup 1988).

Figure 2 Rav-Aage's vej, 2021. Thyborøn. Photograph by the Author

The story of Cheminova spirals downwards descending upon Bjarne as a legacy difficult to escape. The pollution persists, not as history, but as a toxic heritage; a haunting continuity that refuses resolution (Kryder-Reid, May 2023). Today, the three largest sites of pollution in Denmark remains. As a strange recurrence of past events, Bjarne, a bearer of intergenerational environmental injustice, is battling the same institutional and bureaucratic inertia. What remains is not only the memory of injustice but the material inheritance of over 120,000 tons of buried waste – an invisible network threading beneath the surface, always threatening to return (Andersen 2024).

Much like amber itself, dislodged by storms and returned to shore, the depot's waste re-emerged through a convergence of natural forces and vernacular vigilance. It refused to stay buried. The chemical inheritance of Cheminova, once deemed contained, became visible through signs that blurred the line between surface and depth – blisters on fish, an oily substance reappearing, and the acrid stench carried by the wind. These were translucent signals: partially legible, partially denied. The depot's material and bureaucratic translucency mirrored one another. As such, amber and toxicity operate as twin figures of return – natural and industrial archives that do not forget, even when institutions do.

5 Return

Standing on the coast, one is able to stand directly on top of the depot. It would be invisible, if not for the small signs that indicate the continuous exchange between above and below. In a small shed-like construction next to the dunes is a pump that filters water that passes through the depot. It is a material manifestation of the continuous flow between surface and depth, but also a visual reminder of the depot's existence. However, due to its camouflaged appearance, looking quite innocent, it only reveals its inner purpose to those who already know. The pump is a precautious measure intended to permanently ward off the buried chemical waste. However, every storm forewarns a return, either of amber or another environmental catastrophe.

Like amber, the depot is much studied but not fully understood. The types of knowledge produced about the depot were predominantly in the hands of assertive engineers who based their claims on monitoring and remote sensing that led to estimations, projections, and models (Lundsteen 2024a, 200-36). The epistemic virtues, based on rationality and objectivity, were not always incorrect, but they did monopolize discourses and create space for decisions about the depot's existence entirely indebted to cost-benefit analysis (Plumwood 2007; Daston, Galison 2007; Lundsteen 2024b). The techno-scientific reasonings established a truth regime that excluded other types of knowing, other archives, or environmental justice claims that insists about the link between socio-economic aspects and pollution (Rønn 2025). The other ways of knowing remain submerged hauntological figures shadowing the technical reports.

The submerged depot, probably the most famous in Danish history, is a well-known but nevertheless secret history – a translucent truth that is hard to fully comprehend even if the circumstances are well known. It is a public secret as a type of knowledge akin to a public secret, as generally known but unable to be articulated; as knowing

what not to know (Taussig 1999, 5). If not for the signs, that differ in style and content from those next to Cheminova, the 120 tons of highly toxic chemical waste buried underground, would elude attention.

And here the ontological status of the buried depot is underlined, as its history and detrimental consequences are well known, the leaking and seeping and its increasingly exposed position are also understood, but in some way, escapes awareness. The depot remains and thrives in open secrecy beneath the surface. During the sunken repository's entire existence silence has engulfed it, only broken by environmentalists who desecrated the secret and, in return, became discredited. Only the innocent looking pumping station or a sign on a little path at the very end of Thyborøn that carries the name "Rav-Aage's Vej" unearths the troubled history of the chemical depot. It is a modest monument to a person who dedicated his life to an environmental struggle and the right to live without excessive chemical pollution.

The wind does not stay silent either. The disruptive element both brings back and foregrounds the exposed state of the depot and the following claims that repeatedly emphasize that the waste is managed, monitored, and controlled. It seizes the future by re-awakening past experiences of institutional neglect or a detailed agnotology, when the relationship between chemical pollution and the high incidence of diseases in the community linked to chemical exposure, is severed. As such, the soundscapes become a provocation for thinking about toxicity and the environment, that disrupts arguments of purity, clean slates, chemicals as isolated entities floating in white space – all of which leads to notions of the existence or possibility of an "away" that does exist (Shotwell 2016; Liboiron 2021; Murphy 2022).

6 Depths

The depot has belonged to the subsurface since 1964. As a proposed solution to an increased waste problem, its existence on the surface was estimated to be too dangerous. Ideally, the toxic chemical waste was supposed to dissolve infinitely through the vast North Sea. However, the waste remained in a perilous and uncertain state, by being exposed to the water and the storms, while coastal erosion intensified an already precarious situation.

As we have seen, verticality, the relationship between surface and depth, is not an entirely innocent concept, but can become imbued with political and environmental implications when entering different constellations. For example, in Harboøre Tange, the depot contains a history where pollution is governed by a specific type of expertise that insists on the toxic chemical waste as safely stored underground. Despite numerous examples that have shown that safe, stored, and underground were not as static and stable as argued.

The storms, however, do not solely bring a once-buried chemical horror back into existence, they also mediate chance encounters by lifting and bringing fossilized resins to the coastline. The serendipitous contingency of finding amber emerges as a material reminder of the inevitable returns of natural processes. It is not the storms themselves that hold an inherent cruel agency, but rather the initial catastrophe of burying an enormous amount of chemical waste on the coastline that is replaced by the tragedy of ignoring its existence and the consequences that entails. And as an ironic twist, driven by the thirst for growth causing climate emergency are also the very same processes that cause the storms to increase and intensify.

We have deliberately introduced a distorted element to your reading experience in the form of a sound piece. It is centered around field recordings taken from walks on Danish beaches, on windy as well as serene days. This juxtaposition between the storm and the calm is especially important to convey, because it touches on the idea of an idealized, good and noble nature. Characteristics which help shape the notion that nature's sole value is instrumental – existing either for pleasure or profit, and otherwise to be abandoned and/or destroyed.

The sound piece accompanies translucence as ways to think about how our perception of environmental issues is mediated through sonic, cultural, political, and economic filters that distort or reframe ecological realities. Moreover, translucency frames environmental knowledge as existing on similar gradients between opacity and transparency, acknowledging the limitations of complete environmental understanding while rejecting total relativism.

Light diffusing through amber is a way of thinking about permeability, boundaries, and partiality. The passage of light, as with the containment of chemical waste, is neither separation nor total submergence but is always in connection with others as the pollutants continually cross these conceived and constructed thresholds. The physical properties of translucent materials: diffraction, refraction, scattering, is an apt prism that reveals how pollution disperses, accumulates, and transforms across different contexts and timeframes. Locating and polishing amber by eradicating the surface and revealing a translucent light provides us with a better understanding of vernacular knowledge of the surrounding environment, and that returns are always possible. Even if it has been gone for timescales beyond our comprehension. Furthermore, the partial visibility resonates with the responses to the incidences of pollution, where the effects of the buried depot are not always visible or immediately detectable, implying the perceptions and responses to ecological threats.

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e-ISSN 2785-2709

Lagoonscapes
Vol. 5 – Num. 1 – June 2025

Rotor – Entangled Matter

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Abstract This visual essay showcases material from an exhibition displayed in Brussels in autumn 2024. The exhibition featured films created for the occasion by Bêka & Lemoine, as well as exhibits borrowed from the collections of Rotor, a Brussels-based collective research and design practice. These movies and objects were accompanied by wall texts and captions, which are reproduced here in an adapted version. The exhibition presented sites where materials are produced, transformed, reused or disposed of within a 200 km radius of Brussels. It addressed the complexity that characterises the organisation of material flows in the current economy. The stills from Bêka & Lemoine's films and Rotor's texts intertwined to create narratives that address various issues, such as the scale of industrial activity, the relationship to work, the role of machines, waste management and the impact of material movement on the landscape.

Keywords Waste. Salvage. Reuse. Material flows. Spoil tip. Quarry. Mining. Underground. Entanglement.

Summary 1 Introduction. – 2 The Becoming and the Unbecoming of Waste. – 3 The Wealth of the Underground. – 4 When a Quarry Exploitation Transforms into Salvage Centre.

This content was first displayed for the exhibition *Rotor – Entangled Matter*, produced by *Architecture A+ in Belgium* and Bozar. The exhibition benefited from the public support of Vlaamse Overheid, Fédération Wallonie-Bruxelles, Vlaamse Gemeenschapscommissie (VGC).

Edizioni Ca'Foscari

Peer review

Submitted 2025-03-21
Accepted 2025-05-20
Published 2025-07-21

Open access

Citation Ghyoot, M.; Vande Capelle, A.; Van Kan, V.; Schoonjans, T. (2025). "Rotor – Entangled Matter". *Lagoonscapes*, 5(1), 159-178.

DOI 10.30687/LGSP/2785-2709/2025/01/007

1 Introduction

In autumn 2024, the journal *A+ Architecture in Belgium* and the arts house Bozar presented the exhibition *Entangled Matter*, in which the Brussels-based non-profit organisation Rotor reflected critically on its practice. Rotor is a cooperative design practice that investigates the organisation of the material environment. It develops critical positions through research and design. Besides projects in architecture and interior design, Rotor also produces exhibitions, books, economic models and policy proposals.

The exhibition was built around a series of nine films commissioned from the film duo Bêka & Lemoine. Entitled *Transmutation*, the series dialogues with objects from Rotor's collections (images, material samples, publications, archives, etc.).

The exhibition presented sites where materials are produced, transformed, (re)used or disposed of, in a radius of 200 km around Brussels. This approach is in line with Rotor's aim to better understand how material flows are organised today: where do goods come from, how they are produced, how they are disposed of and where they usually end up. Most of these flows start from some sort of underground 'reservoir', where 'raw materials' are extracted to produce goods, and tend to end up there too, in various types of landfill. It is what happens in between that interests us the most. Some material pathways can be highly complex, with multiple passages to and from the subsurface, but also dispersal into the atmosphere (usually through a combustion process) and into the landscape. Although we like our exhibitions to be descriptive, evocative and largely open to interpretation, our practice aims to reshape some of these pathways and the models on which they are based, to make them less damaging to the web of life on Earth. Keeping existing goods in circulation through subsequent reuse cycles is one possible strategy to do this. Since its inception, Rotor has played a key role in promoting reuse through diverse activities, such as launching a salvage company in Brussels, helping various building professionals adopt reuse, developing diverse solutions to facilitate reuse, and encouraging public authorities to adapt regulatory frameworks to encourage reuse. Taking a step back from these operational missions, the exhibition highlighted the value – but also the limitations – of efforts by Rotor and others to promote alternative ways of circulating materials, particularly through various forms of reuse.

The films and the artifacts on display spoke to the complexity that characterises the organisation of material flows in the current economy. They weave together entangled narratives that address broader issues: the scale of industrial activity, the relationship to work, the impact on the landscape of the movement of materials, waste management, the changes brought about by climate change,

the role of citizens' initiatives and the possible trajectories of infrastructure conversion.

What follows is a selection of three from the nine sites on display in the exhibition. They specifically highlight aspects of the relationship between the industrial process and the underground – both as a source of 'raw materials' and as a destination for various types of waste.

2 The Becoming and the Unbecoming of Waste

Discarded elements – post-consumer waste, surplus materials, leftovers, 'excreta', etc. – are the inevitable counterpart of production and consumption. However, 'discarded' is not a fixed identity. Waste can be reintroduced into industrial processes when the context changes – e.g. technological developments, price fluctuations, changing standards, etc. – and when it meets industrial characteristics – e.g. large quantities, concentrated reservoirs, predictable characteristics, etc. These practices are as old as industry itself.

The Carabinier mine was located in the heart of the Belgian coal region around Charleroi. It was exploited between 1918 and 1955. The fraction of shale with too low a coal content was dumped on the surface and in the former clay pits left behind by a previous brickmaking activity, gradually forming the spoil tips so typical of coal mining areas. During its years of exploitation, the Carabinier mine produced two spoil tips called Terril n°1 du Carabinier and Terril n°2 du Carabinier. Today, it is the latter that is being exploited.

Black shale can still contain between 5 and 15 per cent of coal, probably considered too low a density when richer veins were easily accessible, but not negligible either, especially as energy prices rise. It is commonly used for its energetic power. Red shale is the result of a phenomenon called subterranean combustion. The complex combination of water, oxygen and iron sulphide can provoke exothermic reactions that burn the remaining coal. The shale then takes on a beautiful reddish hue. It is commonly used in the ceramics industry, to make bricks and tiles, for instance.

e-ISSN 2785-2709

Figure 1 The owner of a company that recovers shale from a former spoil tip

Figure 2 Two workers repairing a sieving machine

e-ISSN 2785-2709

Figure 3 View on the different machines used for processing black and red shale

Figure 4 The owner of the company is showing the central piece of an industrial crusher

e-ISSN 2785-2709

Figure 5 View on the conveyor belts used for processing shale

Figure 6 Processed red shale, ready for pick-up

Figure 7 Black shale from the spoil tip

Figure 8 Pile of red shale

The extraction of black and red coal shale from the Terril n°2 du Carabinier has been carried out since 1988 by a local family business, Immobilière du Terril De Pont-de-Loup Sc. Their activity consists mainly in excavating the spoil tip, sorting the shale, sieving it, crushing it and re-sieving it to obtain granulates with the desired dimensions and characteristics. Extraction can only take place when the weather is fine and the spoil tip is relatively dry. It is then that they build up stocks to sell during winter. A very large part of the original spoil tip has been processed over the last four decades.

In less than a century, the village of Pont-de-Loup has seen a small mountain, almost 120 metres high, form and erode at an accelerated rate! First, the industry dug into the soil to extract clay. The resulting holes were then filled with waste from underground mining activities. This waste was so abundant that it formed high mounds across the landscape. These mounds were then recognised as potential reservoirs of resources. Exploiting them transformed this stock of sediment into a flow of industrial resources that end up in various types of product, some of which, like concrete, will return below the surface of the ground for foundation or filling work. The industry terraforms the topography of the landscape, and the limit between what is above and below ground shifts with it.

3 The Wealth of the Underground

The exploitation of subterranean wealth relies on the 'work' of biogeological forces that shape a wide range of materials, from the most mundane to the most precious. Since the Renaissance, the subsoil has increasingly been seen as an inert reservoir of exploitable resources. Although it still prevails in industry and public policies, this view is being challenged in favour of a more cautious approach to the complex nature of the underground.

The last underground quarry in Belgium is located in Golzinne, in the province of Namur, where the Mazy black marble is extracted, world famous for its incredibly fine grain. The quarry has been owned by the Merbes-Sprimont company since 1928. On average, 250 m^3 of rock is extracted annually from the quarry, of which 10 to 15 per cent can be sold after processing. This amounts to around 800 tonnes. In the stone industry, where large volumes of soil and rock have to be moved to get to the commercially viable part, these fractions are quite common.

Some traces on the walls of the quarry testify to earlier phases of extraction, with marks left by hammers, drills and other early mining equipment. The quarry follows the approximately three-metre-high stratum of marble. This bank emerges at the surface, where an open-cast quarry was originally exploited. It then sinks into the ground at an incline of almost 30 per cent. Continuously operating water pumps have allowed the quarry to be dug down to a depth of 90 metres. A large, semi-automatic chainsaw machine is now used to excavate and cut the blocks, following a room and pillar principle, when some parts of the stratum are left untouched and serve as pillars supporting the overburden.

e-ISSN 2785-2709

Figure 9 View of the room and pillar system in the underground quarry of black marble

Figure 10 The automated saw used to cut the blocks of black marble

e-ISSN 2785-2709

Figure 11 Working to extract blocks of black marble

Figure 12 Use of wedges to detach a block of black marble

Figure 13 Drilling holes to detach a block of black marble

Figure 14 The bulldozer is used for moving blocks and many other tasks

e-ISSN 2785-2709

Figure 15 View of a room where black marble blocks are extracted

Figure 16 Workers of the underground quarry

e-ISSN 2785-2709

Figure 17 Worker of the underground quarry

Figure 18 One of the exits of the underground quarry

e-ISSN 2785-2709

Figure 19 The main exit of the underground quarry

Only four people are currently involved in the extraction of the rock and its subsequent processing into blocks. Despite the company's best efforts to make work easier and to maintain the highest safety standards, working conditions underground remain difficult. The company is struggling to recruit staff. The concession granted to Merbes-Sprimont covers 120 hectares, of which only four are currently being exploited. The rate of exploitation depends on many factors, but mainly they do not want to extract more than is absolutely necessary to meet market demand.

The profitability of the operation is due to the Mazy marble's unique aesthetic. It has often been used above ground in prestigious projects that take advantage of its unique surface – from the Palace of Versailles to the very building where the Entangled Matter exhibition took place, Victor Horta's Centre for Fine Arts in Brussels. Today, it is much sought after for the restoration of historical monuments but also for contemporary design projects. It is not uncommon to find small batches of this marble on the reclamation market, where its high cultural and economic value almost always justifies its salvage.

4 When a Quarry Exploitation Transforms into Salvage Centre

The salvage of building materials for reuse follows a different logic from that of industrial production and waste management. Materials typically come from many small, dispersed sources. They require specific spaces, logistics, skills and know-how to collect, store and process. Salvage practices show a rich gradient between purely artisanal models and more pronounced forms of industrialization. Overall, they provide useful tools for rethinking how to engage with materials.

Figure 20 Heaps of reclaimed cobblestones

Figure 21 Blocks of stone reclaimed from maritime infrastructure

e-ISSN 2785-2709

Figure 22 Reclaimed cobblestone stored in a sandstone quarry

Figure 23 An operator of the cleaving machine that cuts rubble stone to size

e-ISSN 2785-2709

Figure 24 An operator of the cutting machine that is used to process reclaimed stone blocks

Figure 25 Conveyor belt used to sort salvaged paving elements according to type and dimensions

Carrière de la Hazotte is a family business that sells paving materials. Some of its stock is new material fresh from their quarry, but much of it are materials reclaimed from roadworks. As the company name suggests, it was originally a sandstone quarry. Although the quarry is still operational, it is now mainly occupied by heaps of paving stones salvaged from towns and cities in a radius of around 200 kilometres from the quarry's location.

This combination of extraction and salvage is not new for this business. The current owners, the Verhoeven family, bought the quarry in 1968. At the time, it was producing stone aggregates at full capacity, mainly for use in the construction of surface infrastructure

such as motorways and roads. However, this flow was suddenly curtailed by the 1973 oil crisis and the subsequent stop of roadworks (which needed oil not only for the various engine-driven machines but also for asphalt production). Mr. Verhoeven senior quickly had to look for other sources of income. He found them in the salvage and sale of various building materials.

Gradually, the company has focused on reclaimed pavement materials, where it has developed solid expertise. A stonemason works part-time for the company, re-cutting blocks from stones that are salvaged here and there. Over the years, the company has acquired a range of machinery to process the materials, new and reclaimed alike.

Salvaging, processing and sorting these inherently robust materials is often quick and easy (provided the correct equipment is available). However, their reuse potential is widely ignored in public tenders which prioritize the speed of roadworks, or even explicitly excluding reuse altogether. As a result, the local supply of salvaged pavement materials has been declining for some time in Belgium. Furthermore, specialized companies sometimes have to export to other continents. Competition from cheap new materials quarried in regions where labour is much less costly or from concrete paving often limits the sale of salvaged elements to specific applications where their rustic appearance is of value.

References

One of the rooms on the exhibition circuit showcased a selection of books that were used for the project. This installation was designed to provide references on the different topics covered in the exhibition, as well as offering opportunities for further reflection. Although the present essay does not adopt the format of a more conventional scientific contribution, it seemed useful to reproduce the list of books that were on display.

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e-ISSN 2785-2709

Lagoonscapes
Vol. 5 – Num. 1 – June 2025

We Are Tectonic!
A Queer Geophysics for Intra-Solidarities and Resisting the Cloud Regime

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Abstract This paper analyses how Big Tech and global consultancy firms are asserting control over carbon removal certification and governance through infrastructure solutions and technical standards. We argue that defining gaps in the underground constitutes a global takeover of material sovereignty, encompassing both knowledge and geological formations. We unearth Big Tech's strategies of infra-solutionism to demonstrate, drawing on the work of inhuman geographer Kathryn Yusoff, how this takeover reinforces geological grammars and essentialises racialised and sexualised categories that disconnect us from the Earth. Drawing on queer poetry together with work of Marxist agronomist Amílcal Cabral we advocate for resistance to dominant geopower and form transnational solidarities against the cloud regime.

Keywords Infra-solutionism. Carbon Removal. Queer Geophysics. Material Sovereignty. Big Tech. Racial Capitalism.

Edizioni Ca'Foscari

Peer review

Submitted 2025-04-01
Accepted 2025-07-10
Published 2025-07-21

Open access

Citation Pritchard, H.V.; Snelting, F.; Gürses S.; Rocha, J.; Aouragh, M. (2025). "We Are Tectonic! A Queer Geophysics for Intra-Solidarities and Resisting the Cloud Regime". *Lagoonscapes*, 5(1), 179-204.

DOI 10.30687/LGSP/2785-2709/2025/01/008

1 Introduction: Filling the Gaps

This paper analyses how Big Tech and global consultancy firms are asserting control over carbon removal certification and governance by constructing infrastructural solutions and technical standards. This takeover aims to secure financial gain and energy security through naturalising their control of geological resources and subsurface space, potentially displacing existing ecologies and local claims. We argue that defining gaps in the underground constitutes a global takeover of material sovereignty, encompassing both knowledge and geological formations. The paper has three main objectives: firstly, to reveal Big Tech's strategies of what we have termed 'infra-solutionism' in geology, geoengineering, climate governance, and climate science to ensure their longevity and spatial energy needs; secondly, through engaging with the work of inhuman geographer Kathryn Yusoff demonstrate how this takeover reinforces what Yusoff terms "geological grammars" that essentialise racialised and sexualised categories and disconnect us from the Earth (Yusoff 2024, 5); and thirdly, to advocate for the development of "other geophysics of sense" (53) as a form of resistance and to assert material sovereignty above and below the surface, drawing on queer poetry, the work of Yusoff and the work of Marxist agronomist Amílcal Cabral.

Our research emerges from a series of disobedient action research practices (Pritchard, Rocha, Snelting 2020) which aim to foster material resistance against the financial and technological exploitation generated by subsurface computation. It is based in our work as The Institute for Technology in the Public Interest (TITiPI), a transnational gathering of activists, artists, engineers and theorists who follow a public interest perspective to reject what we refer to as the infra-solutionism of Big Tech. Inquiring into the underlying power structures in scenes of extraction; desiring to dismantle harmful infrastructures and their political economies. We seek to offer a counter grammar of the underground through these disobedient action research approaches and speculate through animation, poetry, queer stories and bug reporting below and above the surface to consider forms of solidarity and vulnerable porosities of these scenes. In the face of what we see as the narrative takeover by McKinsey, Stripe, Google and Meta, we propose counter consultancies to resist their greenwashing tales which seek to continue fossil fuel extraction by developing so-called 'green' and 'net zero' infrastructure through carbon dioxide removal.

We argue that Big Tech infrastructures – what we refer to as the cloud regime – attempt to obliterate life and shatter earthly relations with such force that materially requires cracking the earth's core and flushing out everything in its path, grabbing

land, draining groundwater and diverting renewable energy away from local communities. We discuss how currently the dominant imaginaries of the 'twin green and digital transition' in the EU and UK together with concepts like 'net zero', 'urban regeneration' and 'climate neutral (AI) Artificial Intelligence' are deeply tied to an extractive understanding of the underground and dependent on racial capitalism.

In the first part of the paper, we gather queer imaginaries of 'below the surface'. Aiming to counter the narratives that below the surface is absent of life and ahistorical to move beyond a purely ontological understanding of the underground to an epistemological and affective one. This shift to epistemology focuses on how we come to know and feel the underground, including subsurface feelings. We outline how this is crucial for countering and rising-up against the economic rationales often used to justify infra-solutionism of the cloud regime. We want to bring our collective energies to what literary scholar Lara Cohen outlines as Sylvia Wynter's calls for unfolding the nascent modes of sociality of the underlife and the counterstruggle (Wynter 1979 in Cohen 2022, 48). As "not just a resistant force but a wholly different concept of life […] both lived experience and as-yet-unrealized modes of existence" (Cohen 2022, 48).

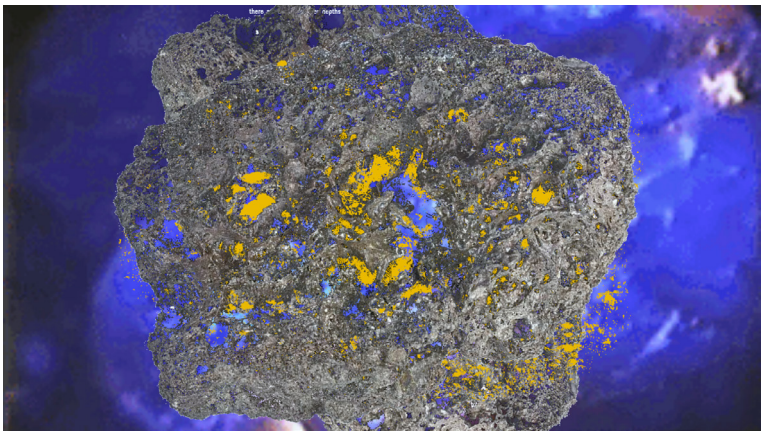

Figure 1 The Underground Division, *Crystal Mutual Aid: Deplacement*. 2025. Cascading animation, screenshot. https://ddivision.xyz/rockrepo/crystals, cc4r

This story begins in an 'airtable' filled with carbon dioxide removal gaps. Entries in this online hybrid spreadsheet-database list technological and financial interventions for reducing carbon levels above the earth's surface, what we term infra-solutions. The 'gap fillers' for carbon dioxide removal include proposals for; legislation and regulations, for skillset acquisition and for technologies that

build, scale, and reduce the cost of carbon removal pathways.[1] The table is hosted by the privately owned 'Frontier Climate'. Frontier Climate is a for-profit company owned by fintech giant Stripe Inc. founded with global Big Tech corporations, Google, Meta, Shopify and global consultancy firm McKinsey.[2] The aim of the airtable is to invite collaborations on identifying the knowledge, technical and governance gaps in carbon removal economies. The 'carbon dioxide removal gaps table' poses as a resource to provide 'quicker' ways for research labs to orient their research, or 'faster' processes for policy makers to understand what's missing. Gaps can be filtered by policy or technical view. The team at Stripe Climate, Frauke Kracke, Joanna Klitzke, Nan Ransohoff, write "to make the initial list of 100+ gaps navigable, each one is tagged with attributes to help orient a user to the gap, how impactful it would be if filled, and who might be best positioned to fill it" (Kracke, Klitzke, Ransohoff 2022).[3] At Stripe Climate they use the description of a gap to demarcate what they see as both an absence of knowledge, governance, or technical skills on carbon dioxide removal. Such as a knowledge gap on the impacts of carbon dioxide removal – "the effects of pore clogging and cracking, during circulation of carbon dioxide rich fluids through subsurface mafic and ultramafic rocks" or "assessing the feasibility for geological storage of carbon dioxide in so far unexplored locations and rock formations" or a governance gap such as "resolving legal challenges and developing frameworks for geochemical carbon dioxide removal at scale (contamination)" (Kracke, Klitzke, Ransohoff 2022).[4] Despite the seeming openness around who might be positioned to fill these projected gaps there are designated categories of which organisations should be doing the work, primarily government and academia, together with a secondary layer listed as start-ups, philanthropists, and established industries. We argue that the institutions Frontier Climate aims to pull into these processes form an experimenting-with both academic and governance spaces. Research and advocacy institute TNI (Transnational Institute) has described these types of processes as part of the global takeover by "multistakeholder initiatives MSIs" (Manahan, Kumar 2021). Indeed, in their investigative mapping of MSI's power in global governance, Mary Ann Manahan and Madhuresh Kumar identify that many of these consortiums are focused on "gaps, 'burning' issues of the day or un-governed tasks in global governance" (Manahan, Madhuresh

1 See the full airtable at: https://gaps.frontierclimate.com/.

2 To read the full description see: https://frontierclimate.com/who-we-are.

3 For more on the CDR gap database see: https://frontierclimate.com/writing/cdr-gap-database.

4 See the full description here: https://gaps.frontierclimate.com/.

2021, 31). Often using planetary crisis as an entry point these "gaps" refer to areas where existing governance is seen as insufficient or absent (Manahan, Madhuresh 2021, 31). The gaps that Frontier Climate want to enrol institutions and academics into – through their research, design and engineering proposals – are not just conceptual gaps but are material power grabs. Seeking to gain control over both the discourse on climate crisis and the earth's subsurface in ways that cross the boundaries of nation-states and involve a deep rendering of corporate, international, and even geological forces. This intensified greenwashing and exploitation of the subsurface for the extension of Big Tech and carbon dioxide removal potentially challenges the geopolitical imaginations of territorial and resource sovereignty. The drive by corporations such as Stripe together with McKinsey, directly raises the question of control over the underground in sites where these companies are proposing developments, but also the influence of both the US and EU in these spaces.

This paper focuses on the infrastructure (including software) of Frontier Climate and its expansion in both the EU regulation space and the 'Carbon Valley', Nairobi, Kenya, a proposed industrial hub which aims to turn carbon emissions into financial opportunities and renewable energy offtake agreements for artificial intelligence, cloud computing, cloud storage, crypto-mining and others. We trace how Frontier Climate and it founders, Big Tech corporations, Google, Meta, Shopify and global consultancy firm McKinsey, attempt to re-crack the sub/surface in Carbon Valley to 'permanently store' carbon in the deep basalt strata in the Kenyan Rift Valley through an extension of financial payment infrastructure and cloud regimes.

Carbon Valley is close to the Kenyan rift valley which is "characterized by diverse geology, including crystalline, volcanic, and metamorphic rocks, shaped by tectonic activity leading to complex faulting and fractured zones" (Khan, Nakayama, Nakaya 2024). These fractured zones in hard rock serve as crucial groundwater reservoirs in an area in which climate shocks, and droughts are magnifying local tensions and conflict. It is also an area in which the violences and harms of carbon offsetting projects[5] have been extensively documented. In the Kenyan territory there has been resistance and campaigning against many carbon offsetting regimes, regimes that advocacy group Survival International have termed 'blood carbon'. In the north of the territory activists recently delivered a huge blow to a flagship carbon offset project run by Northern Rangelands Trust (NRT) used by Meta, Netflix, British Airways and other multinational corporations. The NRT's carbon offset project is reportedly the

5 Carbon offsetting is related but differs from CDR in that it doesn't claim to remove carbon from the atmosphere.

largest soil carbon capture project in the world.[6] However, in 2023, after a report by Survival International accused the company of overestimating its carbon offsetting and violating Indigenous rights, the certifying body Verra suspended credit issuance from it before later reversing course.[7]

Despite the legacies of harm from carbon capture, Frontier Climate and Carbon Valley seek to offer yet another route for carbon removal credit certification, led by McKinsey. This points to carbon removal being part of an ongoing cookie-cutter urban replication of temporal and anticipatory infrastructure promoted by McKinsey consultants in Nairobi (Smith 2017, 38). Urban fantasises, and future vistas that have been proliferating in Kenya for the last two decades schemes and through the specific corporate practice of McKinsey consultancy (Smith 2017, 32).

Through a discussion of Frontier Climate's infrastructure and the Carbon Valley proposal we anticipate future struggle and question whose bodies are touched by the violence of infra-solutionism. Tracing how these infrastructures force displacements. Whilst also expanding the ongoing extractive violences between above and below the earth's surface, to meet the huge demands of energy use by AI and the cloud regime. We conclude by drawing on queer poetry in conversation with Cabral's environmental politics (see Carreira da Silva, Vieira 2025), proposing ways to come to a practice of resistance which counters the language of extraction – and the extraction of language – with expressive practices to inaugurate transnational and porous solidarities above and below the surface.

2 Queer Grammars of the Gap

Although queer theory might not seem like the most obvious choice to intervene in this space, we see it as one of the important approaches in our work, because it works to denaturalize and politicise nature, natural resource and undergrounds. Queer theory also brings sensibilities that help to reject monoculture approaches to life and to the interlinked ecocidal and epistemicidal violences. In this section we bring this into contact with Cabral's writings and practices. Particularly his framing of resistance and the care for soil ecosystems – what he referred to as in-submission (Carreira da Silva,

6 See the full article at: https://www.business-humanrights.org/en/latest-news/kenya-court-halts-flagship-carbon-offset-project-used-by-meta-netflix-british-airways-over-unlawfully-acquiring-public-land-without-community-consent/.

7 https://news.mongabay.com/2023/03/carbon-credits-from-award-winning-kenyan-offset-suspended-by-verra/.

Vieira 2025). In-submission was a core part of Cabral's critical theory to generate better conditions for living through reimagining our relationship to nature and the environment. In-submission creates a very different geometry than gaps, whether in basalt or epistemically. Like the deep time water that is inseparable from basalt in porous undergrounds, in-submission is "rather than either or, inside or outside, in-submission is both, and it is both at the same time. Put another way, for Cabral, 'Man' is both part, and *not* part, of nature; both nature, and its antithesis" (Carreira da Silva, Vieira 2025, 20). For Cabral it is through this in-submission as a practice of caring for soil, that practices of insubmission to colonialism might be nurtured.

Figure 2 The Underground Division, *Crystal Mutual Aid: We Are*. 2025. Cascading animation, screenshot. https://ddivision.xyz/rockrepo/crystals, cc4r

Approaching transitions, climate crisis and dispossession through in-submission and queerness might resource our intersectional and transnational resistances and solidarities. It might also provide some pleasure and radical kinship (Aouragh 2023) with each other for continuing in our struggles. Through radical kinship, queer geochemistry, queer poetry and Black expressive culture we can find the practices that work on the importance of valuing life and living. As digital anthropologist Miriyam Aouragh writes to keep close that the "[b]asic principles of respect, and acknowledging race, class, gender, ability as socially reproduced and intersectional, are values to fight for" (Aouragh 2023).

Seeking to work on how queer theories help build an analytical repertoire of intra-solidarity between above and below the surface, we focus on the grounded scene of gap opening and filling by Frontier Climate, in the basalt crystal underground of the Kenyan Rift. As

artist, media theory and Black studies scholar Romi Ron Morrison writes allowing us to develop infrastructural practices that

> refuse imaginations of the world by which calculable measurement is the only relationship between things and pushes us to meaningfully engage difference as a relationship that we are entangled within. (Morrison 2022)

This intra-solidarity builds on the disobedient action research practice of TITiPI in developing the Frontier Bugreport (2024),[8] a collective research report written over three months of online writing workshops and a series of semi-structured conversations with activists, climate scientists, engineers, agroecologists and economists on the infrastructure of Frontier Climate and including discussions with the Programmable Infrastructures Group led by Seda Gürses and their ongoing work on computational infrastructures and their political economies.[9] In addition, it involves an infrastructural study that draws on queer theory for geophysics speculations that unearth the material and affective infrastructures of Frontier Climate, through analysis of contracts, policy expert group minutes, software repositories, corporate reports and industry literature. Our problematising of 'gap-filling', and greenwashing by Big Tech and financial actors directly addresses our concerns for more just presents, including the abolition of environmentally damaging cloud regimes. To glimpse what Morrison describes as "radical reimagining and visceral reconnection" to our surrounds (2022).

> *we won't say love because it is*
> a difference between vertex and vertices –
> the number of surfaces we break
> enough or many to make the lake
> *loosened from the rock*
> one body's dearth is another body's ache
> *lay it to the earth*
> (extract from "Lake-Loop" by Natalie Diaz, 2020)

Loosened from the rock and laid to the earth, transversally attending to gaps, verticality and volumetrics has given rise to many queer interpretations of the mineralised underground. Getting to know, protect and release the political possibilities of the flows above and

8 https://titipi.org/pub/Frontier.pdf and updated version forthcoming with Logi(c)s, 2025.

9 https://www.tudelft.nl/tbm/onze-faculteit/afdelingen/multi-actor-systems/onderzoek/projects/programmable-infrastructures-project#c938671.

below ground have included textured touching (Ballestero 2019); carboniferous love and insensible cusps (Yusoff 2013); rock crushes and stone butches (Chen 2012); necessary fracturing (Diaz 2020); leather vest granite dykes in *Dyke (Geology)* (Imbler 2020); and stories of fugitive porosity (Morrison 2022) to name just a few. A resistance both to the violence of extraction and racial capitalism *and* as a way to imagine other ways of relating to the earth's mineralised depths as a form of poetic in-submission.

More of an epistemology than an ontology, queer theories engagements with subsurface feelings, have been less about filling the ontological gap of the underground as lively and dynamic and more about building an analytical repertoire of intra-solidarity between above and below the surface. As Kai Bosworth writes "ascription of liveliness to *all* subsurface relations risks flattening the multiplicity of rhythms or temporalities at work, which still include some materials which *resist* liveliness" (Bosworth 2024). Instead, these queer theories generate a collective grammar that work towards countering what Kara Keeling calls the "quotidian violence" of extraction and financial capitalism (Keeling 2020). *Crystal Mutual Aid*, the cascading animation that accompanies this paper in the form of seven screenshots, is part of the work of creating other glittering visions and grammars, an approach we have been developing in the transfeminist visual research and queer poetry *Rock Repo*.[10] Queer theorist Lauren Berlant wrote "it matters to fight for better normative representations of the social, not just because they provide the affective satisfaction of being-in-common but because they affect the very infrastructure that organizes time, health, care, intimacy" (Berlant in McCabe 2011). This is what we aim to do in the *Rock Repo*. The thick animated descriptions of carbon injections, aquifers, ewaste fossils, carbon endings that form the *Rock Repo* are more unruly representations or thick stories, and their computational modelling both articulates and disarticulates the social and the material – fossil fuel racial capitalism and infrastructures of empire (Aouragh, Chakravartty 2016).

10 To learn more about this approach see `https://ddivision.xyz/rockrepo/`.

Figure 3 The Underground Division, *Crystal Mutual Aid: Ready*. 2025. Cascading animation, screenshot. https://ddivision.xyz/rockrepo/crystals, cc4r

Much like Jose Muñoz's description of queerness we work to keep the connection between the material and the social in these queer scenes. To deal with geochemical matter as unknown, untouchable, porous, fugitive and felt as a warm illumination imbued with potential (Muñoz 2019, 1).[11] As Nathalie Diaz (2020) writes;

> what it means to be made
> to be ruined before becoming – rift
> glacial, ablation and breaking
> lake-hip sloping, fluvial, then spilled
> (extract from "Lake-Loop" by Natalie Diaz, 2020)

Geophysical porosity, permeability and chemistry provoke the imagination of queer life thriving in the historical waters of rocks, a queer geophysical dis/inheritance (Nguyen 2020; Lehman 2024). These queer geochemical scenes create quite a different imaginary of the underground and imagine the porosity of undergrounds to shelter marginalised life and make possible life and living. In their discussion of Networked Intimate Publics T.L. Cowan and Jas Rault write about science fiction writer N.K Jemisin's crystal city. The subterranean community called Castrima is "a hidden place that is built and sustained by the energies and skills of the most powerful, rare, reviled, and endangered specimens of humanity: the orogenes"

11 "Queerness is not yet here. Queerness is an ideality. Put another way, we are not yet queer. We may never touch queerness, but we can feel it as the warm illumination of a horizon imbued with potentiality" (Muñoz 2019, 1).

(Cowan, Rault 2025, 129). Interpreting it as a place of glittering mutual aid which "conjures the feeling of being welcomed into the secret inner world that sparks this place into life, of seeing what has been and is being built by the people who make it, protect it, and keep it running" (Cowan, Rault 2025, 131). These are all processes that can also be understood as remaking our relationship with mineralised life and forms of holding the constant construction/deconstruction of earths materials at the heart of Cabral's concept of in-submission. Within this framework, "crystal mutual aid" (Cowan, Rault 2025) emerges as a speculative figure of queer existence, glittering technologies of survival, mineralised solidarity and of potential deep time alterities that lie above and below the surface. Like the acts of imagination in nineteenth century theories of the underground, queer theories of the sub/surface make up a queer geophysics which seems to insist "there are always further depths to go" (Cohen 2022, 16).

3 The Financial Frontier of Carbon Removal: Making and Filling the "Gap"

> The world is awful. The word is better. The world could be better. […] For an orientation to the type of questions we need to collectively address, explore the categories below […] Find relevant gaps using the filters, add/edit/upvote gaps, and take action to fill them/Please liberally edit existing gaps, or let us know about gaps that are missing altogether. Questions? Interested in collaborating on these problems?[12]

This exert might sound like a community organising session or a university research workshop, but instead these orientations are the words of Frontier Climate in their bid to create a dynamic database on the technical and governance gaps for carbon removal economies, framed as a negation of the current state of research. It poses as a resource providing quicker ways for research labs to orient their research, or faster ways for policy makers to understand what's missing. Gaps can be filtered by policy or technical view. This is not simply the case of crowd sourcing the gap in the market, or making the market in the gap, but instead is part of a continuous growth model of these infrastructures to transform the conditions of academic research and climate action. The database works to craft a specific gap in service of their growth.

12 Remix of the Frontier Climate annual letter and the Frontier gaps database manual.

In the section that follows below we show how Big Tech corporations like Stripe are actively "making research gaps" to create markets and opportunities for profit, specifically in carbon dioxide removal and within the fossil fuel industry. This concept of the "gap" as something to be identified, modelled, bridged, governed, and profited from might be understood as a volumetric understanding of what TNI describes as 'the great takeover' of global governance by MSI's. Frontier Climate provides the possibility for corporations to takeover "gaps" in global governance or inadequate responses to global problems to promote their own agendas and solutions (Manahan, Kumar 2021).

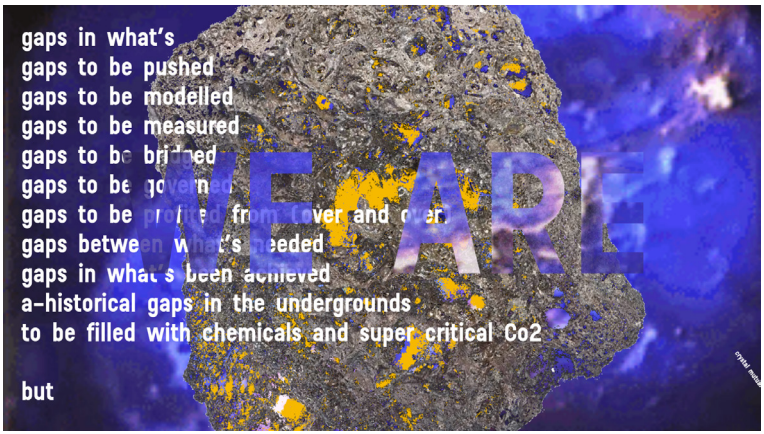

Figure 4 The Underground Division, *Crystal Mutual Aid: Gaps*. 2025. Cascading animation, screenshot. https://ddivision.xyz/rockrepo/crystals, cc4r

Convening stakeholders and producing knowledge, MSI's effectively frame the problems and the ways to address them in line with their interests (Manahan, Kumar 2021). Queer geophysics provides a set of resources to argue that the type of gaps Frontier Climate and their consortiums are attempting to force are not just a neutral ahistorical absence, but a discourse employed by corporate and financial actors to frame problems, identifying opportunities for intervention and profit, and justifying the development of new technologies, policies, and infrastructures, often with significant implications for the environment and existing ecological systems, including above and below the surface.

Frontier Climate is not simply another case of crowd sourcing the financial gap in the market, or making the market in the gap, but instead is part of what Gürses has described as a continuous growth model to transform the conditions of production and research. In this case Stripe and Frontier Climate seek to transform the conditions of production in fossil fuel industry, environmental science and

climate mitigation governance. The head of research at Stripe, Kracke describes the database as a "demand 'pull' – a technology-neutral signal to entrepreneurs and researchers that there is a market for what they're building" (Kracke, Klitzke, and Ransohoff 2022).[13] Their database works to force specific gaps to extend the horizon of extraction. From the perspective of corporate actors like Frontier Climate a "gap" is framed as a technical or governance deficiency in areas like carbon removal. Frontier Climate aims to create a "dynamic database on the technical and governance gaps for carbon removal economies" suggesting that "gaps" are seen as areas needing research, development, and policy frameworks (Kracke, Klitzke, Ransohoff 2022).[14] Specifically Stripe's operations can be understood in terms of gaps to be pushed, gaps to be modelled, gaps to be measured, gaps to bridge, gaps to be governed, and gaps to be profited from (over and over), gaps between what's needed and what's been achieved and most of all ahistorical gaps in the undergrounds to be filled with chemicals and super critical carbon dioxide. These 'gaps' are viewed as opportunities for economic activity and the expansion of infrastructure, even into the Earth's subsurface. The 'finance gap' representing a lack of financial resources perceived as needing to be addressed to further corporate goals.

In the proposed industrial park just outside of Nairobi, the consortium of technology, energy, operating and finance partners and green industry projects are investing in Carbon Valley to fill and make these gaps. The proposal of this so-called green technology hub is to seed, plan and execute carbon removal. Many of the companies constructing facilities for direct air capture or carbon dioxide fracking reach above and below the surface in the Kenyan Rift. These companies are financed by 'Frontier Climate' dreamt up by global consultancy agency McKinsey. The aggressive business model brings them together with Google, Meta and J.P. Morgan claiming to provide the infrastructure for carbon removal and its markets by "filling the gap".

13 For further articulation by Frontier see: https://frontierclimate.com/writing/cdr-gap-database.

14 For more on the building of the database see: https://frontierclimate.com/writing/cdr-gap-database.

e-ISSN 2785-2709

Figure 5 The Underground Division, *Crystal Mutual Aid: Tectonic*. 2025. Cascading animation, screenshot. https://ddivision.xyz/rockrepo/crystals, cc4r

The Carbon Valley industrial 'hub' has been proposed as the green Silicon Savannah.[15] Carbon Valley also plans to offer direct carbon capture and storage and so-called green clouds – and is home to the newly proposed One Gigawatt (1GW) Data Centre a joint venture from Microsoft, Eco-Cloud and G42 Investment Group. Nearby new infrastructures for carbon removal and storage are being proposed to exploit the conditions of the area's basalt fields for carbon removal. Leading Carbon Valleys' founders to devastatingly claim that the region is one of the largest, most accessible (for companies from the US and EU) and most ideally suited sites for carbon storage in the world.[16] However, despite the promotional narratives McKinsey's influence has been met with resistance from climate groups and activists all across the Kenyan territory calling out the firms return to the region and its move into shaping their climate imaginaries specifically in the Carbon Valley proposal.[17] Next to this decarbonisation site Swiss Climeworks and Cella an American owned start-up who also feature in our bugreport, are both investing in large scale facilities in the region funded by pre-purchased carbon removal tonnes purchased by Stripe on behalf of global finance companies operating in the US and EU. Stripe pre-purchased over 333,000 dollars worth of carbon

15 Ready to get started! How Carbon Valley describe projects: https://www.greatcarbonvalley.com/projects/green-data.

16 For more on the development see: https://www.greatcarbonvalley.com/.

17 For more on fury at McKinsey see: https://nation.africa/kenya/business/why-fury-has-met-mckinsey-s-return-in-nairobi-summit-4335336 and https://www.realafricaclimatesummit.org/.

removal tonnes from Cella alone for in-situ carbon mineralisation. In Cella's own words:

> Carbon mineralization involves the formation of solid carbonate minerals through reaction of captured atmospheric CO2 with rocks rich in calcium or magnesium. We inject CO2 deep into volcano rock formations underground (like basalt), where CO2 reacts with water and minerals within the rocks and turns into stone. Our novel in-situ mineralization technology enhances these natural geologic process by speeding up chemical reactions with subsurface minerals to permanently lock away atmospheric CO2 and mitigate the worst impacts of climate change.[18]

In other words, as collaborator and participant in the Frontier Bug Report Elodie Mugrefya wrote Cella proposes "technologies that are basically drilling the f*ck out of volcano formations to lock something 'bad' in them, and then wait to see if it's okay. Normalising techno-solutionism and innovation as the only way out" (TITiPI 2024).[19]

4 Legacies of Damage

Despite the legacy of environmental damage, states and institutions are still relying on the expansion of digital infrastructure to address the increasing risk of large-scale abrupt or irreversible change (World Economic Forum, PwC 2021). The concept of net zero, which has been dominated by fossil fuel industries and Big Tech industries,[20] has surged to the centre of the climate conversation defining framing for long-term ambitions in both national and corporate climate governance (Lund et al. 2023). National and transnational governing bodies in UK, US and the EU have introduced new policies and regulatory frameworks and part of their remit is to address fossil fuel emissions and the rising planetary temperatures. Across Europe, the EU (European Green Deal), and the UK (Recovery Plan and Digital Strategy) are investing in what they describe as "the twin digital and green transition" between increased digitization and decreased carbon emissions. As part of this governance space the EU have set up the "Carbon Removals Expert Group" who meet to regulate and standardise carbon removal (through technologies such as direct air capture and the reverse fracking the captured carbon dioxide into

18 For a description of the process see: https://www.cellamineralstorage.com/.

19 To read our bugreport see: https://titipi.org/pub/Frontier.pdf.

20 https://www.motherjones.com/environment/2022/01/fossil-fuel-firms-google-ads-snippets-sponsored-search-results-study/.

the sub surface).[21] Although the group discusses the processes of long-term storage much of the discourse focuses on the "removal" of carbon dioxide from the atmosphere to capture public imagination. The group has a specific geopolitical focus with the EU aiming to "remake the carbon border policies to include the purchase of future carbon removal".[22] When Global consultancy agency McKinsey and fintech company Stripe did indeed come to the underground[23] for Krauke as a member of the EU's Carbon Removals Expert Group, the infrastructural problem was simple. As lead scientist for Stripe Krauke noted the solution for carbon emissions was the urgent filling of the technical and financial gap for Carbon Removal which would need to include the scaling up of removals and state investment in financial infrastructures for selling and buying carbon removal.[24] A potentially very profitable outcome for Stripe, McKinsey and Frontier Climate. As Laleh Khalili writes about McKinsey:

> their own material makes clear [...] that all the services often spoken of as merely helping businesses and government departments run more efficiently – management consulting, audit, software development – are in fact focused on enabling capitalists to enrich themselves further without the inconvenient interference of workers, taxpayers or regulation. (2022)

As they had earlier proposed to the fossil fuel and Big Tech industry, Stripe and McKinsey outlined to the EU to recrack the sub/surface to 'permanently store' carbon in porous rocks and abandoned wells (amongst other methods) and sell it in future tonnes. They also proposed carbon dioxide fracking in sites of severe environmental damage such as Dimock in Pennsylvania where we have previously researched the impacts of pollution (Pritchard, Gabrys 2016), and to fund a consortium of startups – from capture to storage – in the site of water scarcity in the new Carbon Valley park outside the town Naivasha in the East African Rift Valley.[25]

As discussed in the TITiPI bugreport, Frontier Climate is a planetary infrastructure engineered to transform carbon certification

21 https://ec.europa.eu/transparency/expert-groups-register/screen/expert-groups/consult?lang=en&groupID=3861.

22 https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en.

23 For more on Mckinsey see Bogdanich, Forsythe 2022.

24 For the full expert group transcript see: https://climate.ec.europa.eu/news-your-voice/events/4th-eu-carbon-removals-expert-group-meeting-2024-04-15_en.

25 In this article the proposed Carbon Valley is discussed: https://www.reuters.com/sustainability/climate-energy/kenya-gears-up-direct-air-capture-push-great-carbon-valley-2023-11-13/.

and standardisation, climate science, environmental justice and academia itself through software production under the project of carbon removal (TITiPI 2024). It is part of what Seda Gürses and Joris Hoboken (2017) have described as the tectonic agile turn in which the production and consumption of software has collapsed.[26] These shifts transform the regulation of past and future fossil fuel emissions in which "services bind users into a long-term transaction with software companies" (Gürses, van Hoboken 2017). Tectonic in that the transformations of material conditions and the accumulation from new financial frontiers are so significant that 'computational infrastructures' (Gürses) now demand more energy and water than most European countries and their financial wealth give them more power than them too. These transformations collapse the production and consumption loops of energy and carbon, energy security, carbon borders, and the production of research. When Gürses and van Hoboken made the tectonic metaphor work, for describing these shifts they were witnessing, they hadn't quite imagined software production would literally be cracking the earth's surface, creating geological gaps through fracturing the deep underground, and generating tectonic movements through pushing interventions such as carbon dioxide fracking. Mantle rock is ductile – solid rock which slowly deforms under high stress causing earth quakes and cracks – and the injection of carbon into volatile volcanic rock in Carbon Valley may have already caused a number of earthquakes, causing huge new gaps in the earth's surface to emerge in the Kenyan Rift.

Frontier Climate have materialised their agile tectonics to a deep time-space through building financial infrastructures for the buying and selling of carbon removal. Reshaping and making increasingly volatile – and depleting – the earth on which we stand. Frontier Climate is an example of how these tectonic shifts, create material and symbolic anticipatory infrastructure that is anti-earth and anti-life.

What drives this specific anti-earth and anti-life infrastructure can also be understood as a "financial frontier" (Ballestero, Muehlebach, Pérez-Rivera 2023). The urgency of addressing the rising planetary temperatures; the increasing need for energy by Big Tech companies; and the introduction of financial benefits for reductions in emissions creates a negative infrastructural frontier for capital accumulation and exploitation. Whilst intentfully denying any pre-colonial financial imaginaries (Ballestero, Muehlebach, Pérez-Rivera 2023). Key to these tectonic shifts is that Frontier Climate's work in the making of

26 As Gürses and van Hoboken write the "agile turn is so tectonic […] the production and consumption of software is collapsed".

this frontier is the making of the gap, of naturalising the absence of life, and it is this emptying out of the underground of life itself which becomes profitable. This making of gaps as financial frontiers can be understood as the making of conditions for displacement, trapping and death. We ask with such grief what if these deaths, thefts and displacements of life and memory are of the unknown potential of political disruption and material resistance?

This denial of history and the exploitation of basalt to fulfil digital shopping carts of carbon dioxide removal curtails the lives of the undergrounds. As Yusoff reminds us this obliteration of life before our technologies of presence even have the possibility to register them is an aesthetics of loss (Yusoff 2012, 58). A curtailment of life "[t]oo small, too obscure, too reticent to have graced our archives, these beings blink out of existence without ever making their presence felt" (Clark, Hird 2014, 45). A curtailment that Myra Hird has described as passed down to become our inherited life-worlds. This forced displacement is also similar to what Ballestero outlines in her work on financial frontiers. That often for those on the ground, the frontier pairs theft and dispossession with the excesses of accumulation; holding together exhausted worlds and new hopes for autonomy and even freedom (Ballestero, Muehlebach, Pérez-Rivera 2023). The holding together of exhausted worlds with new hopes of autonomy can be seen at work in Frontier Climate – forcing anticipatory material and symbolic infrastructures to create new opportunities for financial expansion above and below the ground. In their "Cave Canon" architects Kabage Karanja and Stella Mutegi, founders of cave_bureau, outline the historical importance of the caves and rocky masses of the Kenyan Rift:

> through the movement of rocky masses around the endless number of suns that tectonic shifts within planets of rock-melting lava flows afforded the formation of spaces of shelter for living things to thrive […] From civilization's oral and recorded histories of religious revelations, to philosophical metaphors and narratives, and as a surface to embed our cultural thoughts and values, caves have formed an intrinsic part of our past, present, and soon-to-be future. (Karanja, Mutegi 2021, 3)

By making and filling all the gaps (that they can) above and below the earth's mantle, Frontier Climate and Stripe are obliterating the shelter of the caves for life and creating a deathly "negative infrastructure" (Barnard, Cohen 2022).

Partly this negative infrastructure is an affective one. The incredible myth making that Frontier Climate and McKinsey have invented is that basalt has any gaps at all. The pores of basalt are saturated with deep time fossil water and microbial life, which

becomes displaced by the foamy injected carbon dioxide. These connate waters are literally named as "made at the same time" as the basalt strata, some over 25 billion years ago. Poet Sabrina Imbler in *Dyke (Geology)* describes these deep time rocks and waters as

> a record of history that exists outside of human modes of remembering and therefore could never be recorded in human modes of remembering. A common acronym that geologists use is Mya, which stands for millions of years ago, and when I first heard it in an interview, I thought it was the singer – M.I.A. But it's just this whole different kind of lexicon. (Imbler 2020)

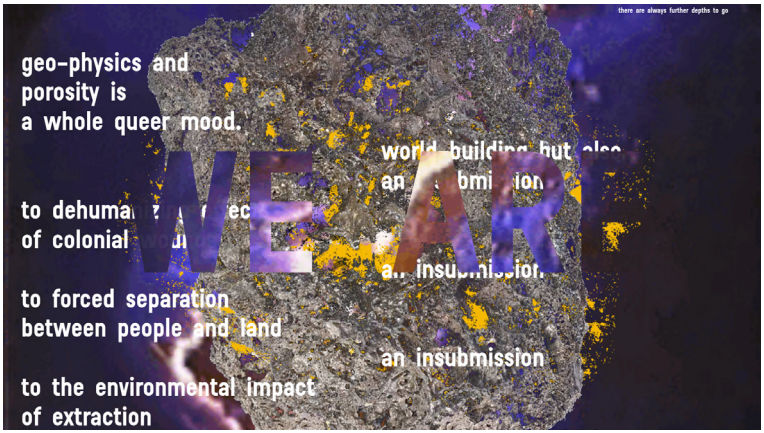

Figure 6 The Underground Division, *Crystal Mutual Aid: An Insubmission*. 2025. Cascading animation, screenshot. https://ddivision.xyz/rockrepo/crystals, cc4r

5 Whose Futures are Given?

To be given a future by McKinsey and Stripe Climate in the words of Ly Thuy Nguyen, is to "inherit white supremacy, hetero-patriarchy, private property […] structures which also limit how we can imagine the dispossessed's biopolitical survival" (2020, 220-1). Frontier Climate's project is to make profitable the inherited 'debt' of carbon emissions to become consumed and reproduced by their financial infrastructures. Reinforcing and reshaping what Yusoff calls the operational zones and inheritances of geopower:

> These operational zones are the material (land, value, property, discourses, epistemes); the psychic (relation); the bodily (race, labor, gender, sexuality); the geophysical (chemical, thermal, permeable, porous, gravitational, dynamics of force); and the

> valence of geology's grammar to organize modes of experience and sediment forms of geopower as naturalized forms of power. (Yusoff 2024, 197)

So how might we unsettle and resist these new and existing forms of geopower that are sustained by consortiums like Frontier Climate? How can we maintain a queer tectonic intimacy and make grammars for in-submission? This is what we ask here. What are the futures from the vantage point of radical queer politics and insurgent intersectionality.

In recognising the constant transformation of rocks as life itself Diaz in response to the poem "Lake-Loop" writes of seeing and feeling the San Andreas fault that runs along the Mojave Desert, of existing with it – "the idea that this country tried to give us no space to exist, yet we made that space, and make it still – in stress, in friction, glide and flow, slip and heave. We are tectonic, and ready" (Diaz 2020). A resistant call. In M-Archive, Alexis Pauline Gumbs also writes of those who are part of the lands actions who "develop the capacity to live underground, as close to the core of the earth as necessary [and…] learn to move above ground and return undetected" (Gumbs 2020, 95). Referencing Cheryl Clarke's queer trouble making in the poem *Living as a Lesbian Underground* (1986) in which she writes: "Leave signs of struggle. Leave signs of triumph. Leave signs".

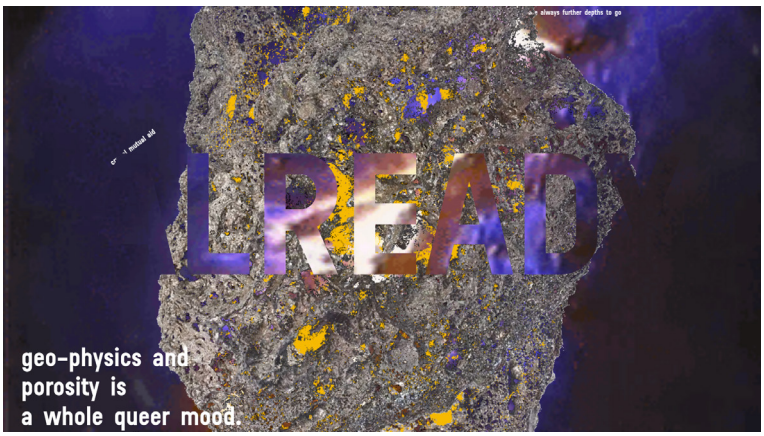

Figure 7 The Underground Division, *Crystal Mutual Aid: Already*. 2025. Cascading animation, screenshot. https://ddivision.xyz/rockrepo/crystals, cc4r

Cabral might describe these references as providing a material and social resistance to the rendering of the underground as an absence or a gap. But also, as a space to gather to build physical forms of resistance as felt in M. Jacqui Alexander's *Pedagogies of Crossing*

"[s]he had to feel what it was like to survive above ground, while really living underground by fire" (2006).

These 'geo porosities in action' described by Diaz, Alexander, and Imbler are a recognition of what Yusoff describes as a "queer geochemistry that moves through bodies: human bodies, bodies of earth, bodies of water, space bodies, bodies that begin and end in the earth" (Yusoff 2024, 478). These queer intimacies and geologic roots queer notions of materiality and inhuman materiality as inseparable from racialised, gendered and sexed accounts of the body (Yusoff 2024, 45). A queer intimacy with soils, rocks and minerals, which is both world-building and an in-submission to the forcing of gaps, to the dehumanizing effects of colonialism, the forced separation between people and land and the environmental impact of extractivism (see Carreira da Silva et al. 2024 on Cabral).

Geophysics and porosity is a whole queer mood. As Imbler writes of the orienting magnetic firey energy of the underground for queer life

> as the fire dies into the hardness of basalt, it preserves the exact magnetic forces working on Earth at the time of its cooling. This is how Kohala learned of the changing of the poles. She felt it in her lava. (Imbler 2020)

6 Conclusion

The activities of companies like Stripe, Google, Meta, J.P. Morgan and McKinsey in forming Frontier Climate and investing in sites like the Great Carbon Valley exemplify a form of global takeover that focuses on naturalising the obliteration of life, in the quest of extreme experimentation for new horizons of accumulation, resource grabbing and profit. We hope that this thickening of the story also helps to make palpable the more generalisable story of these ecocidal and genocidal tendencies of Big Tech infrastructures. Their initiatives to re/crack the sub/surface and to establish financial infrastructures for carbon removal demonstrate an ability to exert control over geological resources in specific countries driven by economic and security imperatives operating on a global scale. Frontier Climate transcends national borders, as these corporations, based in the US and working with EU bodies, seek to utilise the subsurface of other countries for financial gain, effectively asserting forms of resource sovereignty. Rather than attempting to 'fill the gap' through detailing the ways in which subsurface might become lifted above the surface in these financial frontiers, we have turned to queer poetry as a practice which reconfigures the underground into a space to gather, providing a material and social resistance. We extended our bugreport into the specific scene of Carbon Valley to encounter the stories of how the

promise of carbon removal is facilitated by Big Tech infrastructuring, which has entered into a new era of (MSIs) Multi Scalar Initiatives. Consuming and reproducing the inheritances of fossil fuel racial capitalism through extensions of financial infrastructures, enrolling institutions, the state and researchers into their power grab and naturalisation of emptiness until they come to the underground. This global governance takeover shows how financial actors, including mega-philanthropies and investment funds, play significant roles in various MSIs, including those related to the environment. Creating negative infrastructures that undermine the ecological integrity and the rights of those who live in relation to these environments. Whilst also creating new forms of quotidian violence, that appear in distance sites such as shopping baskets, institutional goals for net zero or the greenwashing of Big Tech. We call for a queer geophysical campaign between above and below the surface rooted in Cabralian insubmission to come to new practices of caring for the soil, halting all fossil fuel extraction and resisting these new forms of dominant geopower. This resistance is grounded in a radical queer politics and insurgent intersectionality that aims to defend against the violent conquests for net zero and form transnational solidarities to resist the cloud regime. We are tectonic!

Acknowledgements

This paper builds from “Frontier: A Bugreport” which was prepared by The Institute for Technology in the Public Interest (Miriyam Aouragh, Seda Gürses, Helen V Pritchard, Jara Rocha, Femke Snelting) and collaboratively drawn up with Cassandra Troyan, Elodie Mugrefya, Eric Snodgrass, Martino Morandi, Therese Keogh, Aggeliki Diakrousi, and Livia Cahn. Thank you Joan LLort, Guillemette Legrand, Harun Morrisson and Donald Jay Bertulfo for your comments.
Thanks also to the comments on the draft paper from the editors of this special issue Simone M. Müller and Livia Cahn, the participants of the writing retreat “Cracking the Surface”; the peer reviewers, and our colleagues in SoLiXG (The Social Life of XG – Digital Infrastructures and the Reconfiguration of Sovereignty and Imagined Communities): Manuela Bojadžijev, Alexander Harder, Stefan Jonsson, Karin Krifors, Camilo Alvarez-Garrido, Anna Pillinger, Lukas Egger, Mauricio Rogat, and Roland Atzmüller.

Funding

"SoLiXG: The Social Life of XG – Digital Infrastructures and the Reconfiguration of Sovereignty and Imagined Communities" is funded by the Collaboration of Humanities and Social Sciences in Europe (CHANSE, 2022-25), supported by the Economic and Social Research Council and Arts and Humanities Research Council of the United Kingdom, German Federal Ministry of Education and Research, the Austrian Science Fund, and FORTE: Swedish Research Council for Health, Working Life and Welfare, under CHANSE ERA-NET Co-fund programme, which has received funding from the European Unions Horizon 2020 Research and Innovation Programme, under Grant Agreement no. 101004509.

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e-ISSN 2785-2709

Lagoonscapes
Vol. 5 – Num. 1 – June 2025

When the Ground Drops
Sinkholes and the Verticality of History

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Abstract Focused on a massive sinkhole in Winter Park, Florida of 1981, the article investigates evolving human environment relationships within Central Florida's karst environments as an interplay of logics and logistics of above *and* below ground. The article argues that these relationships are formed both in acute situations due to the pressures of increasing urbanization and groundwater extraction in the twentieth century and over the course of millennia due to long-term karst formation processes. The piece focuses on the different types of property damage caused by the sinkhole and introduces insurance companies as guardians of above-ground order. It illustrates that, although the sinkhole briefly overpowers the above-ground logic, it ultimately does not distort existing social inequality. Using the sinkhole as an interscalar vehicle, the article shows the intersection of the horizontal and vertical planes and with it the volumetric intersection of place, space, and time.

Keywords History. Verticality. Sinkholes. Florida. Critical zone. Place. Space. Time. Anthropocene.

Edizioni Ca'Foscari

Peer review

Submitted 2025-03-24
Accepted 2025-05-21
Published 2025-07-21

Citation Müller, S.M. (2025). "When the Ground Drops". *Lagoonscapes*, 5(1), 205-226.

DOI 10.30687/LGSP/2785-2709/2025/01/009

> "If a sinkhole forms in the woods, does anyone hear it drop?" (Brinkmann 2013, Preface)

1 Introduction

On the evening of 11 May 1981, Mae Rose Owens had just stepped out of her house into the cool air when she heard a peculiar swishing noise. The African American woman turned around and saw the tall sycamore tree at the end of her plot in the small town of Winter Park, a suburb of less than 25,000 people north of Orlando, Florida, "quivering and shaking as though in the grasp of a giant's unseen hand". Next, she noted a sound as if "a hundred beavers [were] chewing on a log all at once", before the massive tree slipped out of sight beneath the earth's surface. All that was left were "a few stray leaves drifting down in the same direction" (McLeod 1986). Sycamores are a long-lived species, typically surviving at least 200 years and possibly as long as 500-600 years (Keeler 1900, 263-8). This one had only been on Mae Rose Owen's plot for forty years – as long as she had lived in that house – a life cut short within minutes by the appetite of an earthly crater.

The hole in the ground was not done eating – to remain in the multi-species vocabulary of the news at the time. Its savoring of the sycamore tree marked only the beginning of rapidly evolving events over the course of the weekend (Associated Press 1981b). On Saturday at 4:00 a.m., Mae Rose Owens woke to a "cracking of the earth", which indicated the substantial expansion of the crater in the ground. By noon that day, the sinkhole had reached Mrs. Owens' house, which subsequently toppled into the opening, followed by the rear part of a car repair shop and five Porsche cars. "Still hungry", so contemporaries' assessment, the hole next took a big bite out of Winter Park's public swimming pool and large portions of Denning Drive, a four-lane thoroughfare (Carrasco 1982). By Sunday, the diameter of the hole had increased to 107 meters, with a depth of 30 meters (Walker 2024).

Sinkholes are a common geological phenomenon in Central Florida. The region's landscape, shaped by geological legacies from the early Cenozoic era 66 million years ago, features a bedrock of limestone known as the Ocala Uplift. This has created a landscape that on the surface "looks like Swiss Cheese" with numerous groundwater-filled lakes dispersed throughout (Brinkmann 2013, 108). Yet even within the context of a karst landscape, Winter Park's sinkhole exhibited distinctive characteristics that transcended conventional geologic parameters, thereby integrating social, legal, economic, and geological dimensions. At the time, the incident received significant media attention and to this day aerial photographs of

e-ISSN 2785-2709

the hole garner textbooks in geology and physical geography. U.S. property remediation companies utilize Winter Park as sounding base, estimating that the frightening image of a home in a hole helped convince potential customers. Additionally, the Winter Park disaster spurred a plethora of inquiries regarding the state of the underground, thereby giving rise to a robust sinkhole science and law in Florida. Both aided insurers to become guardians of the status quo (Brinkmann 2013, 108, 218).

On a broader level, Winter Park's sinkhole is emblematic of the evolving human-environment relationships in the Anthropocene era, a period characterized by the profound impact of human activities on global ecosystems.[1] Starting in the mid-nineteenth century when large-scale white American settlement began in the former indigenous territory, Florida's existing sinkhole landscape – which had been rather static up to that point – was increasingly encroached upon by residential and agricultural development. In the twentieth century, the world-famous but water-hungry Disney World amusement park added pressure to the karst underground (Brinkmann 2013, 61). As a result, the close habitation between settler people and rock formations along with their competing thirst for water led to conflict and disruption. Due to growing human-engineered pressures from above and below – from urbanization and water extraction – the karst landscape became increasingly volatile and new sinkholes appeared with greater frequency (McLeod 1986). Although Winter Park's sinkhole was the most dramatic in terms of its size and impact, it was only one of thousands that appeared in Florida and around the world in response to human pressure on the underground. It exemplifies what Martin Siegler reading Gavin Bridge characterizes as the *Hohlozän* – the "hole world" formed by centuries of global resource extraction (Siegler 2024, 58; Bridge 2009).

Honoring the tenth anniversary of the Winter Park sinkhole, the *Orlando Sentinel* ran the headline "Time Swallowed Up Sinkhole" (Pankowsky 1991). Ambiguously framed as the headline is, it begs the question: Had time swallowed up the sinkhole, or had the sinkhole swallowed up time? The *Orlando Sentinel* offered no explanation. Yet analyzing the sinkhole's "eating" offers a conceptual entry point for the volumetric intersection of the horizontal and the vertical planes as proposed by this special issue that can be, I argue, particularly fruitful for historians.

In the Western world, history tends to be linear, emphasizing change over time and horizontal logics and logistics (Berber 2019; Barak 2009). In this history, the world is usually rather flat, with

1 Publications on the Anthropocene amass in rapid speed, for a start see Erle 2018; Will 2021; Antweiler 2024; Banjohr 2020; Chakrabarty 2021; Maß 2024.

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surface logic trumping subsurface logic. According to Eyal Weizman, it is a world that builds on geopolitical discourse "that tends to look across rather than cut through landscapes" (Weizman 2002). In contrast, a few historians have shifted their focus downward. "Unten ist das neue Oben" (down is the new up; transl. by the Author) historian Sylvia Berger Ziauddin subsumes the scholarly movement that has discovered the underground as the "ultimate resource", adopting a vertical gaze to history that was previously found in political ecology, architecture, culture, literature, and urban studies (Berger 2016).[2] Inspired by Bruno Latour's concept of critical zones as a permeable layer from tree tops to groundwater, this special issue, and this contribution, move beyond the vertical to the volumetric (Latour, Weibel 2020). Winter Park's sinkhole, emerging from combined pressures of urban development, infrastructure, and extracting groundwater reservoirs, demonstrates the movement of matter between above- and below-ground.

Alongside verticality, historians nowadays also struggle with scale and the big picture (Poskett 2024; Coen 2016). In particular, with the rise of global history, historians have continuously expanded the spatial scope of their studies, albeit horizontally. Fascinated by the nineteenth-century expansion of global commerce and communication, historians have documented the importance of steamships, submarine and radio telegraphy, and railroad networks (Müller 2016; Tworek 2018; Wenzlhuemer 2012). Recently, some global historians have turned to big data collection and broad structures and geographies. However, as more histories became global, this invited the methodological critique that people and events were getting lost in more general, macro narratives. How could one ground – 'place' – research that only seemed to scale out and up? (Ghobrial 2019).

Similarly, the growing importance of the Anthropocene as a conceptual framework for the humanities presents a challenge for environmental historians. In addition to global networks of human-made connections and disconnections, historical inquiry is now also influenced by the biosphere, the atmosphere, and the hydrosphere. In response, a kind of writing termed planetary history has emerged that is heavily influenced by Earth System Sciences and large-scale, more-than-human imaginaries. While these studies have demonstrated the material fabrication of a globally interconnected ecosystem, they have not adequately illustrated how this planet emerged through the workings of global capital, international organizations, and other very human activities (Müller, Mueller 2025). Consequently, alternatives such as the Capitalocene, the Wasteocene, or the Chthulucene have

2 Furthermore see Hardenberg, Mahony 2020; Barak 2009; Williams 2008.

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emerged (Moore 2015; Armiero 2021; Harraway 2016). Another key point of critique has been the presumption of the existence of *one* humankind (Yussof 2018). Where, then, should the Anthropocene be placed, and how should difference be accounted for?

In response to the conceptual challenges of studying the big picture, both Global and Environmental historians, such as John Paul Ghobrial and Gabrielle Hecht have interestingly found merit in considering scales. Ghobrial does so in a micro-history of the global, while Hecht emphasizes the interconnection of scales and the importance of inter-scalar work for "locating" the big picture, in her case, the Anthropocene (Ghobrial 2019; Hecht 2018). Combining micro- and macro-scales while navigating between them has also influenced my own thinking (Müller 2024). Focusing on the 1981 sinkhole in Winter Park as an interscalar vehicle, this contribution unpacks the entanglements of different vertical and horizontal scales, ranging from the Cenozoic era to the present and from the locality of Winter Park to Disney World's global tourist infrastructure. This approach offers a conceptual reading of the volumetric intersection of place, space and time. It also enables me to recount a (not 'the' as Hecht notes, Hecht 2018, 112) history of the Anthropocene in which the world is neither geologically flat, nor socially flattened. Ultimately, one big, hungry hole holds "planetary temporality and specific human lives in a single frame" (Hecht 2018, 135).

2 Florida's Porous Underground Archive

Approaching Winter Park's 1981 sinkhole as an interscalar vehicle for the Anthropocene, it is best to start with the hole's habitat: the underground. From a geological perspective, Florida's underground is a porous archive filled with many holes, such as Winter Park's (which turned out to be more than just a hole) (McLeod 1986). It is an archive based on a stone and clay-turned memory of an ocean that existed 66 million of years ago at the onset of the Cenozoic era, our current geological era. The Cenozoic comprises the Pleistocene, the Holocene, and possibly, the Anthropocene. The Cenozoic era is characterized by the dominance of mammals, following the dominance of dinosaurs. It is also the era when large deposits of organic matter were preserved in swamps, laying the foundation for today's petroleum and coal deposits – key resources in the age of humankind (Brinkmann 2013, 19-20, 23).

There are no exploitable petroleum or coal deposits beneath Florida's surface, solely limestone. Limestone is primarily composed of the mineral calcite, which is formed from mud consisting of the remains of small marine life, animal bones, and crustacean exoskeletons. At given temperatures and pressures, the remains

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of these animals and crustaceans help form limestone rock, which also contains fossils of mammals that once lived there, such as giant sloths and saber-toothed tigers. Along the Panhandle and the east coast of Florida, a deep layer of clay covers the limestone, preventing the topsoil from collapsing into pockets in the limestone. However, in the lake region of the Central Highlands, which extends around Winter Park, the clay layer is relatively thin or nonexistent, and the limestone – the Ocala Uplift – is close to the surface. This creates a pronounced karst landscape with lakes, dunes, and primarily underground waterways (Brinkmann 2013, 19-20, 23; Marcus, Caviedes 1983, 3).

More than the earthly memories that fill the limestone rocks, Winter Park's story is about the voids between them – the negative space between the solid rock particles. These voids formed as the line between the surface and the seafloor continuously shifted throughout the Cenozoic era. The carbonate limestone rocks in Central Florida formed in shallow, warm seas. However, the karst processes that created the voids through corrosion only occurred when the rocks were not saturated with seawater. Over thousands of years, Florida's underground archive gradually became "honeycombed with cracks and pockets, some room-sized, caused by water seepage" (McLeod 1986). These voids represent the birthplaces of sinkholes, or dolines as geologists call them.

Sinkholes in Florida are usually between three and nine meters deep, though some reach up to 30 meters (Brinkmann 2013, 24; Marcus, Caviedes 1983, 4-5). Their diameter can range from less than one meter to hundreds of meters **[fig. 1]**. They can be divided into two groups according to how they form. One type forms when the roof of an underground limestone cavity collapses under the weight of the overlying layers. This is called a collapse doline. The other type is formed when the overlying soil layers erode. Slow penetration of the overlying soil into the limestone cavities causes mud-filled holes and leaching phenomena to develop in the overlying rock. Eventually, the overlying rock collapses too (Spear 2001). Before sinkholes enter the human sphere through collapse, they wander sideways and primarily upwards. This process begins when rainwater drains through the soil, dissolving the limestone at a rate measured in millennia. Over time, caverns form in the rock, growing outward at up to five feet every 1,000 years. Then, tunnels emerge and extend upward from the limestone cavern into a thick layer of clay. Over time, these soil pipes work their way upward through as much as 80 feet of clay. Once they break through the clay, only 40 feet of sand blocks a soil pipe from poking its head into the blue sky (Spear 2001).

Experts slowly deciphered the seasonal pattern of sinkhole formation starting in the 1980s. While dolines' underground processes were "unhurried and unpredictable", according to a

sinkhole expert, the moment when "the earth takes a bite out of its own surface" followed a schedule that aligned with droughts and periods of heavy rain, which was increasingly understood (Spear 2001). Almost half of all sinkholes in the Orlando area occurred in April and May, due to a growing gap between the groundwater and the limestone aquifer below. Normally, the aquifer has enough pressure to support the groundwater table, but in Spring when "the ground [is] tremendously thirsty" from the very little rain that usually falls then, the aquifer pressure is low, and groundwater can flow downward more easily (Spear 2001). The dry ground then triggers sudden collapses, sending dirt, grass, trees and buildings plunging toward huge and deeply buried caverns. Even the moon, experts such as Barry Beck, director of the Sinkhole Research Center at the University of Central Florida, learned, can trigger sinkholes. The earth 'flexes' imperceptibly in response to the moon's gravitational pull, which influences the equilibrium between water and earth. Over time, this can cause enough stress on the fractures to have an effect (McLeod 1986). However, the largest effect on sinkholes is human cohabitation.

Figure 1 Winter Park Florida Sinkhole of 1981. Washington D.C., US Geological Survey, Winterpark. Photo by Anthony S. Navoy. Public domain

e-ISSN 2785-2709

3 Florida the Empty Canvas

Hardly anywhere else in the world exists such a close cohabitation between people and sinkholes as in twentieth-century Central Florida. For nearly 12,000 years, the area of Central Florida had been loosely populated by various Native Peoples, such as the Timucua, Calusa, and the Apalachee. Theirs was a territory marked by three mighty rivers, numerous wetlands and more than 7,800 inland freshwater lakes, by salt marshes and a vast river of grass – the Everglades stretching southward from Central Florida to the end of the peninsula. The indigenous groups primarily lived with the land and its waters. Then came the occupation by different European powers – the Spanish, the French, the British, and the United States. Particularly the latter dramatically reshaped the peninsula in terms of its culture and politics, but also its hydrology and geology (Ste. Clair 2017, 9, 18).

While the Spanish had violently claimed the surface landscape as La Florida in the sixteenth century, large-scale European settlement only started after the Third Seminole War in the latter half of the nineteenth century. In 1821, when Florida became U.S. territory, the non-Native population only stood at 8,000 people. Even with counting slaves, it took Floridians a long time to reach the required 50,000 people to apply for statehood in 1845. Meanwhile, the landscape witnessed a violent emptying of Native settlements whipped out by military violence and European diseases, followed by the massive in-migration of other Native groups pushed south from the Carolinas, Alabama, and Georgia by Euro-American colonizers. These diverse groups of Natives, that also included runaway slaves, formed the Florida Seminoles. Over the course of the early nineteenth century, three violent conflicts erupted between Seminoles and white settlers. In their course many Seminoles were relocated to the American West, while others resisted and fled south into the Everglades. The conflict ended in 1858 without a peace treaty. War weary and facing starvation, most of the remaining Seminole agreed to be moved to 'Indian territory' out West in return for save passage and cash payments; others retreated even deeper into the Everglades (Ste. Clair 2017, 19-20; Coogan 2022, 13; Gannon 2013).

A European settlement called Lake View was established in 1858. It was renamed Osceola in 1870 and rebranded as Winter Park in 1887. Located about 70 kilometers from the Atlantic Ocean and 130 kilometers from the Gulf Coast – former Seminole territory – it drew American colonists and settlers to the region of Central Florida. They came few and slowly. A turning point came in 1880 when the South Florida Railroad Company began laying tracks a few miles west of the settlement. This provided a connection from Osceola both to Orlando to the south, a sprawling urban development dating back to 1838, and

to Sanford to the north, a port city at the intersection of Lake Monroe and the St. John's River. Since its incorporation in 1877, Sanford had developed in a major hub for shipping agricultural products. Importantly, the railroad transported not only goods but also brought wealthy visitors from the northern U.S. to the area. As early as the 1870s, residents from the northern U.S. seeking refuge from the cold winters visited Florida as tourists to enjoy its mild climate and natural beauty (Harvey 2003, 66; Winter Park Founders 2025).

In 1880, the railroad brought Loring Chase to Central Florida from Chicago. He came to the area to recuperate from lung disease and fell in love with the gently-rolling, hilly and lake-dotted landscape just east of the railbed. With another wealthy New Englander, Oliver E. Chapman, he purchased a large plot of land around Osceola and planned a new town there – Winter Park. Over the next four years, the two men designed the town's layout, opened streets, built a town hall and a store, planted orange trees, and required that all buildings meet stylistic and architectural standards. Next, the two self-proclaimed urban planners advertised Winter Park as home to "snowbirds" from the north, looking for a place to hibernate in the winter (Lanier 1875). In 1885, a group of businessmen formed the Winter Park Company. Chase and Chapman sold the town to the new company. On 21 October 1887, Winter Park was officially incorporated as a town and in 1925 reincorporated as a city (City of Winter Park 2025).

From a surface-driven, horizontal history, Winter Park was the State of Florida's first *planned* European city based on exploiting nature as an empty canvas. Chase and Chapman were among the first land developers to capitalize on the region's mild climate and beautiful landscape. Central Florida with its "sunny beaches, blackwater rivers, clear springs, and (to Europeans) unfamiliar flora and fauna", was "sufficiently exotic and romantic" to become a major tourist attraction (Harvey 2003, 66). At the time, they were unaware that sinkholes had made the lake-filled landscape. By the 1920s, over 1.5 million people were visiting Florida annually, and so many of them stayed that the state's population grew four times faster than that of any other state in the United States (Harvey 2003, 66-7). After a slight decline during the Depression, numbers soared again after World War II. Central Florida, especially the area around Orlando where Winter Park is located, witnessed tremendous population growth. Orange County's population grew from 70,074 in 1940 to 263,540 in 1960 and to 471,660 in 1980 (Marcus, Caviedes 1983, 8).

In their development schemes, land developers and the tourist industry touted the climate, recreation, and ambiance, selling a way of life that often included an escape from the modern world. Much of what was built in Florida contained utopian elements and had a fanciful quality to it: Moorish architecture, Venetian pools,

and a town designed to resemble the mythological Greek city of Heliopolis. "Florida was a blank canvas on which anything could be painted" (Harvey 2003, 67). However, each of these designs came with an ecological cost. In 1981, the principles of urban planning that disregarded Florida's geological limitations and catered to human desire and imagination spelled catastrophe in Winter Park.

4 Water Wars between Settlers and Underground

Water is a unique feature of the Florida peninsula. Because of the abundance of water stored in its limestone aquifers, Florida is one of the few subtropical peninsulas that is not a desert (Belleville 1982). Maps from the mid-seventeenth century referred to the Florida peninsula as an island territory. Covered with sinkhole lakes fed by groundwater, crisscrossed by approximately 41,700 kilometers of rivers and marked by a river of grass – the Everglades – Florida represented "a place where land and water interweaves" (Florida Department of Environmental Protection 2018). Yet in response to European visions of land development, many of those islands, lakes, and wetlands disappeared or were transformed by the twentieth century. Instead, water wars had begun between settlers and underground as Florida was increasingly running dry above and below ground (Belleville 1982).

Unlike the indigenous population, the American colonizers viewed the watery terrain as an obstacle to their development plans for Florida's 'empty canvas.' From the second half of the nineteenth century onward, land developers and politicians alike pushed for large-scale amelioration projects and supported plans to reclaim the land by building canals across the peninsula. At the center of their imagination was the wetland landscape south of Orlando where after 1858 the few remaining bands of Seminoles resided, the Everglades. Already in 1881 – when Loring Chase envisioned Winter Park – industrialist Hamilton Disston purchased four million acres of land in the South. He spent more than ten years engaged in land development, canal dredging, and establishing sugar plantations. Ultimately, Disston failed, but this gave the watery landscape, which stretched from Orlando to the southern tip of Florida via the Kissimmee River and Lake Okeechobee overflow, only a short reprieve. Extensive landscape modifications in the twentieth century, such as the construction of the Hoover Dike around Lake Okeechobee and the channelization of the Kissimmee River reduced the Everglades to half their historical size (University of Florida Library 2015; Ritter 2016).

Proponents of amelioration believed that the muck and mud found in the wetlands would make a superior soil for agricultural purposes.

Consequently, with the draining of the land came the in-migration of agriculture and industries, including high water-intensive forms such as sugar farming, cigar manufacturing, phosphate mining, sponge harvesting, and large-scale commercial agriculture which then targeted Florida's groundwater (Museum of Florida History 2025, 8).

The Florida aquifer underlies approximately 100,000 square miles, including all of Florida, southern Georgia, western Alabama, and southern South Carolina. This aquifer is one of the most extensive and widely used sources of groundwater in the United States. Particularly in the winter months, when citrus fruits and vegetables ripened and foliage crops were grown, agriculture and industry consumed excessive amounts of water (Tibbals 1990, E4; Marcus, Caviedes 1983, 8). Urban centers also emerged and drew water. Starting in 1887, the city of Savannah, Georgia, began supplementing its surface water withdrawals from the Savannah River with groundwater from the Florida aquifer. Around 1900, an estimated 200 to 300 wells in southern Georgia pumped water from the groundwater source, too. By 1910, the aquifer system was being pumped along the east and west coasts of Florida. By the 1950s, the Floridan aquifer system supplied all of Orlando's municipal, domestic, and industrial water, as well as about half of its agricultural water. By 1990, more than 3 billion gallons of water were being pumped daily from the aquifer system (Tibbals 1990, E4; US Geological Survey undated; Marella, Berndt 2005; Miller 1986).

As early as the 1960s, scientists began measuring a gradual decline in groundwater levels that they could not attribute to deficient rainfall. Instead, they connected it to an increase in groundwater pumping year after year, which coincided with a surge in population growth, particularly in the Orlando-Winter Park area of Central Florida (Tibbals 1990, E72). A water demand study from the early 1970s also considered population growth. The study calculated that the daily water requirement for every 10,000 new settlers – not including the 35 million annual visitors to Florida – would be 4.9 million liters (Marcus, Caviedes 1983, 8). The study was more than timely.

A new strain on groundwater sources emerged in 1971 with the opening of Disney World, a 11,000-hectare amusement park only 30 kilometers from Winter Park. Searching for an East Coast equivalent to his successful Disneyland amusement park, Walt Disney had settled on Central Florida. The land was inexpensive and abundant, the weather was sunny and stable, and the area was easily accessible by highways. At the time, most Floridian tourists still travelled by car rather than by plane (Mittermeier 2020, 59). Built on drained land with thousands of tons of concrete poured into sinkholes to fill and stabilize the ground, Disney World overwrote the characteristics of Central Florida's karst landscape. Additionally, the amusement park relied heavily on groundwater. Disney World created

an artificial watery landscape with 3,000 kilometers of water pipes, 65,000 sprinklers, an 18-kilometer canal system, 30-kilometer dikes, and 30 automatic sluices. At EPCOT, the Experimental Prototype Community of Tomorrow, there is a 17-hectare lake whose water level is constantly kept at the same level with the help of pumps. From the beginning, Disney's water usage was immense. In response, groundwater levels around the amusement park sank by roughly 2.5 meters between 1968 and 1973. By 1985, the daily water usage was at 37 million liters (Mauch 2022, 178; Marcus, Caviedes 1983, 8).

The massive extraction of water – both above and below ground – has had a significant impact on Florda's karst landscape, accelerating changes at an alarming rate since the 1970s **[fig. 2]**. Key to these changes were the ever-new sinkholes. As early as 1968, geologists Lichtler, Anderson, and Joyer had established a link between droughts and sinkhole formation. On the one hand, declining groundwater levels resulted in the withdrawal of support from the surficial materials overlying and filling cavities in the carbonate aquifer. On the other hand, the excessive pumping out of the aquifer created a suction effect, causing surficial sand and clay to collapse into solution cavities in the underlying carbonate rocks. Both processes contributed to the formation of sinkholes (Lichtler et al. 1968). A 1980 US Geological Survey study of 4,000 sinkholes in Alabama since 1900, found that 3,800 of the sinkholes were triggered by excessive groundwater pumping (US Geological Survey 1980, 128).

Figure 2 Sinkholes in West-Central Florida. Freeze Event of 2010. Washington D.C., US Geological Survey, Dover (FL). Photo by A. Tihansky. Public domain

e-ISSN 2785-2709

Scientists only began researching sinkholes in Florida systematically after the Winter Park incident. Yet, in hindsight, they concluded that Central Florida had it coming. The engineers who examined the sinkhole in Winter Park reported that it had been forming for decades as the overlying sand eroded into subsurface voids. They also stated that the sinkhole's formation was accentuated over the last 50 years due to the steady drawdown of the Floridan aquifer, which shifted from +20 meters in the 1930s to +14 meters in the early 1980s (Jammal 1984, 363-9). Already in 1972, Henry Swanson, an agricultural agent and local expert on Central Florida water had sounded the alarm. He had warned all Orange County mayors that if local governments continued to allow "too much water to be drawn from the ground and to cover the land with buildings and parking lots, they [could] expect sinkholes, especially in the west Winter Park area" (Robison 1987). The months prior to Winter Park's sinkhole incident in 1981, were one of the state's worst droughts in a decade. Normally, the area around Winter Park received an average of 1280 mm of precipitation per year in the 1970s. From January 1980 to April 1981, the sixteen months before the Winter Park sinkhole, there was a precipitation deficit of around 270 mm, with seventy precipitation-free days immediately before the event. The ground was extremely dry, and in response to below-average rainfall and extensive well pumping Florida's aquifer had dropped to a record low of 12,2 meter (40 feet) below normal (Marcus, Caviedes, 1983 5; Kirchheimer 1981; Robison 1987).

5 Earth with an Appetite

"From the sky", Florida's sinkholes look like "huge pockmarks dotting the Florida landscape", wrote Rocky Moretti of the *Tampa Times* in May 1981. Most of the *old* sinkholes are no problem, he continued, "if anything, they make nice fishing ponds or swimming holes". The problem was rather the hundreds and hundreds of *new* sinkholes that occurred annually, reducing property values, damaging structures, and creating headaches for property owners (Moretti 1981). Winter Park's 1981 sinkhole was one of those new sinkholes that from below ground fundamentally impacted Florida's social and economic stratification above ground while triggering people's imaginations. "There is something eerie", wrote *Orlando Sentinel* journalist Michael McLeod, "in the very idea of the earth opening up to gobble great mouthfuls of its own surface". Perhaps, he continued, "sinkclone" should be coined "to suggest the Dante-esque weirdness of the phenomenon" (McLeod 1986).

From the moment it first appeared on 11 May 1981, people began to treat Winter Park's sinkhole as if it were a living creature satiating

its appetite. The growth of the hole was framed as an elaborate meal that began with the sycamore tree as a light appetizer. Mae Rose Owen's three-bedroom home was the first course. The second course was five luxury cars, followed by seven additional trees, a shed, and large sections of the local pool and Denning Drive. While the hole was enjoying a fancy dinner, local authorities could only stand-by and watch natural forces unfold. "We have to let Mother Nature take its course", said Winter Park Fire Captain Gus LaGarde. Hour by hour, the hole expanded a couple of meters here and there, while the authorities remained unsure of its trajectory. "There is a couple good-sized baseball fields nearby", LaGarde said. "We wish it would go in that direction" (Associated Press 1981a). But the anthropomorphized sinkhole was not only "going places", it was also "taking bites" and "gulping down". By Sunday, "the monster [with] a voracious appetite" as the *Associated Press* described it, did not stop eating until it had swallowed an arena the size of a football field (Associated Press 1981c).

The spectacle of the living, monstrous underground – a traditional, historical image of the world below – soon drew hundreds of onlookers to Winter Park. At times, crowds of more than 500 people gathered around the hole; perhaps adding in another stop along their tour to Disney World. Fairbanks Avenue, another road leading past the hole, eventually had to be closed due to the increasing number of rear-end collisions. People were more preoccupied with gawking than driving (Carrasco 1982; Marcus, Caviedes 1983, 2). Entertainment and enterprise soon followed. Some "enterprising spectators" set up a lemonade stand, while others sold T-shirts bearing the slogan "Winter Park Sinkhole" (Associated Press 1981c). As the sinkhole persisted, Winter Park resident Lou Montesi became the "king of souvenirs". For months, he sold Frisbees, sinkhole T-shirts, and sinkhole photographs. On some days he made as much as U.S.$ 900. He even built an observation platform for those wanting to get a better view (Roen 1982; Colarossi 2002). Among them were busloads of geologists who were enthusiastically venturing into the new disciplinary subfield of sinkhole science that emerged in the incident's aftermath. In 1982, the Florida Sinkhole Research Institute was established at the University of Central Florida in Orlando with the aim to create a sinkhole database (Griffin 1987). In the years following, whenever geology conferences were hosted in Orlando, the most consistently sold-out side trip was the bus tour of the Winter Park sinkhole (McLeod 1986).

Jeff Briggs, Winter Park's city planer had sympathy for the crowds: "Where else do you see a house swallowed up" or "Porsches in a Sinkhole?" **[fig. 3]**. Public curiosity about the sinkhole was not about fatalities – anyways a rarity when it came to sinkholes in Florida. At the time, the only confirmed account of a sinkhole causing a fatality

e-ISSN 2785-2709

in Florida dated back to 1959, when a man drilling for water was buried in a sinkhole collapse. A nearby geologist was buried up to his neck but managed to escape uninjured (McLeod 1986). People's guilty pleasure was their focus on property damage. However, as Mae Rose Owens house sat next to German luxury cars, it showed how the sinkhole took no note of social difference and how people had different resources to deal with the catastrophe.

The part of Winter Park where the sinkhole collapsed, about a mile southwest of downtown, symbolized America's ambivalence towards its cities. Though generally a low-income area, it was marked by stand-alone family homes and vast green spaces. Fairbanks Avenue, the town's main thoroughfare was a busy shopping street; Denning Drive was an important access road leading, among other places, to Disney World (Marcus, Caviedes 1983, 8; UPU 1981). And yet, the small 3-bedroom home of Mae Rose Owens stood next to a car dealership that sold high-end Porsches manufactured in Germany. When both the African American woman's home and five Porsches toppled into the hole, a discussion erupted over what to save.

Figure 3 Navoy, A.S. Winter Park Florida Sinkhole of 1981. Image 5 out of 15. 1981. Washington D.C., US Geological Survey, Winterpark. Public Domain

e-ISSN 2785-2709

Real estate agent Bob Govern was home when he received the message that his US$ 40,000 Porsche sports car, which had been at the dealership for repairs, had toppled into an earthly crater. Together with two other Porsche owners, Govern considered a helicopter rescue of the cars, which, at the time, were still upright and virtually intact, hanging in there about 15 meters (50 feet) down the side of the sinkhole. Initially, city officials vetoed the idea due to the danger of further cave-ins (Associated Press 1981c). The following Monday, county officials similarly rejected Govern's second idea to lift the car out with a crane. On Thursday, finally, they approved the mission after the Reliance Insurance Company of Orlando, the car's insurer, pledged a US $5 million liability policy to cover possible damages for city and county governments (Kilsheimer, Carrasco 1981).

On the day of the luxury car rescue, about 100 people from Winter Park attended a meeting with geologists and city and county officials to learn more about sinkholes in general and the current situation. Mae Rose Owen was the focus of attention. She had lost everything to the sinkhole, from pictures of her five children and antique furniture that her mother had given her to a small box containing about US $100 that she had won on a trip to Las Vegas and had planned to give to her grandchildren (McLeod 1986). However, the *Orlando Sentinel* portrayed her as a stoic woman who did not understand what a geotechnical engineer said about how sinkholes are formed, nor why homeowners who lived at the edge of the sinkhole "had to pay to stabilize the slope to prevent further erosion". She seemed like the perfect victim in a narrative that saw the sinkhole as cause of the catastrophe, but not urbanization or water extraction. Ultimately, the news outlet quoted Owen as saying, "I don't think it's fair, but someone has to bear the brunt" (Kilsheimer, Carrasco 1981).

The trouble was that 'someone' was an African American woman at the lower end of the social and economic strata in an otherwise wealthy state of the US, or in other words: Mae Rose Owen. Since the properties at the edges of the sinkhole were private, the city of Winter Park was prohibited by law from spending public money on them (Kilsheimer, Carrasco 1987). As with the Porsche rescue mission, insurance institutions played a significant role also in the story of Mae Rose Owen's home. Yet, while the Porsche insurance company put down US$ 5 million to cover potential damage from the rescue mission for the luxury cars, Mae Rose Owen did not come out on top. Her insurance covered the loss of her home, but not her property. Taking note of the inequality and injustice wound up in the sinkhole case, associates of Winter Park sinkhole expert Jim Jammal ultimately raised money to buy Owen a plot of land on which to rebuild her home (Griffin 1987).

6 Conclusion

It took several weeks for the sinkhole in Winter Park to stabilize after it formed. Initially, a great deal of debris was sucked into the subsurface, including Mae Rose Owen's house and large sections of the city pool, but not the cars, which had escaped a similar fate through a spectacular rescue mission. Eventually, the sinkhole naturally plugged and filled with water. However, before the residents of Winter Park could relax, the sinkhole suddenly drained twice, indicating that the plug had been breached, and that water could flow freely into the subsurface aquifer again. Months passed before the sinkhole plugged permanently and its hydrology stabilized. The ground had finished its destruction, and Winter Park residents could again relate to the seemingly unchanging natural environment based on a stable underground (Jammal, Associates 1982).

Over the course of the following years, the city redeveloped the urban landscape, stabilizing the edges near businesses and converting the former pool into a ball field. The sinkhole was renamed Lake Rose in honor of the woman whose home the earth had swallowed (Brinkmann 2013, 108). Still, little active memory culture remained; perhaps also because there exist just too many sinkholes in Florida. Funding for the Florida Sinkhole Research Institute founded in 1982 was discontinued in the late 1990s, and its sinkhole database was transferred to the Florida Geological Survey (Griffin 1987). Today, residents view Winter Park's sinkhole as an urban recreational lake rather than a local catastrophe, which begs the question: "If a sinkhole forms in the woods, does anyone hear it drop?" (Brinkmann 2013, preface).

Ultimately, Winter Park's 1981 sinkhole is emblematic of the evolving relationship between humans and the environment in the Anthropocene era with all its difference and necessary differentiation. The sinkhole was a key turning point in the live of some and, with the help of the right insurance, solely a drop in the ocean of history in others. Although the forces of the sinkhole from below ground overpowered the logic from above ground in one bold strike, they ultimately did not distort social inequality. Additionally, Winter Park's sinkhole symbolizes the human tendency to avoid close examination, even when standing on shaky ground. Although the sinkhole gave rise to sinkhole science and underground studies, the results did not lead to changes in urbanization patterns or groundwater extraction. Instead, insurance companies became the primary employers of

geologists and their sinkhole data as people seek to maintain the established order above ground through insurance.[3]

Such refusal to respond to the necessary and unchangeable exchanges of flows between above and below ground in a karst landscape represents as much an ecological, economic, and political problem as a conceptual and historical one. It demonstrates the persistence of what Eyal Weizman has called a geopolitical discourse "that tends to look across rather than cut through landscapes" (Weizman 2002). The volumetric perspective as proposed in this special issue, and in this contribution, offers a way to reframe this discourse and to show the strong entanglements of above and below ground logics and logistics.

Funding

Financial support for this article comes from the German Research Foundation, DFG Heisenberg Professorship of Global Environmental History and Environmental Humanities, Grant Number 495535764.

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3 However, the role of insurance as an institution that enforces the established above-ground logic of property law was challenged early in the new millennium. In the early 2000s, Florida's insurance policies offered generous sinkhole coverage. Even minor issues, such as small cracks in driveways or walls, were paid for. This invited unscrupulous individuals to file sinkhole claims for cosmetic damage that was often unrelated to actual sinkhole activity. This created a snowball effect, with insurance companies increasing inspections while fraudulent claims continued. Both eventually led to premiums spiking for everyone and the housing market going into a sinkhole panic. By 2011, lawmakers passed stricter regulations to curb the panic ("Sinkhole Frenzy: How Florida's Real Estate Was Rocked in the 2000s", article available at `https://graystoneig.com/articles/sinkhole-frenzy-how-floridas-real-estate-was-rocked-in-the-2000s`).

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General Section

e-ISSN 2785-2709

Lagoonscapes
Vol. 5 – Num. 1 – June 2025

"Demasiado Poco Homenaje": The Eva Perón Tomato and Absence within Living Memorials

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Abstract Memorials to Eva Perón surround the world, but one example remains overlooked: the Eva Perón tomato. Developed in honor of the former Argentine First Lady, and within a pattern of eight other fruit and vegetable varieties named after Eva and Juan Perón. We ask how the Peróns are represented through these plant varieties. Through an online critical audit of seed offerings, we find consistent absences within their living memorial landscape. We then ask what broader impacts and affects these absences generate within the context of food-based living memorials. We contextualize the idea of living memory and absence's presence shaping the representations and more-than-human affects of biography.

Keywords Memory. Heritage. Memorials. Eva Perón. Absence.

Edizioni Ca'Foscari

Peer review

Submitted 2024-08-03
Accepted 2025-05-28
Published 2025-07-21

Citation Tennant, H.; Rhodes, M. (2025). ""Demasiado Poco Homenaje": The Eva Perón Tomato and Absence within Living Memorials". *Lagoonscapes*, 5(1), 229-246.

DOI 10.30687/LGSP/2785-2709/2025/01/011

1 Introduction

> Within the ecology of life, death is a necessary partner.
> (Deborah Bird Rose, *Environmental Philosophy*, 2012, 127)

The Eva Perón tomato was developed by Professor Abelardo Piovano at Universidad Nacional de Cuyo and named in honor of First Lady, Eva Perón. Meli (2017, 87) writes that the School of Science's board of directors drafted a manifesto that the naming of a tomato was "demasiado poco homenaje" (too little homage; transl. by the Author) for a figure as important as Eva Perón (cf. Tacchini 2018). Despite the legacy Perón left behind and the fact that the tomato is named after her, the tomato's legacy and even its name has paid little homage to her as the tomato today goes by the name Peron sprayless or even Juan Peron (without an accent over the 'o'). Across dozens of online retailers selling or sharing Perón-based varieties, none acknowledge, let alone describe, the life and death of Eva (or Juan) Perón.

Recent research has identified an emergent and growing pattern of using eponyms, or the name of specific individuals, in the naming of plant-based food varieties (Rhodes, Keeve 2023; Rhodes, Bartoszek 2024). Inspired by existing work on the Paul Robeson tomato and the political economies underlying the structures of living memory, our work isolates not only the Eva Perón tomato, but an additional nine varieties named after Eva and Juan Perón. We are left asking the question, however, of *how* the Peróns are commemorated through living memorials or food-based plants, with the follow-up question of why all varieties fail to either mention the historical significance of the Peróns or acknowledge deeper human representations within the eponymic commemoration. After systematically searching through multiple seed websites, inspired by a process of documenting representation in the memorial landscape by D'Ignazio et al. (2022) called a "critical audit", and performing a content analysis, this paper argues how these Perón varieties, instead of memorializing, make absent or obfuscate the human within these human-environment relations. There are also the historical contexts of shifting names, where the Eva Perón tomato is often now referred to as the Peron sprayless tomato, the Juan Peron sprayless tomato, the Juan Peron tomato, or simply the Peron tomato. The erasure of Hispanic and female identifiers of the memorial by removing Eva's name and the accent within Perón also symbolize ongoing patterns found within memorialization, commemoration, agriculture, and everyday ecologies of life and death more broadly.

This paper draws from a mixture of approaches from posthumanism and political ecology to introduce the concept of living memory and then explore how one's legacy is preserved through the memorialization of plant-based food varieties, with an emphasis on

the Eva Perón tomato, as well as other forms of living memory. This work also falls within broader considerations of ecological memory but offers alternative pathways to existing patterns of eco-mourning as we consider the significance of cultural resiliency alongside the ecological memory and heritage work of gardening, plant breeding, and seedsaving. Ecological resistance within memory and heritage work, however, can also reflect or even inspire parallel violence within industrial agriculture of unsustainable production, genetic modification, and the hybridization, patenting, and commercialization of seeds. Reactionary ecologies of life and death also emerge as we find below when some individuals name their own plant varieties in opposition to those named for the Peróns, despite finding minimal biographical engagement, overall. We consider the additional varieties named after Eva Perón, including the Evita tomato, Evita corn, Evita pumpkin, Evita strawberry, and Evita squash, as well as the conflicting nomenclature from the Juan Peron tomato, the Juan Peron sprayless tomato, and the Peron sprayless tomato. After performing data collection across websites that list or discuss these different varieties and attempting content and discourse analysis, we can begin to understand the importance of memorialization and its absence. From here, we can paint a picture of how, although they are named in honor of the Peróns, they fail to acknowledge the mark they made on the world. Furthermore, these living memorials inspire deeper questions of the political ecologies of life and death. Multiple layers include the life and death of the tomato plants, their continuation via seedsaving or agency through adaptation and propagation, and the ecological relationships at work commemorating the life and death of individuals with their own tenuous humanitarian impacts. While Eva Perón's decade of political action is often framed as a symbol of social justice, particularly across Latin America, Juan Perón's legacy of social justice and reform across thirty years of Argentinian politics, has been marred by his fascist sympathies and extrajudicial killings. These various scales of life and lived experiences across the political ecologies of memorialization offer a poignant means of discussing memory and eco-imaginaries within the more-than-human world. We find a clear connection between the political ecology of a capitalist system that strips contexts from our food systems and the lost posthumanist heritage of a previously intertwined living memorial – the Eva Perón tomato.

2 Living Memory

Plants play a critical role in shaping politics, the environment, and the mutual relationship between living non-human elements and humans. Plants are essential to human survival. While over time

humans have shaped the lives of plants through various activities, posthumanist work has more recently centered plants' shaping of the living memory of humans (Head 2009). Living memory is often cited as simply the events and experiences that one can remember. It allows us to understand historical events and construct an image or narrative of the past (Assman 2011). However, we present living memory differently, by incorporating a more explicitly human-environmental relations perspective. Drawing from Rose (2012) and Ginn (2016), we frame living memory as the embodiment of the past in the present. This multispecies and generational approach to time frames every creature as "both itself in the present, and the history of its forebears and mutualists" (Rose 2012, 136). Ginn (2016, 7) states that "creatures become living embodiments of past times". His work in the garden, of using plants to memorialize,

> underscores the transience of life, memory and presence, as plants can become detached from the object they memorialize over time, or can themselves die, grow into new shapes, or become nuisances. (Ginn 2014, 236)

We ask how a more-than-human framing of living memory can shift our perspectives and allow foci not just upon the use of non-human materials for memorialization, but the agencies and affects of spaces just as gardens and groves within our commemorative landscape (Cloke, Pawson 2008; Ginn 2016)?

While living memorials, as we are engaging with them can commemorate living persons, most are memorials for the deceased. In this way, non-human life commemorating the loss of human life finds dialogue with the human contemplation of the loss of non-human life. "Eco-mourning", framed as an emotional response to environmental loss that centers or glorifies mourning over alternative responses, often fails to contextualize the capitalist and colonial conditions within or the alternative futures of response to ecological disasters (de Massol de Rebetz 2020; O'Key 2021). While these comparisons may offer relevant connections, they nonetheless fall into the same traps of eco-mourning itself by isolating the human from the more-than-human. Incorporating a posthuman perspective into living memory instead frames ecological (including human) loss within the same threads of emotional and social responses towards sustainability and preservation in order to not only remember, but to learn and rectify the lost work contributed from those mourned.

Food-based plant varieties also navigate complex social and economic relationships within broader contexts of life and death in the Anthropocene. Rhodes and Bartoszek (2024) find that while older eponymic varieties are considered heirloom and more integrated into local communities reflecting more local cultural traditions, in the

past half century, in particular, we can see an industrialization of these varieties, with private companies naming the majority of living memorials. Growing local plant varieties can benefit the environment when crops are closely linked to cultural landscapes. They are passed down from generation to generation through practices like seed exchange, which contribute to cultural tradition. Jordan (2015, 45) connects these heirloom histories across a spectrum of edible memory and heritage where "at one end are people with their personal edible memories of cherished family heirlooms" and at the other end, a "broader pursuit of local, seasonal, or novel cuisine". This is where living memory comes into play and works to preserve a connection between seed-saving methods, tradition, and generations to come. Seed saving and exchange are important parts of many traditional food-based plant varieties, and they provide farmers with knowledge that can be shared (Campbell, Veteto 2015). Heirlooms and the heritage value they accumulate help to resist industrial agriculture, assigning cultural and economic value through more personalized forms of biodiversity and eco-resistance.

Growing and sharing locally adapted plant varieties strengthens the connection between culture and the seed cultivator, however with the increased industrialization of living memorials and even the commercialization of heirloom varieties there has been both an increased use of commemorative practices solely for marketing purposes and an erasure of biographical narratives alongside the varieties (Jordan 2015; Rhodes, Bartoszek 2024). This intersection of biological and biographical loss connects our work into ongoing studies of eco-mourning.

Nevertheless, cultural narratives passed down from the seed cultivator can help others recognize the cultural significance of seeds. Through shared experience from the seed cultivator, people can remember the specific characteristics of different varieties, such as taste, appearance, and adaptability to local conditions, if they live long enough. Cultural narratives also help people connect. Just like the achievements, impacts, and significance of influential individuals like Eva can be remembered across generations (Nesbitt 2023).

Hispanic (and many other non-English) memorial landscapes also feature a uniquely colonial racialization of language. In a study of 45 major museums in New York and California, 31 of which utilized some amount of written Spanish, Callahan (2014) found that 12 contained errors in translation, spelling, and grammar. Both the California Science Center and the National Museum of the American Indian contained "several" instances of missing accent marks. Eponyms reflecting living memory can memorialize violent historic figures, such as [Confederate General] McCown's Longspur now named the Thick-billed Longspur (Driver, Bond 2021). The *Rubus mussolinii* blackberry was named for Mussolini but deemed merely a variant of

ulmiforia, but *Hypopta mussolinii* continues to memorialize Mussolini via a Libyan moth, and *Anophthalmus hitleri* memorializes Adolf Hitler through the scientific species name of a cave beetle (Heard 2020; Lidz 2023). While these forms of memorialization can indeed cause harm and elevate historically violent figures from the past into the ecological present, absence within the memorial landscape and memorialization more broadly can also commit violence. The "manifestation of willful ignorance or carelessness" when dealing with multiple languages or translations can reflect a written "racialization of language" (Callahan 2014, 103). The use of racially or colonially-coded fonts can obfuscate, or make absent, the written language of cultures (in this case, the diaereses, tildes, and acute accent often found within written Spanish; i.e. the 'ó' in Perón). As Callahan (2014) argues, while this can certainly impact meaning within translation, the symbolic value of this absence can have greater impacts.

In our capitalist society, seeds are a commodity, something that can be bought and sold like any other product. However, because of this, seeds are often forgotten within our food systems. This forgetting decreases the number of diverse food-based plant varieties regularly grown or sold (Nesbitt 2023). In fact, 93% of seed varieties of common foods are at risk of becoming lost (Veteto 2009). As we highlight below, the Peróns, while prominent across Argentine and global memorial landscapes, have likewise become lost within the contexts of their living memorials. By centering not only the posthumanism of these varieties but their political ecologies we hope to understand how "nature pushes back against its exchange value and perceived uselessness within capitalist systems" by isolating the devaluing, absence, and forgetting within our plant and food systems (Rhodes, Keeve 2023, 427).

3 The Peróns, Memorialized

María Eva Duarte de Perón (i.e. Eva Perón), commonly referred to as "Evita", was born on 7 May 1919, in Los Toldos, Argentina, a small village outside of the nation's capital, Buenos Aires. She moved to Buenos Aires in 1935 and was considered working class with limited opportunities and social mobility (Navarro 1977). Weinstein (2006, 170) writes,

> [Eva Perón's] lower-class origins were allegedly inscribed on her body and clothes, as well as in her discourse and ideology.

This changed when she met Juan Perón, who would eventually become her husband and the President of Argentina from 1944 until 1955 (Favor 2011). Eva rose to fame as the First Lady of Argentina. She used

her platform as the First Lady to advocate for women's rights and the working class, securing women's suffrage in 1947 and establishing the Perónist Women's Party (Hammond 2011; Navarro 1977).

Eva established the Eva Perón Foundation, which oversaw welfare programs focused on providing housing, schools, and medical care for women and children. One of her most notable achievements was the development of the Female Peronist Party, which worked to promote women's involvement in politics. For the first time, Argentine women were granted the right to vote with the passage of the Women's Suffrage Law in 1947 because of Eva Perón's political and cultural work. Although her efforts did not come without criticism for using state money to arguably boost her and her husband's (Blanksten 1953), she became known as a "myth of a spiritual leader" (Taylor 1981). Because of her influence and reputation as an advocate for social justice and women's rights, her legacy extended outside of Argentina to become an iconic figure internationally (Misemer 2008; Spaderna 2002). At the age of 33, Eva Perón's political career was cut short when she passed away from cancer on 26 July 1952. Despite her short life, her legacy left an everlasting mark on Argentine politics and society, including a wide landscape of monuments and memorials and the Eva Perón tomato (Del Rosario Betti 2006; Vega, Vohnsen 2021).

Eva Perón was considered to be one of the most powerful female figures in Argentina before her death in 1952. The Monument to Eva Perón, standing outside of the Fundación Eva Perón, in Buenos Aires is a representation of her power in politics, her contributions towards Argentina's working class and commemorates her status as a champion for social justice. The monument depicts Eva Perón standing on a large pedestal, her right arm raised, and expressively addressing a crowd. The monument portrays her as charismatic and powerful political figure and her relationship with the Argentine people. The statue also features plaques surrounding it that recognize Eva's moments in her early career as an actress, her relationship with Juan Perón and her political work to improve the lives of women and the working class. The plaques contain quotes from her political speeches that signify her impact on the lives of the people of Argentina both politically and socially. The monument honors Eva's legacy and her efforts to improve society.

Eva Perón advocated for women's empowerment and the working class. She portrayed herself *descamisada*, a woman of the poor countryside, to connect with the working-class people and maintain her relationship with the poor (Masut 2006). She also utilized her powerful voice, emotions, empathy, and ability to understand and argue for the struggles of women in society. Eva created her own image through her speeches and public image. Her popularity endures and continues to impact Argentinian politics. Argentina felt as if the former Perónist president, Alberto Fernández, who was

voted out of office in 2023, did not live up to the Perónism ideology during times of inflation and rising poverty rates in the country. Many people evoke Eva as a needed contemporary influence in promoting social mobility in Argentina in times of new presidential leadership (Poloti 2022).

Eva's life story and her work with Juan has been showcased in numerous books and artworks. Abroad, Eva's life story was told through the 1978 Broadway rock musical, *Evita*. The musical was so successful that it was followed by the publication of *Santa Evita* in 1995, which became a best-selling novel. These pieces of work sparked an interest in Evita around the world. Eva's image as an international icon was confirmed following the adaptation of musical *Evita* into a 1996 Hollywood film of the same name which featured the American singer, Madonna as Eva. A little more than a decade later in 2011, the film *Juan y Eva* was released and told the story of Eva and Juan's relationship and their efforts to improve the lives of those in Argentina (Vega, Vohnsen 2021). More recently, *Santa Evita* a Disney+ mini-series based upon Martínez's (1995) novel of the same name, streamed seven episodes in 2022. These works capture the impacts Juan and Eva had on society and commemorate their life and roles globally by highlighting their achievements and the legacies within Argentina's political landscape.

Juan and Eva's influence on Argentina is celebrated and remembered through public spaces like monuments, statues, and parks. These places serve as tangible reminders of how Juan and Eva impacted society and politics. They also serve as places where people can come together and honor their memory. Like any memorial, these landscapes simultaneously serve multiple purposes. First, memorials originate out of cultural and historical context in the space and time and in memory of those being memorialized. While memorials indeed shift in their meanings and interpretations over time, Lowen (1999) nonetheless argues that these original historical contexts and the originally implied motivations and meanings sustain throughout and even following the life of a memorial. Second, every memorial has a memorial entrepreneur, a figure or figures with social, political, and/or economic motivations for the continuation or creation of a specific collective memory (Jordan, 2006; Rhodes, Bartoszek 2024). Third, memorials do change, as do their broader assemblages and cultural contexts from which collective memory form. Stone weathers, metal corrodes, the surrounding landscapes shift, information can be added or retracted, responses can be built nearby or result in selective or holistic memorial destruction, and the very identities which shape and interpret the memorial from fluid and plural political and cultural perspectives also consistently shift. While statues and public art monuments, often found within urban centers, may be perceived as immovable, physically and culturally, many works explore the

inherent contentiousness of our memorial landscapes (McKittrick 2006; Heath-Kelly 2018; Steinberg 2022).

Argentina's capital, Buenos Aires is home to many memorials that are dedicated to Juan and Eva. The presence of the Peróns throughout Argentina is still felt. It is common for speeches, gatherings, and candlelight ceremonies to take place on the date of Evita's death, and the contributions she made has resulted in museums, statues, and monuments built in her legacy. The presidential palace, The Casa Rosada, or "The Pink House", is where Evita often addressed supporters of Peronists from the balcony. Today it allows visitors to take part in free tours and stand in the very spot from which Eva connected with and spoke to the people of Argentina. It was also the film location for the song released in honor of Eva, *Don't Cry for me Argentina*. Additionally, the palace features presidential regalia, campaign posters, and slogans all of which depict Perónism's impact on Argentina (Luongo 2012). The Museo Evita in Buenos Aires preserves the memory and legacy of Eva's work to improve the lives of women and children across Argentina. The museum was declared a National Historical Monument in 1999, and it now serves as a living museum where people can learn about and honor the life of one of the most influential women in Argentina's political history.[1] The General Confederation of Labor Building in Buenos Aires showcases an image of Eva in the center, which is lit by eternal flame. It is the site of Eva's corpse which was embalmed in and stored there until a monument in honor of Eva was constructed. The site continues to commemorate Eva Perón and her embalming through the museum's narratives (Luongo 2012).

Today Eva Perón's body lies in the Recoleta Cemetery in Buenos Aires, approximately 5 meters underground to protect her remains. Her memorial is a popular tourist attraction in Argentina and people honor her by leaving fresh flowers on notes on her tomb. On the anniversary of her death on 26 July, the tomb attracts crowds of thousands of people (Vega, Vohnsen 2021, 34). Until 1999, an official monument of Eva was nonexistent until finally a statue honoring her memory was placed at the National Library and called the Evita Monument. The bronze statue depicts Eva as the powerful and charismatic figure she was, striding forward to address a crowd of people. (Vega, Vohnsen 2021, 143). Along with the other living memorials that showcase Eva's lasting legacy, the monument stands as a symbol of her impact on Argentine society.

1 The Museo Evita's website is available at `https://museoevita.org.ar/`.

4 Evita Corn, Pumpkin, Squash, and Strawberry

Table 1 Results from webscraping websites offering or discussing Evita corn, pumpkin, squash, and strawberry varieties. Across 11 sites, none acknowledge either the Peróns' or the varieties' histories

	Evita corn, pumpkin, squash, and strawberry	Acknowledge Peróns	Acknowledge history or Argentina
Individual Websites	10	0	0
Etsy Listings	0	0	0
Amazon Listings	1	0	0
eBay Listings	0	0	0
Seeds Savers Exchange	0	0	0
Scholarly Texts	0	0	0
Total	11	0	0

Although we focus upon the commemorative tomatoes memorializing the Peróns, we did first explore the memorialization of the Evita corn, pumpkin, strawberry, and squash varieties. We performed data collection, first broadly using a Google search engine, and then specifically searching host sites, such Seed Savers Exchange or Amazon, for any specific mention of these varieties. Across all four varieties, we only found 11 websites, none of which acknowledged Eva. Based upon the community-generated gardening website, Dave's Garden, the only place Evita corn can be found online, the only two provided notes on the Evita corn indicate that it existed in 2009 and is a variety of sweet corn. We also found very little background information into the histories of these varieties: the squash is a Lebanese variety supposedly developed in 2005, and the Evita strawberry was registered with the USDA in 1995 following development by Peter Edward Vinson and Simon P. Warren in 1988 in the United Kingdom. We were relatively disappointed in the lack of data across all four varieties, which points little beyond the absence of Eva from these Evita varieties, with little additional information.

5 The Perón Tomato(es)

The Eva Perón tomato was developed by National University of Cuyo Professor Abelardo Piovano. However, like the previous four Evita variety results, our search for the Eva Perón tomato actually resulted in only a single result, a book published by the University mentioning the history of the tomato itself. The university text vaguely indicated that that the Eva Perón tomato was developed following Eva's death

in 1952 (Meli 2017): "en homenaje a la primera dama, design con el nombre Eva Perón un tomete product de un cruzamiento" (in homage to the first lady, named a crossbreed tomato after Eva Perón; transl. by the Author).

While it is implied that the name followed Eva's death, that is uncertain. Following additional archival research, another history written about the faculty of the university (Tacchini 2018, 92) lists only two varieties as originating from Piovano's "ideología política" (political ideology): the "17th of October" and the "Eva Perón".

In addition to the Eva Perón tomato, the Juan Perón tomato is more commonly listed in seed catalogs. Data collection was performed across the same platforms using the keywords "Juan Perón" or "Perón" and "Tomato". While the Juan Perón sprayless tomato was noted 40 times and the Juan Perón tomato 13 times across different websites, none of them acknowledged who Juan Perón was nor the impacts he made. Research instead reveals that these two different varieties (the "Juan Perón" and "Perón Sprayless") are in fact one-in-the-same. Several websites even state that the Juan Perón tomato is "also called the Juan Sprayless Tomato". Both tomatoes are noted as being developed by Professor Abelardo Piovano at the National University of Cuyo in Argentina, the same developer and location and around the same era as the Eva Perón tomato. Looking further into what this may mean, we found that Glecklers Seedsmen introduced the Perón sprayless tomato variety in 1951, while the USDA lists the Juan Perón tomato as donated from a Mrs. James E. Winfield in Painted Post, New York on 4 April 1951. We find a consistent pattern of the Juan Peron tomato also being referred to as the "Juan Peron sprayless tomato". A Tomato Genetics Cooperative (1960) report further dates the variety to 1948 and identifies it under the name "J. Peron Argentine 1948 Resistant to disease". However, in December 1954, the USDA also records receiving a "Perón" variety of tomato from Professor Piovano. Going into the actual Gleckler 1951 seed catalog also revealed that the variety was not introduced as the Juan Peron tomato or the Juan Peron sprayless tomato, but simply the "Peron sprayless" tomato, referred to elsewhere in their same catalog as simply Peron. With these sources, it becomes quite obvious that these are both the same variety, but what of the Eva Perón tomato listed in the recorded histories of the same university which supposedly introduced the Peron sprayless? In neither text are a Juan Peron or a Peron sprayless tomato mentioned (Meli 2017; Tacchini 2018). Given that we were unable to find any mention definitely linking Abelardo to a variety other than Eva Perón; that all direct sources of Abelardo's contributions only ever say Peron, Perón, or Eva Perón; that Tacchini (2018) who further sought to link Abelardo's work to his political ideology only ever mentioned the Eva Perón tomato; and that there is no specific date given for when the

Eva Perón tomato originated as opposed to the Perón tomato, which we traced to 1948; we can confidently state that we believe that there is only a single Perón variety: the Eva Perón tomato.

In contrary addition to the complications of tracking down the history of the Perón tomato variety/varieties, the Evita tomato is clearly identified as a small heart-shaped "balcony" tomato developed by Blumen Eber, a German nursery. Based on our findings, only five sites list or mention the Evita tomato, and a similar silence with the Evita tomato follows the other one-to-four tomato varieties, with no mention of either Eva or the variety's history.

Table 2 Web pages referencing the Juan Perón tomato and their acknowledgment of Juan Perón, history of the variety, or Argentina

	Juan Perón Tomato Sites	Acknowledgment of Juan Perón	Acknowledgment of history	Acknowledgment of Argentina
Individual Websites	4	0	3	3
Etsy Listings	1	0	0	0
Amazon Listings	0	0	0	0
eBay Listings	3	0	0	0
Seeds Savers Exchange	5	0	0	0
Scholarly Text	0	0	0	0
Total	13	0	3	3

Table 3 Web pages referencing the Perón sprayless tomato and their acknowledgment of the Peróns, history of the variety, or Argentina

	Perón sprayless tomato Sites	Acknowledgment of Juan or Eva Perón	Acknowledgment of history	Acknowledgment of Argentina
Individual Websites	31	0	26	25
Etsy Listings	1	0	1	1
Amazon Listings	0	0	0	0
eBay Listings	3	0	3	3
Seeds Savers Exchange	5	0	0	0
Scholarly Text	0	0	0	0
Total	40	0	30	29

Table 4 Web pages referencing the Evita tomato and their acknowledgment of Eva Perón

	Evita Tomato sites	Mention of Eva Perón
Individual Websites	4	0
Etsy Listings	0	0
Amazon Listings	1	0
eBay Listings	0	0
Seed Savers Exchange	0	0
Scholarly Text	0	0
Total	5	0

6 A Present Absence

While our original goal was to code and conduct a discourse analysis, following Rhodes and Keeve's (2023) analysis of the Paul Robeson tomato, given the absence of data illustrating the ways in which Eva and Juan Perón are memorialized, we were unable to move forward as planned. And while we set out to understand how the Peróns are memorialized, we have raised additional questions as to why such a large data gap exists between the Paul Robeson tomato, which Rhodes and Keeve (2023, 433) identified 63 sources related to the tomato with 41 (65%) acknowledging Paul Robeson himself. We, on the other hand, found 69 sources, with only a single mention in an academic text. Of the 69 sites, only the academic source describing the history of the Eva Perón tomato includes an accent on the 'o' in Perón. Beyond representation, this data speaks to a failure of memorialization and a narrative of absence embedded into the more-than-human memory of Eva Perón. This absence intersects with ongoing considerations of eco-mourning and ecological loss in several ways. These absences also mirror the historical contexts of the more-than-human blurring of biographical and biological recognition, where racist and colonialist lenses of humanity were used to justify "political, social, and economic hierarchies" (Ives 2019, 2). Taking a step back, it is necessary to discuss why the Peróns are not acknowledged through plant-based food varieties named in their honor. After all, Eva was admired just as much as she was criticized and viewed as a controversial figure. Could this negative light shown on her perhaps interfere with how she is memorialized? Or could it be the fact that seed varieties such as those named after Eva and Juan are seen as commodities? And does this point toward diverse plant-based food varieties becoming lost as a result of an economy that is driven by capitalistic practices? Rose (2012, 130) situates

more-than-human memory within "generational time", which they state, "clearly involved both death and birth", however, that cyclical generational time includes such processes as "hatching, germinating, and sprouting". While commercialization certainly does not preclude, and can even fervent living memorialization processes (see Niala's 2023 work with a 1918 British allotment garden), it can corrode the generational time which drives heirloom, heritage, and landrace varieties of plants which were developed primarily for subsistence with rich historical and cultural contexts. The Paul Robeson tomato, for instance, is "unmarketable" because of the "tomato's physical inconsistencies" (Rhodes, Keeve 2023, 440). Unlike a Soviet-grown tomato with frequent "scarring, splitting, and disfigurement" (Rhodes, Keeve 2023, 426), the Argentine-grown Perón tomatoes were deliberately developed by and for agricultural science (Meli 2017). Capitalism, in this case, shapes the narratives of the Perón agricultural commodities rather than generational time embedded into the meanings and memories of heirloom varieties. While there are cases where commercialization and heritage blur within landscapes of heirloom conservation and education (i.e. Glover and Stone's 2018 work with Ifugao rice) or where the agency of plants actively resists the privatization of public commemorative spaces (Cloke and Jones's 2004 work with cemetery trees) sociopolitical contexts and political economies do shape biographical and biological representation and narratives of life and death.

When considering that the memorialization of Eva could be lost due to her being recognized as a controversial figure, it would be unusual for her to be memorialized in multiple forms but not plant-based memorials because of her politics. Today, she continues to be remembered through statues, music, museums, movies, music, and political ideology. These forms of memorialization, alongside the broader urban fabric of Buenos Aires (streets, buildings, parks, and neighborhoods) commemorating Eva and Juan (Betti 2006) capture the lasting social and political impacts of the Peróns on Argentine society.

It is clear that Eva Perón is still an iconic figure who is actively memorialized in a plurality of formats. Future steps require additional archival research to further contextualize the development of these food-based plant varieties. Additionally, firmly identifying the history surrounding the naming of the Eva, Juan, and Perón sprayless tomatoes may offer additional context for their absence within these living memorial landscapes. In both cases of memorial absence and the broader ecological loss in the Anthropocene, we can point towards a possible capitalist root of violence.

7 Conclusion

This paper demonstrates the memorialization of Eva Perón and Juan Perón through living memorials, specifically focusing on the Eva Perón tomato and other food-based plant varieties named after them. Despite the significant impacts and historical significance of the Peróns, these living memorials fail to acknowledge their lived experience and the contexts surrounding how they impacted the lives of others. The lack of acknowledgment in the memorialization of the Peróns through these plant varieties raises questions about how influential figures are remembered and how their legacies are preserved and the intersecting role of industrial agriculture and capitalist foodways to not only strip away biodiversity and other environmental services but to make absent the very core of what makes an heirloom an heirloom: the living memory and heritage embedded within its story.

The concept of living memory involves the events, experiences, and people that are remembered and shape our understanding of the past, which is crucial in the preservation of legacies. Food-based plant varieties play a significant role in local cultures and communities, and their cultivation and exchange contribute to cultural traditions and the passing down of knowledge. However, in the case of Eva and Juan Perón, there is a lack of commemoration being passed on. This paper examines the memorialization of Eva and Juan Perón through the Evita tomato, corn, strawberry, squash, and pumpkin. It also explores the varieties named after Juan: the Juan Perón sprayless tomato and the Juan Perón Tomato and their connections to the no longer referenced Eva Perón tomato. By highlighting the lack of acknowledgment of these individuals and their historical significance, we find that their contributions are not properly represented through these varieties, despite Eva Perón's status and broader memorialization. Through this research, we understand the importance of recognizing and preserving the significance of influential figures like Eva and Juan Perón through living memorials, but also the significance of eco-mourning and how commemorating that biological, ecological, and more-than-human loss itself may now be necessary. This work calls for further investigation and examination of the gendered patterns observed in the memorialization of the Peróns through food-based plant varieties, but broader work into the role of foods and plants and their impacts on memory and heritage in the contexts of a post-human conceptualization of loss within the Anthropocene.

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e-ISSN 2785-2709

Lagoonscapes
Vol. 5 – Num. 1 – June 2025

Narrating the Dead in the Anthropocene Hesitation and Existential Pluralism in Karl Ove Knausgård's Novel Series *The Morning Star*

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Abstract In the *Morning Star* series (2020-), Karl Ove Knausgård explores blurred boundaries between life and death, challenging traditional views of mortality. This study uses T. Todorov's theory of the fantastic and V. Despret's existentially pluralist philosophy of the dead to examine how the dead in Knausgård's novels defy binary categorizations. Through narrative techniques e.g., tying and severing of narrative knots, the series creates a space of ambiguity where the dead influence the living, inviting readers to confront questions about reality, agency, and interconnectedness.

Keywords The dead. The fantastic. Existential pluralism. Narrative techniques. Other-than-human.

Edizioni Ca'Foscari

Peer review

Submitted 2024-07-31
Accepted 2025-05-29
Published 2025-07-21

Open access

Citation Rasmussen, M.S. (2025). "Narrating the Dead in the Anthropocene". *Lagoonscapes*, 5(1), 247-266.

DOI 10.30687/LGSP/2785-2709/2025/01/012

1 Introduction

In Karl Ove Knausgård's novel series *The Morning Star* (2020-), the boundaries between life and death appear blurred. Throughout the series, the Norwegian author reimagines conventional notions of death, questioning what it means to be dead and how the dead relate to the living. He delves into enigmas surrounding the limits of human knowledge, what lies beyond, as well as our capacity to distinguish between what is real and unreal, particularly when it comes to the line between life and death, the living and the dead.

In this paper, I explore how Knausgård's novels reimagine the ontology of death and the dead. Specifically, I ask: How do these texts depict the dead as entities that resist simple categorization, challenging rigid, binary ways of thinking? What does Knausgård's depiction of the dead contribute to broader discussions about the entanglement of the world and the decentring of human-centric perspectives? In this light, the dead become nonhuman agents, despite their human origins, because their existence and actions extend beyond the boundaries of familiar human experience. In viewing these once-human beings as such, while acknowledging their ability to partake in the ongoingness of the world, my interpretation of *The Morning Star* exemplifies the post-anthropological shift toward recognizing the agency of other-than-human forces in shaping reality.

Throughout my paper, I draw on Vinciane Despret's theoretical work on how "the dead come into the lives of the living" (Despret 2021, 18), as well as Tzvetan Todorov's theory of *the fantastic* (1975). Further inspired by Marco Caracciolo's (2022) work on how stories can convey complex interdependencies between human and nonhuman actors, I focus on the storytelling methods Knausgård uses in his series to unsettle the notion that "the dead have no destiny other than nonexistence" (Despret 2021, 4). Ultimately, I aim to show how the series' unique ontology of death invites readers into a space of epistemological ambiguity. This space allows for a more open-minded and fresh way of reimagining death and the dead – not as the stark opposite of life and the living, but as a part of a more fluid, entangled existence. This reimagining raises questions about how it might reshape our understanding of the place of the dead in our lives, and whether contemporary societies are prepared to embrace this fluidity in their relationship with mortality.

2 Theoretical Points of Departure

2.1 Vinciane Despret

2.1.1 The Reality of the Dead

In *Our Grateful Dead: Stories of Those Left Behind* (2021),[1] Belgian philosopher, psychologist, and ethologist Vinciane Despret offers a perspective that challenges traditional binary thinking about how the dead figure in the world. According to Despret, the dead are typically relegated to a realm of either (physical) nonexistence or (imagined) psychic existence, often dismissed as hallucinations, superstitions, or mere products of the imagination. Despret, however, proposes an alternative view.

> The dead have 'ways of being' that make them into actual real beings in the register that is their own, that they manifest accountable ways of being present, and of which we can feel the effects. (Despret 2021, 8)

Rather than viewing their existence in terms of a binary system, as either fully material or entirely imagined, Despret urges us to view the dead as existing beyond the confines of these poles.

Throughout her work, Despret explores real-life accounts of people who have experienced the presence of their loved ones after death. She argues that the dead continue to play roles in the ongoingness of the world, but they require the cooperation of the living to do so. As Despret explains, "[the] dead have things to accomplish, but they themselves have to be the object of an accomplishment" (9). In this way, the relationship between the living and the dead is symbiotic, bordering on ecology (9-10), forming a kind of ecological interdependence that reflects broader patterns of interaction between human and nonhuman forces.

Philosophically, Despret's approach is grounded in 'existential pluralism', a theoretical framework associated with the French philosopher Étienne Souriau (1892-1979) that recognizes multiple modes of existence, each with its own reality, meaning that entities – whether living, dead, material, or immaterial – coexist in different ways without being reducible to a single, fixed understanding of reality (Noske 2015). The concept of different modes of existence is central to Despret's argument that the dead, like all things,

1 Originally published in French under the title *Au bonheur des morts, Récits de ceux qui restent* (2015).

exist – albeit not in the same way as the living. "The reality of the dead is obviously not the same as that of mountains, sheep, or black holes", Despret reminds us, "but their difference does not negate their existence" (2021, 7). This recognition allows for a more nuanced understanding of the reality of the dead. Through their influence, the dead continue to exert agency. As Despret emphasizes, "We effectively know about their presence because of their potential to act, or rather, to give rise to action, through their capacity to affect us from the 'outside'" (8).

Through Bruno Latour (2011), Despret borrows the concept of 'instauration' from Souriau (2015) to explain how the dead appear in the lives of the living. Instauration refers to the process of bringing something into existence, suggesting a more complex form of creation than mere fabrication. As Despret explains in her interpretation of Souriau's philosophy, instauration is a collaborative process, where beings – including the dead – are co-created through mutual interaction. Despret argues that it is not a one-sided construction by the living; instead, "we help the dead to be or become what they are; we don't invent them" (7). In summary, concepts such as instauration and modes of existence challenge rigid definitions of reality by acknowledging that forces beyond the strictly material or imagined, such as the dead, actively influence the world.

2.1.2 Post-Anthropological Relevance

Despret's understanding of the dead aligns with post-anthropological ideas, such as those found in Latour's actor-network theory (e.g., 1996) and Jane Bennett's vibrant matter (2010), which recognize the agency of nonhuman forces in shaping the world. In Despret's view, the dead exert agency through their ongoing influence on the living, a process that challenges rigid binaries by recognizing the dead as entities with their own mode of existence, affecting the world without being living human beings. Donna J. Haraway (2016) acknowledges Despret's role in "bringing the dead into active presence" (Despret 2021, 6), illustrating how her philosophy contributes to a broader reimagining of entangled realities. Despret's emphasis on the joint agency of the living and the dead, as well as the symbiotic relationship between them, fits naturally into post-anthropological thought, where humans and nonhumans are interconnected. However, for some readers, labelling dead humans as nonhuman might feel imprecise, as it overlooks their lingering connection to their former human state. This raises the question: how do we account for their unique status without losing sight of their origins?

2.1.3 Proposed Term: Once-Human

When reading post-anthropological discourse, we often see terms such as 'nonhuman' and 'other-than-human'. However, throughout my work, I have found that these existing terms do not quite fit beings that 'used to be human' but whose mode of existence have since shifted beyond those we typically associate with the human state. To address this, I propose the term 'once-human', referring to beings that were originally living humans but now exist in a different way – whether through regular death (e.g., Harry's parents in *Harry Potter*), corruption into monstrous entities (e.g., the Ringwraiths in *The Lord of the Rings*), ascension to a higher state of being, such as becoming a god (e.g., Talos in *The Elder Scrolls*), or any combination of such transformations (e.g., the Dead Three in *The Forgotten Realms*, who through death ascend to monstrous divinity). This term helps differentiate once-human beings from living humans while acknowledging their origins in human nature, setting them apart from other nonhuman actors like animals, plants, or fungi.

While the term once-human risks sounding as though it strips the dead of their humanity, I employ it with caution. The term is not meant to dehumanize beloved deceased family members by equating them with fantastical entities like the Ringwraiths; rather, it serves as a conceptual tool to recognize that all beings who once lived as humans can continue to exist and influence the world in ways that differ from living human beings. This term acknowledges the uniqueness of each once-human being's mode of presence, whether it involves a gentle lingering or a more mythologized form of ongoingness. Being once-human does not necessarily erase one's connection to humanity – though it may, as seen when comparing the enduring presence of Harry Potter's parents to the corrupted forms of Tolkien's Ringwraiths. There are also those who occupy an intermediate space, such as ghostly beings in Gothic fiction (e.g., Poe's *Ligeia*), where the once-human being's humanity persists even as it takes on a more monstrous character.

2.2 Tzvetan Todorov

To understand the narrative strategies that blur the boundaries between life and death in *The Morning Star* series, I draw on Tzvetan Todorov's concept of 'the fantastic'. In his work (1973), Todorov describes how stories featuring seemingly supernatural events can lead readers to hesitate between natural and supernatural explanations. If the strange events are explained through supernatural means, the story is 'marvellous'; if rational explanations prevail, it

is 'uncanny'. When hesitation remains unresolved, the narrative occupies the realm of 'the fantastic'.

Despret's critique of binary thinking about the reality of the dead challenges the tendency to classify them as either purely imagined or non-existent. Connecting this to Todorov's framework, different stories conceptualize the dead in various ways: uncanny narratives often dismiss the dead as dreams or hallucinations, reinforcing the view of death as life's opposite. In strictly marvellous texts, the dead continue to exist in ways that defy natural laws, suggesting a challenge to binary thinking. These narratives grant the dead their own mode of being, but because they are tied to supernatural frameworks that remain impossible in the world we recognize outside of fiction, they do not necessarily suggest a plausible representation of how the dead could exist in the real world. By contrast, fantastic texts maintain a state of hesitation, where readers cannot fully resolve whether the dead belong to the realm of the imagined or the otherworldly. This ambiguity allows the dead to occupy a liminal space, supporting Despret's call for multiple modes of existence.

Applying Todorov's theory to Knausgård's work serves as a tool to explore the complex ontology of the dead in his novels. Classifying the narrative as uncanny, marvellous, or fantastic is not the end goal but a means to understand how Knausgård portrays the fluidity of reality between life and death. This analysis helps reveal what kind of existence his narrative grants to the dead, how it challenges traditional binaries, and how it might expand on Despret's ideas about the interconnectedness of the living and the dead.

While Todorov suggests that the fantastic thrived in the eighteenth and nineteenth centuries, when the lines between reality and unreality were less defined, Knausgård's novels might invite us to reconsider this claim. It is possible that these boundaries are becoming blurred again, reflected not only in post-anthropological thought but also potentially in contemporary literature, where the dead may be portrayed as entities that challenge clear distinctions between the real and the unreal. Further studies are required to argue this notion.

e-ISSN 2785-2709

3 Scope, Method and Relevance of this Paper

3.1 Scope

While I speak broadly of *The Morning Star* series as a whole, this paper will focus on examples from the first three instalments, as they (at the time of writing) are the only volumes available in English translation, accessible to a wider audience. This includes *The Morning Star* (2021), *The Wolves of Eternity* (2023), and *The Third Realm* (2024), originally published in Norwegian as *Morgenstjernen* (2020), *Ulvene fra evighetens skog* (2021), and *Det tredje riket* (2022). Although my analysis is based on the original Norwegian versions, all references throughout this paper will be to the English translations. Future research will incorporate the fourth and fifth novel as well as any subsequent instalments to this ongoing series, to assess how later volumes might challenge or reinforce the findings presented here.

3.2 Method

My analysis uses a methodological model I developed to examine narratives across various media where death or the dead appear in unconventional ways, such as in the TV-series *The Haunting of Hill House* (2018) and the video game *Slay the Princess* (2023). Drawing on the theories of Tzvetan Todorov and Vinciane Despret, the model explores how these stories reinforce or challenge binary views of the dead's reality.

In this paper, I focus on moments in Knausgård's novels where the dead 'behave' in ways that blur the line between life and death. Using Todorov's theory of the fantastic, I analyse how hesitation arises when characters and readers question whether these events are rationally explainable or supernatural. This involves determining whether the ambiguity remains or resolves into the uncanny or marvellous. Ultimately, I explore how Knausgård's portrayal of the dead suggests a more fluid understanding of existence, expanding beyond traditional human-centred views to acknowledge the agency of once-human forces.

3.3 Relevance

This paper explores how Knausgård's *Morning Star* series challenges rigid, human-centric views on death and the dead, contributing to the broader understanding of death in the Anthropocene. It explores how narratives can embrace the influence of once-human forces as part of

the world's intricate ongoingness, aligning with post-anthropological literary studies that recognize the agency of nonhuman forces – e.g., forests, mycelium, frogs – and extending this to include the dead.

4 Analysis

4.1 Identifying Ways the Dead Act

As a new star appears in the sky, strange events unfold. Demonic figures emerge in the wilderness, and the dead begin to defy the boundaries of death. This is the premise of the *Morning Star* series, where the dead challenge conventional roles, resisting the expectation to remain absent or passive in the world of the living.

One example is Egil's encounter with a dead girl named Emma. Despite her death, Egil sees Emma sitting beneath a tree by a pool, her presence vivid enough to unsettle him. She rises, turns, and walks away, leaving Egil questioning what he witnessed (Knausgård 2021, 662). This moment blurs the expected separation between the living and the dead, suggesting that the dead may retain a presence that defies simple explanation.

Another instance involves Ramsvik, a deceased patient in a chapter narrated by the nurse Solveig. During his own heart transplant surgery, Ramsvik revives, forcing the medical staff to halt the procedure. "'What the hell is happening?' said the surgeon. 'It can't be, it's impossible!' […] 'The definition of death is that it's irreversible […] No one can come back from the dead'" (Knausgård 2021, 179). This scene challenges the medical definition of death, confronting both characters and readers with the idea that the boundary between life and death may be more porous than assumed.

Similarly, the priest Kathrine encounters a deceased man named Kristian Hadeland under puzzling circumstances. She recognizes him in his coffin as someone she met just two days earlier, even though records show he died a week before (Knausgård 2021, 82). After his burial, Kathrine sees him again at a supermarket, but he disappears when she tries to follow him (320-1). This encounter adds to the series' sense of uncertainty, as the dead seem to remain active in ways that defy linear notions of time and death.

Syvert Løyning's encounters with his deceased father also complicate the expected relationship between the living and the dead. His father appears in dreams, offering subtle hints that encourage Syvert to delve into his father's hidden past. These dreams spark Syvert's curiosity, leading him to uncover secrets, including the existence of a half-sister living in Russia. Here, the dead influence

the living indirectly, guiding Syvert toward discoveries that reshape his life as well as his understanding of his father's life and death.

Moreover, during what seems to be a psychotic breakdown, the artist Tove sees a swarm of undead beings pouring over the land as the new star rises, screaming her name as she hides – like a scene from a myth or nightmare (Knausgård 2024, 441).

These instances show the dead disrupting conventional boundaries between life and death, suggesting a lingering presence that defies straight-forward explanations. This presence, as I will explore next, deeply influences the living, shaping their actions and perceptions in unexpected ways.

4.2 Instauration and Joint Agency

Building on how the dead defy expected roles, we see their presence in the *Morning Star* series extending beyond mere haunting to actively shaping the world of the living. This furthers Despret's work on instauration, where the dead participate in ongoing life processes.

In the *Morning Star* series, the dead do not simply vanish; instead, they continue to influence the living, shaping thoughts, actions, and destinies. Egil's encounter with Emma, for example, deeply alters his worldview. After seeing Emma, Egil becomes absorbed in exploring the nature of death, embarking on an intellectual journey that changes his perspective on reality – not as defined solely by scientific models, but as a network where human understanding is intertwined with nonhuman, including once-human, forces.

> I could not forget that I had seen a dead girl sitting by an outdoor swimming pool, silent and withdrawn, dressed in the clothes she had been wearing when she died, nor could I pretend not to have seen her. So I began to write about it, and about what it could mean. And as I wrote, it was as if something opened up inside me, I began to understand to what great extent our language constrains the world, arranging it and placing its various elements in logical systems that are of such nature that we see neither the system nor the logic, only the world it presents to us […]. I saw the oak trees in the house, so ponderous and calm, and I saw that they too, as us, were living things, without name, boundless and free. In glimpses, I saw the world behind language, a world of transformation and mystery, and one night I saw my [deceased] mother, Torill, in a dream […]. [It was as if she] had been waiting for me in that dream, and was already there when I came. (Knausgård 2021, 664-5)

This introspective shift suggests that Emma's presence catalysed Egil's deeper understanding of the world – one that goes beyond conventional

rational explanations. It shows that the dead, in Knausgård's narrative, can play an active role in shaping the living – an example of instauration, where the dead become participants in the world's ongoing creation.

Similarly, Syvert's dreams about his deceased father lead him to uncover hidden truths. In one dream, his father's cryptic comments in the basement laundry room hint at future events, such as their mother's illness (Knausgård 2023, 68). These dreams blur the line between life and death, guiding Syvert to discover his father's secret life, a half-sister in Russia, and the possibility that his father's death was a suicide. Despret describes such dreams as "oracular" (2021, 64), not because they predict the future but because they prompt the dreamer to reflect and act. Syvert's father, though dead, continues to guide his son toward knowledge he might not have sought otherwise.

This theme continues when Syvert, decades later, meets his half-sister Alevtina in Moscow. She recognizes their father from a photograph, despite never having met him: "I've seen him before! I've dreamt about him. Oh my goodness. How is that even possible?" (Knausgård 2023, 777). This encounter, like Syvert's own dreams, suggests that the dead can cross boundaries, leaving traces that defy rational explanation. Even though Alevtina quickly rationalizes her experience, it still leaves room for a marvellous interpretation, especially since it coincides with the new star's appearance and the mysterious cessation of death, themes from the series' first instalment.

Through such stories, Knausgård challenges traditional notions of agency, showing how the dead can shape the lives of the living, actively participating in the world's ongoing creation. This challenges conventional thinking that links life to action and death to passivity. Characters like Egil and Syvert, who are transformed by their encounters with the dead, encourage readers to see the dead as more than just memories – they are active, evolving forces shaping the world, furthering Despret's ideas. This blurring of boundaries embodies instauration, revealing how the living and the dead engage in a shared process of becoming.

These examples of instauration demonstrate how the dead influence the living's understanding of reality. Yet, Knausgård's narrative technique also plays a crucial role in shaping how these influences are perceived, blurring the lines between what is real and imagined.

4.3 Narrative Knotting-Technique

While the influence of the dead on the living is clear, the ways Knausgård presents these interactions is key to the reader's experience. Through a narrative knotting technique, he intertwines perspectives and links storylines to create a tapestry that challenges straightforward interpretations.

He employs this technique by weaving together multiple perspectives, connecting disparate storylines through recurring motifs and events. These 'knots' blur the line between the supernatural and the rational, suggesting deeper connections between occurrences. By overlapping narratives, Knausgård encourages readers to identify patterns that the characters themselves don't notice, adding layers of complexity to the interpretation of supernatural events.

One example is Egil's encounter with the dead girl, Emma, in the final chapter of series' inaugural novel. This story is framed as the second part of an essay by Egil titled "On Death and the Dead" (Knausgård 2021, 611-16). The encounter begins the night before, during a sleeper train journey across Norway, where Egil meets a stranger named Frank. Frank insists that Egil stay up with him to drink beer and cognac. As the night progresses, Frank reveals that he has recently started seeing dead people and insists he is not insane (646). When Egil asks if anyone else has seen these dead people he sees, Frank admits that no one else has. He's troubled by why he alone is experiencing this. Frank recounts that one of the dead pointed at him and said, "You are doomed!" (647) – words that echo those spoken to Turid, another narrator, by a resident at a care facility after she encounters a demonic figure in the forest (560).

This type of narrative knotting is discussed by Marco Caracciolo in *Narrating the Mesh: Form and Story in the Anthropocene* (2021). He examines "narratives featuring plotlines that, while seemingly independent, come together in a surprising convergence", referencing Arnaud Schmitt (2014) and calling "the confluence of [such] distinct plotlines a diegetic 'knot'" (Caracciolo 2021, 37). Knausgård frequently uses this technique, where narrators experience similar events without directly interacting, leaving the reader to trace the connections between their stories. For example, the demonic figure seen by Turid reappears before other narrators. Turid encounters it in the woods while searching for a missing care facility resident (Knausgård 2021, 363-9). Tove speaks to it during a psychotic episode (Knausgård 2024, 429-30). Egil hears it near the sea, considering the possibility that it might be an undead (Knausgård 2021, 439). Policeman Geir spots it in a video clip while investigating a ritualistic murder of death metal band members, showing it to Kathrine for her clerical perspective (Knausgård 2024, 471-6). Jostein, during a coma, encounters multiple such figures in a space between life and death (Knausgård 2021, 579-609). It is unclear if these figures are the same; Jostein's vision of many suggests they might differ. Yet, their repeated appearances make it hard for readers to dismiss their reality within the story. No single character can piece these events together, leaving interpretation to the reader – much like the role of the dead in the series.

After recounting a time when a dead man spoke to him, Frank accuses Egil of disbelief. Egil responds:

> I believe that you saw what you saw. But I don't believe that what you saw was an accurate representation of reality […]. I saw a dead person too once, my grandfather. He was as plain to me as you are now. But he wasn't there. He was in my mind. (Knausgård 2021, 648)

Frank asks, "What was he doing there?" (648), humorously suggesting that Egil's grandfather might have had some agency in appearing. This dialogue resonates with Despret's ideas about the relationships between the living and the dead. She discusses the "inventiveness of the dead and the living in their relationships" and warns against the living taking all the credit for this creativity (Despret 2021, 19) – as Egil does here.

Frank then reveals that Emma, his daughter, is dead: "She was six years old. Hit by a lorry on the road outside our house" (Knausgård 2021, 648). He links her death to the pronouncement of his doom. When the train reaches its destination, Frank shares that Emma's funeral is that day and convinces Egil to join him. Both drunk from the night before, Egil hesitates, but Frank persuades him. At the church, Egil notices Frank is shunned by his family: "No one seated there acknowledged him. They made room without a word. What had he done? What was his sin?" (654). Frank grows more agitated throughout the day:

> [Emma is] in the ground. She can't talk. Do you understand what I'm saying? She can't move. She can't even think! She's lying there completely still and alone. It's so terrible. And then that cunt of a priest with her hymn about the little flower in the forest. And what else did she say, that Emma was a star in the sky? She's nothing! Nothing! Nothing! (660)

Eventually, they arrive at a public pool where Frank used to take his kids. They see a little girl, and Frank believes it is Emma. He speaks to her: "Emma, I'm so sorry. I'm so terribly sorry. You're the most precious little girl in all the world. Do you know that?" (662). At first, we likely assume that Frank is simply confusing this girl for Emma – perhaps due to grief, intoxication, or the fact that this place reminds him of his daughter. But then:

> She gave no indication of even noticing he was there. All she did was stare into space. A sliver of doubt crept into my mind as I noticed that her T-shirt was flecked with what appeared to be blood. 'Say something to me, Emma. Anything at all. I love you.

> I love you, my petal.' She stood up, and a chill went through me. The right side of her head was crushed. 'Don't go,' said Frank. 'Not now that I've found you again.' She walked up the slope towards the fence where there was some thick shrubbery, and then she was gone. (662)

The encounter thrusts readers into Todorovian hesitation. Is Emma's ghost real, or are Frank and Egil hallucinating? Each narrator's story can be rationalized – Frank's vision of Emma might be attributed to grief and intoxication, just as Kristian Hadeland's lingering presence might be Kathrine mistaking someone else for him. But identifying these narrative knots deepens the ambiguity. Egil's encounter with Emma connects his story to others, like Syvert's dreams of his dead father and Ramsvik's revival. As more narrators experience similar phenomena, it becomes harder to dismiss the idea of a supernatural force.

The recurring appearance of the new star is another knot that seems linked to these strange events. Perhaps the dead's presence is intertwined with these knots? Together, these intertwined elements create a complex narrative where readers can't be certain if the dead are fully absent or present. They prompt us to wonder if otherworldly forces might be at work – something tied to the new star and the demonic figures. Yet, the ambiguity remains, and that's the point. The hesitation is the point. As these threads intertwine, readers are left suspended between rational and supernatural explanations.

This narrative structure, encouraging readers to find patterns among perspectives, is further enriched by Knausgård's intertextual references, adding layers of meaning through connections to older literary and religious traditions.

4.4 Intertextuality

By weaving intertextual references into his narrative, Knausgård deepens the thematic complexity of his narrative knots. These references – often to biblical texts – connect the presence of the dead to broader questions of mortality and cosmic change, adding further depth to the semantics of the series.

In the first and third books of the *Morning Star* series, the appearance of the new star seems linked to the restless dead. This association invites readers to connect the rise of the new star with the undead, a symbol that Egil ties to biblical references to the morning star, which symbolizes both Christ and Lucifer (Rev 22:16; Isa 14:12-15). The biblical intertext is central to the series' meaning. Its epigraph, taken from the Book of Revelation, states: "And in those days shall men seek death, and shall not find it; and shall desire to

die, and death shall flee from them". The biblical prophecy describes an apocalyptic scenario where death vanishes, leading to a period of destruction and torment, at one point people will suffer while unable to die, before a new world is born (Rev 9:3-11). Knausgård's use of this epigraph highlights not the promise of eternal life but the endless suffering that characterizes the cataclysm.

Egil's reflections echo this apocalyptic theme, as he suggests that "those days" have arrived. "I believe 'them' to be us", he writes, linking the disappearance of death to a looming sense of doom (Knausgård 2021, 642). He then asks, "But if it is the case that death one day will be gone, what then of the already dead?" This question captures the series' tension between life and death, amplifying its exploration of immortality and the unknown. It also mirrors Jostein's journey through the liminal realm during his coma, where he finds the bridge to the land of the dead blocked – an evocative metaphor for the inaccessibility of death (571-608). Together, Egil's musings and Jostein's vision form a narrative knot, suggesting that the new star and the restless dead are tied to a fundamental change in the nature of death. This link emphasizes the idea that the boundary between life and death is eroding, aligning with the series' apocalyptic undertones.

Knausgård's intertwining of apocalyptic themes with his portrayal of death raises further questions. At times, the series implies that immortality is undesirable, aligning more with Gothic literature's dark visions than with the Christian promise of redemption. Unlike the Christian afterlife, where eternal life is a divine reward, Gothic fiction often depicts the return of the dead as a curse. As Simon Marsden (2021) observes in his article about the Gothic and the apocalyptic imagination, "When the dead return in Gothic, they tend to do so not as the redeemed and resurrected bodies of Christian hope, but in the monstrous forms of zombies, vampires, and spectres" (481). Sometimes, the return of the dead in Knausgård's series appear in such a manner, surrounded by emotions of dread, such as when Yevgeny hears thuds and knocking coming from inside liquid-filled tanks containing human corpses (Knausgård 2023, 712). The scene invites the reader to imagine what it must be like to wake up inside such a container, drowning yet unable to die.

However, at other times, the presence of the restless dead offers solace and continuity. Syvert's dreams of his father, for instance, help him understand his family's past and connect with his half-sister, while Egil and Frank's encounter with Emma fosters a moment of connection amid loss. Here, the lingering dead act as a bridge between past and present, allowing the living to preserve the legacies of those they have lost in a way that grants solace, reunion or moments of clarity.

This duality – where immortality is both a source of horror and comfort – contributes to the series' overarching ambiguity. It challenges readers to navigate conflicting interpretations of life beyond death, complicating any straightforward understanding of the new star or the nature of the restless dead. Knausgård may be suggesting that the mysteries – especially those around life, death, and immortality – elude simple human comprehension. As explored in later sections, this uncertainty deepens the novel's engagement with the unsolvable, inviting readers to confront questions without clear answers.

These intertextual elements add depth to the series, but they also contribute to its ambiguity, further blurring the line between the rational and the supernatural. To further explore this ambiguity, it is crucial to examine how the series navigates between the uncanny and the marvellous.

4.5 Uncanny, Marvellous, or Both and Neither?

As intertextual references deepen the narrative's ambiguity, they contribute to the tension between uncanny and marvellous interpretations. The *Morning Star* series keeps readers suspended between these two modes, challenging them to question the true nature of the events unfolding.

The possibility of rationalizing the strange occurrences within each narrator's perspective, combined with the connections between their experiences, creates a state of uncertainty. This makes it difficult to determine whether the dead are imagined or otherworldly. This ambiguity aligns with Tzvetan Todorov's concept of the fantastic, which hinges on hesitation between natural and supernatural explanations.

Literary critic Tom E. Hverven (NRK Radio 2020) interprets *The Morning Star*'s events as products of dream states, hallucinations, or altered mental experiences. Rikke A. Kraglund (2022), however, views this as reductive, drawing on "Unnatural Narratives, Unnatural Narratology" (Alber et al. 2010) to argue that the story encourages readers to consider the possibility that these events might be genuinely supernatural. I lean toward Kraglund's perspective, not because it definitively categorizes the story as marvellous, but because it encourages an openness to multiple possibilities.

In Todorovian terms, Hverven's reading leans toward the uncanny, while Kraglund leans toward the marvellous. Perhaps both interpretations hold merit. For instance, while in a coma, Jostein wanders through a liminal space between life and death. He finds the bridge to the land of the dead blocked, suggesting that death itself has become inaccessible (Knausgård 2021, 571-608). Nearby, he

witnesses demonic figures performing rituals. This vision implies a crumbling boundary between life and death, resonating with scenes involving Ramsvik, Emma, and Kristian. Meanwhile, in one of Tove's chapters, a demon tells her of the new star's arrival before it appears (Knausgård 2024, 434). These knots suggest connections between the star, the demonic figures, and the dead's presence, nudging toward a marvellous interpretation. Yet, Jostein's experience could be seen as a dream – a product of his coma – and Tove's visions could be dismissed as part of her psychosis. Such explanations align with Hverven's uncanny reading. Still, the recurrence of these themes and figures across narratives invites a broader supernatural interpretation.

Todorov argues that a story falls into the fantastic when both readers and characters hesitate between natural and supernatural explanations. Jostein, upon waking from his coma, shows no such hesitation; he appears to forget his entire vision (2021, 607-8). This contrasts with Egil, who remains puzzled by his encounter with Emma. Egil's reflections in the final chapter of *The Morning Star* reveal a growing belief that the dead linger in our world, suggesting a porous boundary between life and death. Yet, when he first sees Emma, he attempts to rationalize the experience: "It couldn't be true. It could only be a hallucination. But we'd both seen her. Was I now so completely on Frank's wavelength as to have been induced to see the same as him?" (663). Egil's blend of belief, doubt, and introspection embodies the hesitation Todorov describes, keeping the ambiguity of the encounter alive in both his mind and the reader's. This echoes the uncertainty in Edgar Allan Poe's Gothic story "The Fall of the House of Usher" (1839), where critics debate whether Madeline's return from the grave is a physical resurrection or a shared delusion (Shackleford 2017). Todorov classifies Poe's story as uncanny, but I argue that it holds signs pointing to both uncanny and marvellous interpretations, resisting a definitive categorization.

Similarly, *The Morning Star* resists clear classification. Like Madeline in Poe's tale, Emma becomes something in between – a presence that cannot be easily defined as real or imagined. This mirrors Despret's idea of the dead occupying a unique mode of being, a "register that is their own" (Despret 2021, 8). The narrative does not provide enough evidence to fully accept or reject the reality of Emma's presence, instead inviting the reader into a space of perpetual ambiguity.

The tension between the uncanny and the marvellous is further enriched through the series' intertextual ties, drawing on ancient stories and religious themes. These references can fill in gaps for the reader, but they often point in different directions, adding complexity rather than clarity. Instead of resolving the ambiguity, they reinforce the notion that the dead defy a binary understanding of existence. Yet, this openness to multiple interpretations is complicated by

inconsistencies within the narrative, which challenge a cohesive marvellous reading and suggest that simple categorization cannot capture the series' full complexity.

4.6 Inconsistencies and Severing of Knots

Earlier, I discussed Tom E. Hverven's and Rikke A. Kraglund's differing views on *The Morning Star*, suggesting both might hold truth. While each narrator's story leans toward the uncanny – where encounters with the restless dead can be rationalized as hallucinations, dream states etc. – the series as a whole leans toward the marvellous, suggesting supernatural forces at play. However, this view oversimplifies the series' complexity. Not all elements support a marvellous interpretation, even when considering the series collectively. Inconsistencies emerge in the depiction of the dead across the narratives. For example, in *The Morning Star* and *The Third Realm*, the dead seem tied to the rise of the new star. But in *Wolves of Eternity*, Syvert's father communicates through dreams long before the star appears. These variations suggest that the "rules" governing the dead are fluid, resembling what fantasy author Brandon Sanderson calls a "Soft Magic" system (Sanderson 2007), relying on ambiguity and mystery rather than clearly defined explanations. Such discrepancies unravel the narrative knots, pulling readers back into Todorovian hesitation between the uncanny and the marvellous.

Knausgård's writing creates a constant oscillation, where readers move between two realities: one where the dead are imagined (on an individual scale) and another where they are supernaturally real (on a collective scale). As the story unfolds, distinguishing between these interpretations becomes increasingly challenging. Knots are tied and untied, leaving readers in doubt. The dead exist in a space that is neither entirely material nor fully imagined, immersing us in a realm of persistent ambiguity.

Ultimately, *The Morning Star* series resists a clear-cut interpretation, inviting readers to navigate its ambiguous terrain, where life and death, natural and supernatural, blend fluidly. This refusal to provide definitive answers is perhaps its most enduring feature, drawing readers into the uncertainty at the core of its narrative.

5 Final Remarks

Knausgård's novels present a form of existential pluralism, where multiple realities about the lingering dead coexist. The continuous tying and severing of narrative knots create a sense of ongoing hesitation, keeping readers from fully committing to an uncanny or

marvellous interpretation. These novels align with Todorov's concept of the fantastic while resonating with Vinciane Despret's idea that the dead occupy a space beyond binary distinctions – neither fully material nor entirely imagined.

Todorov claimed in 1970 that the fantastic was tied to earlier centuries when the boundaries between the real and the unreal were less defined. Knausgård's novels challenge this assertion, suggesting that these boundaries are once again becoming obscured. By creating a multi-layered narrative where the dead appear to possess a lingering presence, Knausgård destabilizes the strict divides between life and death, materiality and imagination.

In *The Morning Star* series, two conceptions of immortality emerge. On one hand, the story suggests a marvellous, physical immortality – an eerie phenomenon where death itself seems to stop following the rise of a mysterious star. Characters like Egil and Syvert reflect on the unsettling implications of such a world, fearing that a deathless existence might lead to stagnation and repetition. Yet, the role of this storyline, which unfolds subtly within the characters' otherwise mundane realities, may be to draw our attention toward a deeper, more elusive form of deathlessness. Beyond the notion of living forever in a physical sense, the series gestures toward a kind of immortality that is more nuanced – one where the ontological boundaries between life and death are blurred, and the dead remain active through a reciprocal relationship with the living.

Knausgård's narrative does more than explore these ideas – it *embodies* them. Egil, in his reflections, acknowledges the limitations of language and thought when faced with the mysteries of life and death. He writes of how our system of thought, our language, is poorly equipped to grasp such questions. And this struggle is mirrored in the narrative itself. Within the words of each narrator, the mysterious encounters with the dead become uncanny – rationalized, explained away, or dismissed as imagination. The dead are deemed just that – dead, with no further influence or presence. Yet, something different emerges in the spaces between the lines, between the narrators' stories, and between the words themselves. It is here, in these gaps and overlaps, that a more marvellous reality takes shape.

By inviting readers to read between the lines, to identify the unspoken knots that make the story lean towards the marvellous, Knausgård's series asks us to reconsider the boundaries of our own perspective. It suggests that what we cannot explain through our current language or rational systems might still hold a form of reality. This leads us to ask: What might it mean to imagine a world where our understanding of reality is not the only one that holds? Where other forces – perhaps even once-human forces – have their own ways of shaping reality? Knausgård's narrative suggests that our perspective may be just one among many, and that a more open-minded view

could allow for a reality where the dead, like other nonhuman agents, have their own modes of being that constitute reality.

Knausgård's narrative challenges us to reconsider how rigidly members of modern society approach the unknown, especially our conceptions of death and the dead. His characters mirror many of us, brushing off experiences that defy easy explanation, rationalizing away what they cannot fully understand. The priest Kathrine convinces herself that the man she saw after his death must have been a lookalike (Knausgård 2021, 187); the medical staff performing a heart transplant on a patient who suddenly revives attribute the event to faulty equipment (2021, 181); Syvert's half-sister, upon recognizing their father from a dream, dismisses it as *déjà vu* (Knausgård 2023, 777); and so on. This resistance to ambiguity and mystery reflects a broader cultural reluctance to accept a world where the boundaries between the living and the dead, the real and the unreal, are not so fixed.

By tying knots between events and steering the narrative toward the marvellous, Knausgård challenges the modern impulse to dismiss what cannot be measured or conventionally explained. The series invites readers to imagine possibilities that elude its characters – suggesting that the dead might persist subtly, influencing the living and participating in the world's ongoingness in ways beyond rational or scientific comprehension. This perspective on death, where the dead are part of an entangled reality, prompts us to ask: Are contemporary societies ready to embrace such a shift? Can we accept that our understanding of reality might be incomplete, shaped by forces and presences beyond our grasp?

The novels seem to imply that we are not ready. Most characters dismiss the unknown, clinging to rationality and rejecting possibilities that lie beyond explanation. Yet, the narrative as a whole critiques this outlook, suggesting it is short-sighted – a refusal to acknowledge the depth and complexity that exists at the margins of understanding. It encourages us to remain open to mysteries, hinting at the potential richness gained by embracing what lies beyond the boundaries of explanation.

Ultimately, the *Morning Star* series does not provide clear answers about the nature of the dead. Instead, it opens a space for readers to engage with these questions, challenging us to navigate the uncertainties that lie at the edges of our understanding. It shows us that while language and logic may limit our grasp of the unknown, the spaces between – those moments of ambiguity and hesitation – might reveal a deeper, more interconnected reality. By leaving its mysteries unresolved, the series prompts us to reflect not only on the dead but on the limitations of our own perspectives, suggesting that one step on the path to understanding our entangled world might lie in embracing the ambiguity between the living and the dead.

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e-ISSN 2785-2709

Lagoonscapes
Vol. 5 – Num. 1 – June 2025

Cristina Brito *Humans and Aquatic Animals in Early Modern America and Africa*

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Review of Brito, C. (2023). *Humans and Aquatic Animals in Early Modern America and Africa*. Amsterdam: Amsterdam University Press, 270 pp.

In this recent book, biologist and environmental historian Cristina Brito explores the early-modern Atlantic spaces of cross-cultural interspecies interactions from a global Portuguese perspective. In her account, aquatic animals were at once resources, partners, and symbols in the context of early American-European and African encounters and clashes, when Iberian conquerors crossed the Oceans and set in communication continents that had been previously separated. Her aim is to contribute to Anthropocene humanities' multidisciplinarity by looking at the many agencies of history-making:

> I am trying to historicize nonhumans as beings that change over time and space, trying to find new evidence of nonhuman life and human interactions with it in anthropocentric archives and sources while most of us have been trained to edit animals out of our analysis. (32)

The book has a protagonist, who appears on the cover, in a colourful image: the manatee. In the stories that she carefully and lovingly

Edizioni Ca'Foscari

Submitted 2025-05-20
Published 2025-07-21

Open access

Citation Omodeo, P.D. (2025). Review of *Humans and Aquatic Animals in Early Modern America and Africa*, by Brito, C. *Lagoonscapes*, 5(1), 267-272.

DOI 10.30687/LGSP/2785-2709/2025/01/013

collected for us, not only the species count but also some exceptional individuals. Among others, in the first chapter, she recounts an episode that was transmitted and varied in sources and visual representations. Sixteenth-century Spanish historian Francisco Lopéz de Gómara, famous for his report of Hernán Cortes's conquest of Mesoamerica, was the first who narrated the story of Matto, a manatee from Hispaniola. Matto was a domesticated female, who lived in captivity in a water enclosure, and belonged to the Taíno chief Caramatexi. The animal was so familiar with him and the natives that she would come to them to be fed when they called her name. Occasionally, she carried human children on her back. Sadly, her trust to people was broken when a young Spaniard hit her with an arrow. Although she was not hurt, thanks to the thickness of her manatee skin, she was deeply affected by this experience. After the aggression, she refused to appear to the water surface in the presence of 'Christians'. Eventually, an exceptional flooding of a nearby river offered her the occasion to flee and never come back to her human family. Such a story of a harmonious human-animal relation broken by the advent of the European conquerors is repeated and varied many times in the historical sources. According to Brito, part of its success depended and still depends on its highly symbolic meaning: the narrations point to a colonial rupture in the relation between people and their environment in the Americas. It indirectly denounces the violent attitude of the European conquerors, whose impact on the ecologies of the new worlds was as destructive as it was towards indigenous people and their cultures. Brito does not Romanticize the natives, as they had exploitative attitudes towards their environment, as well. However, their long adaptation and familiarity with local nature allowed them to develop more balanced and caring approaches. Moreover, the alterations of the natural and social settings during modernity offer her an occasion to reflect on the historicity of "nature-cultures", as spaces of human-nonhuman cohabitation and co-dependency in the time of transition from the precolonial world to the colonial and capitalist era.

Another exemplary story (connecting chapters 2, on aquatic mythologies, and 3, on aquatic monsters) relates to a sea monster that an intrepid Spaniard killed in San Vicente, today's Santos close to São Paulo, Brazil, in 1564. A water demon came to the shore and scared both Europeans as well as native people whose imageries were populated by aquatic monsters, called *igupiara*. The story of this terrific encounter largely circulated in Europe, especially in the follow of Pêro Magalhães Gândavo's account, in his *História da Província de Santa Cruz* (1576). The episode was then retold and varied. It was also transmitted through engravings illustrating the fight between a European with a sword and a standing monster with a fish tail and anthropic features, e.g., widely stretched arms. In the

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zoology of wonder of early modernity, this creature occupied a place close to sharks, alligators, water reptiles and the devil fish. Brito argues that the Gândavo's monster must have been a sea lion. Its transfiguration into a devilish figure is revealing of a mental world that became increasingly common between Europeans and other people. The testimonies of marvellous encounters are countless. Christopher Columbus, for instance, sighted three "ugly" mermaids in the Caribbean, while natural philosopher Ulisse Aldrovandi, in Italy, allotted scientific relevance to zoological wonders including specimens that he himself assembled (98-9).

The boundaries between science and imagination are often difficult to establish. Brito discusses the question of the veracity of her stories, independently of their apparent untenability for today's readers. For her, the reliability of early accounts of encounters with "the other", including the monstruous, cannot be reduced to establishing facts. It is rather a question of mentalities and interpretation frameworks. In her view, mythologies must be rooted in real experiences, codified in accordance with categories that can be imaginative and narrative, as well as scientific. Furthermore, a priori cultural spectacles inform perception, understanding, action, and scientific discourse. For instance, mermaids and tritons inhabited the imagery about the oceans so firmly that Carl Linnaeus found it natural to include the manatee, in the first modern scientific taxonomy, in the family of 'sirens' – with reference to the well-known mythological hybrid water beings of ancient cultures. The manatee itself is a symbol of hybridity: "the last of the beast and the first of fish" (15). This is the manner, in which writer Oliver Goldsmith still conceived of it in his *History of the Earth and Animated Nature* (1774), a work reprinted several times and widely circulated in the nineteenth century. Manatees and sea lions alongside other terraqueous and anthropomorphized animals build epistemological bridges between representations and realities and set knowledge in motion "through a dialectical process between experience and preconceived ideas" (17).

In this perspective, early modern aquatic animals were at once "living beings, resources and symbols" (as the title of chapter 4 goes). Locals as well as newcomers from Europe hunt the manatees for their meat, fat, skin, bones, and teeth. However, within Atlantic transactions of trade and extraction, their exploitation intensified and acquired new monetary value within an expanding market economy. Despite the cold rationality of capital accumulation, indigenous practices and forms of hunting never ceased to enchant Europeans. This was the case with those symbiotic practices, in which animals most clearly appeared as 'partners' of human activities. European sources report that the inhabitants of Jamaica, Cuba and Hispaniola used to hunt sea turtles and big fish with the help of domesticated sucking fish, or remoras. The natives treated these animals as intelligent partners,

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spoke with them, and encouraged them to behave with courage before they went hunting together. They bound the remoras' tails with a rope and let them stick to big preys, which could be brought to the shores with incredible skill. At the end of the action, the fish was carefully detached from the prey by means of kind words of persuasion. The Europeans mocked those discourses as superstitious but at once acknowledged the indigenous' practices were very sophisticated and efficient forms of human-animal cooperation.

This and other habits, conceptions and mythologies of early-modern aquatic naturecultures in the Americas and on the African shores of the Atlantic are the basis for general considerations (especially in chapter 5) about processes of scientific codification. Brito points out that Iberian reports on the new world have not always made their entrance in the scientific discourse of modernity nor in mainstream historiography of science, owing to north-European cultural hegemony or Anglocentric approaches. By contrast, her book offers a strong argument for the reassessment of a broader "blue Anthropocene" – a global modernity marked by aquatic experiences and interactions connecting Portugal and Spain to the two shores of the Atlantic. Economic components played a fundamental role in the consolidation of empires and new political entities, for instance, colonial Brazil where whaling practices proved remunerable and called for regulation and governance. As Brito writes revising established economic histories,

> The Atlantic world was constructed on the backs of whales, sea turtles, and manatees, as much as it was from sugar and cotton plantations. (245)

Hence, she proposes to shift the historical focus of environmental humanities from land to water in order to fully comprehend a modernity marked by exploitation and other "exes": *ex*plorations, *ext*ractions, *ext*irpations, *ext*inctions, *ext*ensions, *ex*haustions. Brito calls it the *Extocene*, thus extending the list of quasi-Anthropocene periodizations: Chthulucene, Capitalocene, Plantationocene, Wasteocene… She adds to others' understanding of the geo-anthropological interconnection a perspective that is marked by zoological empathy and historical sensitivity. And by narrativity, too. Her attention to mythopoesis and story-telling makes her book a particularly pleasant reading – a rare quality in history-writing.

One of her stories well conveys the emotional sense of ecological loss. In the seventeenth century, father Cristóvão of Lisbon denounced the blind killing of manatees in the New World as it was producing a dramatic drop in this animal's population. Among others, Cristóvão reported the following case that he eye-witnessed:

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> I saw a female being killed and skinned and they put the skin on the shore; and in the next day, when they went to collect water, they found the cub lying on the skin and took it. (246)

Indeed, extinction and the extirpation of future generations – human and nonhuman alike – marks the tragedy of the Anthropocene. But since human relations with their environments and other species are not only destructive, as they are revealing of strong ties of care and empathy as well, Brito's retrospective glance on historical water-cultures also opens up the possibility to imagine a different, more sustainable future.

e-ISSN 2785-2709

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