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Published in:
Journal of Cultural Economy

DOI:
10.1080/17530350.2023.2246990

Published: 31/08/2023

Document Version
Publisher's PDF, also known as Version of record

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Please cite the original version:
Rumo, D. (2023). Grounded circularity: the livelihoods of surplus clay. *Journal of Cultural Economy*, *16*(4), 631-639. https://doi.org/10.1080/17530350.2023.2246990

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Journal of Cultural Economy

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rjce20

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To cite this article: Delphine Rumo (2023) Grounded circularity: the livelihoods of surplus clay, Journal of Cultural Economy, 16:4, 631-639, DOI: 10.1080/17530350.2023.2246990

To link to this article: https://doi.org/10.1080/17530350.2023.2246990

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JOURNAL OF CULTURAL ECONOMY
2023, VOL. 16, NO. 4, 631–639
https://doi.org/10.1080/17530350.2023.2246990

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Grounded circularity: the livelihoods of surplus clay

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ARTICLE HISTORY Received 24 April 2023; Accepted 8 August 2023

Editors' note: This commentary paper is part of a series initially presented at the Waste/Economies/Ecology hybrid international symposium at the Institute for Culture and Society at Western Sydney University, Australia, in February 2023. The symposium was part of the research project 'Investigating Innovative Waste Economies: Redrawing the Circular Economy' funded by the Australian Research Council. The symposium brought together academics and artists from around the world who are thinking with waste to enable novel response to its ethical and political challenges. We thank all our contributors to this special commentary section for their participation and thinking.

Introduction

Under current constructions lie turbulent economies of soils. Some excavated earth materials, called surplus soils, are reused on sites of construction others have been contaminated by former industrial activities, or contain naturally occurring substances that become hazardous when disturbed. In this paper, I examine the life of surplus clayey soils in the disposal of earth materials as an experimental case for discussing diverse economies in industrialized construction. My aim is to draw from Ethan Miller's (2019) account of ways to involve more-than-humans in economic thinking to address the space for, and the role played by, geological processes in earthwork activities. The paper offers a new conceptual approach to the economization of clayey soils by exposing a different material reality of surplus soils that is concerned with geological temporalities. As I encounter thousands of years old clayey soils and their inhuman timeframe, I am interested in moments of shared vulnerability, responsibility, and ethical engagement. I suggest that being attentive to clay's pace of existence is one way to open imaginaries for more ethical livelihoods.

Soil circulation

Laying foundations for constructions increasingly includes the removal and movement of soils. Surplus soils are one of the most voluminous material streams of building activities (Eurostat 2023). In Finland, excavated earth materials are the greatest source of construction waste, with approximately 20–30 million tons of soils being discarded each year according to data available from the European Commission (2015).[1] This large volume creates an incentive to plan and design projects that require the reuse or circulation of soils. In the last decade, the circular economy

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concept has gained traction in earthwork activities, and contractors increasingly circulate surplus soils among different construction projects. The development of circular solutions creates opportunities for the construction industry to capitalize on the flows of excavated earth materials. Reusing soils on construction sites, either onsite or in the surrounding area, reduces costs and limits the need for long-distance transportation (and carbon dioxide emissions). Soils are also reused on the sides of motorways as sound-absorption barriers or are taken into account in the planning of urban green spaces.

The reuse of soils is seen as an essential part of more sustainable construction and changes are being implemented in Finnish regulations to facilitate the reuse of certain types of surplus soils in pre-construction. Even so, defining what earth material can be reused in construction or requires landfilling is challenging. Evaluating soil quality is difficult, as reliable and accurate information on the numbers and locations of harmful substances is lacking, the criteria and procedures for determining types of substances are complicated, and naturally high concentrations of certain substances only become problematic when soils are disturbed. Besides, once excavated, soils require space to be stored, reused, or dumped, and plans for surplus soils are often nonexistent, leaving earthwork contractors with no clear information on where to deliver excess soils. This in turn increases transportation costs and makes soil storage too costly. Considering the unclear definitions of excavated earth material in disposal and the ambiguous locations, amounts, and handling of soils, earthwork is often guided by profit maximization, with little to no consideration of environmental impacts.

Clayey economies

In Finland, excavated earth material from construction sites often contains soft clay. Southern Finland consists of clayey soil deposits that are approximately ten thousand years old (Mokma, Yli-Halla, and Hartikainen 2008). These soils have been shaped under unique post-glacial conditions and have been formed by contact between bedrock, the hard and solid rock beneath soil surfaces, and air or water. Great at absorbing and releasing water, the fine-grained, sticky, and stiff clay forms sensitive soils that are problematic for the structure of constructions (Saresma et al. 2021). Due to their high plasticity and low stability, clayey soils challenge the work of geotechnical engineers, civil engineers, and construction workers. In other words, building residential, commercial, industrial, and infrastructure construction projects in clayey areas is a difficult engineering exercise. Thus, as clay resists conventional construction techniques, it is usually removed and discarded.

In December 2022, I followed piles of surplus clay in disposal and examined their sociomaterial configurations—gatherings of earth materials, excavators, engineers, environmental permits, relationships with geologies, and circularity discourses. The method of *following* is a way to inquire about often-overlooked processes of soil disposal, exposing complexities and injustices (Appadurai 1986; Cook 2004; Sodero 2019). As I discussed the practicalities of more circular earthwork with people who worked in the soil circulation business, I encountered two different worlds: clayey soils and their geological temporality and my human guides entrenched in a short-term capitalist mindset. This raised several questions. What can clayey soils, the surplus from building activities, tell us about the current economies of industrialized construction? Can thousands-of-years-old clay provoke alternative readings of the economic status quo? What can we learn from clayey soils to enlarge or reconfigure the economic thinking of construction?

In order to discuss the role played by clayey soils in the economies of construction, I draw from Ethan Miller's account (2019) of ways in which to broaden the meaning of economization. In his work, Miller exposes different strategies to understand and involve more-than-humans (the entities that form biological and geological processes) in human living-making activities, which Miller defines as economic activities. In Miller's approach, the economy is an enactment of livelihoods oriented towards processes of life sustenance, performed in anthropogenic and ecological configurations. Miller draws from economic geography approaches to diverse economies to emphasize the role of the dynamic interdependencies between humans and natural environments, showing that

economic activities are in fact inherently social and ecological processes. Diverse economies thinking provides alternative readings of the economic status quo, with its dominant pathway of increasing environmental degradation (Gibson-Graham and Dombroski 2020; Miller 2019; Gibson-Graham and Miller 2015). The diverse economies framework develops approaches that focus on rethinking how economic activities involve ways that humans and more-than-humans get organized to reproduce life. Life-making activities or economic activities are defined by ethical exposures and negotiations through diverse forms of configurations. In other words, negotiating co-existences with more-than-humans is a practice of affective concerns for the becoming of unexpected configurations.

Storage of clay

I visited a site of soil circulation in the middle of a snowstorm. It was in this seasonal pause in construction that I encountered different forms of excavated clayey soils at different locations: a storage area, a riverbank, and an industrial site under construction. As I engaged with stories of soil circulation and immersed myself in the phenomena of clayey soil disposal, I initiated a deep hanging out practice. The method of *deep hanging out* is a type of localized, closed-in, vernacular field research (Geertz 1998; Walmsley 2018). I used deep hanging out as a critical practice of joyful attentiveness to the economies of soil circulation. I paid attention to the interdependencies and entanglements between people and geological processes, feeling the silence and stillness surrounding the piles of soil under the snow. These poetic encounters were moments that enabled me to magnify time. I practiced slowing down to pause over ethical particularities, observing through my camera, and bringing my attention to the different paces at play, including those of soil circulation and clay formation. These were openings for learning about surplus soils—not as an accumulation of knowledge, but 'in the sense of becoming other' through my engagement with people and respect for geological processes (Gibson-Graham and Roelvink 2010, 322).

My encounters with clayey soils occurred in Porvoo, 50 km east of Helsinki. The City of Porvoo is part of the Towards Carbon Neutral Municipalities network (Hinku) which aims to reduce carbon emissions by 80% from 2007 levels by 2030 (Finnish Environment Institute 2021). Porvoo also aims to reach the 2027 targets of the Finnish National Waste Plan, by decreasing the amount of waste (including surplus soils) from construction and recycling or reusing at least 70% of all construction and demolition waste (Ministry of the Environment n.d.). The aim is to reuse as much of the soils removed from construction sites as possible, either onsite or in nearby construction projects. The circulation of soils requires four sites to be operating at the same time: (1) a storage area, where soils can be treated for easier reuse; (2) an area for unreusable soils (e.g. contaminated or dredged earth materials); (3) an area where soils can be used in construction; and (4) the actual construction site, where soils are excavated. Surplus soils are moved around the city in a sort of a dance.

I discussed Porvoo's circularity goals with an environmental engineer working on increasing the circulation of soils as we drove to a storage area for surplus soils located outside the city (Figure 1). The site is approximately 100 hectares and has been in operation since 2016. It is divided into zones for different types of soils, including forest topsoil and tree stumps, crushed rocks, organic soil, and clayey soil. Soil storage requirements are based on specific environmental permits and on the activity reports of each year of storage. Piles of excavated soil can be stored for up to three years before being considered hazardous terrain rather than storage. During these years of storage, the growth of trees and other vegetation is managed to keep problematic seeds at bay, such as non-native seeds. Other activities in the area include the mechanical treatment of soils (e.g. adding nutrients such as calcium and sand, and grinding rocks into the desired shape and size).

I stepped on a snowy pile and looked at the invisibilized clayey soils waiting to be reused in a new construction area. I observed this in-between moment for soil circulation, perhaps an interstice in the fast-paced economies of construction (D'Alisa and Kallis 2020). In a few years, most of these soils will be used to construct a nearby residential area consisting of houses, schools, and daycare

Figure 1. Site of soil circulation in Porvoo, a storage area for surplus soils.

centers, but for now, the soils lay under the snow, interacting with the nearby forest ground, slowly eroding the capitalist timeframe.

Lingering toxicity

At a different location on the west side of Porvoonjoki, the river crossing the city of Porvoo, I encountered liquid clay. The plan for the area was to deepen the riverbank to enable larger boats to cruise the river, supporting the boat manufacturing industry. An excavator was digging the dredged material and pouring it out onto the riverside. The liquid clay forced people to build pools where the material could solidify (Figure 2).

Liquid clay acts as the memory of former industrial activities. Porvoonjoki contains contaminated clay, mainly heavy metal leftovers from 1950s industrial production of leather manufacturing, for example, which used coloring that contained lead; and metal manufacturing and boat maintenance activities in which people used lead paint to protect against rust. The removal of the contaminated clay and the safe reuse of clayey soils in a circular economy go hand in hand, as soil circulation practices create opportunities to dig up the toxic past. However, clayey soil, with its lingering, hazardous substances, resists circulation. Contaminated soils require specific landfilling sites with the relevant environmental permits. Porvoo has one landfilling location for lightly contaminated soils, although it is now almost full. Heavily contaminated soils force earthwork workers to travel more than a hundred kilometers from the city to landfill the surplus clay. I spent time at the river side, observing how circular practices visibilize contaminated clay that resists reuse and is eventually removed out of sight.

Figure 2. Site of soil circulation in Porvoo, removal of liquid clay from Porvoonjoki.

Clay disruption

I visited another site where a different form of clayey soil resisted circulation. The industrial area was under construction, located 15 km west of Porvoo. Its earthwork plan is to reuse 90% surplus soils, an aim which is considered achievable as the site is large enough for moving and storing the soils. To qualify for circulation, the surplus soils excavated from the area need to be classified as uncontaminated and must not contain certain substances at concentrations above certain thresholds. The challenge is that the site contains naturally occurring high concentrations of sulfur-rich clay, which accumulated at the bottom of the ancient Baltic Sea and rose to become dry land due to the post-glacial rebound. Sulfide-containing soils are harmless when left in place. However, they become hazardous when excavated and disturbed because their sulfur-rich sediments generate sulfuric acid when exposed to oxygen – an acid which lowers the pH of soil, causing harmful quantities of metals to dissolve from the soil into the environment. Sulfur-rich clay requires specific handling to reduce the risk of acidic runoff and can only be used in oxygen-free conditions to minimize contact with surface water.

Although the industrial area's soils are regularly tested for harmful substances and sulfide-containing soils are only used in certain oxygen-free conditions, the exact locations and structural layers of sulfide-containing soils, and the specific methods used for handling them are not always clear. Existing practices only temporarily and partially minimize the risk of harmful substances leaking or leaching into the environment over time. This is because harmful substances will inevitably escape, affecting subterranean life forms, or the activities of microbial communities (Meulemans and Granjou 2020). I paid attention to these entanglements of momentary controlled activities and permanent unpredictability through monitoring and reporting. I noticed brief moments of oversight and long-lasting environmental uncertainties. Amid these different

temporalities and the muddy mess of earthwork practices, sulfur-rich clay ascribed indeterminacies to circular practices (Alexander and Sanchez 2020). The disrupted clay blurs the boundaries between what is considered contaminated soil and what is not, what is considered reusable soil and what is not, or what is considered virgin soil and what is not. The clay is in an in-between time, escaping ideas of either reusable or waste soil, awaiting classification. It shifts identity when excavated and troubles the capitalist logic.

At the pace of clay

As I engaged with the complex configurations of soil circulation, I observed bizarre dynamics. In the world of the people whom I met on the earthwork sites, soil circulation work was a practice of more sustainable construction, as it prevents the excavation of certain virgin materials and reduces soil landfilling. In this model, sustainability is a commodified idea that focuses on economic growth and carbon emission reduction. The reuse of surplus soils go hand in hand with the design of new construction projects; creativity is spurred on in a fast-paced, profit-driven economic system. A noisy motorway becomes the justification for constructing sound-absorptive berms, and the removal of riverbank soils is to support the boat manufacturing industry and the construction of green leisure areas (the reason for years of soil treatment and control through adding nutrients and testing water quality). These types of sustainable solutions have monetary benefits but often fix one single way of thinking about more sustainable economies.

I pondered on the voluminous piles of excavated clay that elusively disappear under vegetation growth. I paused to the point of stillness and looked at the clayey soils, respecting their inhuman temporalities. I felt the tension and violence that current economies generate towards and through people and clay—the tension between short-term profit-maximization through circulation and the ancientness of clayey soils—as I spent time on the earthwork sites and chatted my afternoons away. In these sociomaterial configurations, I wondered in what ways opening the interstices of time and allowing space for affective encounters with geological processes could inspire imaginaries for more ethical economization of soils.

While driving around Porvoo, I hung out with an environmental engineer who bitterly shared a story about their involvement in a project at the beginning of their career. As they told their story, a ghost of a blasted bedrock raised its head (Tsing et al. 2017). Certain geoengineering projects cause disturbing feelings of loss. About ten years ago, approximately two million tons of crystalline hill bedrock, formed 1800–2000 million years ago, were blasted for the harbor expansion in the port of Tolkkinen (in Finnish: *Tolkkisten Satama*). The grieving process unfolded throughout the discussion as we drove to different soil circulation sites. Sadness and regret were palpable as my guide recalled memories of the old pine forest that grew on the rock and the views over the city while walking in the hills. The blasting of the bedrock made the lights of the nearby Kilpilahti industrial site's manufacturing activities—the largest oil refining and petrochemical cluster in the Nordics—visible from the city at night, as the bedrock no longer obscured the industrial activities. Today, the harbor project is still in its planning phase, and a crushed granite company has now begun operations in the crater of the blasted rock, exploiting the area for more profitable stone excavation. The entanglement of the irreversible loss of ancient bedrocks and ten thousand-years-old (more than a hundred human lifetimes) clayey soils, the fast-paced human activities of constructing, the roadmaps to a circular economy, biodiversity loss, and the meaningful work of making a living made me feel uneasy. Today, thanks to the work of my guide, less bedrock is being blasted, but clay continues to be removed, disrupted, displaced, and changed forever.

Clayey agency

In order to address the economization of clayey soils and treat the fate of clay with ethical consideration, I turn to Miller's idea of *distribution* to 'enlarge the space of agency' in diverse economies

thinking to not only humans but all sorts of more-than-human entities (Gibson-Graham 2008, 14). Miller proposes three strategies: (1) a strategy of *inclusion*, which makes more-than-human living-making visible by applying frames from existing economic agency and expanding ideas of need, surplus, consumption and commons to more-than-humans, (2) a strategy of *extension*, which transfers categories generally understood to be exclusively human—such as labor—to more-than-humans, and (3) a strategy of *distribution*, which uses the idea of assemblage, according to which more-than-human agency can be understood as the result of struggles over diverse configurations of all sorts of human and more-than-human entities (Miller 2019).

According to the strategy of *distribution*, the economies of earthwork can be understood as configurations of interdependent, ever-changing, and unexpected relations and processes—gathering fine-grained earth, bedrock, forest vegetation, geological temporalities, environmental permits, water quality measurements, real estate arrangements, excavators, memories of blasted landscapes, and circular economy discourses. In this world, clayey soils are part of struggles over always-tenuous economic, social, ecological, and geological configurations. Clay not only challenges the work of engineers in their attempts to make surplus soils more circular, it also performs its own living-making processes – the weathering of bedrocks and the formation of fine-textured deposits over geological timescales. Clay is not merely an inert resource for construction that goes through the loops of circularity for the use of real estate development; clay is a part of geological configurations that enables specific forms of economic existence and resists specific forms of economization.

In my encounters with clayey soils, these forms of economic existence were produced through the articulation of affective concerns for the destruction of geological sites and desires to decrease the environmental impact of industrialized construction (among other feelings). Not only storage spaces, excavators, and regulatory documents have agency over the economies of earthwork, but feelings of wonder, sadness, or loss, provoked by the passing of time and the long formation of clayey soils, influence these economies. To acknowledge these configurations is to acknowledge a sense of vulnerability and responsibility towards different temporalities, fast-paced human lives, and slow geological processes. Clayey soils hold, by their seemingly immobile and inert nature, 'radically inhuman timeframes and movements' (Clark 2011, 6). As they differ from humans' living speed, they also hold wisdom for the becoming of human societies. Perhaps clayey soils could help us reframe the economies of construction by extending, or rather, distributing modes of attention, ethics, and relations. Here, what happens during encounters with clayey soils can be just as important as governments' or large corporations' actions for more sustainable construction, although in different ways, as clay unhurriedly *participates* in inhuman ways in human economic activities.

Conclusion

Clayey soils are deeply interconnected with the human economies of building. It is nearly impossible to imagine industrialized construction in ways that would not require some sort of soil disruption. In line with the growth imperative, the intensification of capital-seeking investment increases the demand for constructions, intensifying the flows of excavated soils. In response to the voluminous amount of surplus soils generated by the building industry, people are developing soil circulation practices. In a circular economy, surplus soils are transformed into valuable resources in a managed and controlled fashion. However, my encounters with clayey soils brought attention to certain messy entanglements, displaying moments of economic indeterminacy through the unknown quality of soils, soil coordination ambiguities, and the long-term impacts of hazardous soils on their environment. This does not mean that soil circulation work is in vain. I show how the work of people dealing with soil circulation is important in order to encourage discussion on the diverse possibilities for economizing soils in a less destructive way. Engaging with people who closely work with soils also opens up moments of affective concerns about the becoming of geological more-than-humans through feelings of loss and responsibility.

By paying attention to the livelihoods of clayey soils, I have exposed a material reality of soil circulation concerned with the inhuman temporality of geological processes. Ancient, slow-forming clay became a provocation for rethinking the role and involvement of geological more-than-humans in the economies of industrialized construction. Spending time in snowy landscapes, listening to the stories of the people who work closely with soil circulation, surrendering to the sense of grief concerning bedrocks, and acknowledging the inhuman temporality of clayey soils can make space for new perspectives on how to engage with these economies. My intention is not to encourage slow engagement with clayey soils at all times, but to emphasize the plurality of the paces in the diverse economies of construction, and to spark questions about issues of exploitation, extractivism, and pollution. I suggest that involving clayey soils in economic thinking can offer ways in which to imagine more ethical forms of economization, beyond short-term, fast-paced economic growth and capitalization. Clay is an entity formed over several hundred human lifetimes, a geological process that rests under our buildings. Its presence inspires us to magnify our human time, and to look again, respectfully.

Note

1. According to Finnish soil circulation experts, the actual total volumes of excavated soils could be significantly higher, as the available data gathered from construction companies make estimates uncertain.

Acknowledgements

I wish to thank the informants who participated in the data collection and the clay that became entangled in this work. I also wish to thank Gay Hawkins, Stephen Healy, Eeva Houtbeckers, Luis Vega, and Emilija Veselova for their generous and critical comments that helped to improve this paper.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was carried out with funding from Aalto University and the Finnish Cultural Foundation (funding decision 00220887).

Notes on contributor

Delphine Rumo is a trained designer and a sustainability researcher, Delphine Rumo explores the materiality of diverse economies and post-anthropocentric practices. She is a Doctoral Researcher working with the NODUS Sustainable Design Research Group at Aalto University. Fascinated by the timing of human-geology economies, she writes about the life of soils and rocks in construction and her encounters with spirited geologies.

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