WORKING TITLES

Journal for Practice Based Research

Issue No. 02/2023: COMPROMISED VISIONS: "Lately, she's been seeing things differently"

Working Titles is an online journal for practice-based and led research initiated by students enrolled in the Ph.D. program for art and design at the Bauhaus-Universität Weimar. By "working titles" we hint at the journal's main objectives: To serve as a platform for the presentation of research carried out through any practice – from oil painting to anarchist urban plumbing – and to facilitate the self-publishing of practice-based working papers. Contributors submit their contributions to a non-blind peer review by those they deem suitable, regardless of their academic affiliation, and based on friendship and trust.

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Special thanks to Francis Hunger and Be Körner

Supported by Bauhaus-Universität Weimar, Professorship Arts and Research.
Published by Working Titles, c/o Bauhaus-Universität Weimar, Ph.D. Studiengang Kunst und Design, Geschwister-Scholl-Straße 7, 99423 Weimar

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Soiled Sights

Kirsty Badenoch and Teagan Dorsch

Abstract

How can we see more than what is visible?

We typically experience soil as the brown earthy particulates that muddy our boots and stain our clothes. But soil is not dirt, dust nor detritus. Beyond its physical matter, soil comprises a system of essential biochemical procedures invisible to the naked human eye – additions, losses, transformations and translocations. Containing more than 25% of all biodiversity on the planet, soil is a highly complex living entity.

It is our lack of ability to 'see' the complexities of soil that has contributed to it being overlooked, commodified and sterilised. The 2020 European Commission's *Caring for soil is caring for life* report estimated that 60-70% of EU soils are now unhealthy, an urgent yet invisible environmental and agricultural reality. Without visualisation, we lack empathy. We get a glimpse of soil health indirectly through plants and produce – through the secondary processes, products and systems that link to it. But these remain metaphors and inadvertent diagrams. How can we truly see soil in-and-of itself?

Fig. 1: Brent River Soil Sample, *Earth Works Vol. 1.*

How Dirty Is Soil?

As children, we are viscerally drawn to mud. The satisfaction of squelching slime through our fingers or feeling the slow suck of resistance as we stomp our boots through fields and woodlands. We also quickly learn to take them off before going inside. We stand our muddy wellies in plastic bags, hose our coats down, and absolutely-by-no-means touch anything until our grubby little fingers are well-soaped and sparkling. Sanitised outerwear remains in porches, halls or utility rooms, the inside world is a place to be kept clean from the disorganised filth of the natural world. A select few plants in approved sterilised soil mixes may be permitted, provided they remain in their corners, and any re-potting be conducted in the garden.

Mary Douglas famously discusses dirt as being "matter out of place" (44), proposing that the existence of dirt "implies two conditions: a set of ordered relations and a contravention of that order" (44). When soil exists outside, it is soil. As soon as it is brought into the ordered realm of the home, it becomes dirt. It is transformed into a messy matter, a threat to human order and systems of classification. It is brown, smudgy and difficult to get out the carpet. It is categorised with other vaguely annoying displaced detritus – with dust, biscuit crumbs and plughole hair – whose main purpose is to remind us of how little time we've had to keep on top of our chores. Yet soil holds upwards of twenty-five percent of the world's biodiversity (Directorate-General for Environment 1), including countless undiscovered and unnamed organisms (Environment Agency 11). Soil holds three times as much carbon as the atmosphere (1). It directly or indirectly influences 95% of global food supplies (5). Just a teaspoon-full contains millennia-old nutrient cycles, around 10,000 different species and upwards of 1 billion microscopic cells (UK Centre for Ecology & Hydrology 1).

The UK's Natural Capital Committee identifies soil as providing ten key essential services. The biogeochemical processes of soil filter water and reduce surface flooding; absorb and reduce pollutants; regulate atmospheric gases; provide habitats for soil dwelling organisms; hold potential for developing new medicines; provide a stable medium for plants; provide raw materials; protect cultural heritage; and form the platform for construction of our towns and cities (Environment Agency 5).

The UK's soil crisis has been extensively documented across recent news and literature. We are currently losing soil at rates faster than it can naturally form, primarily due to erosion, sealing, contamination and landfill (Environment Agency). Large-scale agricultural and construction industries have long extracted, rinsed, commodified, transported and dumped vast quantities across the country. In England and Wales alone almost four million hectares of soil are at risk of compaction, blocking root growth thus preventing nutrient transfer. Arable soils have lost forty to sixty percent of their organic carbon and the Environment Agency has deemed roughly three-hundred thousand hectares of land as contaminated (Environment Agency 3). Further still, soil is classified as a non-renewable resource. It takes over 100 years to produce a 1 cm layer of topsoil – a process that cannot be shortcut, and in human terms, is imperceptible (Natural Capital Committee 2).

Perhaps the most concerning issue is that, despite the Environment Agency being the best advocate soil has in Britain, even they classify it as a "natural capital resource" (Environment Agency 5) – as a material asset. Yet our continued regard of soil as being an inanimate matter or a tradable stock as opposed to a connected body of processes inherently underlines the commodification and manipulation of it. We need to start seeing soil differently.

There is a deep disconnect between soil's vital role in sustaining planetary life and ensuring the healthy functioning of the Earth's ecosystems, and our commonplace reductive, even slightly distasteful perception of it. Environmental philosopher and visual culture theorist Lukáš Likavčan poses that "understanding the power of visual infrastructures that produce our imagination of the planet might be one of the ways of meaningfully influencing" (101). Likavčan goes on to discuss the importance of the visual in transforming post-Anthropocene perceptions of the world, as a window to allow us to escape from old norms into new imaginations (101). The process of image creation, how an image is made, is critical to how we engage with and disperse knowledge of the subject being depicted.

If we are to critically interrogate our relationship with earth processes and look towards more ecological forms of understanding, then we need a better visual infrastructure to support this. We need to establish novel models or re-establish old techniques for sensing, reading and recording planetary systems that acknowledge inherent complexities and systematic natures. Such visual toolkits will be vital in avoiding our over-simplification of natural processes down to vague classifications or material manifestations, such as dirt.

Fig. 2: Earth Processing in the Studio, *Earth Works Vol. 1.*

Practices of Soil Imaging

We start by examining conventional depictions of soil from across different disciplines, in particular, the diagram. The definition of a diagram is "a graphic design that explains rather than represents" ("Diagram" def. 1) – it's a telling of a story in the clearest way possible. As such the act of diagramming reveals much about the perception of a subject, and the primary characteristics it is recognised for.

For the eye of the geographer, soil is illustrated as a stack of extruded rectangles of varying colours and textures, through a gradient from grey and chunky bedrock to smooth and brown decomposed materials (Patrich 179). Paradoxically, the more complex the biological life, the simpler the diagram becomes. These drawings imply that soil is rock, just smaller and less lumpy. In the diagrams of biology and ecology, the situation gets slightly better. The image is extended outwards to include a small plant and some worms. Arrows are introduced, crudely pointing in, out and around – movements and exchanges are implied (Natural Resources Conservation Service 4). Soil may still be depicted as a homogenous backdrop, but it is implied that it interacts with recognisable living creatures, and constitutes a site of exchange.

In the architecture and construction professions, things go downhill again. Soil gets reduced to a series of black and white hatches, denoting territories at scales of circa 1:500 (Periscope). They are vague, homogenous and far away. Soils that lie outside site boundary lines or below 1500 mm depths are often insinuated as not within the project's scope and blocked out in another colour as void. Details referencing specifications give a little more information, but this generally stops at a broad need for stability.

The diagrams of the laboratory begin to get a little more complex. Soil health is typically gauged through standardised laboratory tests, breaking down samples into their constituent parts, pH levels, nutrient and mineral compositions. The visual outputs are data sheets containing charts and statistics, in turn leading to diagnoses, recommendations and anticipated outcomes in relatable timespans ("Soil Test Results (Agronomic Crops)"). Such diagrams are akin to hospital charts for bodies, and as such begin to reveal the living interactions of soil as a space of exchange. This is an important advance toward understanding the complex network of processes beyond the matter.

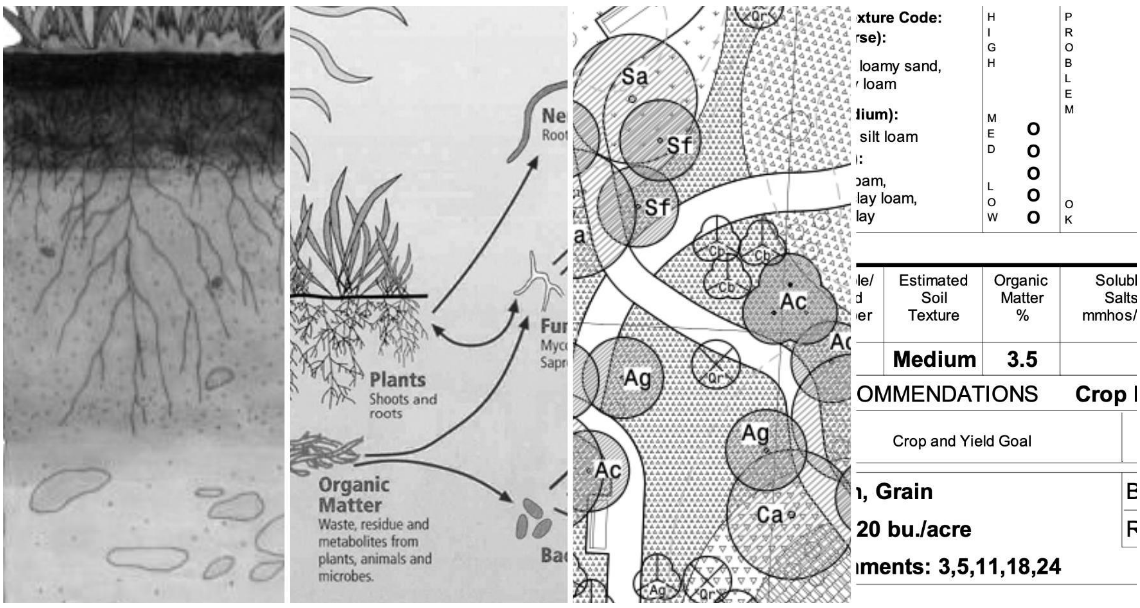

Fig. 3: Soil Diagrams across geography, ecology, architecture and agriculture (Patrich 179; Natural Resource Conservation Service; *Periscope*; "Soil Test Results (Agronomic Crops)").

However, contemporary soil health tests do not look outside their remit, nor consider ecological behaviours or trends over long time scales. Standard contemporary soil testing does not allow for soils' interactional complexity and changeable state, thus neither does its imagery. It is very much bound to technocratic labelling, doesn't consider the wider environmental sphere of influence, nor the evolving layers of complex processes that arise in soil. This form of imaging has been derived by human means to look for specifics related to an anticipated human purpose – fertility to inform agricultural crop yields, for example, or heavy metal content to comply with human health standards.

The health, vitality and diversity of plant life are projections of the localised health, quality and characteristics of the soil that lies beneath. Ecologists will assess plant health and index organisms in a set radius of soil to understand its condition. Farmers will assess yield to paint a portrait of subterranean health. This means of seeing soil involves looking through the indirect lens of plants and not by means of the soil itself. Soil processes are viewed as secondary to the quality of plant life they create. In the same way that we 'view' a solar eclipse by looking at a projected diagram of the sun against a cardboard box, when we look at soil through the lens of plants we are not seeing soil for its own essential complexity but through an attribution of value associated with its yield in plant quality. What we see is just a single moment out of a complexity of momentary soil interactions.

Fig. 4: Soil Performance. *Earth Works Vol. 1.*

The diagramming of soil is at best, always a secondary system. Each disciplinary approach gives a layer of understanding, but also creates both barriers and filters, disrupting the details. This leads us back to our question of how soil can be described in-and-of-itself. How can soil be the driver in testing and exploring its own qualities, can we allow its expression beyond human categorisations? If we are heading towards the perspective of soil as being a lively system of processes with tendencies and rhythms rather than an inert matter, how can we embark in mutual dialogue with it?

Searching for Soil: Performing Processes

If we are to engage directly with soil imaging, we need to get dirty, to become as viscerally engaged as we were when we were children. Setting off on our personal expedition to see what soil really is, we dusted off our wellies, dug out our shovels and squelched a muddy riverbed right through our studio. Removing the dichotomy between exterior 'soil' and interior 'dirt' became our first invitation, as we both physically and visually started to bring soil into our studio.

Our journey began by excavating samples of alluvium from Brent River Park in West London. After talking with soil specialists at UCL's People and Places Lab, we decided to begin very simply, by separating the soil into its constituent parts. Employing traditional ceramic techniques, we sequentially filtered out gravels, sand, silt, organic matter, and most importantly, clay. The process of clay extraction is technically simple, but practically slow and messy. It involves repeatedly suspending mixtures in water, sieving, draining, re-suspending, skimming, kneading. We enacted this process and, at the end, were left with nine relatively homogenous clay tiles that fired to a rich red tone, and a set of jars of useless particulates. We had successfully separated and commodified a living entity. We had fallen into our own trap of materialism.

Our output may have been reductive, but the process of getting there revealed a lot. The term 'soil' encompasses four broad categories of processes: additions – material being deposited from above or below, translocations – material that moves from one location to another within the soil, transformations – changes to materials through other processes like decomposition or geological weather, and losses – removal of materials, such as through erosion (Soil Science Society of America 2). We observed that tracking the exchange of buckets, the traces of foot and fingerprints, and the colour changes of the filter cloths actually beautifully re-performed the biological processes we were looking to engage with. The more important visual infrastructure for engaging with soil was in the performance of processing, not the material end-product.

Fig. 5: Soil Filtration Cloths. *Earth Works Vol. 1*.

Soil Chromatography

Through our first experiments, we determined that the activity and processes of the soil needed to be the creator of its own image. Building from Lukáš Likavčan's premise as to the importance of the visual medium in transforming perception (101), we propose that a post-Anthropocene visual infrastructure must come from the interplay of biological, geological and chemical activity, allowing the material processes to represent their own essential qualities rather than being led represented by human-centric objectives. We need to find a receptive method in which to allow the activities of soil to make their own imprints.

It was at this point that we stumbled across soil chromatography. This is a chemical separation method used to test the biological qualities of compost and soil, based on simple photographic methods. It is commonly used in US permaculture communities, yet partially due to it requiring qualitative judgement to decode rather than presenting 'absolute' results, it remains underused in mainstream practice. The practice has been contested in some scientific circles, yet there is sufficient evidence that proves that a huge level of information can be obtained from them, not at least due to their more nuanced tendencies.

Professor of Political Theory Dr. Nandita Mellamphy discusses the diagrammatical science of ecological notation and its importance for ecological literacy (8). She describes the primary aim of ecological notation as "to chart human and non-human movements across the landscape" (4). Ecological notation takes planetary processes and freezes moments in time out of their complex evolution. Soil chromatographies are just that, a visualisation of a specific moment in the developing history of a particular moment of soil. Mellamphy goes on to discuss how ecological diagrams "work as prosthetic devices that become vehicles of intuition" (9).

Through wicking a sodium hydroxide digested soil solution through silver nitrate infused paper, soil chromatography creates images with distinct (and often indistinct) zones delineating minerals, organic carbons, and enzyme activity (Pfeiffer 47-86). Chemical breakdowns and reactions leave live organic imprints at a 1:1 scale. As with any non-digital activity, there is an amount of unpredictability in the making process, and the environmental conditions in which the chromatographies are made leave them open to chance disturbances. However, when performed carefully in a controlled environment, soil chromatographies are stable – through repeating the process, we found that soil solutions from the same raw sample share a similar visual identity and make close to identical images. Through capillary action, a vibrant kaleidoscope of colours, channels, structures, and zonal disruptions reveal themselves. This patterning relates to the minerals, organic humus, and microorganisms entangled in soil processes. Soil chromatography exposes inaccessible soil complexities, and interestingly, the more complex the structure of the image, the more ecologically healthy the soil is deemed (Ford et al. 4).

Fig. 6: Barking Riverside Soil Chromatography. *Earth Works Vol. 2*.

Fig. 7: Queen Elizabeth Olympic Park Soil Chromatography. *Earth Works Vol. 2*.

To read a soil chromatography takes a degree of cross-referencing, judgement and experience, but with some effort, complex knowledge can be gleaned. For example, if the central zone is highly patterned (fig. 6) the soil has a higher mineral content. Stronger structures in the median zone (fig. 6) indicate the presence of proteins, organic carbon and organic matter. And greater numbers of edge spikes (fig. 7) indicate available nutrients and bacterial enzyme activity (Ford et al. 7). The translation of soil chromatographies is qualitative and requires cross-referencing, as it contains behavioural as well as matter-based information. The more chromatographies that are collected over a longer period of time, the more relative and informed assessments can be made.

This type of reaction-based image-making differs from the scientific laboratory approach in the way that information is collected, held and distributed. The reactions that occur within the making of soil chromatographies are encouraged, but not directed by human hand. Nor are they filtered for a set of binary outcomes or understandings. Rather than separating constituent parts, soil health is displayed in a manner that maintains the complex engagement between elements – that visualises momentary interactions.

We set about making soil chromatographies along a whole stretch of the Brent River, making them larger, over longer periods of time – testing the limits of the process. As we repeated them, the images began to expose clear tendencies, alongside unexplainable quirks. We wanted to go further. We started to collect soil samples from all across London. From riverbanks, parks and ancient woodlands. From post-industrial land, contaminated sites and urban tree pits. We were looking for similarities, patterns and inconsistencies. We were looking to be led by the processes that were themselves emerging, to create an alphabet of London soils that hinted to the complexity across the subterranean city. We categorised our expeditions into four – contaminated anthropic soils, urban soils, semi-domesticated soils, and park soils. We trekked from Barking Riverside to Hampstead Heath, from the Queen Elizabeth Olympic Park to Meridian Water. We continue to add to this soil dictionary.

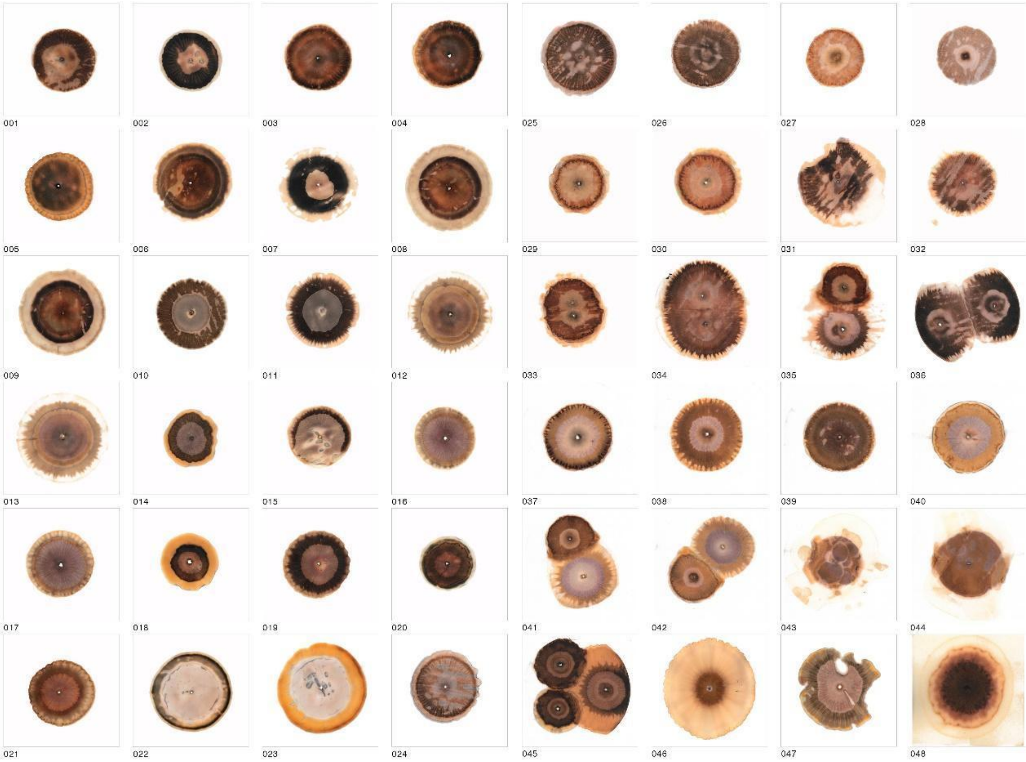

Fig. 8: An Inexhaustible Alphabet of London Soil. *Earth Works Vol. 2*.

A New Visual Infrastructure

During the testing process, we rigorously undertook iterations in order to perfect our methods, alongside compiling spreadsheets of qualitative data readings. Alongside this mindset of experimental collectors, we were also acutely aware of the visual depth of the images we were making – the longer we looked at them, the more details, channels, and flows we discovered. Rather than detracting from any objective learning, the complex and subjective allure of the visuals increased our sense of value and empathy. As we got to know each soil's visual properties, we began to play. We started pushing the process by intersecting multiple samples to see how they would affect one another, conducting experiments over longer timescales and at larger physical scales. By revealing the visual infrastructure of the complex processes unfolding as soil itself, we sparked our own imaginations and a different form of empathy for soil.

Soil is a planetary process. It is an evolving system of uncategorisable processes and exchanges. Through working with soil chromatographies, we engaged with a simple, cheap, hands-on, and site-based method of interacting with these. We got physical and we got messy. Over time, we didn't need to rely on tables or other secondary guides to read the pieces, we started to understand their behaviours sensitively and intuitively. We began to see soil.

If we are to develop better sensing toolkits through which to interact with the natural world, we need to engage with natural processes as processes in their own right. We need visual infrastructures that encourage interactions between living things to represent their own nuanced qualities. We need to work with processes that require us to go outside, and tread the outside back in again - creating higher porosity between the organised interior and messy exterior while we connect with nature. Soil chromatography is just one approach to visualising the complexities of our environment, there are many more such opportunities. And as in our experiments, many of them likely come from reinstating traditional, non-binary, analogue means, and from allowing play with our analytical processes.

Fig. 9: Interactive Chromatography Experiment Lab. *Earth Works Vol. 2*.

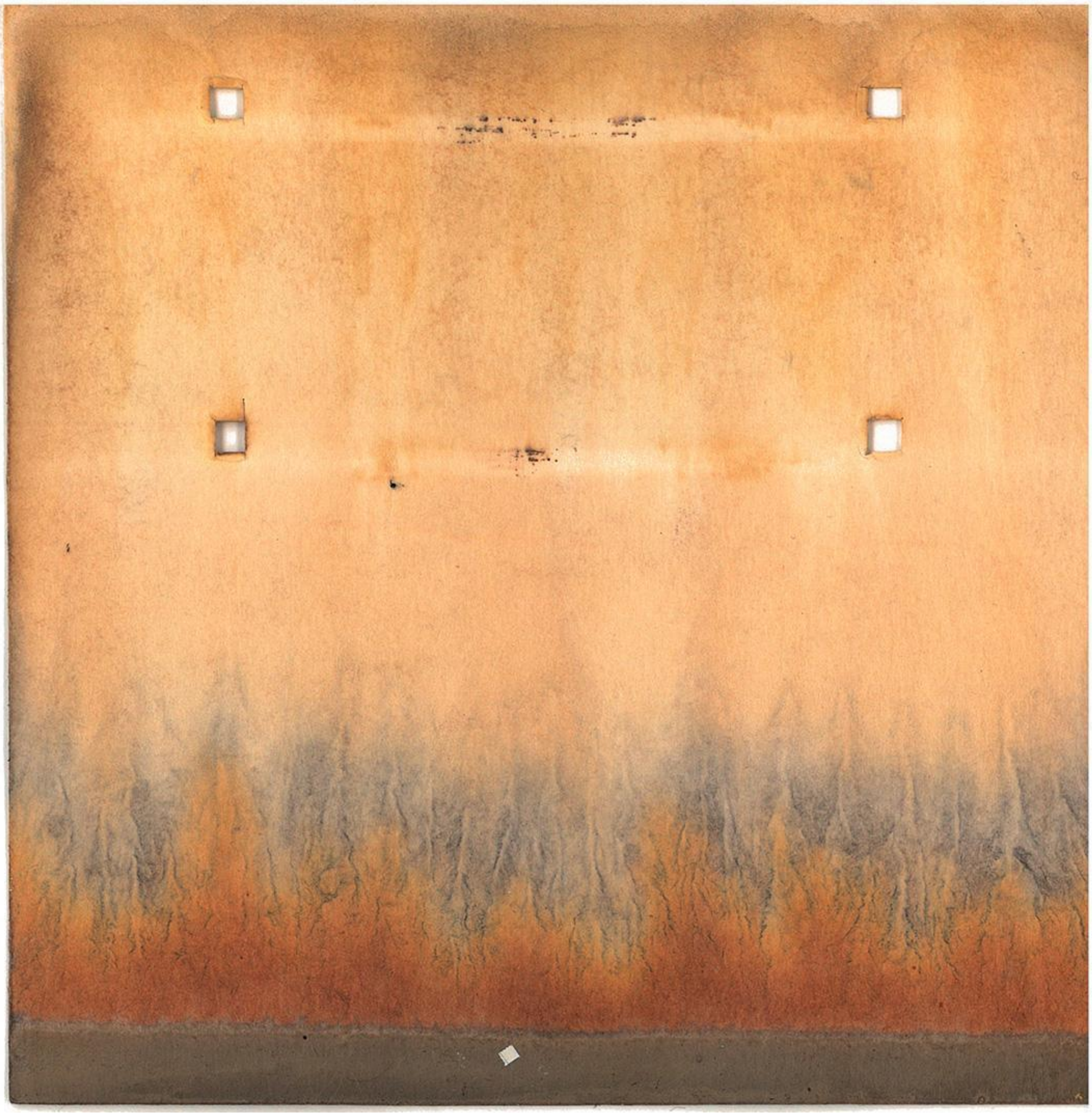

Fig. 10: Barking Riverside Soil Chromatography. *Earth Works Vol. 2*.

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The authors thank **Daniel Rea** and **Alberto Campagnoli** for the open peer review.