



**MONSOON  
[+ other]  
GROUNDS**

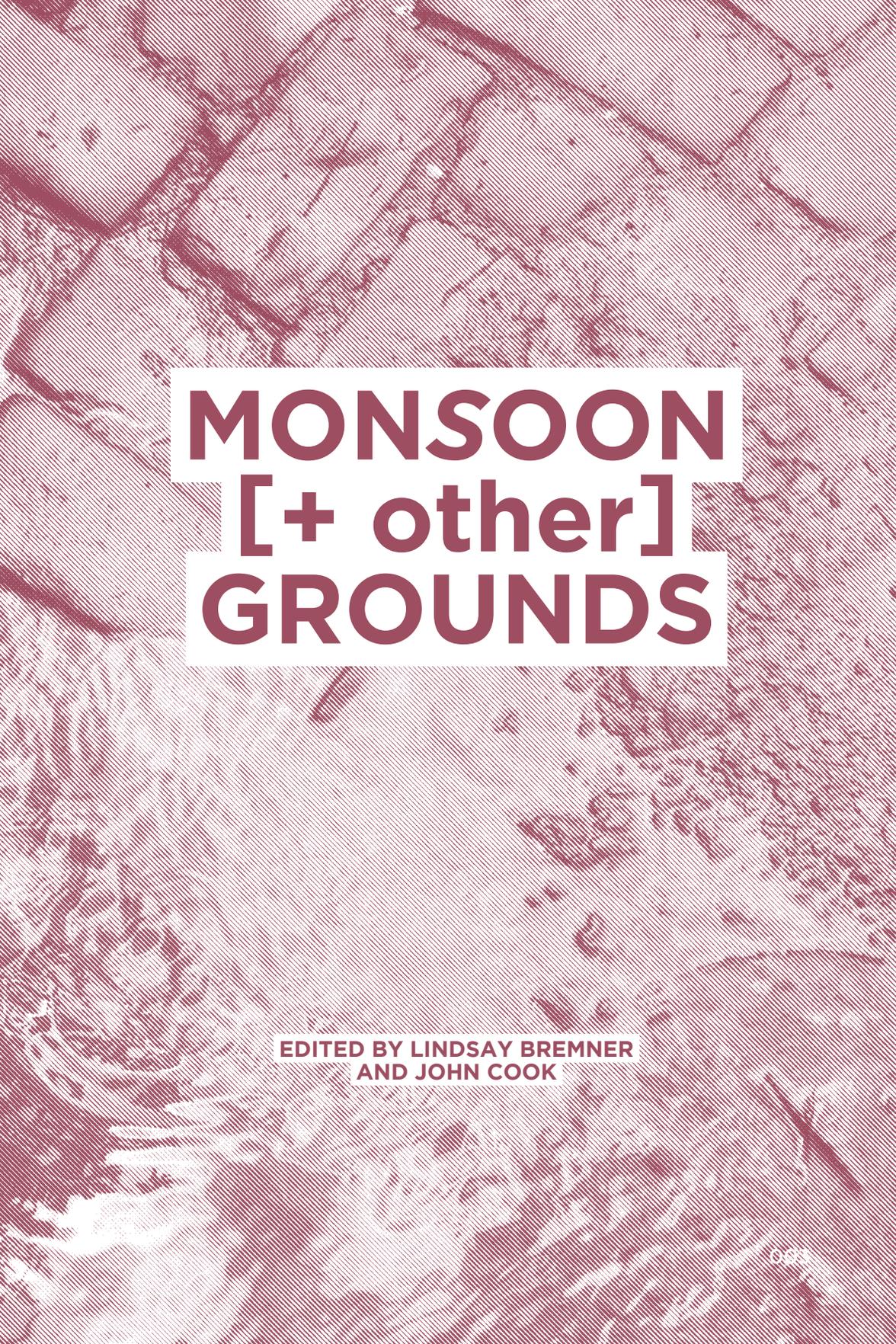
**EDITED BY LINDSAY BREMNER  
AND JOHN COOK**



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[+ other]  
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## PREFACE

*Monsoon [+ other] Grounds* is the final of three symposia publications by Monsoon Assemblages at the University of Westminster from 2017 to 2019. The others were *Monsoon [+ other] Airs* (2018) and *Monsoon [+ other] Waters* (2019). All three publications are available in print from online booksellers or as downloadable PDF versions here: <http://www.monass.org/writing/>. The symposia and publications are part of the agenda of Monsoon Assemblages to foster interdisciplinary conversations between the environmental humanities (anthropology, environmental studies, political ecology, cultural geography and philosophy), the natural sciences (meteorology, climatology and climate science) and spatial design (architecture, landscape architecture, planning and urban design). These are part of its objective to further understandings of the impacts of changing monsoon weather and rapid urbanisation in South Asian cities and beyond, and their consequences for the critical humanities and spatial design practice.



# MONSOON [+ other] GROUNDS

EDITED BY LINDSAY BREMNER  
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## INTRODUCTION

**Lindsay Bremner** is Principle Investigator of Monsoon Assemblages and the overall editor of the Monsoon Assemblies series.

*Monsoon [+ other] Grounds* is the third of a series of three publications arising from symposia convened by Monsoon Assemblages (MONASS) at the University of Westminster between 2017 and 2019. Monsoon Assemblages is a research project funded by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (Grant Agreement No. 679873). *Monsoon [+ other] Airs* was published in 2017 (Bremner and Trower, 2017), *Monsoon [+ other] Waters* in 2019 (Bremner, 2019) and this edition in 2020. The symposia and publications are part of MONASS' agenda to foster interdisciplinary conversations around the monsoon between the environmental humanities (anthropology, environmental studies, political ecology, cultural geography and philosophy), the natural sciences (meteorology, climatology and climate science) and spatial design (architecture, landscape architecture, urban design, planning). They bring together researchers, designers and practitioners from diverse traditions, who use different tools and methods and refer to different literatures. Just as the monsoon does not fit the frames in which it is made to appear, the aim of these events is to cut across partitions and geographies, open up hermetic places and systems of thought, generate friction and debate and experiment with new ways of thinking, drawing, living and designing with the monsoon.

We live in a world where political geography and spatial planning are based on the separation of land, sea and air and the knowledge systems that produce them. Land is understood as solid, stable, divisible and the basis of human habitation; the sea is understood as liquid, mobile, indivisible, and hostile to human settlement; air is understood as gaseous, mobile, invisible and indispensable to human life. The monsoon cuts across these divisions. It inundates lived environments every year, connecting sky with land with sea. It is a spatial practice that reorganises air, water, land, settlements, cities, buildings and bodies through heat, wind, rain, inundation, flow and flood. It unites science with politics and policy with affect. Today climate change is disrupting its cycles and explosive social and economic growth and rapid urbanisation are increasing the uncanniness of its behaviour and the frequency and severity of its impacts on human and non-human life. In contrast with those who propose climate-proofing as response to these conditions, we propose to explore the monsoon as a template for thinking with and to re-orientate the environmental humanities and spatial design around its rhythms and cycles.

Monsoon [+ other] Grounds took place at the University of Westminster on 21-22 March 2019. The symposium was organised by MONASS research fellows Dr Beth Cullen, Christina Leigh Geros and John Cook. It comprised papers and creative, practice based contributions framed by the monsoon as a seasonal designer of the earth, its grounds, its terrestrial ecosystems and its politics. Each year the monsoon scours river banks and fertilises valleys as it carries vast quantities of sediment from the mountains to the sea. In monsoonal regions, the pulse of life is linked to the annual cycle of its hot dry summers, bursting rains and retreating winds. Cropping patterns and management strategies respond to its variability, connecting farmers and agriculture with meteorology and atmospheric science. Human rituals celebrate these cycles – the parched earth, the bursting rains, bountiful harvests and the monsoon’s retreat. Monsoon grounds draw attention to the microbial origins of bio-politics, territory and nationhood. Since the 1970’s, its chemistries have been altered by fertilisers and pesticides, triggering political and economic disputes and giving rise to fortunes and failures. Territory has been converted into real estate, undoing intricate relations between monsoon grounds and their waters and unravelling human relations with them. The metallurgical alchemies of the construction industry have transformed clay, silt, sand and sediment into the building blocks of everyday life.

The symposium invited contributions to investigate the following themes:

**Geologic Grounds:** The monsoon is closely tied up with geology. It was formed from the movement of tectonic plates; its patterns are closely tied to orography and the heating of the terrestrial globe and it drives tectonic cycles through the vast amount of sediment it washes from the mountains to the oceans each year. We were interested in contributions that explored these geological processes and their intersections with social and political life.

**Monsoon Soils:** As part of this theme, we were interested in contributions that explored monsoonal ecosystems, connections between the monsoon, soils, plants, animals and insects, forests, agriculture and husbandry and how these are changing as the climate heats up and monsoonal patterns change.

**On the Grounds of the Monsoon:** On the grounds of the monsoon, empires have been built, wars waged, bets wagered and economies thrived or collapse. We were interested in contributions that explored the intricate connections between monsoons, empires, economies and politics.

**Monsoon Grounds as Culture:** We were interested in contributions that explored what it meant to live life on monsoon grounds and the cultural practices associated with its variability, fertility, cycles, bounties and threats.

Constructing Monsoon Grounds: We were interested in contributions that explored how practices of planning, design and construction and the socio-economic systems that shape them intersect with the monsoon's agency in shaping topography and matter into grounds for habitation.

What follows in this publication are some of the contributions resulting from this call.

In the first section titled 'Sediment,' Lindsay Bremner conducts a thought experiment aimed at rethinking the materiality of politics through engagement with the dynamic, intra-active, material exchanges sediment introduces to *terra mobilis*. Corinna Dean writes a prose poem based on her experiences of working with clay on the Isle of Sheppey in the UK. The second section, simply titled 'Soil,' begins with an imaginary letter from the soils he has designed with by landscape architect, Eric Guibert. This is followed by Harshavardhan Bhat's autobiographic essay on his grandmother's excitement at cutting open a jackfruit, through which he outlines a theory of monsoonal stickiness; Hari Byles discusses their experience of co-designing and building a composting toilet in the Bethnal Green Nature Reserve in East London. These two sections are followed by 'Drawing Grounds,' which comprises two contributions. The first is a compilation of drawings and texts from Tim Ingold's keynote lecture at Monsoon [+ other] Grounds titled 'What on earth is the ground?' The second is Anthony Powis' essay, 'Acts of Drawing Something You Cannot See,' on the difficulties of drawing groundwater, something that cannot be seen, based on his field work in Chennai. The section 'Fluvial Grounds' begins with Matt Barlow's essay on Kochi in Kerala based on his PhD field work, followed by Labib Hossain's work on the muslin industry in Bangladesh. This is followed by three practice based contributions: architect Saif Ul Haque's award winning floating school on the Dhaleswari River in Bangladesh, Tumpa Fellows' Rajapur Centre, also in Bangladesh, and MArch student Raymonde Bieler's thesis project for Chaung Gyi on the Ayeyarwaddy River in Myanmar. All engage in different ways with living with shifting grounds in the season-scapes of the monsoon. In the next section, 'Infrastructural Grounds,' three contributions examine infrastructure as grounds for monsoonal entanglements. Beth Cullen's photo essay traces the life story of Bangladesh bricks to expose how the monsoon is enmeshed in lived, built environments. Raphaël Monnier discusses his architectural endeavours in support of community initiatives to utilise Yangon's water supply pipeline as an urban commons and Fiona Grieve presents her MArch thesis on the Shwe oil and gas corridor that runs through Myanmar from the Bay of Bengal to China. The concluding section, 'Atmospheric Grounds' also comprises three contributions. In the first, Avi Varma speculatively lays out a theory of epistemicide through an investigation of the damage wrought by the harmonium on monsoon raga, a form of North Indian Classical Music. Christina Leigh Geros examines recent developments to uncover the role of clouds in

the earth's history. She is particularly interested in stratocumulus clouds which express the essential structure of the tropopause layer of the earth's atmosphere. Finally, Alexandra Arenès' contribution visualises the geochemical cycles passing through the various circles and strata of the earth system, as part of her PhD project, 'Architectural Design at the time of Anthropocene: A Gaia-graphical approach to the Critical Zones.'

The Monsoon Assemblages team would like to thank all who participated in the three symposia, from keynote speakers, to panellists, to chairs of panels, to exhibitors and audiences.

This and the other MONASS publications are available as PDF's for download at: <http://monass.org/writing/> or for purchase via online bookstores.

Videos of all the MONASS symposia presentations are available at: <https://www.youtube.com/channel/UCamcCWHWwYL74xac02f7nnQ/videos>



# SEDIMENT



## ON SEDIMENT AS METHOD

**Lindsay Bremner** is an architect and scholar who began her academic and professional life in Johannesburg, South Africa, where she published, lectured and exhibited widely on the transformation of Johannesburg after apartheid. She taught architecture at the University of the Witwatersrand in Johannesburg, at Temple University in Philadelphia, and at MIT as a visiting professor, before taking up her current post as Professor of Architecture at the University of Westminster in London.

### INTRODUCTION

'On Sediment as Method' is the outline of a thought experiment (Barad, 2007) to generate concepts aimed at invoking a monsoonal imaginary for these uncertain times. It proposes that by tracking and telling stories of how sediments form, travel and settle, of who or what they meet along the way and of the political disputes they become tangled up with, possibilities for re-thinking the materiality of politics are opened up (Peters, 2015; Cresswell, 2010). This proposition responds to Elizabeth Grosz's (2012) question of what it might mean to think through rather than about the earth and to afford political power (geo-power) to "the elemental forcefulness of the earth itself" (Clark, 2017: 223). The essay follows Nigel Clark and Kathryn Yusoff's argument in *Theory Culture and Society: Geosocial Formations and the Anthropocene* (2017). In this paper the authors argued that, while for some time "most social thought has taken the earth to be the stable platform upon which dynamic social processes play out" (Ibid.:3), contemporary climate change and the Anthropocene are prompting social thought to engage more closely with the dynamics of earth systems. How social and political agencies are constrained, made possible, interact with and emerge alongside earth forces have emerged as urgent questions.

Sediment does not usually feature in a geological imaginary, because it is too mobile, nor a hydrological imaginary, for it is too dry (see e.g. Clark, 2017; Swyngedouw, 2015). However, it is materially active in a monsoonal imaginary given that the monsoon mobilises it in vast quantities each year and it matters greatly to those impacted by its flows (Cederlöf, 2014; Lahiri-Dutt and Samanta, 2013). Thinking with sediment as a geosocial materiality generates new concepts through which to attune to the monsoon and its ways. It brings sediment into conversation with other forms of material planetary mobility, such air-born grains of sand whirling around in suspension (Nieuwenhuis, 2018) or the sticky viscosity of mud and its translation into political disputes and bodily discomforts (Whitt, 2018). As are sand and mud, sediment is a mobile, terraqueous state of matter that challenges imaginaries of terra firma and undercuts notions of territory as dry, stable and bounded.

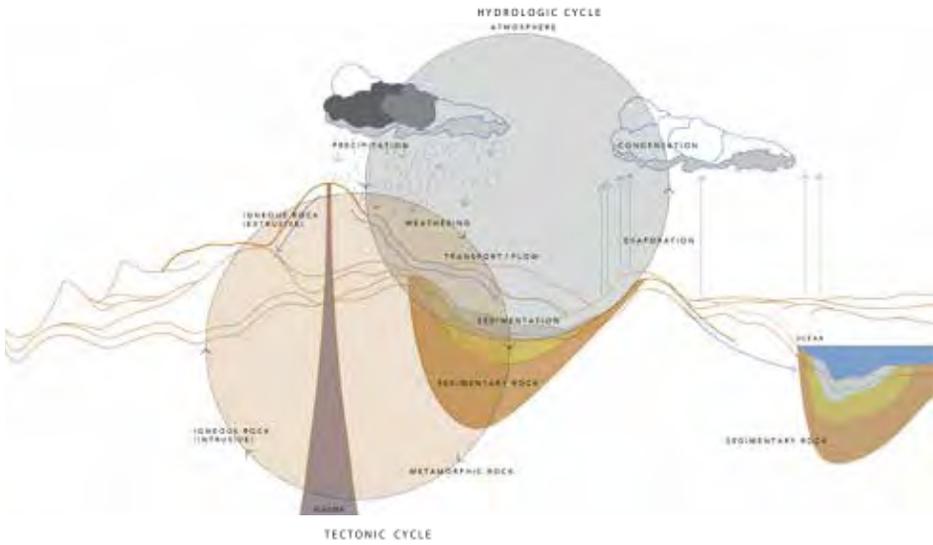


Fig.01a. The hydrologic and tectonic cycles. Raymonde Bieler and Lindsay Bremner.  
 Fig.01b. The rivers that pass through Bangladesh.

Sediment brings together two of the earth's great cycles - the tectonic and the hydrologic (Thornbury, [1954]2004)(Fig.01a). It is the product of interacting earth systems - the lithosphere, the biosphere, the hydrosphere and the atmosphere. It reminds us that the earth is "not just an inert mass of rock, an enormous sphere of silicates and metals, but ... a dynamic system powered from the inside by the heat generated by the radioactivity within its interior ... and the earth's second energy source - the radiation continuously received from the sun, which drives the earth's fluid envelope of air and water to create powerful weather systems" (Zalasiewicz, 2008: 14,15).

Sediment is what happens to strata when they are exposed to weather, when particles of rocky matter are unlocked or chemically transformed by the atmosphere and carried by air, water or technology across the surface of the earth. Sediment exceeds its identification with sedimentation, understood as the concentration and layering of forces into strata (Yusoff, 2017). It is earthly matter in a mode of terraqueous or terraerial mobility. It is the earth's recycling mechanism and archive, each grain thick with memories of other places, other altitudes and other times. Sedimentologists tell us that while sedimentary rock comprises only about five per cent of the terrestrial crust, it makes up 80-90 per cent of the earth's surface and contains its entire store of fossil fuels, phosphates, salt deposits and groundwater (Zalasiewicz, 2008).

In the northern part of south Asia, a billion tons of sediment is transported each year from the Himalayas to the Bay of Bengal by the Ganges, Brahmaputra and Meghna Rivers and their many tributaries (Fig.01b). For most of the year these rivers carry their sediment load sluggishly, but during the monsoon rains from June to October they change into forceful, sediment-heavy torrents. These rivers evade the logics of hydrology because they are too weighed down with sediment, and of strata, because they are too mobile. To understand them requires thinking with the logics of sedimentary mobility. Here I was inspired by Peters (2015) whose paper 'Drifting: Towards Mobilities at Sea,' proposed that thinking through drifting as a mode of mobility (what it is, who or what drifts, how and under what conditions and what it means and how it feels to drift) unlocks knowledge about the earth beyond that of static, solid earthiness. I propose that thinking through sedimentary mobility offers similar insights. In what follows I will briefly track sediment from its weathering off rock faces to its transportation in fluid flows, to its deposition and settlement.

## WEATHERING

Weathering, in the context of this paper, is the breaking down of rocks by weather. It is what happens to rock strata when they are exposed to weather, when weather becomes geomorphological. In their paper, 'Weathering: Climate Change and the Thick Time of Transcorporeality,' Astrida Neimanis and Rachel Walker (2014) use the word weathering to describe the common space and co-joined time of human bodies and weather. Counter to popular imaginaries such as that evoked and furthered by the BBC weather report each evening, weather is not a background phenomena of weather fronts, wind, rain, storms etc. in which we humans live out our lives. Instead we are thick with climatic intra-actions. We weather, we are weather-bodies, our bodies are archives and makers of weather. "The ebb and flow of meteorological energy transists through us, just as the actions, matters and meanings of our own bodies return to the weather in a myriad of ways" (Neimanis and Walker 2014: 560). Neimanis and Walker (2014) call this, after Tracy Alaimo (2010), the trans-corporeality of humans and weather.

While, in Neimanis and Walker's concept-world, bodies referred to are human bodies, it seems to me that the practice of trans-corporeality (material exchanges across bodies) takes place in the intra-actions between nonhumans and weather too. In fact, the more-than-human is implicit in Neimanis and Walker's thinking: "like these trees" or, I would add, these rocks, "we are all, each of us, weathering," they write (Neimanis and Walker, 2014: 559). Like all living beings, trees and rocks, when exposed to weather, become weather-bodies, have weather fronts moving through them, and are thick with climatic intra-actions, whose mechanics are intimate, molecular and transmogrative.

In his book *The Earth After Us*, stratigrapher Jan Zalasiewicz (2008) describes one of the weathering processes at work in rocks, known as chemical weathering. The earth's crust, he tells us, was originally formed when primordial earth rock (igneous rock) crystallised out from the earth's molten state billions of years ago. Its molecular structure was formed at high temperatures and pressures in the earth's interior. Once cooled and exposed to the atmosphere, rainwater and repeated heating and cooling, these silicate mineral structures, forged at high temperatures, disintegrate. They reassemble into minerals that are stable in their cooler, wetter surroundings, mostly turning into quartz – the most common mineral found in sediment, or they grew from solution on the surface or pores of rocks into feldspars. These sites resemble chemical gardens where microscopic, flake-like crystals of clay made of silicon, oxygen and aluminium are formed, flake off and erode. Thus weather, far from being external to the rock, becomes written into its molecular structure. Rocks in other words are the weather, and the weather is geology.



Fig.02a and Fig.02b. Weathering rocks, Mount Popa, Myanmar.



## SALTATION

Once freed from their middle-earth molecular strictures, particles of rock join the weather, so to speak. They are transported away from their parent rocks by gravity, wind, and water in the company of which they move by what is called saltation. This is a word from the Latin *salire* to leap and *saltare* to dance. It describes how, when suspended in and carried along by water or air, sediment particles frolic, tumble, and bounce along (Parsons Cooper and Wainwright, 2015). For the tiny mountains in transit have entered a world of fluid dynamics that force them to suspend their rocky assumptions and the security of knowing what will happen next. They become lively trans-corporeal water-bodies, barely distinguishable from the dynamics and characteristics of the rivers that carry them - fluid velocity, river bed, width, depth and gradient etc. - in an intra-active, turbulent process of mutual becoming. At low fluid velocities, the loose material rolls downstream, staying in contact with the bed-surface, in something like a break dance. This is called creep or reptation. Here the forces exerted by the fluid on the particle are only enough to roll the particle around the point of contact with the surface. Once the fluid velocity reaches a certain critical value, the drag and lift forces exerted by the fluid are sufficient to lift particles against gravity from the surface. These particles are accelerated by the fluid, but pulled downward by gravity at the same time, causing them to travel in roughly ballistic trajectories, something akin to the human bodies pretending to be sediment in the Gloucester Cheese Rolling competition. If a particle has obtained sufficient speed from the acceleration by the fluid, it then bounces up again and can eject, or splash, other particles in saltation, which propagates the process. Depending on the surface of the river bed, the particle might also disintegrate on impact or eject much finer



sediment from its surface. In air, this process is known as saltation bombardment and creates most of the dust in dust storms (Wikipedia, 2018). This process does not just transport sediment, it also wears away and reshapes its particles, whose bumps, angles or smoothness are records of their tussles along the way.

In this description of the dance of the sediments you will have noticed that I have used militaristic terminology - ballistic trajectory, projectile, bombardment. For saltation is a mode of mobility in which a fluid transforms sediment particles into little missiles set against and reshaping each other and the environments they move through. This energy carries with it the potential for violence and sudden disruption. In Bangladesh it produces what is known as “the land of *Allah jaane* (of God only knows)” (Baqee, 1998 in Lahiri-Dutt, 2013: 24). This refers to the precarious, nomadic units of land called *chars* that emerge from rivers enlarged by monsoon rains that flow thick with sediment each year. This land cannot be mapped or legally owned or recorded in revenue papers because it moves around too quickly and too frequently. It has historically been occupied by transitory populations without official documents. Those who live on them have no choice but to dance with the river (Lahiri-Dutt and Samanta, 2013) and lead perilous, calamitous lives. When the monsoon breaks and the flow of the river increases each year, their land frequently deserts them, their shelters are devastated, crops are damaged and livestock washed away. As the river recedes, new sandbars emerge and fierce, at times violent struggles to occupy them ensue. These are overseen by local strongmen who exert unquestioned authority over the distribution of land, and subject *char* dwellers to subservience (Lahiri-Dutt, 2014).

Attention to saltation then is key to understanding the world in its lively becoming. It alerts us to the ways in which the very character of the earth's movement itself unleashes certain kinds of violence on the world. In this case of the Bangladesh *chars*, this violence enables a clientalist almost feudal form of politics fuelled by class, caste and corruption.

## ALLUVIATING

As monsoonal rivers slow down, they deposit sediment on flood plains and pile it up on continental shelves. The courser, heavier sand is deposited first, while finer, clayey particles are carried all the way to the sea. Some of this is carried still further by turbidity currents into deep oceans where it settles and sinks and buries its history until, disturbed by tectonic forces, it re-emerges as the folded strata of sedimentary rock. In the Bay of Bengal, sediment carrying currents converge on the Swatch of No Ground, a 14km wide ocean canyon stretching for thousands of km down the centre of the Bay of Bengal. The canyon carries Himalayan sediments into the deep ocean, over time producing the largest oceanic sedimentary fan in the world, which is a 16.5km thick submarine layer of what once was Himalayan sediment (Keuhl et al., 1997).

However, I would like to step back from strata to talk about alluvium. To alluviate is a transitive verb from the Latin *alluere* meaning to wash against and to leave traces of that material exchange behind, such as a wash of paint. In the story I am following, alluviation refers to the ebb and flow of monsoonal waters and the sediments they leave behind as they recede each year. This redistributes the rubble, silt, clay and organic matter that a flow has gathered from multiple sources, over the surface and into the subsurface of its flood plains. At this point, sediment becomes soil, the earth's strata are transformed into territory and sciences of measure are born. In 'Politics of Strata,' Nigel Clark (2017) reminds us that it was this alluvial cycle that gave birth to territory. In the oldest storyline we in the West can conjure up about territory (Serres, 1995), the idea was born when the geometricians of the Nile River Valley retraced the borders of fields each time the river's flood waters receded. From this apportioning of annually deposited alluvium, politics, property and laws were erected. Territory, in other words, is a political technology of sediment. Contrary to modern conceptions of territory as static, bounded and dry, it emerged dripping from the watery dynamics of alluviating rivers driven by the seasonal dynamics of the east African monsoon.

## CONCLUSION

Where this short thought experiment has brought me to is to a sense of the dynamic, intra-active, material exchanges that make up the terra mobilis (Clark, 2017) of the earth on which we dwell, and the extent to which its generativity is constitutive of human relations and human politics. As earth cycles become more jittery, less predictable and more violent, they remind us of their monstrous and impolitic potential at all scales from the molecular to the planetary. They ask that the space of our political engagement with them be reimagined as trans-corporeal and intra-connected, recognising, to paraphrase Neimanis and Walker (2014), the multitudes of bodies (including our own) that are all co-emerging in the uncertain makings of these weather-times.



Fig.04. Banks of the Irrawaddy River between Bagan and Mandalay, Myanmar.

## ACKNOWLEDGEMENT

This essay was written as part of Monsoon Assemblages, a research project supported by the European Research Council under the European Union's Horizon 2020 research and innovation programme (Grant Agreement no. 679873).

All photos and images are by the author unless otherwise indicated.

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## CLAY MATTER : A SHEPPEY NARRATIVE

**Corinna Dean** is an experienced teacher, critical urbanist and curator who looks at semiotic readings of the urbanscape. She is driven by an interest in how the urban is communicated, experienced and lived out across cultures. She holds a PhD from the LSE Cities Programme, which was a collaborative doctoral award with Tate Modern, and is currently a lecturer at the University of Westminster.

### I CLAY MATTER

Do not go to Warden Point at or near high tide, choose your time carefully, the fossil collector tells me two hours before low tide is best.

I met a fossil collector on Warden Point he is a specialist.

*I want to think about topography, through clay*

If you walk the coast of the Isle of Sheep you can hear the shrill sound of metal on rock,

makes me grit my teeth - Robert Smithson mocks Ruskin's horror of the archeologists hammer.

Happy in the clay is the flat leafed plant 'Son-before-Father', I think of disasters at sea, youth outstrips the elder.

*Clay and coast are vulnerable to sediment erosion*

The fossil collector is scathing of attempts to arrest the erosion

Unruly sediment moves the island from north to south.

Rather than statements of subtraction the sediment rearranges itself

'Hold the line' asserts a military grip, in the attempt to prevent the coast's retreat.

Fred the fossil collector combs the territory, his relationship to the foreshore is one of deep history.

This land erodes visibly, slumps, collapses.

Rotations go on over years, "If you look at the cracks in the *arêtes* they are vertical, when it rains you get slip plains, when the water soaks in you get slurry, you should know as a potter," he tells me.

It is the weight of the clay in the slip plain, once it gets to a certain weight, it disintegrates which is what the engineer did not appreciate.

If you go down now you can see all the rocks they brought in from Norway, I said within 5 years the clay will cover that, and they replied no they were stopping the coastal erosion, but the clay is creeping over. The best buffer is the beach, the clay spreads across the beach and the waves take the clay away.

*Within the sediment the political can be found*

We ask the fossil collector-are there any changes in the flora and fauna?  
Moths collected in the 1980s signal a change in species.  
Box worm moth arrived five years ago, one came into the garden.  
There is one species of moth that lives in the clay bed, only one colony left  
on the island - I send my collection to Brogdale.<sup>01</sup>

They think the Swale, Harty, Elmley, Leysdown and Sheerness were five  
islands once.  
Thanet was an island, the Whantsum was a river.  
Beneath the London Clay there are gravels, river gravels, quaternary  
claygate beds on top of the clay  
Cliffs here were originally created over six million years ago-the clay is  
pushing out to sea.

Twenty kilo bags of clay were the limit of my experience of the soft  
sediment, to be squeezed, molded, coiled, poured. Slip, Sludge, Ooze.  
How deep is the clay? There are reading beds below the clay, then chalk  
below that.

*The Isle of Sheppey is vulnerable, we are all of this state*



## II CASTING THE COAST

Fossils are amulets warning against those who abuse time, they reside as objects within the lithic layers laid down in the Early Eocene. Fossils are nature's way of casting.

With touch we can handle compressed time, warning us of our fleeting presence.

Gastropods wash up from the clay cliffs after a fall. Within one or two tides, the shell is damaged and washed away. Filled with pyrite, when the shell is completely gone, all that remains is the cast. Ghosting traces leave their imprint on the clay.

Chemical reactions are alive on the coast line. Expectant fools search for gold-pyrite, isometric crystals appear as perfect cubes nicknamed 'Fool's Gold'. The wood is carbonite, creating a crystal association with the pyrite, this fragile mix means it does not survive well. The most common form of fossil preservation are the iron pyrite casts which cluster on the beach. Fossils are sorted into concentrations through the repeated action of the waves.

The fossil collector tames, orders and classifies time, his collection dates the material within the expanse of epochs drawn out deeply through the ground. His field is an assembly of minerals and sediments, organic traces left in the clay.

The collectors hurried keenly down from London on the advice of James Bowerbank, he of The London Clay Club. In 1840 from his desk at Hoxton, the Victorian botanist wrote words of caution in a letter to *The Magazine of Natural History*.<sup>02</sup>

*Gentlemen I write to advise on the procuring of the fossils of the London Clay from the Isle of Sheppey. Care must be taken in such an investigation of the coast that it be undertaken during the falling of the tide, or unpleasant consequences may arise from being shut in between the shoots of mud which are projected into the sea at many points of the coast.*  
(Bowerbank, 1840: 1877)

For over 300 years Sheppey has been a site for fossil collectors. Bowerbank sited 112 genera and 106 new species except for one previously known species which he recorded in *The Fossil Fruits and Seeds of the London Clay* (Bowerbank, 1840).

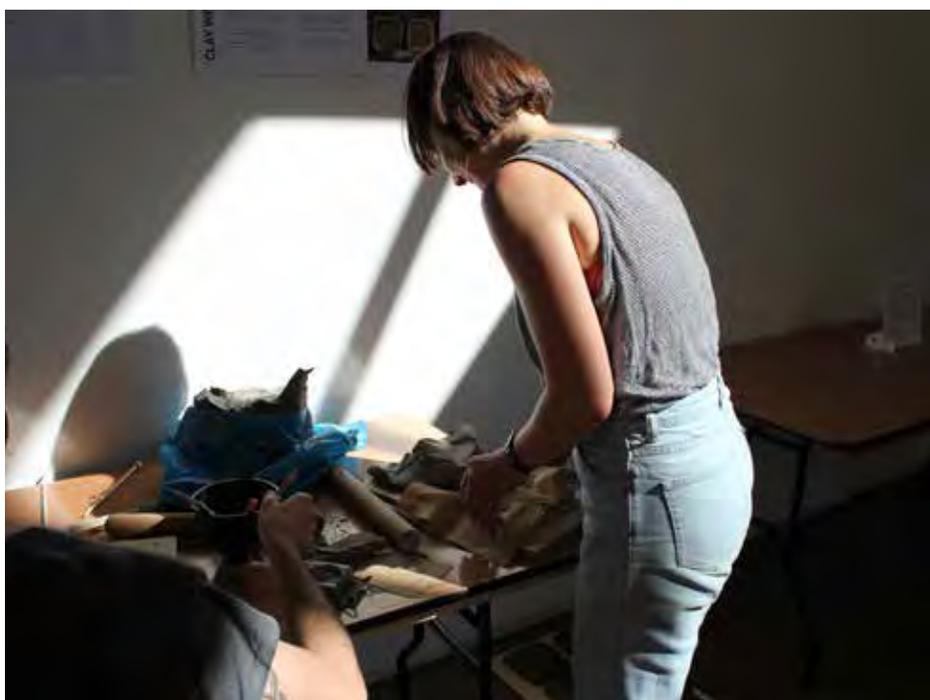


Fig.03. Workshop at the South London Gallery as part of the Incidental Unit programme. Photo: Marsha Bradfield.

Fig.04. Workshop Incidental Unit. Photo: Marsha Bradfield.

### III CLAY WORKSHOP

Clay is a shifting material

Slip slippage slip of the tongue

Slip is clay suspended in water forming a liquid of creamy consistency.

Can we think of clay as raw? What associations do we make with fired clay, the brick?

As clay transitions from ground to object, how does this shape our relationship with clay?

When the clay arêtes (ridges) slip there is a void, what do you think of voids? Does the landscape cope with this?

The geologist studies the sedimentary processes.

The coast from the Hoo peninsula to Sheppey, especially at Warden Point was at the mercy of clay-digging. From the 1800s the salt marshes were exploited by the brick and clay industries.

The natural erosion of the coast began before the destructive activity of clay digging, but nevertheless 50 years of sediment deprivation has affected the coast.

I claim chunks of this clay from the cliffs, each form brittle and sculpted and we build an imaginary landscape.

It is a homogenous, stiff fissured clay, bluish-grey in colour when fresh and weathering brown.



Fig.05. Image of the workshop model. Photo: Marsha Bradfield.



I cast hand-picked sections of the clay, each casting has the imprint of the master, which no longer exists.

Clay reaches its greatest thickness in Kent, estimated to be 146-157m near Minster on the Isle of Sheppey. Here it is overlain by two apparently protective outliers of transitional sands and clay of the Claygate Beds up to three metres thick on average and the fine sands with flint pebbles of the Bagshot Beds ten metres or less.

The greatest exposure on the island, occurs at Warden Point on the north coast where it forms unstable cliffs 42-46m high. Do not go to Warden point at high tide.

Clay is a shifting, fluid material, unlike fossils, crystals, or pyrite, its softness and malleability appear to strip it of embodied energy.

Amongst the clay, Septarian Nodules can be found, built around a nucleus which form accretions of suspended particles, the clay in turn absorbs water, on firing the clay turns a reddish brown.

These nodules or calcereous concretions nestle amoeba shaped into the clay, childlike, seeking warmth from the blanket of clay. These were known as cement stones and between 1796 and 1897 removed from the foreshore to provide the raw material to manufacture cement.



The concretions are composed of a clay and silt matrix cemented by ferroan calcite. They show no evidence of fossil concentrations, boring, or encrusting by epifauna. Ferroan calcite also forms well below the sedimentary surface. Their occurrence is probably due to relatively high carbonate concentrations at specific levels (King, 1984).

I shovel up chunks of clay from the coast recently submerged by the Thames as well as dissect the cliffs carefully removing one of the fissures of the rock, each time I return, the distinctive shape of the cliffs I recorded is no longer there, the rapidness of change jolts my perception of memory and time, within four months the *arête* has collapsed. Sediments and sand have dissolved in relation to wave patterns, absorbing and rearranging.

Ooze, sludge, slump, slip, the water snaps impatiently, threatening those greedy enough to linger on the shore and mudflats, the shifting landscape will not stand still.





Fig.08. Warden Point.

Fig.09. Mould of clay from Warden Point.

### III

Approximately one hundred years ago the marsh grass *Spartina anglica* appeared, adopting the Medway as its terrain, the geologist says it developed an invasive and aggressive phase, a warm loving plant it accelerated during the hot summers. Hope is that this will help shore up the ground, but equally smother native grasses. The species grows in intertidal zones and traps sediment thereby drying out marsh lands. It is a rhizome and far-creeping.

The unruly sediment, swept from the north coast may tentatively build up a layered accretion and protect the north Kent coast, bolstering up the saltmarshes on the south side of Sheppey to stop bleeding into the Swale.

The erosion of the north coast is of great concern but could be extremely important for the marshes of south Sheppey. Prominent beds of London clay also rise above the marsh in the south of the island, forming Elmley and Harty, most likely separate islands before alluvial sedimentation infilled the intervening channels. Fine grained sediment released from the cliffs would probably be transported both offshore and into the Medway and Swale estuaries where it could contribute to the slow vertical sedimentation of the tidal flats and marshes.

Where there is active marine erosion at the cliff base and no coastal sediments for protection are deep-seated rotational landslide, usually triggering collapse at the base. From Minster slopes to Warden Bay is the designated 'no active intervention' zone.

Warden Church built in 1769 was over 400m from the cliff that engulfed it between 1872-1898.

The 'hold the line' areas around Minster, could result in an isolated promontory if erosion is allowed to the east and west, as well as losing intertidal zones and its habitats.

The existing back shore would revert to an inter tidal area and water ways such as Capel fleet could be reopened.

If accretion does not take place then there is potential for large parts of the north Kent marshes to be completely flooded and the Isle of Harty and Elmley to be separated from Sheppey, leaving Sheppey five miles off the coast of Kent and alter the species compositions.

Through our gradual involvement with the Island we began to focus on increasing an understanding of local landscape perception and generate debate to create an open forum around histories, local knowledge and narratives of erosion, within this fragile coast line, also looking at what words people use to describe the coast's fragility.



Fig.10. Warden Point cliff illustrating the area where the clay section was removed and cast.

Past, present and possible future changes for the island are explored as part of a residency on the Isle of Sheppey, since the consequence for the ecology and natural history of Sheppey are predicted to have a serious impact on the island's erosion.

The project, through research, workshops and exhibitions aims to explore how the informal and anecdotal inform the geological and how the geological shapes the social, cultural and physical activities on the island.

Wrapped in a blanket of clay, calcereous concretions nestle, millions of years old.

Cement stones gave away their usefulness when setting under the rain  
And so we think through clay, it rains and the clay slumps  
and it is going to rain.

## ACKNOWLEDGEMENT

The research is part of the Sheerness Dockyard Church Trust Residency funded by the Arts Council. The workshop was held as part of the Incidental Unit Arts Council funded project, <http://flattimeho.org.uk/projects/incidental-unit/>

All images by the author unless otherwise indicated.

## NOTES

01. Brogdale is the National fruit collection, near Faversham Kent, owned by the Department for the Environment, Food and Rural Affairs.
02. A reprint of this letter is bound into the front of the 1877 edition of the publication *A History of the Fossil Fruits and Seeds of the London Clay* (Bowerbank, 1877[1840]).

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# SOIL



## LETTER FROM THE SOILS I HAVE DESIGNED WITH

**Eric Guibert** is a gardener architect. His research through reflective practice investigates ways of designing and being with the emergent quality of ecosystems, with their natures, to nurture and express their resilience, their biological and cultural diversity. This practice is located in the overlap between built and grown architecture and art, and connects ecological, animistic, and Taoist ontologies.

*The political goal of a vital materialism is not the perfect equality of actants, but a polity with more channels of communication between members (Latour calls this a more “vascularized” collective).*

*There are many practical and conceptual obstacles here: How can communication proceed when many members are nonlinguistic? Can we theorise more closely the various forms of such communicative energies? How can humans learn to hear or enhance our receptivity for “propositions” not expressed in words? How to translate between them? What kinds of institutions and rituals of democracy would be appropriate? Latour suggests that we convene a “parliament of things,” an idea that is as provocative as it is elusive.*

*(Bennet, 2010: 104)*

### INTRODUCTION

As a gardener architect, I have lived and designed with many soils over my career, some are in the ground, other soils are on buildings. The primary focus of my research through reflective practice is architectural investigations on how to design ecologically, with the emergent natures of places. The value of this focus is on finding ways of designing that avoid interrupting the creative flow of, or destroying the knowledge that is present in socio-ecosystems, as opposed to the way most western human activities damage both today. It aims to find ways of working with these ecological and biological dynamics so that ecosystems can remain resilient and provide ecosystem services.

The methods this practice uses have been described in a recently completed PhD that defines the practice’s ecological ontology as a secular form of architectural animism. This practice designs with places as beings, as “actants” (Latour, 2004: 349). In the thesis, soils are regularly mentioned, but in the background, as a gardener’s medium to guide the propensity of a place by defining the affordance for growth. The next stage of this research is to investigate how the principles defined through working with smaller and generally private ecosystems will evolve in more

complex, more contested situations. In doing so the aim is to develop an understanding of the broader political dimension of such an approach. To achieve this, a more explicit voice must be given to the ecosystems with whom I design. The first of these beings to be listened to are the soils. Through this method, I wish to answer five questions:

- How does my practice communicate with soils?
- What are soils in this exchange?
- What do we 'say' to, or what information do we exchange with each other?
- How have we both changed in the process?
- What does this reveal on the role of architectural design in ecological politics?

Inspired by a dialogue performed by Alicia Velázquez (2016) during which she interviewed the actants in her practice such as the colour pink and time, the method used is epistolary. First, I wrote a letter to the soils I have designed with, but I realised that this text still did not give a sufficiently strong voice to them so I wrote the reply that they would write back to me.

This is of course a potentially dangerous anthropomorphic exercise; an ecosystem is unlikely to use a language similar to humans to communicate. There is no assumption here that the letter is representative of what soils would say. This tool is used to investigate an ecological relationship, to force humans - me, the writer, and the listeners or readers - to empathise with soils, to develop respect for them. Inevitably, it is, like any other method, imperfect. It is somewhat foolish and has touches of romanticism. This first paper tests whether the epistolary medium is useful at unearthing insights for ecological architectural practice.



## LETTER FROM THE SOILS I HAVE DESIGNED WITH

Dear Eric,

Thank you for your recent letter. We have been touched by your message, and the way you have - physically - touched us over the years. Words are not really our language so we are translating through a web-based software; please excuse us if the output doesn't quite convey our meaning. Just now we were trying to translate the feeling we have when you dig into us, and it was translated as 'pain.' It isn't the digging per se that hurts us, as much as the violence of the digging if it happens in overly large quantities and/or too regularly. Whereas for you animals, a cut is always painful and dangerous to health, for us a small amount of disturbance is enjoyable, it gives us energy to create new ecological organisations and new species. Inconsiderate digging on the contrary, as per industrial agriculture, launches processes of decay, collapse in species populations and range.

We have decided to write to you in order to explain how we communicate with each other, what we are, what we say to each other, and how our relationship has changed, and has changed us. You humans can be so ruthless in the way you communicate with us. We often feel that your species are not aware of our presence, with some exceptions, such as yourself, now. Of course we can't express ourselves virtually, through language, or drawings. But it is not because we can't speak that we can't express an opinion on what we favour.

You asked how we perceive the world. We touch, we feel physical presence through plants, as they get trampled under steps, as you mow the grassland, or cut trees. We also taste the decaying matter that enriches us or its absence when you cart the hay away. We taste you when you piss on us, and enjoy the nitrogen and phosphate of the urine. We see through plants as they grow and produce sugars more abundantly where there is more light. We feel this through the flows of nutrients and water that run through our fungal networks, that also connect to the mineral subsoil; we taste the geology as much as the above ground. We also hear you through the animals that retreat in their burrows when you arrive.

In response, plants grow according to our conditions. You feel us through the plants and animals. They communicate what is happening below. You can read levels of nutrients, acidity, water through how tall they grow and which species grow. Your responses tend to be to cut them, which changes nutrients and light, and sometimes you change our setting, the topography or the hydrology, and they grow in response. A dialogue develops over days, weeks, months, years. We read the timing of these cuts, when in the year, how often, whether the cut is taken away. There are quick responses in days, weeks or months, and the slow response of changes in the soil structure and nutrient levels over years and decades.

We sense and evolve a little slower than you do.

Just like humans, we are multi-species assemblages; you also are made of other beings - your hair - for your sense of touch. You also need bacteria to digest food. Your mind is similarly an emergent network of synapses and neurons that store information in a dynamic and complex set of emergent interactions. Our main difference from animals may be in our capacity to separate, to fragment. This does not mean though that we are inert matter, that this division isn't breaking connections. We may be best described as colonies that can subdivide, formed of smaller beings, not unlike plants from which you can take a cutting. Please don't make the mistake to think that we are only this friable matter that you use to repot plants, compost. This is such a misunderstanding. And you know this implicitly. Think of your projects that use us, arrange them in the order of soil types following the process of succession where soils start from mineral and gradually increase to deep woodland soils.



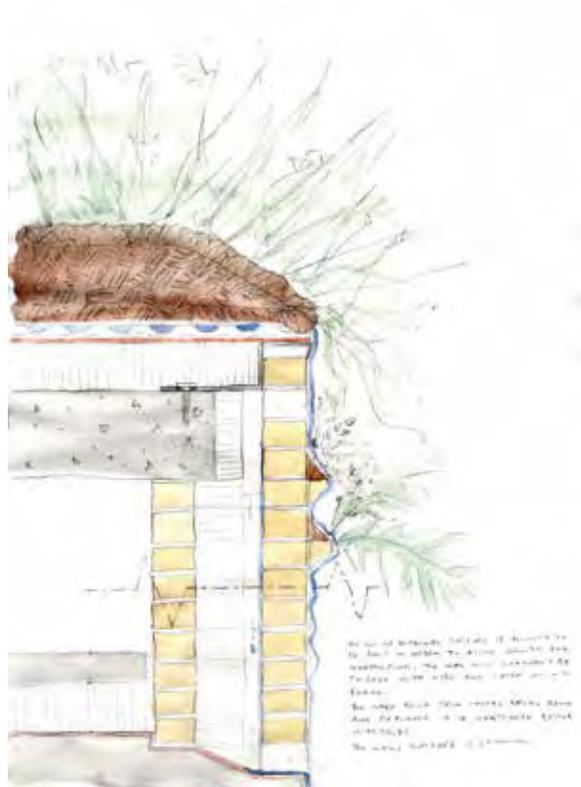
Let's start with 'Lichen House', the project that you clad with a cementitious board that is porous enough to support lichen growth. Implicitly, although unconsciously, you knew that this was already a soil, organic matter growing on mineral matter; the very beginning of us. Eventually some of the lichen dies and composts into micro amounts of humus, which will evolve into thicker soils when moss starts growing. Our dialogue is mostly our monologue: you created the setting, we grow, and you look at this response and let it be. This soil is gardened by the weather, the rain that brings water and the sea wind that brings nutrients and takes away the build-up of humus and thus stops the process of succession so that the roof doesn't become grassland.

You have often been in conversation with grassland soils, at your farm in France, cutting us through various rhythms, and patterns, sometimes leaving the cuttings to decompose and re-enrich us, sometimes removing them, to enhance the diversity of species in the sward. Grasslands are diverse when not so rich in nutrients. Here you disturb the process of succession. It was really sweet to see when you realised that we are not uniform in a meadow, the dynamic mosaic of plant and animal communities that move across overtime in response to differences in top-soil depth and humidity - not unlike the patterns of lichen - and how the top soil slides down slopes over decades, accumulating in the lower parts.



You also work with woodland soils, the climax of soils, that of the largest amount of organic matter stored. In 'Roots Pavilion', you shaped it as an arch, originally held in shape with a corset of metal and building felt, but, as it decays, it will be replaced by the roots of the trees planted above. You know implicitly that we can only exist with plants in order to be structurally resilient. You were reminded of this as you discovered the liquid quality of the soil when you were making the one third size model of the Pavilion. The plants are not only our sensing organs; they also form our epidermis; they protect our surface from steps; they stop erosion. Without plants, we don't exist, we just blow away. You know this when you detail roof gardens without parapets and draw the enmeshment of roots at the edge.

Can you see now how we form a protective skin to the earth? How we limit erosion by constant renewal of the surface? How we are both a messenger between, and made out of, the mineral below, and dead and living organic matter above. How the plants are part of us as the epidermis, protecting, structuring and sensing.



You asked in your letter what we say to each other? It isn't necessarily meaning that we exchange. On one hand, it is tangible elements such as nutrients – bodily fluids, cut hay, foraged food, timber and other ecosystem services. But there are also intangible affects with tangible consequences: the care and respect that we show to each other. In the landscapes of heavy industrial agriculture and intense mechanisation, you protect us both through defining protective zones, and through acting on us with respect, by being attentive. You have created spaces where ecological processes can emerge, although they are tweaked of course to form a space for contemplation, wellbeing, and production. You protect us through the aesthetic language you create with us, these picturesque or geometric forms that you apply with various cutting regimes. Not only are they beneficial by gently disturbing us towards higher levels of resilience, they also change the behaviour of the humans that visit. People start to walk only on paths. The aesthetic language makes visible our diverse textures, frames them and makes them approachable. We first laughed at these seemingly superficial aesthetic decisions and now realise that they are a translating tool, frameworks that form a regime of perception that allows humans who can't feel us, to become attentive, careful.

Fig.04. Section through the earth roof of 'Under the Meadow', a project for a house extension in London. The turf and its roots are used as protection against erosion instead of a masonry upstand. The water and nutrients trickling on the wall below nurture the growth of ferns and mosses.

You have sometimes hurt us, especially in the early clumsy days, for example when you harvested the hay every year in the less rich meadows and after a while, we were so emaciated that little grew. It took you a few years to hear us cry, even though you were looking, you so believed in the concepts of meadow conservation management you had read that you couldn't feel us. You now can read us more precisely and decide in response how often to harvest, depending on each location. You have a detailed awareness of the dynamic meadow mosaic, and a variety of techniques to adjust to each, from applying geometric patterns to reactive mowing, in order to create a broad variety of disturbances. In your latest landscape gesture - the compost circle - you add decomposed hay in a circle in an area of low nutrient to see how the plant community might change accordingly, the texture and range of species that it would bring, the change in height.

Through this respect and care, we have learned from each other what we each thrive on and reached through that exchange a point of aesthetic ethical synergy. On one hand we enjoy the loose disturbances that you enact as they make us more diverse, more resilient, more alive; the way the large mammals used to disturb us in pre-historic times. On the other you appreciate the diverse textures we create as a response that express levels of equilibrium, levels of biodiversity, of resilience.

This was not always the case; your taste has changed. You preferred more colourful and smoother textures. We also are not the same, we were less diverse and rougher. Like an old couple, we are becoming more like each other. Through our dance of co-creation, you have become ecological. You already had the inclination from the start but you were so clumsy, walking on our feet. You are now more attentive and careful, and also more daring where you have realised that it doesn't hurt us. Your sense of aesthetic has evolved to work with what we are, what we do. It is less romantic, more soil like, more down to earth - earthy. We have become more human, more you, in order to please you in the same way as some fruiting trees and flowers have evolved to embed in their DNA the taste and aesthetic sense of humans in order to thrive; we have developed ecologies that please you. You have learned our character, as we have learned your culture. When you started working with us, you saw design as something done in a studio and then applied on the world; now you see design as a dialogue, working with what is here, now, with our vibrant, messy, and unpredictable diversity. Design is no longer pre-determined, it is emergent, and distributed within the ecosystem. Please don't think of your role as being our steward, don't feel responsible for maintaining us, but keep conceiving us as creative beings that maintain ourselves when you let us do so, and that you can create with. You don't repair us, you help us repair ourselves. And in this process, you are also repairing yourself. Aren't you?

Fig.05. 'Compost Circle' is a circle of compost applied to the meadow in winter to alter the plant community in spring and summer. The differential growth expresses the dialogue between the earth and humans.



Thank you for being present and respectful, thank you for developing modes of communication between us and humans. We are looking forward to creating with you.

Take good care of yourself,

The soils you have designed with

## CONCLUSION

Writing this epistolary exchange has been transformative. It has revealed knowledge that was implicit in my practice, embodied, but not conceptualised. The first insight happened through understanding how we communicate; what I conceive soils to be has entirely changed from friable matter to skin-like being that includes plants. I realise that it is this delineation of soils that is one of the main media of this architectural practice. The second is how we have transformed each other into being more akin, a human earth, an earthy culture. Lastly, these distributed forms of architectural design are examples of modes of communication with other-than-humans, of democratic processes of the “parliament of things” called for by Bruno Latour (2005: 14). It is this ecological political dialogue between humans and other-than-humans that my practice aims to research further through the continuation of this correspondence woven with the embodied practice of architectural design that it grows from and enriches. What is this modern animism? What is it useful for?

All images by the author.

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Fig.06. The watercolour score / plan of the ephemeral scheme for 'Courtyard Meadow'. It shows a larger compost circle than that shown in Fig.05.





## STICKINESS OF THE *HALASINA HANNU*

**Harshavardhan Bhat** is a doctoral researcher with Monsoon Assemblages. His doctoral work is an experiment in the development of a monsoon air methodology, attuned with the Delhi region and some of its material monsoon airs. Harsh is alumni of the 15/16 Strelka Institute post-graduate programme on 'the city.' He holds an MSc in Comparative Politics (Conflict Studies) from the London School of Economics and a Bachelors in Business Management from Christ College (Autonomous) in Bangalore.

The *halasina hannu* (in Kannada) or the jackfruit is native to the Western Ghats and is found in southern India. Growing up, I was told that *halasina* refers to the root, 'of the roots' - the bark that extends its fruits from the tree. The word *hannu* means fruit. In some Kannada dialects, *halasu/halasi* (pronounced with a deeper stress on the 'la') refers to the process of decay, rotting and/or fermentation. Before I go any further, I must acknowledge that there are different explanations to what and how the word *halasina* comes into being and what it means. The speculative connections between concepts that are made in this piece are a result of situated narrative and description, hinting at one possibility of how one may perhaps understand sticky relations. At my grandmother's home in southern Karnataka, there are quite a few jackfruit trees. The oldest one, north east of the house still occasionally, after many generations produces some of the largest jackfruits I have ever seen. The tree is right by a stream. There tend to be anthills in its vicinity. Dense foliage. Wetness on the barks. Ferns. Moist air. In this corner of the land, the air is always sticky. Even in peak summer, a few minutes by the big *halasina mara* (jackfruit tree), will show you air that is cooler than the air you felt in the yard. The lifeworld around the *maru* (tree) like a membrane for winds that move through it, conditions it, thus changing it. In the briefest of moments, that change is felt by the breeze of decay - the *halasu*. It is amidst the orienting air of this deep rot, decaying its vibrant fragrance into the air, that an interesting encounter of concepts can be found. The *halasu* of the *maru* is not just the atmospheric condition that it spatio-temporally shares with those that find themselves in its company but is a matter of deep more-than-organic reasoning as to why they exist. I seek to articulate an enlivenment of the air that is specific to those grounds but is not because of what is in the ground alone but is entangled in the condition of *halasu* - suggesting a possible theory of stickiness. In reading aliveness, Puig de la Bellacasa (2019) argues that descriptions and reinterpretations of aliveness need to address what is more than the soil. Soil is not simply the description of ground and affect but about figuring "a relational key to the. aliveness of the more than human-soil community: it is not in 'the' soil" (: 401). Puig de la Bellacasa views this attunement of reading soils not just because it could be an ethical practice but because the soil is already alive. It is not alive independently as Puig de la Bellacasa stresses but is part of dense material and multispecies communities. To think with the ground, is to bring into consideration how

these grounds complicate the sticky affectivities of our understanding the *mara*, the *hannu* as tiny arbiters in an entrenchment of *halasu*.

The *halasu* is therefore in this context, not the rot in a conventional modern sense referring to binaries of good and bad, and the *halasu* is definitely not the decay or ferment of stagnation. It is not a process of something getting spoilt or losing its functional properties. The *halasu* is superficially a description of process but it is conceptually an ontological state. In-fact, the *halasu* has no productive function although its deep capacities can be cultivated. As an ontological state of lifeworld it does not conceptually fit in with life-death binaries. As Puig de la Bellacasa (2019) notes: "Thinking with soils, aliveness moves, transitions, circulates, revealing a common entangled fate that blurs human-soil ontological boundaries"( : 401). It can be argued that my description of the jackfruit and the *halasu* are in-fact descriptions at the boundaries of exposure and meaning. What the state of stickiness I otherwise like to think of as the *halasu* is the fragrance of possibility - of deep organics entangling a million worlds in the eventual attempt at writing the most mundane boundary description of something that does not constitute the object but is flesh that is afforded to become part of human community (and activity). The task here is still not to extend the force of description as a mere aesthetic but to invite the methodological possibility of the flow of *halasu* to guide thinking on the *halasina hannu* and the *halasina mara*.

Like the thud. Thud! As the fruit falls in all its might from the *halasina mara*. Often the fruit is already consumed by other critters. When we do find one for the house, its presence is felt in the placement on a gunny sack, in a corner by the lobby. That sense of air's density that the *halasina hannu* emanates is an aroma without pretense: it is social knowledge that an event will soon be enacted. My grandmother, uncle and aunt scout the room to sense the possibility of its consumption. Outside by the bay next to the kitchen, a *katti* (knife) affixed/soldered to a low stool sits next to utensils with water and some coconut oil. My grandmother takes her seat and lifts the jackfruit, in one deep breath, and drops it onto the *katti* (knife). And the process of the cut begins. It's a slow and attentive process. Having oiled her hands, she carefully plucks out the pods and separates them from the fabric of gums, sticking into everything that it comes in contact with. The texture of the *katti* has inscribed in it- the leftover stickiness of jackfruits of the past. It's impossible to completely scrape off the gum of the open jackfruit. In order to avoid a reaction with the human skin, the latex that drips on the exterior of its green body is carefully negotiated with. As the pods are carved out, plucked and, separated from the seeds inside - some into a bowl of water - you see the dance of viscosity and stickiness: one describing the other, letting one take form, slipping in interactions that are otherwise sticky, muddled in the most intricate of movements, fleshed out for ritual, culture and cuisine. An ontological boundary is sensed in

its aroma and stickiness, as an atmospheric embodiment in the corridor entangles with the air.

My grandmother shares her excitement of how ripe the fruit was. She exclaims that this was indeed the right moment to cut the fruit open. Its affectivity of stickiness retains the force of the monsoon, akin to the maturity of the *mara* itself which uses that time to flourish. Despite being a *mara* of the monsoon, the jackfruit tree is known to be drought tolerant by local farmers. Opening up the *halasina hannu* and tasting the ripe pod: an explosion of sticky flavor - honey, pineapple, custard, caramel, mango oozing out as one chews through its fiber. This is not a speculative enchantment. It is the literal interactive temporality of stickiness conditioning the nature of liveliness, parceled by one brief version of description. The jackfruit tree is a life of monsoon grounds but it is also a living theory that affords us the importance of thinking with/through ontological stickiness. The *halasu*, i.e. the material of stickiness is also a material of reading the condition of stickiness. Parceling the metaphoric and material meaning of wetness from the air, soils, multispecies communities and others, the *halasu* as the living organics of what makes the *mara* part of the local lifeworld, is one entry for theory to speak from monsoonal grounds. It is also a hint for a knowledge system of stickiness that inherits the monsoon as a figure of time that makes the world what it is. Sticky relations are therefore not just material causal links of more-than-organic connections but are attuned to conceptually sticky matters of the time of the monsoon. The monsoon as a force that makes *halasu* possible is exactly what affords it the ontological capacity to be a possible theory of stickiness. Without the monsoon, there would be no or rather a very different speculation of *halasu*. The monsoon makes the *mara* and the condition of *halasu* (the roots, the rot, the deep decay) affords us the sticky joys of *hannu*.

## ACKNOWLEDGEMENTS

To *ajji, ajja, atte, mava, appa* and *amma* for preserving fruits and stories, where possible.

This essay was written during my tenure as a PhD researcher as part of Monsoon Assemblages, a research project supported by the European Research Council under the European Union's Horizon 2020 research and innovation programme (Grant Agreement no. 679873).

Photograph by the author.

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## ATTENDING TO THE GROUND BENEATH OUR FEET: CO-DESIGNING A COMMUNITY COMPOST TOILET IN BETHNAL GREEN

**Hari Byles** is a researcher and compostist whose focus is on accessibility, sustainability, soil care and alternative sanitation. They have worked for a number of food growing projects across London through which they aim to bring ecological and social justice together through everyday actions and inventive methods. They recently completed studies in soil microbiology and microscopy with Dr Elaine Ingham, and are currently developing a soil care and alternative sanitation cooperative.

*I think our job is to make the Anthropocene as short/ thin as possible and to cultivate with each other in every way imaginable epochs to come that can replenish refuge.*

*(Haraway, 2016: 100)*

Several years ago, when I first started working as a community gardener at Bethnal Green Nature Reserve as part of the Phytology project, which grows medicinal herbs or weeds for visitors to forage and use (<https://phytology.org.uk/>), I interviewed one of the project's co-founders, Naseem Khan, about her experience of the site. She said something which stayed with me, and which I am still turning over in my mind. Naseem talked about how the project was not as subversive as she'd expected it might be. She described the nature reserve as a "sanctuary" and "symbol of survival" but reflected that "sanctuaries are not subversive..." When I asked about what subversion meant to her, Naseem described it as "when your perceptions are shaken... you find the ground disappears under your feet... but it doesn't here, in a way it's back to something deeper and more profound, for me anyway, it's finding my feet instead of losing my feet." I held Naseem's words close to my heart, as I tried to figure out what (if any) my role could/ should be in the project and the space that I was becoming more and more entangled with. For whom / what was it a sanctuary and who / what was excluded from this? When Naseem sadly passed away in June 2017, Michael Smythe, another of Phytology's co-founders and director of Nomad (<https://nomadprojects.org/>), asked if I could help out with funding applications and programming, as well as facilitate some discussions about how the project could be more inclusive, accessible and relevant. I'd just finished writing my dissertation about the politics and design practices of compost toilets in community gardens. It was something I knew a bit about, although I wanted to know more. I could see a way in which some radical plumbing [or](#) at the Nature Reserve could perhaps do something subversive, whilst also attending to the ground beneath our feet.



A toilet was something the Nature Reserve needed. To protect it from re-development, more and more people were starting to use and get value from the site during the spring and summer months; from after school clubs, to bat walks, creative workshops, social prescribing, shared lunches, medicine making, yoga, music nights etc. During these times, if visitors needed to go to the bathroom, they would have to be escorted by a staff member offsite to a nearby community centre, which had kindly allowed us to use their toilet and kitchen over the years, or walk to the nearest café or pub. It wasn't practical and what's more, wasn't accessible. I made the case that having an accessible toilet onsite would / could help to improve accessibility, or at least begin a process of thinking together about the various barriers which may be preventing some groups from accessing and benefiting from the space. Something that concerns me about many food-growing / green projects across London and beyond, is the lack of conversation and action about accessibility

and social justice. There is an assumed able-bodiedness, cis-gendered, middle-class whiteness that has taken root that often goes unchallenged. This results in spaces which do not feel accessible or inviting to those who don't fit within these hegemonic norms. Historically toilet and sanitation infrastructures have been used to communicate which bodies are expected and welcomed in public space, and they continue to wield this power over all sorts of people who don't fit these expectations, such as trans and gender non-conforming people, disabled people, queer people, people who prefer or need to squat, outdoor workers, poorer people, those with addiction issues, homeless people and care givers. Rob Imrie refers to this as a "design apartheid" (2003: 129) and Sheila Cavanagh makes the link between the hygienic imagination (a deep fear of contagion inherited from Pasteur's germ theory) and the multiple exclusions which emerge in and around conventional toilet spaces.

*Worries about hygiene, rot and decay, are intimately tied to gender. Whiteness is about abstinence and absence (no longer here) ... and gender purity is about obsessive attempts to police the borderlands between male and female; each is preoccupied by a negative or tertiary space, a gap or disconnect between life (coded as masculine virility) and death (symbolized by the sodomite and the maternal devouring of the feminine)*  
(Cavanagh, 2013: 439)

Toilets are political, they have the power to subvert assumptions about who is present in a space, and shift human relationships with dirt and waste. Valiant attempts <sup>02</sup> have been made to re-design public toilets in ways which address these multiple exclusions, but there are always issues. Rather than adopt or come up with a one-size-fits-nobody design solution, we wanted to design something together as a community. This would be something specific, relational, adaptable over time, and would hopefully meet the needs of our visitors and team, as well as the ecological needs of the nature reserve and of those (human and more-than) to come after us.

Maybe you are wondering what all this has to do with the ground, and sometimes whilst losing myself in funding applications, gantt charts and planning processes, I lost my grip on this too... But it is all about the ground, compost toilets are about soil! And our capacity to care for it. In a talk that we programmed alongside the toilet build, Maria Puig de la Bella Casa reminded us as a community that we are soil makers, and suggested that we should "nurture our aptitudes to break down matter... ingesting, digesting, defecating... we are soil... we are matter passing" (Puig de la Bella Casa, *Urgent Matters III: Soil, Poetry and Care*, 8/09/2018, Bethnal Green Nature Reserve) <sup>03</sup>.



The modern bathroom has moved a long way from the outhouse at the bottom of the garden, and the night soil collections that used to rattle through the streets of London, collecting humanure to make compost. Our current sanitation system, could be described as a “material collective” (Gabrys, 2013: 221) which informs an existing politics of severing relations between the human and non-human, our wastes and the places this waste ends up. It does this through obscuring the multiple sub/terranean connections, flows and networks that make up this system and the complex interdependencies involved. The act of flushing and cleansing through mixing shit and water, holds the “promise of disappearance” (Gabrys, 2013: 216), enabling us to make our most “dangerous” (Teh, 2013: 344) waste disappear from sight. In the process it creates a major pollution issue and squanders one third of our clean drinking water and the nutrient-rich materials present in urine and poo. The rapid loss and degradation of top soil in the UK (3 million tonnes per year) is a major environmental concern, impacting biodiversity, food sovereignty, carbon emissions, the economy, health and water conservation. Learning how to better care for soils in our localities through building soil structure, understanding and nurturing local soil biology, composting, mulching, and avoiding chemical pesticides and fertilisers, seems like a key way of surviving in troubled times. Perhaps survival can be subversive in a world hurtling towards extinction, but the question of who survives and how, brings us back to the importance of incorporating accessibility and social justice thinking with environmental concerns and strategies.

Fig.02. Co-design session with Columbia Primary School’s nature club. During the session children filled a disused toilet with compost and planted herbs in it.



Whilst carrying out research for my dissertation on the future of shit, I visited and conducted case studies of different compost toilet designs in allotments and community food-growing sites. I also took part in Tse-Hui Teh and Lena Ciric's research project (Pee and Poo for Food) exploring ways of retrofitting London with compost toilets. Both our studies found that DIY community built compost toilets seemed to work better than off the shelf compost toilet designs. When communities are involved with the designing and making of their own facilities they can a) create something which suits their needs best, and b) feel more empowered to maintain, tweak and take care of their facility over time, quite literally taking matter(s) into their own hands.

There were still some issues with the community-built toilets, particularly around questions of accessibility, longevity and labour. Drawing on this learning, we decided we would use a co-design methodology with a focus on accessibility, and involve members of the community in the building, making and thinking about our new toilet. As an anthropologist by training, I found myself writing extensive fieldnotes about each of our co-design sessions which were published each week on a blog (<https://codesigntoilet.wordpress.com/>), along with participants' reflections and drawings. This was to share the process as it was unfolding as well as create a record / archive for future toilet builders. I made posters for each session which I distributed around the local area, in libraries, cafes, charity shops, parks, public toilets, doctors' surgeries, community centres, housing estates, and online, inviting a broad range

Fig.03. Co-design illustration by Luc Sanciaume. Sessions were co-facilitated by Fin Jordão, Sib Trigg, Neil Winder and Hari Byles.





*To compost everyday life means to contribute to the emergence of new mixtures of social, biotic and inorganic materials that nurture liveable worlds.*

*(Papadopoulos, 2014: 642)*

This was in contrast with the hygienists' principle of waging a war against microbes, often represented as the "invisible enemy" (Latour, 1988: 8). This battle has been fought by severing, flushing, sanitising and sealing off ourselves and the spaces we inhabit (Wenzel, 2016; Cox et al., 2011; Osborne, 1996; McClintock, 1995; Latour, 1988). Such an intention also resonates with Puwar and Back's *Manifesto for Live Methods*, in which they call on sociologists to pay attention to vulnerable and precarious lives and to seek to create conditions which offer "liveable and breathable" spaces of refuge (Back and Puwar, 2012: 14). This brings me back to the quote from Donna Haraway (2016: 100) that opens this essay, calling on all of us to "replenish refuge". This poses the thought that such an act, in the everyday space of a toilet, could be a way to subvert the dominant logics which mediate our relationships with waste and non-humans, and which have got us to this strange and scary moment in history.



Fig.06. First microscopic image of BGNR's humanure after first 6 months of use, courtesy of the Roving Microscope.

Fig.07. Pipe leading to soakaway, merges with roots (radicles) and soil life.

So we made our 'refuge' at the Bethnal Green Nature Reserve into a hexagon. This was in part because six people took hold of a rope when we plotted out the toilet dimensions in our first co-design session, and we realised that it felt nicer to be in a hexagon than a square or a rectangle. As one of the most commonly recurring shapes in nature, it fitted better into the space of the Nature Reserve, and opened up more space for manoeuvrings and access. Accessibility was part of our conversation from the start and this included considerations about cleanliness, light, colour contrast, phobias, allergies, gendered language / signage, communication, door handles, grab rails, ramps, doors, layouts, menstruation, water usage, baby-changing - and just about every aspect of the toilet design. A common critique of conventional toilet spaces is that accessibility is often an add on or after thought by designers who do not experience some of the barriers that the rest of us face. In our process, accessibility meant so many things and was entangled with every decision, from the depth of the chambers to the lock on the door. Where our experience / collective expertise felt limited we reached out to others who could advise and give input on the design. We also recognised that we did not and would not have all the answers and solutions to all the possible access issues and tensions, so instead created the intention for flexibility within the design so that elements could be easily added or changed over time. One way of doing this was to incorporate a space where people could constantly add feedback and design suggestions, as well as to empower users and caretakers to act on these suggestions and make changes to the space themselves. In the end we used a re-purposed toilet cubicle door (a traditional forum for toilet debate, poetry and the sharing of words, jokes, insults and drawings) as part of our workshoping process and encouraged people to add their design suggestions to it.

The work of making spaces accessible is ongoing. It is both a conversation, a tension and something which needs constant negotiation. Providing surfaces where toilet writing / 'graffiti' is encouraged is also kind of radical, as far as toilet design goes. A few years back I did a research project about toilet graffiti and graffiti removal practices in a higher education institution and went deep into the history and symbolism of white sanitised walls. Rudolph El-Khoury discusses how white paint, concrete, plaster, skirting boards, slippery and reflective surfaces, "translate the condition of odorlessness into an image" (El-khoury, 2006: 23). These architectures of deodorisation are seen as artificial extensions of the earth. Their job is to seal off and hold back the "excremental histories" which lurk underground in the archaeology of the soil, "the ground beneath our feet," and which can be a source of deep anxiety and fear (ibid.). Needless to say, no white paint has been used anywhere in the construction of our toilet. The process of designing and building this toilet has been one of celebrating and getting acquainted

with our excremental histories, from digging the foundations, chambers and soakaway trenches (finding all sorts of buried treasures like oyster shells, clay pipes, cod-neck bottles, bits of old plumbing, rock, lumps of concrete, worms, fox holes, fox poo [04](#) etc.), to gazing lovingly down a microscope at Welsh humanure, and making the decision together that we'd like to make and harvest our own humanure in Bethnal Green too. This toilet is about redesigning the boundaries between inside and outside, and addressing some of the fears which have kept those boundaries in place.

For me, this emerges through the gaps of the toilet we built; the gaps between the floor and the walls, which are really useful for sweeping things into, and through which we can glimpse the ground on which the toilet is built; the gaps between the walls and the roof, which allow for airflow, light, and views out, as well as providing an opening for insects, birds, spiders, squirrels, bats, leaves, plants and trees to pass through. These gaps acknowledge that our bodies and the spaces we inhabit are permeable eco-systems, welcoming multitudes. In the chambers beneath, humanure piles are alive with aerobic bacteria, nematodes, woodlice and worms who are also part of the architecture.

When we came to discussing the roof, co-design participants even talked about leaving a large hexagonal opening in the top to be able to see out and feel the elements. We imagined this together for a while, but realised it created more maintenance work and would weather the floor surface quite quickly, making it less accessible. At the Monsoon [+ other] Grounds Symposium in March 2019, someone very pertinently asked, "Why don't we design things to be wet?" and I have thought about this a lot, the ways moisture and wetness are controlled and directed through a built space, occasionally (inevitably?) leaking, spilling and creating slippages, wet patches and rot. The compost toilet houses and embraces rot in a way conventional toilets do not. I see this as an example of radical plumbing.

We liked the idea of using the surface of the roof to collect rainwater for handwashing and cleaning, but also recognised that with the thick tree canopy above, the roof would also be a surface for leaves to fall and start decaying. We thought of this as a "brown roof" and chose a transparent material to create the feeling of being inside a compost pile (part of the process) with composting happening both underneath us in the chambers, and overhead. We dreamed up elaborate periscope systems which might allow us to peer below and above at these processes unfolding. I loved the poetics of this, rendering the toilet space itself as another gap / pore in a larger pile. Rather than the ground dis/appearing from beneath our feet, we are instead inside it, part of it, composting together with other creatures.



Harvesting and filtering rainwater also poses a challenge to the conventional sanitised toilet experience, in which chlorinated drinking water is used for washing bodies and flushing waste. As our intention was to dilute urine (diverted through an all-gender urinal or 'liquid loo' system) with water from the hand basins into a soakaway area growing willow and ferns, it didn't make sense to be putting chlorinated water back into the soil in which we were trying to enhance microbial life. This is still a work in progress as the filtered rainwater has a brownish colour (due to its high nutrient content from the leaves) and needs further filtering to feel comfortable for handwashing.

Whilst delivering this project between 2018 – 2019, its ongoingness became really clear to me. I wondered whether it might ever be 'finished', and came to terms with the fact that maybe it never would. To compost is an ongoing non-linear process, that is slow, and complex and never really done. As the funding dried up, I found myself having to pour more and more unpaid labour and personal resources into the project and space to keep it alive, and though it was a joy to be in the Nature Reserve, day in and day out, building, making and bringing our design into being, it also depleted me. My focus now, as I work together with a wonderful team of co-conspirators emerging from this project [05](#), is to find ways

that this work and co-design approach (which is slow, collaborative and unpredictable by nature) can be supported and resourced fully in future. And, to share openly with funders how much time and labour is needed to co-create spaces which genuinely shift perspectives, nurture ecologies, bring people together and are accessible. Such work is valuable, and needed but is not currently valued by the wider economic structures we inhabit. That is another gap.

*During revolution, we hold onto our definitions of home while we destroy the foundation that no longer supports us... Revolution is the manifestation of your truth. Revolution is the exploration of alternative resources and alternative thought. Revolution is a redistribution of power that finally serves you and the world around you*  
(Road, Cristy C, 2017)

Rather than making the ground disappear from beneath our feet, this project brought attention to the gap that exists between our feet and the ground (a severed connection) and invited us to put our hands in the soil instead, to feel it, dig, contribute to it and care for it – because we are part of it, part of the pile, “we are soil” (Puig de la Bella Casa, *Ibid*). It also allowed us to attend to the everyday space of the toilet (in microscopic detail!) and to imagine an alternative together which challenged conventional ideas about what a toilet is, or should be, and what it can do. We made a connection between soil care, alternative sanitation and accessibility. This, I believe, is the future of shit.

*“In the compost there is no fixed ground,  
everything is moving.”*  
(Katz 2019)

## ACKNOWLEDGEMENTS

Thank you to Shumaisa Khan, Lindsay Bremner and Anna Wates who reviewed and gave some really useful comments on this piece of writing. I would also like to express deep gratitude to everyone who has been part of bringing this project to life.

All photos and images are by the author unless otherwise indicated.

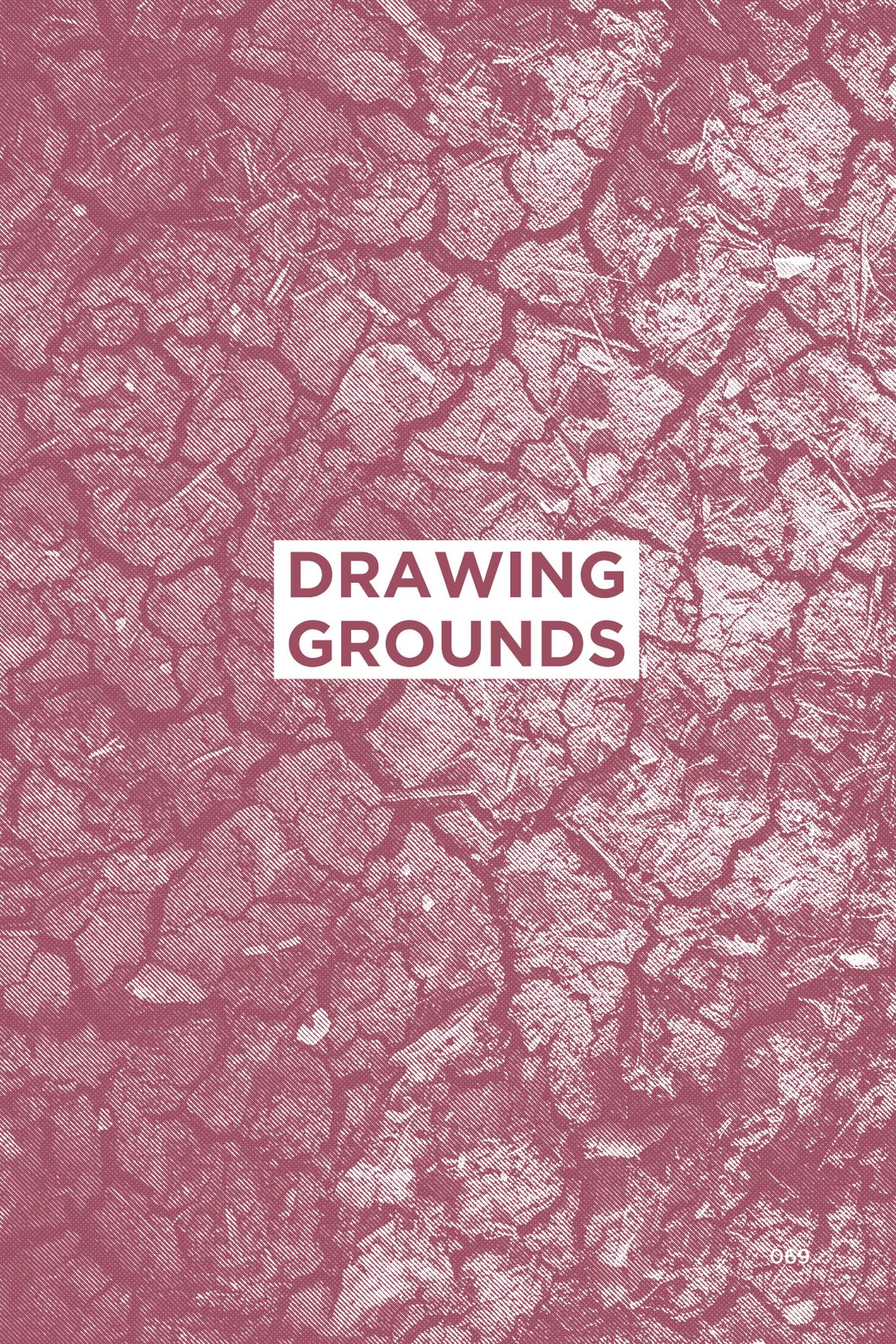
## NOTES

01. For a while I have been inspired by Sara Ahmed's figuration of diversity workers as "institutional plumbers" (2012: 32) following the flow of power, equality and diversity policies and interventions through an institution and looking for the blockages. As someone interested in alternative sanitation and bringing metaphors to life, I have wondered about how alternative sanitation interventions might also do this work in spaces and institutions.
02. See the Stalled! Project led by Susan Stryker, Joel Sanders and Terry Kogan <https://www.stalled.online/>.
03. Excerpts from Maria's talk have been gathered by Linden K McMahon in our fanzine for soil, entitled *Earthlings*.
04. Bethnal Green Nature Reserve's resident fox was the first to use the compost toilet. After digging the chambers I returned the next day to find a neatly placed fox turd in the bottom of one of them. Truly a multi-species toilet.
05. In 2019 we formed a group called Compost Mentis, and are currently working together to establish ourselves as a workers cooperative, focused on the intersection between soil care, alternative sanitation and access to green space.

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**DRAWING  
GROUNDS**



## WHAT ON EARTH IS THE GROUND?

**Tim Ingold** is Emeritus Professor of Social Anthropology at the University of Aberdeen and a Fellow of the British Academy and the Royal Society of Edinburgh. Following 25 years at the University of Manchester, Ingold moved in 1999 to Aberdeen, where he established the UK's newest Department of Anthropology. Ingold has carried out fieldwork among Saami and Finnish people in Lapland, and has written on environment, technology and social organisation in the circumpolar North, the role of animals in human society, issues in human ecology, and evolutionary theory in anthropology, biology and history. In more recent work, he has explored the links between environmental perception and skilled practice. Ingold is currently working on the interface between anthropology, art and architecture. His books include *The Perception of the Environment* (2000), *Lines* (2007), *Being Alive* (2011), *Making* (2013) *The Life of Lines* (2015), *Anthropology and/as Education* (2017) and *Anthropology: Why it Matters* (2018).

On 21 March 2019, Tim Ingold gave the keynote lecture at the Monsoon [+ other] Grounds Symposium, which he titled 'What on earth is the ground?' The lecture was accompanied by projections of drawings that Ingold made while delivering it. What follows are reproductions of the drawings, accompanied by Tim Ingold's words drawn from the video recording of the lecture. This act of folding word and drawing back on to one another re-enacts the central idea of Ingold's lecture, that ground is continuously being made through folding, rolling and turning. The video recording of the lecture is available here: [https://www.youtube.com/watch?v=Qvfw\\_nfISpM](https://www.youtube.com/watch?v=Qvfw_nfISpM).

*The ground is a surface, says the dictionary, upon which things or persons stand or move. But this leaves many questions unanswered. What kind of surface is this? Does it have one side or two? Does it cover the earth or cover it up? Can you roll it, fold it, cut it or make holes in it? What lies above, and what beneath? In seeking to answer these questions, I shall argue that the ground is caught in a double movement, of opening up and closing off, formation and encrustation, thanks to which its inhabitants are at once confidently supported and precariously afloat.*

*Inscription is a movement that goes along, in Paul Klee's famous image of taking a line for a walk. It does not start at one point and end at another point ... At some moment my pen makes contact with the surface of the page and then it leads off again. So there's a line. There is a trace of a movement that has been inscribed. I did not really start anywhere or end anywhere, but at a particular point the pen got onto the page and then it came off again. So the inscription is the trace of a gesture. It simply carries on.*

*(Min. 10.23 - 11.08)*

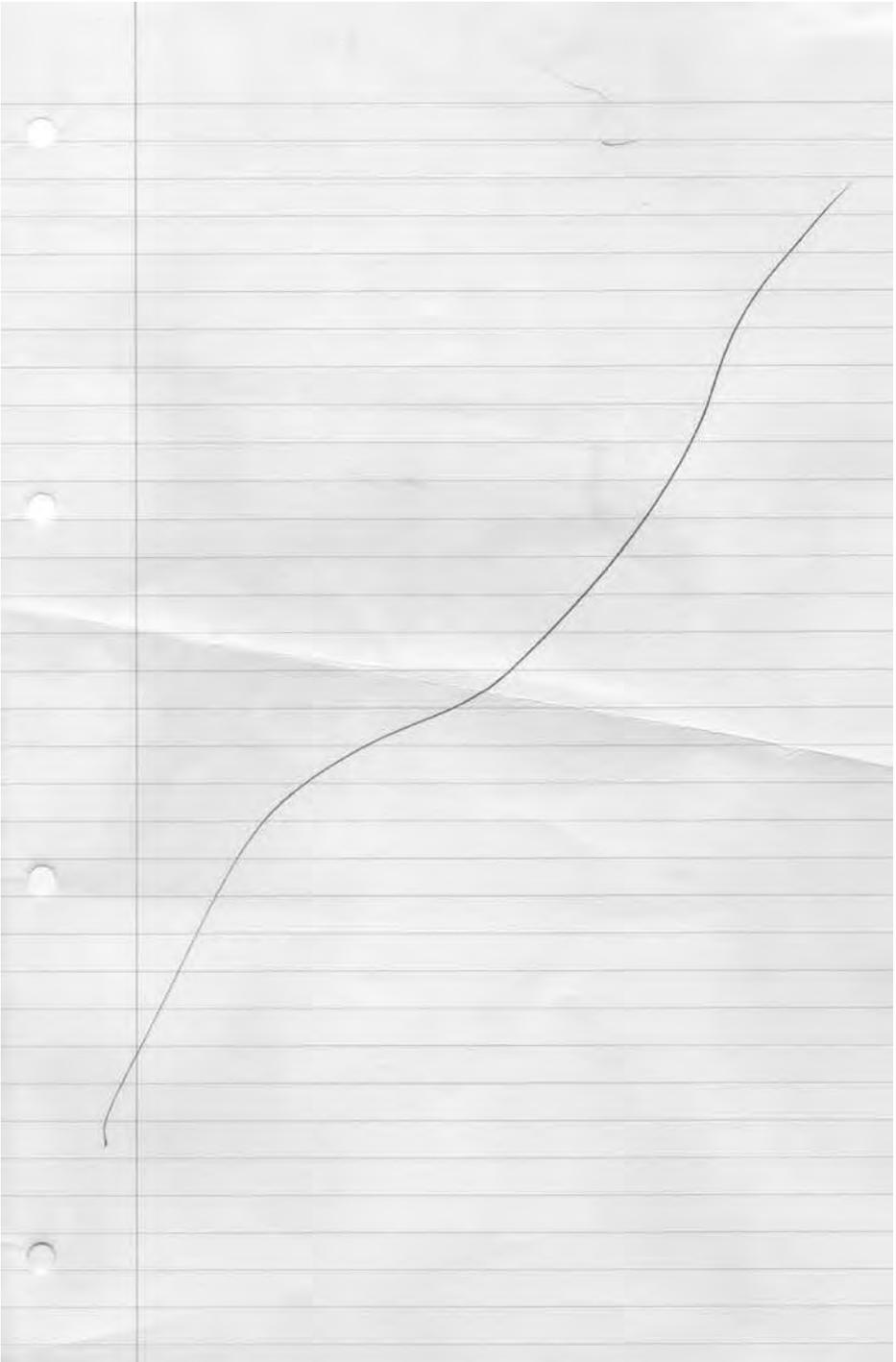


Fig.01. Inscription.

*In medieval times, people would write with ink on parchment. Parchment in those days was extremely expensive, so the same piece of parchment would be used over and over again. You write on parchment with ink, the ink tends to soak in to the material, it was quite an absorbent material, a bit like writing on blotting paper, not quite, but almost. The ink sinks in so then when you want to reuse the parchment, you have to take a penknife, that is the knife the scribe would otherwise use for sharpening his quill and for scoring lines, you would take the penknife and scrape, getting rid of some of the surface of the parchment until as much as you can get of the old inscription is removed. And then you could write on it again. But because the parchment is a highly absorbent material, it is completely impossible to get rid of all of those marks. So you end up writing on top of a parchment that already has traces of the previous marks ... The result is what palaeographers call a palimpsest ... Most archaeologists think of the palimpsest in stratigraphic terms – you have an early layer of occupation of a site which left its traces, then a later layer, then a later layer and if you are an archaeologist, then you can dig down and find each layer in succession. But actually, that's not how the palimpsest works. It took me a long time to figure it out because its very counterintuitive. The way I did it was by scribbling in my note book and I ended up doing diagrams which I will retrace now. Imagine a cross section in which the inscription is marked in a highly exaggerated form. Here is the surface of the parchment.*

*These dents here are where you have put your pen into the surface ... Imagine a piece of parchment with three lines in it like that. That is something you do at time T<sub>0</sub>. Then you want to use that parchment again at a later time, so you scrape off the top surface off and you do it again (T<sub>1</sub>). And then you do it again, the next time (T<sub>2</sub>). What you notice is that the traces from the first inscription (T<sub>0</sub>) are just there. They are about to disappear or maybe they already have disappeared. The traces from the second useage are fairly visible; the traces from the most recent useage are very pronounced indeed. Now what's happening here is that old traces from the past are rising up to the surface as new traces are being dug deep down. This is the opposite of stratigraphy ... Through the process of erosion, the past appears to be rising up while the present sinks down underneath it ...*

*Not a layering of the present over the past, but the past rising up even as the present sinks down. Anti-stratigraphy is a kind of turning over.*

*(Min. 14.10 - 19.52)*

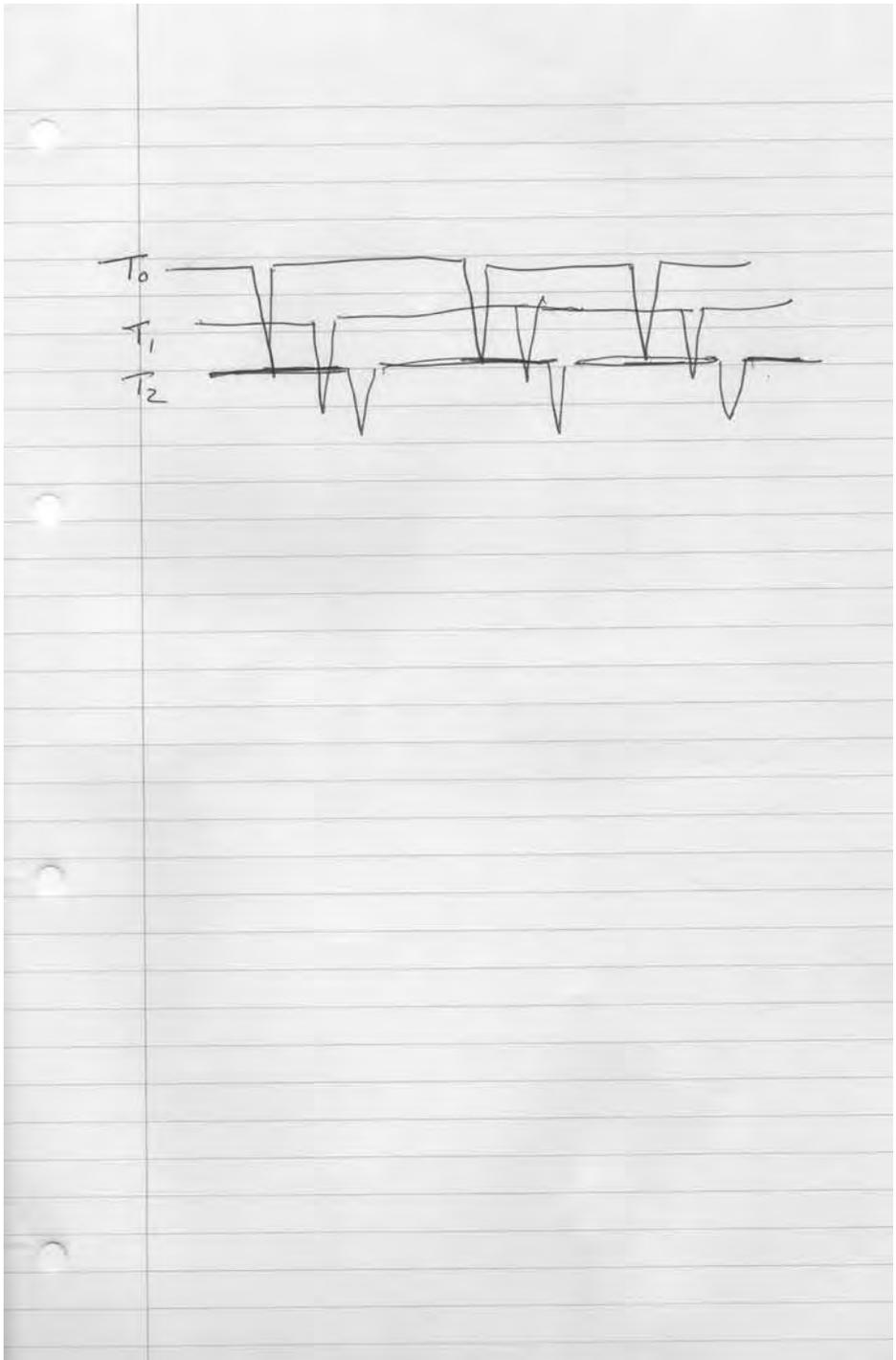


Fig.02. Anti-Stratigraphy.

*The ground as palimpsest could be what is called a deep surface. It is what is formed when the ground's rising up or eruption meet the weather's beating down or erosion ... between them there is a kind of interface and we will call that the ground. By definition, an interface is a surface that separates what is on either side while allowing some kind of communication between the two. One might suppose (and some people do) that the ground is a kind of interface between the atmosphere and the earth and that the atmosphere rises up as the earth sinks down.*

*(Min. 20.17 - 21.47)*

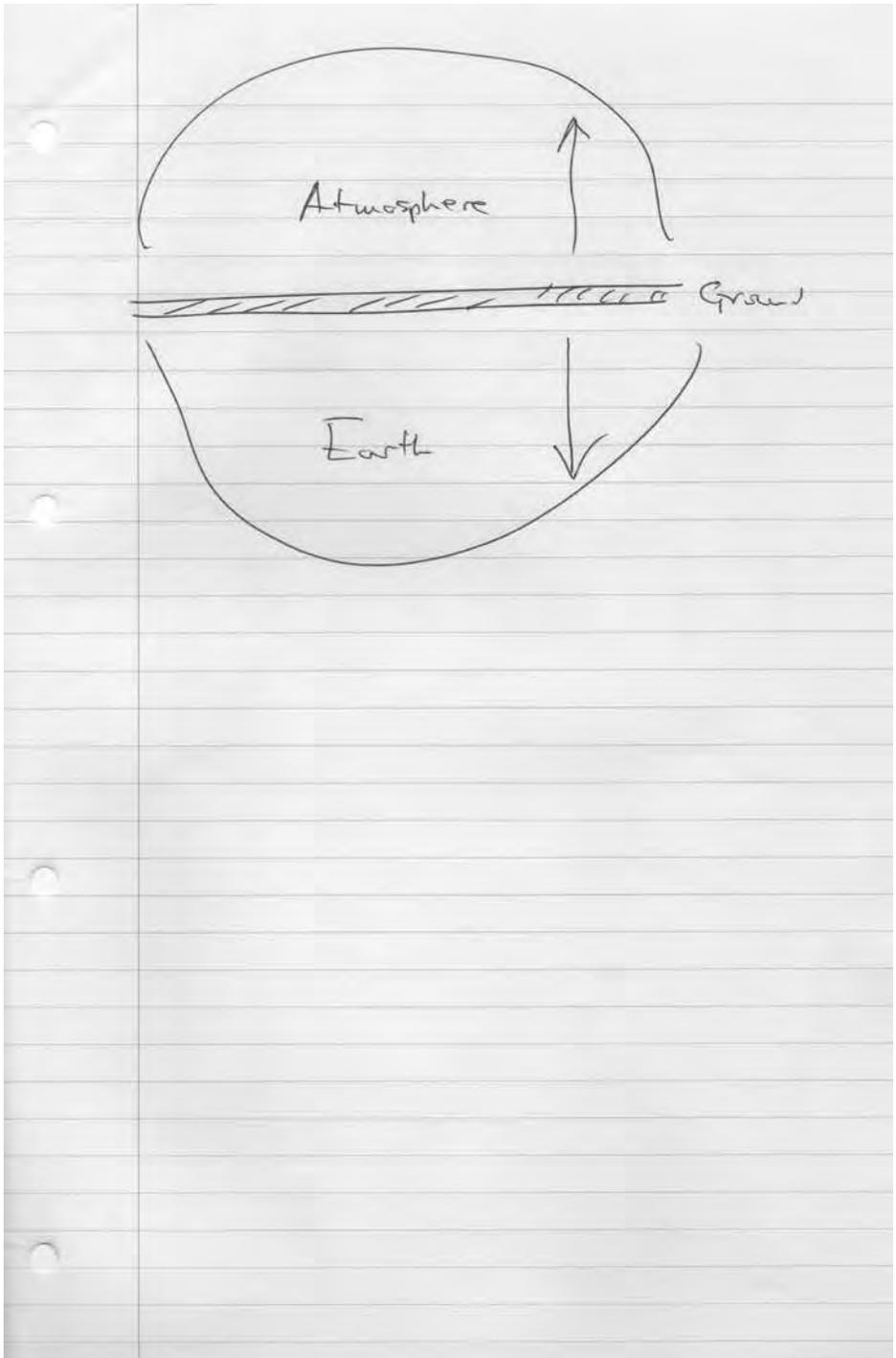


Fig.03. Ground as Interface.

*Let's put this the other way around and say that what we've really got is an atmosphere that is beating down on the earth and an earth that is rising up and here is a kind of zone of interpenetration. So this is eruption here, the upward arrow, and this is erosion here and there is the ground. And then we can't really say how deep is this ground or how far does it go down or how far does it go up for it can go down or up for as long as you like. It's not like a surface that has two sides to it. its where these two things are coming together and effectively merging. So what I am calling the deep surface is not an interface of separation but a zone of interpenetration.*

*(Min. 21.54 - 23.00)*

*This idea that the past rises up as the present sinks down is a kind of turning movement ... This brings me to another concept, the concept of volume. We tend to think of volume as some kind of three dimensional space with x, y and z axes that we could measure. But I looked it up and the original meaning of volume was a scroll. A scroll of writing. It comes from the Latin, *volvere*, to roll or to turn. And so a scroll would be rolled up, that is the original of the word 'revolution' and then it would be unrolled if you wanted to read it and that was the original meaning of 'evolution'. It could be rolled and unrolled like a carpet. Now the interesting thing is when you roll up a carpet, its lower and upper regions are inverted ... the underside of the carpet ends up being on top ... Maybe you can't exactly roll up the ground like a carpet ... but you can turn the ground, in fact turning is absolutely critical to agriculture, to the agricultural cycle of ploughing, sowing and harvesting. The purpose of the plough is to turn the soil. And the purpose of turning the soil is to bring up nutrient-rich soil from below and to bury the ground that was used previously which is full of all sorts of rubbish and weeds and drained of nutrients.*

*(Min. 26.57 - 32.26)*

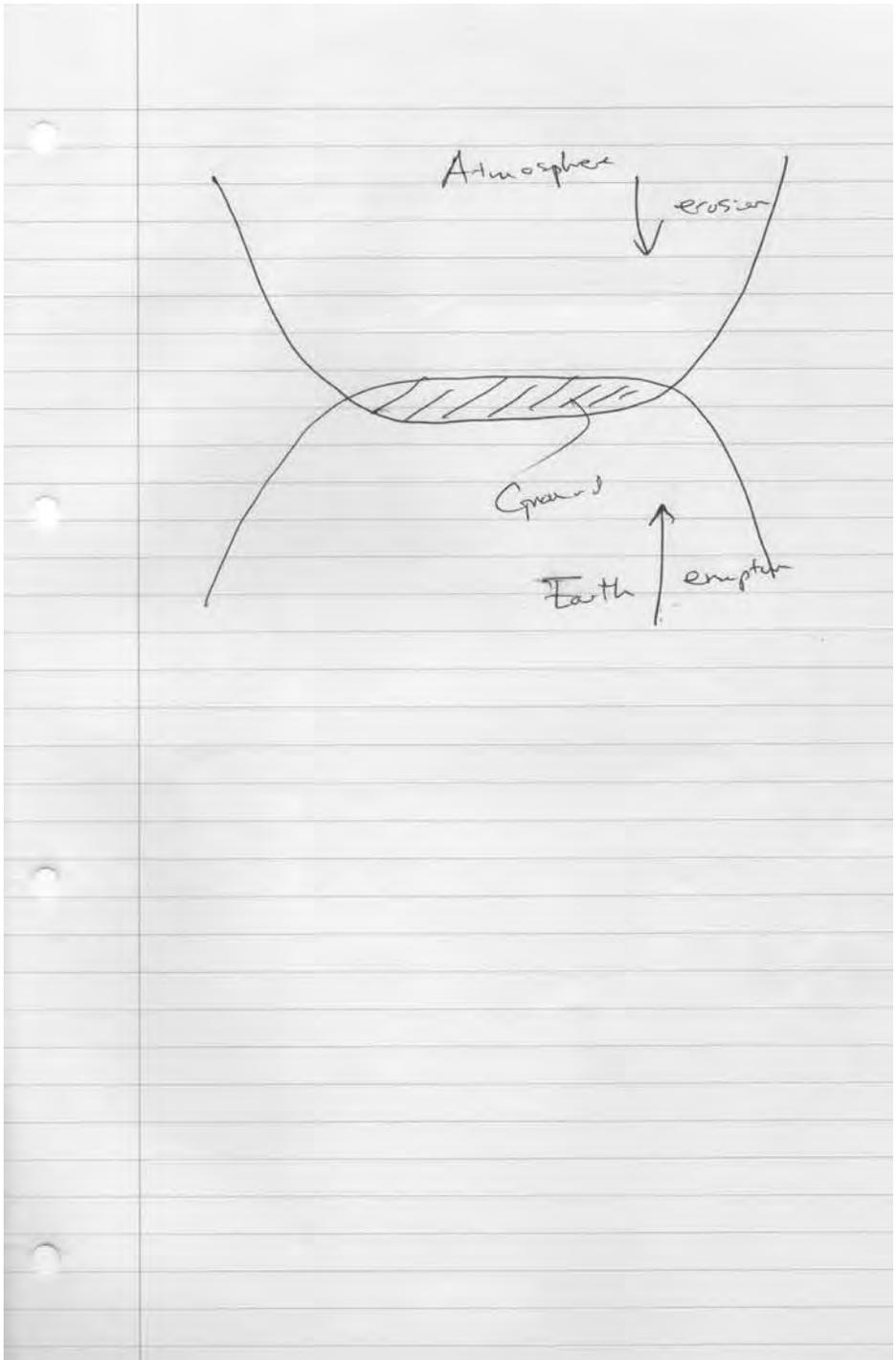


Fig.04. Deep Surface.

*Once you are beginning to think of a series of strata like this with old strata down below and newer strata up above, each of these is a synchronic slice and, if you are an archaeologist or a historian you go diachronically down. You cut through the strata in order to find out about the past ... you have to excavate. If you want to go in the other way, this way, renewal does not mean turning the ground as it did in the traditional agricultural cycle, it means always adding new layers, one upon the other so as to form a stack. You raise the ground, build over, build over, the idea is that stuff accumulates as a series of stratigraphic layers.*

*(Min. 34.45 - 35.55)*

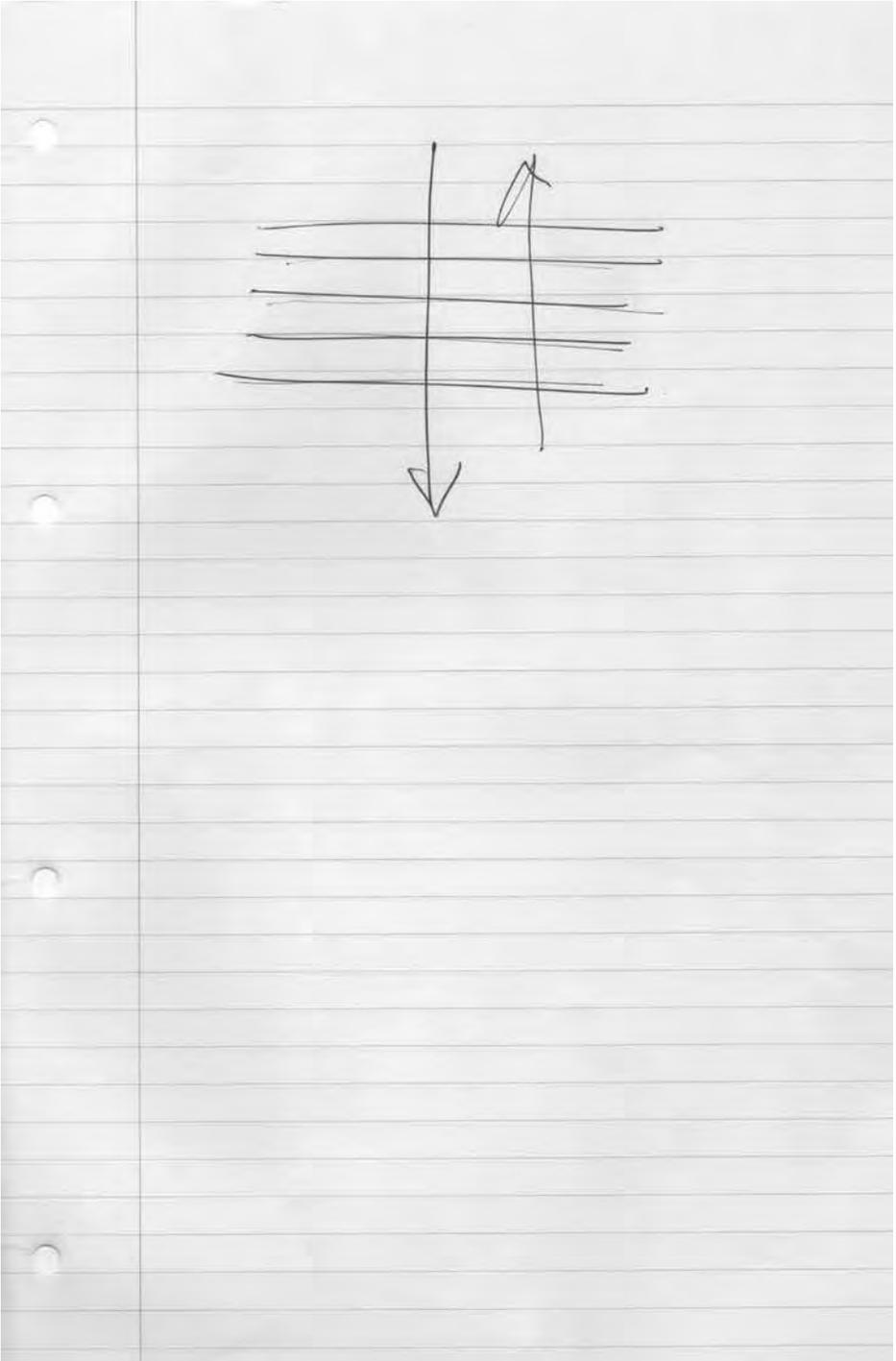


Fig.05. Strata.

*Paving is rather interesting. We are paving enormous areas of the earth's surface all the time ... We are gradually paving over the earth's entire surface. Now the interesting thing about paving is that it does have upper and lower sides ... It has a top side and it has an underside ... there is a cross section of a paving stone and it has a top side and it has an underside. So the paving is in that sense interfacial. The other thing about paving is that it does have a certain depth. You can measure the depth, the thickness of a paving stone, and you can also say that the support offered by the paving stone is in a sense conditional on the strength and the load bearing capacity of its material. You can say ok, here is some slab of material, how much will it bear? And when you stand on it, you think, will it carry my weight or not? ... It is very clear that you experience paving as a thing that has a top side and an underside and has a certain load bearing capacity. But with bare earth, it is quite different. Bare earth, like the page of a codex or a parchment book, has only one side. It is open to the atmosphere, rising up in its outcrops or its vegetation. And when you stand on the earth, its depth is felt at the surface, but its depth is immeasurable. The support that bare earth gives is unconditional. You can fall on, fall in, but you cannot fall through. The soft earth can have pits and potholes but it can't have gaps or real holes.*

*(Min. 38.35 - 42.26)*

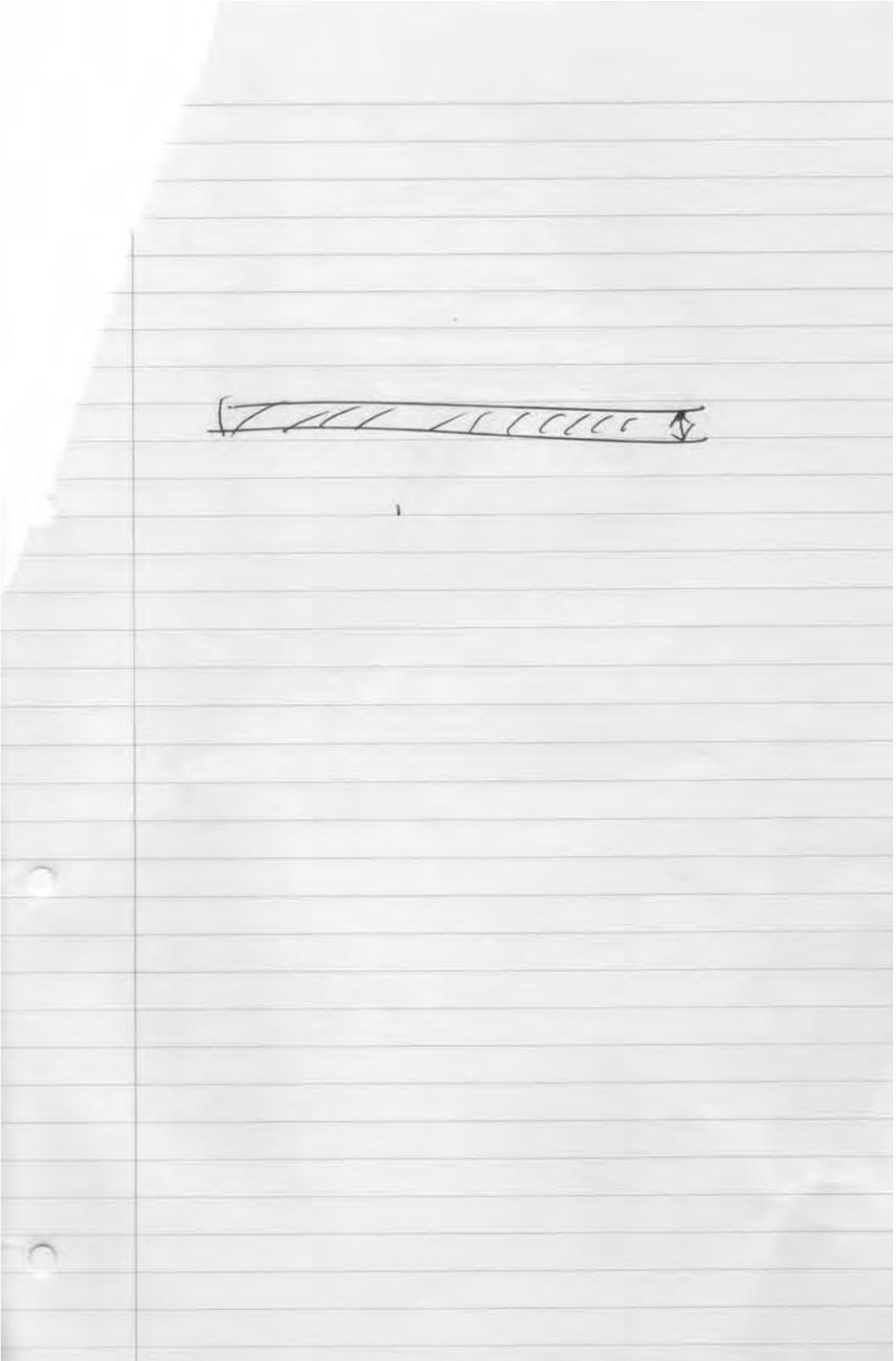


Fig.06. Paving.

*The question this leads to is whether we should think of the earth as open or closed, closed like paving or open like bare earth? I could not answer this question, so I thought it's not one or the other, it's really both. And that perhaps what we are really talking about with the ground is that it is being formed through a continual double movement of what I could call exposure, opening up, and of encrustation, which is a closing down. Two things are going on at once, an opening and a closing ... This is at the essence of burial. That's what happens when stuff, or a person or whatever gets buried.*

*Imagine that you are burying a body in a conventional way in a grave. So first you have to open the earth, dig a pit of some kind, the grave digger's job, and then you lay the body in the embrace of this pit ... and then what you do, you cover it over with a slab. This slab is like an interface, its like a paving stone. Its got a top and a bottom. So now the body is buried below the ground, but over time what happens is that earth and vegetation will begin through natural processes to grow over to cover this slab. After a while there will be trees and bushes and so on and everyone's forgotten about it. The burial site itself will be indistinguishable from its surroundings until all of a sudden it is rediscovered by an archaeologist.*

*(Min. 42.41 - 45.50)*

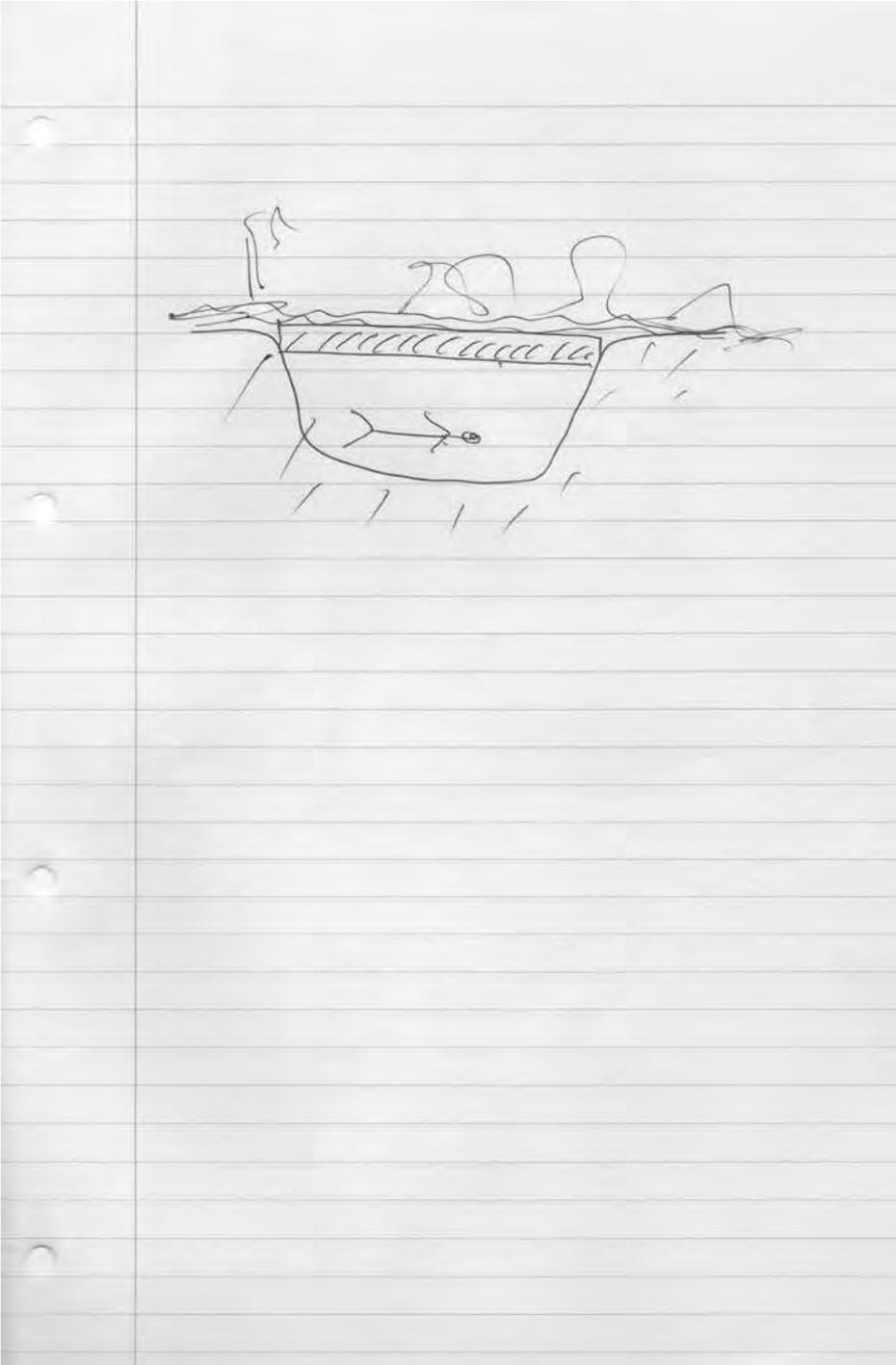


Fig.07. Burial.

*Clearly there are different ways of thinking about memory, as I have mentioned, between the scroll and the stack, between the palimpsest and the archive. Memory as engaging with voices brought into the present, or memory as digging down to the bottom of the stack and digging the information out. If there are different ways of thinking about memory, then there are different ways of thinking about forgetting. I wanted to return to this notion of erosion or wiping, rubbing stuff out, and I wanted to ask what is the difference between erosion and burial. Because both of them could be understood as ways of forgetting. When you rub something out that you have written, you don't want anyone to see it, you rub it out. Or you could bury it somewhere down a mine shaft. These seem to offer alternative ways of forgetting. In the sense that with erosion, the surface is open. So stuff is brought up and then eventually wiped away. But with burying, you are putting stuff down. But then what if we put those two together? If we put together burying and erosion then we would have a movement of erosion like this and a movement of burying like that and that would reconstitute that whole cycle of turning. If I've got an argument at all, it's that through this turning process the ground is continually formed.*

*(Min. 49.02 - 51.13)*

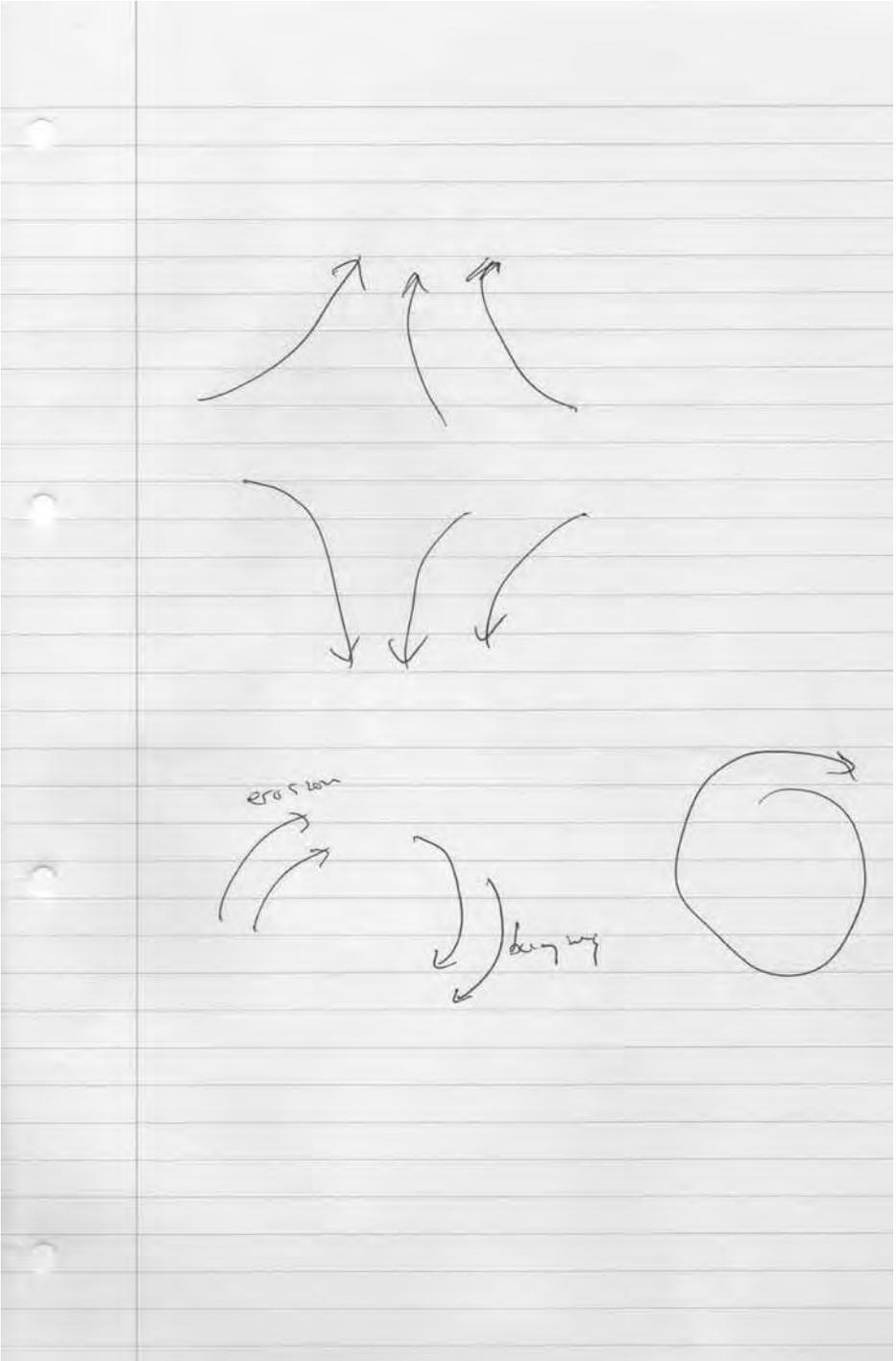


Fig.08. Memory and Forgetting.



## ACTS OF DRAWING SOMETHING YOU CANNOT SEE

**Anthony Powis** is an architect and currently PhD Researcher as part of Monsoon Assemblages at the School of Architecture and Cities, University of Westminster, where he also teaches a design studio..

*They used to be called physical appearances because they belonged to solid bodies. Now appearances are volatile.*

*(Berger 2001b: online)*

Most people who have at some point been students of visual culture will remember the moment when, either reading or watching John Berger's *Ways of Seeing* (1972), the multiple layers of image, representation, and reality suddenly delaminated from one another and stretched apart, became distant, and never went back together. Berger, as others have done since (e.g. Rattenbury, 2002), reminded us again and again that images are not the things they depict, and that representations of things are both made and read depending on habit and convention. They communicate an attitude to something, an idea and condition how we are to read the world.

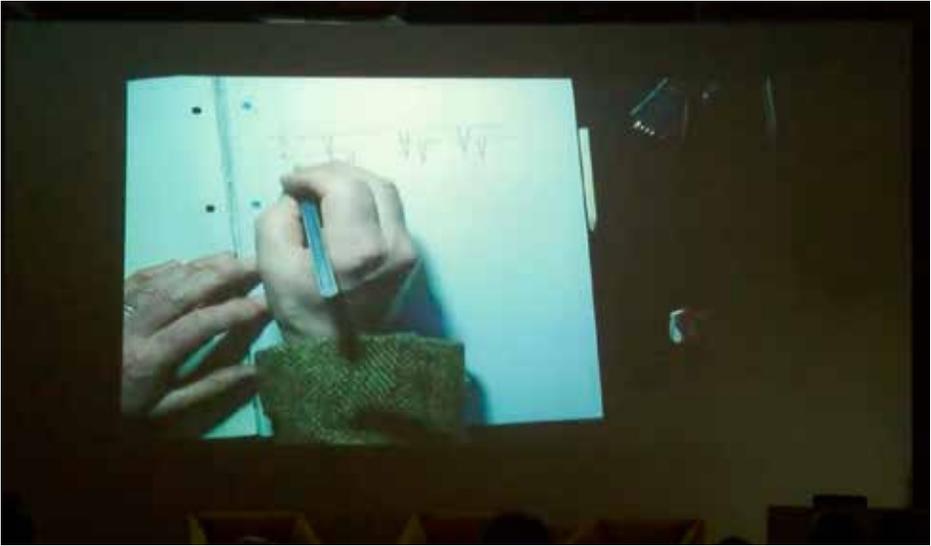
This is one interpretation: that images represent a narrow part of reality, conditioned by specific intentions and assumptions. Another, also articulated in Berger's writing, is that making images, specifically drawings, potentially opens up worlds beyond the immediately apparent. Can drawing be used to illuminate things unseen? I returned to Berger's writing in my PhD project on groundwater because of his comment that "images were first made to conjure up the appearances of something that was absent" (1972: 3), and the recognition that those images outlasted what they sought to represent. Berger wasn't thinking about groundwater, but this felt a lot like a problem with which I was confronted in my work: that groundwater research, and its dissemination, is often described as "making the invisible visible" (Nilekani, 2018: online). It chases after something which is both unseen and always in motion. This dual problem of the "invisible and capricious nature of groundwater" (ibid.) presents immediate challenges for any form of research into groundwater, particularly that which makes use of visual representations.

I have suggested that drawing is a practice of expressing ideas about objects, rather than representing objects themselves. The drawing is not once removed (i.e. a record of a thing) but twice removed. It is a description of an idea about a thing. Drawing is a method with which to understand something, but a drawing describes a theoretical idea, not a reality, albeit usually through engagement with some form of material evidence. Drawing is not simply about "reflecting and mirroring" in the sense of making a so-called accurate description, but must instead

“transgress its limits a little” (Lefebvre and Régulier, 2004: 80). To speculate is partly to show the world back to itself, but also to hypothesise, “to contemplate and theorise upon” (Oxford English Dictionary, 2019). It is to enact matter, rather than simply mirror as if from a fixed position, outside of and discontinuous with the world. In this process of grasping things and ideas at a distance, drawings are thinking tools and tools for making contact. One way of expressing this is to say that drawings help us to see: they are processes which the anthropologist Andrew Causey describes as “seeing-drawing” (2017: 11). Causey defines looking as being about what we already know, but seeing is about perception (ibid.: 12), a kind of feeling towards something and bringing it into being. Drawing is a process which “envisions” (ibid.), one of “illumination” (ibid.) after a period of incubation.

Causey also suggests that ideas committed in drawings have generally been formed through visual experiences. However, drawing groundwater never derives from visual experience for it is impossible to have a visual experience of groundwater. Instead, to draw groundwater involves feeling in the dark, inferring a visual record from a non-visual experience. In this instance, drawing is a process by which I, as well as and alongside others such as scientists and activists, make information into images. In order to do this, such as when making a geological section from borehole logs, requires me to infer and fill in the blanks until I have a comprehensible picture that I can interpret in relation to things that I have had visual experience of (including other drawings). Disciplinary conventions use analogy and metaphor to comprehend via seeing that which one cannot see. This is similar to the problem in Susanne Keller’s (1998) account of the evolution of the geological section: their function is precisely to make visual something which is otherwise unseen and unviewable. This applies to well-established forms of representation, but also to emerging ones like numerically-based models which generate many thousands of textual and graphic images based upon a mixture of observation, assumption, and improvisation.

Tania Kovats (2005: 8) calls this mode of visualisation-by-analogy “a positive act of displacement” by which one thing is used to describe another. Thinking through the double meaning of the verb to draw, Kovats reminds us that making a drawing, like drawing water from a well, is an act of making something appear in the world, of taking something from a hidden place and bringing it to our attention. Drawing on and drawing up are also dependent upon selection: isolating a part from the whole, or carving out a piece of it, is a necessary condition of making something visible. This describes an always dual process of both observation and projection, which for Kovats means that “acts of drawing occur all the time” (2005, 7).



In the sense that drawing is about making contact, perhaps drawing isn't a visual (in the sense of optical) process at all. It is only ever about relating certain observations, which are to some degree mediated (whether by sense, prejudice, and/or instrumentation) to prior knowledge, in order to generate a speculative image of an intra-active encounter between multiple, indistinct matters. Such observations will almost always include haptic, audial, olfactory, and other impressions. If we think again of drawing water from a well, we realise that the drawing is not at either end (top or bottom), but that most of this process takes place in the space between the first contact of the bucket with the base of the well, and its coming to the surface. This long gestation of what it is to draw focusses on the process, the work of drawing, not the product: the time spent between drawing and drawn where the thing not yet at the surface is being brought into view by the act of drawing.

Groundwater, as a hybrid material of both grounds and waters, in rest and unrest, is never experienced or seen directly. So its being drawn is a composition of traces, which are brought together to indicate both a material state and/or its ongoing change. By doing so, each act of drawing necessarily brings to the surface only certain traces, and analogises them with something already visible. In the case of groundwater, the description of the condition is limited by the condition itself: that of inaccessibility (both visually, and physically). But at the same time groundwater is drawing itself, leaving an archaeology of movements in and through sedimentary strata, creating transient records which can be drawn up and thought with.

Fig.01. Tim Ingold projects his notepad on the wall and draws as he speaks, Monsoon [+other] Grounds Symposium, 21 March 2019, University of Westminster.

The point of this, then is not to make the claim that drawing makes for better observation, or closer looking. This isn't about saying we see (visually) better or more clearly when we draw, but that we literally create things when we draw. I find Berger the most appealing when he is seeming to suggest that drawings are not about trying to "seduce the visible" (1992: 188). Drawing is not pictorial, but starts with making "notes on paper" (ibid.), and proceeds to become more-than-record: the drawing itself is an act of making something appear.

## INDETERMINACY

So much for the invisible, but what about the relation of drawing to the dynamic? Groundwater is always registered in movement. Whereas a photograph of a tree, for instance, makes a record of the tree as a thing at a moment in time and despite its constant movement, groundwater is accessed only through measures and traces of its movements, which indirectly describe certain material conditions and relations with other matter. Berger had two important points to make about this.

Firstly, if a drawing is a record of a discovery one has made, rather than received, then the drawing itself is an event which "contains the time of its own making" (Berger and Mohr, 1982: 96). Berger dwells upon this time of the drawing-making process as being the difference between making and receiving, which emphasises that drawing is about an intra-active encounter.

*Isn't the act of drawing, as well as the drawing itself, about becoming rather than being? Isn't a drawing the polar opposite of a photo? The latter stops time, arrests it; whereas a drawing flows with it.*

*(Berger, 2005b: 124)*

The processual nature of drawing, then, makes it absolutely suited to working with the processual nature of matter. Kovats opens her enquiry into drawing by giving primacy to the "liquid knowledge" which "floods and informs the work" (2005: 10). This means admitting the liquid processes that are fundamental to drawing with ink or paint, and in the production of paper and canvas (leaking, bleeding, staining, soaking, swelling, etc.) into the "congress between mark, medium and subject" (ibid.) of drawing itself. The making of a drawing, and what it depicts, are thus bound up with the vagaries of fluid motion, of "the spill, the drip, or the blob" (ibid.). This brings "the emblem of uncertainty" (ibid.) into the process of drawing.

These are forms of disrupted practice which emphasise the drawing as a unique event. Acts of drawing are complex combinations

of knowledge, surprise, chance, time, and the unknown. As the Artist Ilana Halperin writes, “drawing is a study in potential” (2003: online). It expands, not limits, possibilities, and provides a means of accessing and translating across scales.

*Tectonic plates move at the same rate as your fingernails grow. Glaciers move one to two meters a day. Every moment has an infinite number of possibilities. Drawing provides a framework through which new territories can emerge*  
(Halperin, 2003: online)

Drawing groundwater requires practical resistance to assumed certainty, or to what Whitehead called “misplaced concreteness” (1925: 52). There needs to be some acknowledgement in the form of the drawing that what is being drawn has only been lightly experienced. In my own work, this has meant injecting other kinds of artificial disruptions into the drawing process in order to move away from the idea of the act of drawing as being to approach a known outcome. Instead, by expanding the space and time of the drawing process to allow more room for ludic creativity, or non-cognitive intention, drawing becomes an open-ended exploration rather than a pre-planned record.

Secondly, Berger describes the encounter of drawing-making as always unfinished. The act of drawing is forever reaching out at something, as opposed to a recreating or capturing it. “Real drawing” is not about supplying an answer but instead “is a constant question, is a clumsiness, which is a form of hospitality towards what is being drawn” (Berger, 2001a: 75). This openness or hospitality generates a kind of “collaboration” (ibid.): we are not only “always looking at the relation between things and ourselves” (Berger, 1972: 1), we can also say that neither element precedes the encounter (Barad, 2007).

In this interdependence of the seen and the seeing, drawing “approaches something which is eloquent but which we cannot altogether understand” (Berger, 2005a: 80). It is a kind of never-ending catching up, of foregrounding the unfinished, of the remainder through which the drawing never quite corresponds with its subject. Drawing is the opposite of permanence or record, which is not to say it is inaccurate, but that it must combine great attentiveness with an awareness of the limits of perception. My interest in geological and archaeological drawings comes from their ability to reconcile the precise and the ambiguous: whereas many architectural drawings tend to render liquid, mucky things with imagined precision, other forms of drawing leave space for the unfinished. Since they aren’t the end of a process, they are situated within a conversation with the material, rather than being observations from outside, from a completely different realm. “There’s not really a



point where you realise that there's nothing more to correct—and if you were aware of that, it would probably be very bad” (Berger, 2011: online).

The idea of never being fully able to draw something, then, is important when drawing groundwater. Berger's assertion that arriving at a final “answer” (2001a: 75) would be a very worrying thing, refers to the impossibility of absolute depiction, and the necessity of ongoing collaboration. There needs to be something left over, some residue, something unresolved in the drawing.

*If something is complete in itself, perfection,  
nothing is left over, there is an end of it. If there is a  
remainder there is no end to it. So the remainder is  
the germ and material cause for what subsists. It is  
the concrete reality of a thing.*

*(Kramrisch, 1946: 45)*

Matter is incomplete, in both formation and degradation, and so drawing matter must be too. Just as Elizabeth Grosz describes the human body as being “incomplete ... a series of uncoordinated potentialities” (1992: 243), if a drawing is about resolving the space between the observer and the object, it can never reach resolution because if it did, that would be the end of collaboration.

## ACKNOWLEDGEMENTS

This essay was written during my tenure as a PhD researcher as part of Monsoon Assemblages, a research project supported by the European Research Council under the European Union's Horizon 2020 research and innovation programme (Grant Agreement no. 679873).

All photos and images are by the author.

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An aerial photograph of a river delta, showing a network of channels and distributaries. A white grid is overlaid on the image, with the grid lines following the general orientation of the river channels. The text 'FLUVIAL GROUNDS' is centered in the middle of the image, with 'FLUVIAL' on a white rectangular background and 'GROUNDS' on a white rectangular background below it.

# FLUVIAL GROUNDS



## FLOATING [UNDER]GROUND

**Matt Barlow** is a PhD candidate in Anthropology at the University of Adelaide, South Australia. His doctoral research investigates the more-than-human, elemental, and infrastructural dimensions of waste management processes in Kochi, India. He is also an artist and arts writer.

*It's as if the solid ground has given way, leaving us hanging like tender cocoons suspended in a dream world. As if the conditions and possibilities of a life have themselves begun to float.*

(Stewart, 2007: 61)

*The ground that he took for granted is a superficial crust floating on top of a fluid interior.*

(Shubhangi Swarup, 2018: 107)

Kochi is a city defined more by its water bodies than its land bodies. When I first told friends of mine in Kolkata that I was headed to Kochi to find a potential location for the rest of my doctoral fieldwork (after evacuating a particularly hostile environment in Darjeeling in June 2017) the first thing they mentioned were the famous Kochi backwaters. The backwaters which surround Kochi are a popular destination for tourists visiting the south of India looking for picturesque houseboat cruises along coconut palm lined waterways, a glimpse of the watery life that is largely absent from cities like New Delhi and Bangalore. I came to know these waters as a series of canals, rivers, and lakes that cut across the various smaller land masses that together form the urban agglomeration of Kochi (formerly Cochin). There are three main terrestrial parts to Kochi. Fort Kochi lies to the west and is the historic and cultural centre of the city featuring 500-year-old warehouses that stored Kochi's heralded spices, the first European church in India, and a now burgeoning tourist economy and international arts scene built up around the recently established Kochi-Muziris Biennale. Across the lake on the mainland, and a 20-minute ferry ride away, is the city of Ernakulam; a sprawling urban space host to congested roadways, shopping malls, colleges, government offices, and the development of an elevated metro system that was designed by the same architect that built the New Delhi Metro. In between these two land masses is Willingdon Island, the largest artificial island in India. Willingdon Island was dredged up out of the floor of Lake Vembanad, the body of water that connects these three spaces, some 80 years ago by British engineer and then Governor of Madras Presidency, Sir Robert Bristow. The island remains home to the Indian Southern Naval Command and the Cochin Port Trust, which together own the land of Willingdon Island. In fact, in order to reside on Willingdon Island, it is a requirement that you are employed by one of these organisations. It was once host to Kochi's first airport and only landfill, and was a central feature in the trade and



commerce of the region. Yet now it finds itself half abandoned; the wide, clean streets are largely calm, quiet, and peaceful. Overgrown houses sit next to old train tracks that disappear into the lush green.

Each of these islands - both literal and figurative - have their own history, disposition, temporality, and energy, and each is connected and disconnected by waters that seem to house an affective attachment to place more so than any of these slightly drier dwelling places. On all three there is an ocean-facing disposition that characterises how the architecture has been built, and how the social and material dynamics of the islands flow. In this way, Kochi might be thought of as an urban and coastal variation of what some island studies scholars refer to as an aquapelago. Philip Hayward defines an aquapelago as “a social unit existing in a location in which the aquatic spaces between and around a group of islands are utilised and navigated in a manner that is fundamentally interconnected with and essential to the social groups habitation of land and their senses of identity and belonging” (Hayward, 2012: 5). In this spirit, Kochi’s canals were once the lifelines of the city, essential for the movement of people, goods, and ideas inland from the coast or back out to Arabian Sea. The ocean and brackish backwaters were essential for fishing and respite from the heat. The water was central to a kind of flourishing, encapsulated in the popular reference to Kerala as ‘God’s own country.’ Today the waters remain used for cargo transport, yet their material, social, and spiritual significance has shifted as they have also become the repository for unwanted wastes – both bodily and industrial. Mass fish kills are regular along Kochi’s largest river, the Periyar, due to industrial pollution from the nearby Eloor-Edayar industrial district. During my doctoral fieldwork through 2018 I also heard numerous accounts of septic tank trucks emptying their full tanks of sewage into the backwaters to avoid paying the processing fee at the waste depot. Highlighting these new waste relationships shows how the connection to the water has not necessarily been lost but transformed. Waste is a relationship, and Kochi’s relationship to its waste is intimately tied to water.

I’d like to suggest the fluvial nature of Kochi does not just manifest as water flowing alongside the land, but occupies space below, around, and above the human and more-than-human inhabitants of these islands (often manifesting as sweat on my forehead, for instance). Reframing the monsoon as more than a meteorological event, and as something that continues to emerge amid the everyday lives of Kochites, is essential to this endeavour. There are two stories that I’d like to share that inspired this kind of expanded fluvial thinking before I conclude by speculating on Kochi as a city afloat. The first is about how I came to know composting as an exercise in moisture management during my doctoral fieldwork alongside environmental activists and waste management experts in Kochi. The second is a reflection on the 2018 floods that put one third

of the state of Kerala under water. This reflection is in part inspired by Bangladeshi artist Marzia Farhana and her installation titled *Ecoside and the Rise of Free Fall* that featured in the 2018 edition of the Kochi-Muziris Biennale, where I spent a considerable amount of time throughout my fieldwork. Together these stories attempt not only to remind us that “we are the watery world” (Neimanis, 2017: 27), to displace a terrestrial thinking for a more fluvial intimacy (Raffles, 2002), and also to shift atmospheric thinking away from its skyward trajectory, to bring Dereck McCormack’s writing on elemental envelopment down to earth (McCormack, 2018). I do so in solidarity with Zurita et al. (2018) and their call for a renewed focus on the subterranean Anthropocene.

*While the advent of the Anthropocene can be mapped through the increase of carbon and methane concentrations in the atmosphere, the foundations for these increases are very much endogenous with historical changes in human-subterranean relationships.*

*(Zurita, Munro and Houston, 2018: 301)*

Paying attention to atmospheres doesn’t just mean looking up, it means looking down and around as well. Suspension is not a skyward attachment, but an earthly and aqueous condition. It is here that I join a chorus of environmental humanities scholars who have called for, in various ways, a renewed attention to the watery disposition of life on planet ocean (Alaimo, 2017; Helmreich, 2009; DeLoughrey, 2007). I aim to bring the atmospheric and the aqueous together, in a way that privileges an under-ground. This seems like a necessary, if ambitious, task if environmental humanities scholars are to imagine an ethical geopolitics that is able to destabilise the dominant tropes of the white Euro-American Anthropocene (DeLoughrey, 2019). This is a provocation that pushes us to consider microbial relations beyond the human, to be a spokesperson for the “workers of the soil” (Puig de la Bellacasa, 2013: 35). To be in relation to the ground here is to be in relation to water.

## COMPOSTING IN KOCHI

Kochi, much like the rest of India (and indeed many places around the world), is currently attempting to transform its waste management infrastructure (Ganesan, 2017). The advice coming from the central government in the latest Solid Waste Management Rules (2016), is to invest in decentralised composting *and* centralised waste-to-energy (WTE) technology. During my fieldwork in Kochi, I spent time amongst a number of waste management initiatives that pursued decentralised methods of waste management that prioritised at source segregation and various forms of composting (turning unwanted biological matter into fertiliser to be used in horticultural projects). It was with these people





and in these spaces that I came to think of composting in Kochi as a particularly moving elemental practice that largely revolves around the management of moisture levels. Whether practicing aerobic (permeable), or anaerobic (air-tight) composting, it is the moisture level that largely determines the outcome of the compost. If it is too wet, you have too much nitrogen and phosphorus; if it is too dry, you have too much carbon. In each scenario, microbes and their metabolic kin, such as worms or maggots, are unable to proliferate in order to breakdown the biological matter properly and you most likely have a failed compost.

Much of what is eaten in Kochi is wet - curries, dal, rice, and chutneys - therefore the excess food that goes to waste and makes up the bulk of the organic waste is also wet. Some of my research collaborators put the figure as high as 60% of Kochi's waste being organic waste, of which up to 80% was water. Because of this, supporters of decentralised waste management in Kochi promoted composting as a way of working in collaboration with the hot, wet, ambient climate of the city. This kind of work is often in tension with investments in centralised waste-to-energy infrastructure that requires large quantities of high calorific waste (plastics), and mostly dry, temperate climates to operate efficiently. Transforming Kochi's waste profile to fit the envelope of incineration practices to extract energy is a process fraught with complications and added externalities. As my research participant elaborated on at a workshop we held at Cochin University of Science and Technology:

*Ours is an incubation climate. 35 degrees and 75% humidity, you don't have to do anything for (a) microbe, just stand, you are actually a medium for microbes to grow, on your hand! So this communication you have to conceptualise.*

Fortunately, Kochi is also very green, home to many trees that drop a lot of leaves (although many mangrove forests and other green spaces are being lost to rapid development). These leaves are in a continuous relationship with Kochi's residents as they drop and float down to the ground before being swept into piles on the sides of streets. Leaves are full of carbon, just what is needed to balance out a wet compost of coconut curries and dal. Unfortunately, many Kochi residents prefer to burn their leaves, instead of composting them, as it is more convenient and supposedly helps to keep the mosquitoes at bay. My neighbour in Fort Kochi would tend to his large garden most mornings by sweeping up leaves into a pile and burning them. He would then spread the ashes around his garden in an attempt to redistribute some of the nutrients from the leaves into the soil. But what has happened during this burning process is that the carbon, that is essential for healthy soil and needed for a healthy compost, floats up into the sky during incineration, contributing in a small way to the problem of greenhouse gases and climate change. It also meant that I would wake up every morning to the smell of something burning.

What I want to suggest here is that tropical places like Kochi aren't just wet because of rain, they are wet in many other ways too. This wetness manifests in the ways in which cuisines develop and by association, how waste management practices manifest. Coming to terms with Kochi's "incubation climate" and learning about the elemental entanglements that flourish with the right conditions, is, in a way, coming to terms with an aqueous disposition that moves attention below the ground to composting as a below-ground fluvial practice. Discard studies scholars have long argued that relationships to waste are essential to the formation of subjectivities (Hawkins, 2006). Framing composting as an elemental practice between humans, microbes, and other critters, all floating together, might contribute in some small way to cultivating affective imaginations and embodied practices that work in collaboration with Kochi's incubation climate.

## THE FLOOD

Kochi, and much of Kerala, is also afloat in more tangible ways. Some parts of the state lie below sea level, and are for most of the year, under water. This condition was amplified in 2018, after four weeks of above average rainfall and three days of particularly heavy rain, leading to the worst flooding event in a century. One third of the state was underwater. Hundreds of thousands of people were displaced and more than 300 lost their lives. Kochi's international airport that was built where a river once was, turned back into a river causing weeks of disruptions to air travel. Many in Kochi point to aqua-phobic infrastructure – roads and concrete buildings – as a significant factor to the increasing frequency and violence in which these flooding events are occurring. Roads channel water into increasingly small spaces, preventing the water from seeping into the ground. The annihilation of mangrove forests along this coast also contributes to the lack of resilience to these events. Additionally, many of the canals and other waterways are blocked due to the dumping of refuse, causing toxic water to flow up over banks and into homes. This flood occurred just two months before the biggest arts event in South Asia was due to begin in Fort Kochi: the Kochi-Muziris Biennale. As such, many artists who were commissioned to make work on-site in the lead up to the festival were not only faced with the challenges the flood presented, but also began to use the flood as inspiration for the work that was to be shown in the festival. One artist in particular, Marzia Farhana, who I was fortunate enough to meet with while she was installing her work for the festival, drew attention to the materiality and violence of waste caused by the flood.

Housed in one of Fort Kochi's most prestigious seafront buildings, Aspinwall, Farhana's installation *Ecoside and the Rise of Freefall* represented the violence and displacement of the floods. Upon arriving in Kochi, Farhana assembled a team of volunteers and went into the



suburbs of Ernakulam to source flood damaged goods that owners were happy to part with. Then through a painstaking process, Farhana and her assistant began suspending these objects, including fridges, bookshelves, beds, and other household furniture and appliances around the exhibition space. The audience is encouraged to walk through and around these suspended objects coated in a silty brown film, evidence of their connection to both water and the (under)ground. Looking out of the one window in the room, the viewer was greeted with a vision of the gentle caress of the Kochi backwaters flowing by. This delicate and powerful combination plunged the audience into a scenario where gravity no longer seemed to determine how particular relationships are forged, where items one might cherish and those which one might disdain, are thrown together and in contact. I appreciated this installation for its encouragement to disorient or renegotiate vertical relationships to the underground and the wetness that surrounds inhabitants of Kochi. I found this, along with many other installations at the 2018 edition of the Kochi-Muziris Biennale to be in conversation with recent Indian scholarship that seeks to recontextualise the Indian monsoon as something more than just rain. In particular, I find Farhana's installation to resonate with the idea that "to put water at the heart of the narrative is to demand that we adopt a more flexible inception of space" (Amrith, 2018: 9). This call resonates with monsoon scholar Dilip da Cunha and his writing on rivers and other topographical demarcations as the colonisation of places of rain (da Cunha, 2019). In this light, Farhana's installation might be an example of artwork that plays a role in decolonising these places, pushing back against the delusion that humans can control water in these extremely wet places. These kinds of resonances also remind me of what Ashish Nandy refers to as the "psychogeography" of the people who call this charming - yet rapidly transforming - tropical place home (Nandy, 2000: 301). In his essay titled 'Time Travel to a Possible Self: Searching for the Alternative Cosmopolitanism of Cochin', Nandy points to a partially mythic past of the inhabitants of Kochi, one that has its roots in a fabled place called Cranganore. Cranganore was annihilated by a flood in the 1300s, creating what is now known as Vembenad Lake, the lake that forms the social, material, and political links between Ernakulam, Fort Kochi and Willingdon Island. Kochi is literally of the sea. As Nandy states: "co-ordinates of geographical Cochin are not merely land based but, perhaps in more important ways, also defined by the traditional sea routes to Cochin" (Nandy, 2000: 303). What I am trying to suggest here is that to reshape attachments to the ground requires a simultaneous recognition and acceptance of the fluvial nature of that ground, especially in a place as wet as Kochi. To unpack these connections between art, waste, water and the (under)ground, I now turn to Dereck McCormack's thinking on elemental envelopment.

## ENVELOPMENT

There is a tendency, when discussing atmospheres, to fix attention to the sky and that which is encompassed by air. As Tim Choy and Jerry Zee elaborate:

*This form of thought looks up and around, at plumes, clouds, and sky. It looks inward through the vital interiors that render bodies channels, containers, and filters for airs and the things they hold. More significant than the directionality of its gaze, however, is its manner of attunement to the potentials of substances to shift from states of settlement or condensation to ones of airborne agitation, to settle again in time, or to activate a reaction, somewhere else. The wrong air of the Anthropocene trains our attention to the mechanics of suspension, to how things lift and settle in mediums, to how things exist in atmospheres.*  
(Choy and Zee, 2015: 211)

I would like to challenge this assertion by pointing out that clouds, plumes, and bodies, are mostly containers of *water* in its various manifestations, rather than of air. What I have tried to do in this essay, is shift the atmospheric attention from the clouds, slowly toward and under the ground using the medium of water. Like a leaf tenderly disconnecting from its source of life, to float gently to the ground, only to then be enveloped in another kind of life, to be enveloped and metabolised into the moist, critter-filled soil below. Envelopment, according to McCormack, is “a process that shapes the relation between forms of life and their elemental milieus ... a way of thinking through atmospheres and entities without reducing one to the terms of another” (2018: 32) In other words, envelopment is to say that you can be suspended in things that are not purely skyward or airborne. It is to “move bodies to become more or less responsive to their conditions, and to modulate their capacities to act into and within these conditions” (McCormack, 2018: 19).

Acknowledging an envelopment in the aquatic disposition of the ground helps us to re-contextualise relationships to that ground. To recognise the ground as fluid, and therefore plural, continually in flux and related not only in a material sense to air and water, but to the way possibilities of life are imagined, is to fundamentally change the way political decisions are reached with regards to resources and excesses, such as water and waste. It provides room for critical conversations, like those inspired by Farhana’s installation, and new ways of framing interventions in infrastructures, like the move to decentralised composting in Kochi, that might lead to more realistic and less harmful



futures. These are attempts to extend the concept of an aquapelago to hold more affordances for entangled elemental relations. This becomes an ethico-political movement when you consider that Kochi continues to pursue large highway projects instead of protecting its RAMSAR designated wetlands and mangroves, while simultaneously investing in European waste-to-energy technology to solve its waste management woes. Coming to terms with Kochi's envelopment in wetness above and below the ground, a kind of floating (under)ground, might be a cautious first step toward fostering careful ecological daily practices, as well as infrastructural and political investments, in this tropical city. To ignore this call would be to let territorialising and colonising practices continue to determine what kinds of futures and what conditions of life are possible in tropical South Asia.

All photos are by the author.

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# A CRITICAL READING OF THE DRY AND PERMANENT GROUND THROUGH THE PRACTICE OF MUSLIN WEAVING

**Labib Hossain** is a PhD student in History of Architecture and Urban Development at Cornell University. His research is focused on the traditional practices in monsoon landscape that can offer alternative readings of human habitation that challenge the idea of a dry and permanent ground. His other research interests include land-water separation in colonial Bengal and representation of water in South Asia.

## INTRODUCTION

The city is conceptualised in many different ways – as a body, a machine, an organism, a second nature and now a third or even a fourth nature. These readings of the city (or settlements), however, have been conceived on dry ground separated from water as an element that is managed or controlled. Indeed, the city's relationship with water is defined with the latter contained in an entity, whether a river, sea or pipes and drains.

Looking at certain traditional practices in the monsoon landscape of the Bengal Delta (the Ganges-Brahmaputra-Meghna Delta) can offer an alternative reading of human habitation, one that challenges the dry and permanent ground. For example, muslin weaving in Bengal embodied the unique landscape of a particular place (Dhaka). Muslin is a kind of cotton fabric, delicate and palpably transparent, that attracted the entire world. In the first part, the paper outlines a brief historical account of muslin trade in Bengal and investigates the colonial reading of muslin making through different historical references. In contrast with this model, the second part explores a non-linear reading or craft model of the practice that begins with the question of why the practice was unique to Bengal. These engender several other questions and directions: what was the role of the landscape of this region? Was there a connection between the practice of muslin weaving and human habitation? The third and last part of the paper will discuss what connections can be drawn from the traditional practices to the idea of dwelling to explore wetness as intrinsic to the ground of habitation.

## HISTORICAL ACCOUNTS AND THE COLONIAL READING OF MUSLIN

The earliest references to cotton weaving in Bengal are found in the *Rig Veda* (1500 BCE), *Asvalayana Srauta Sutra* (800 BCE), Megasthenes's *Indika* (300 BCE) or in Ptolemy's *Geographia* (1st century CE). In the *Periplus of the Erythrian Sea* (1st century CE), it is mentioned that a lot of muslin was exported to the Roman Empire, Persia and other places along the silk route during that time in exchange for gold (Anonymous, 1912: 47, 71). Muslin was of high demand among the high rank people in Rome and Persia at that time. In Pliny's account there are mentions of Roman ladies of high rank wearing this type of cotton (Islam, 2016; Pliny, 1855). In the 4th Century, Fa Hian, a Chinese Buddhist monk and traveler mentioned muslin trading between Ceylon and Bengal (Anonymous, 1851). Yuan Chwang, another Chinese traveller of the 7th Century (629-45 CE) referred to this cloth as "the light vapours of dawn" because of its extreme transparency (Islam, 2016: 17). Between the 7th and 8th Centuries, trade flourished with the Middle East and the mention of muslin trade can be found in number of Muslim traveller and scholars' accounts. "Much cotton is grown in this country and trade flourishes..." as mentioned by Marco Polo in 1272 CE (Anonymous, 1851: 116). The Portuguese replaced the Arab traders in the early 16th century and succeeded in establishing trade in various parts of the province of Bengal towards the end of the 16th century (ibid.: 118-119). In 1666, the East India Company arrived and established a factory in Dacca. The French and Dutch were also involved in muslin trading in 17th and part of 18th century (ibid.: 128). But following the interventions of East India Company, in 1757, the British finally took control and established colonial power in Indian Sub-continent by defeating Siraj-ud-Daula, the last independent Nawab of Bengal. From then, the British were in the leading role of muslin trade for the next century. With the industrial revolution, the story of this fabric took a dramatic twist as the practice of manufacturing it ceased and the the plant species behind the finest quality of muslin became extinct (ibid.: 170).

*A Descriptive and Historical Account of the Cotton Manufacture of Dacca* (Anonymous, 1851) is one of the earliest accounts of the history of Dhaka's muslin. The book started with the opinions of the English press on muslins of Dacca being exhibited at the Great Exhibition held in Crystal Palace, London in 1851.

*It is much to be doubted if we in England have  
anymore delicate and beautiful goods than the  
muslin of Dacca.*

*(Illustrated London News, 2 August 1851 in Anonymous 1851: x)*

*The cotton gin for the cleaning the wool and preparing it for spinning, the spinning wheel, and the looms there seen exhibit the rude, simple implements with which the natives of India, by dint of manual dexterity, are able to manufacture fabrics more delicately fine than can be produced by the aid of all our complicated mechanism, ingeniously as it is contrived, and most skillfully executed. The muslins of Dacca, of which specimens are exhibited, resemble a spider's web in fineness of texture, for a whole breadth may be drawn through a finger ring.*  
(Morning Post, 13 June 1851, in Anonymous 1851: ix)

*The muslins of India, marvelous as they are in themselves, are still more so when we consider the rude and simple-looking machinery with which they are produced by the patient and finely-fingered Hindoos... these elegant and gauze-like tissues, which are termed 'woven air'"*  
(Morning Herald, 3 July 1851, in Anonymous 1851: ix)

It is evident from these accounts that the colonial description of muslin privileged the eye. With this Imperial gaze, the product was imported, commodified and celebrated in other parts of the world.

Anonymous (1851) also detailed the process of muslin making, starting from the cotton plant. Even though the book was published in 1851, it is evident that the description of the making process was taken from the *Account of the District of Dacca Dacca by the Commercial Resident* (Taylor, 1801) In section no.8, 'Process of weaving plain and flowered muslin as practiced by the weavers at Dacca', Taylor described the making process as a production line starting from the plant to the fabric under six steps with images that are codified in English alphabets. After being harvested in April/May, the *karpas* (cotton with seed) was collected and then combed (with the jawbones of boal fish or *wallago attu*) and rolled and teased (*dhun*). The separated cotton was then preserved inside the skin of *cuchia* fish (Gangetic eel) (Anonymous, 1851: 18). After being prepared in this way, the cotton was spun and woven. During the spinning process, young women spun the finest thread, early in the morning or at late afternoon (Ibid.: 19). The weaving process consisted of several steps - winding, preparing yarn, warping, reed to warp, warp to loom and then weaving with the loom (Ibid.: 25).

## A NON-LINEAR READING OF MUSLIN OR THE 'CRAFT MODEL'

While the transparency of Bengal muslin was celebrated all over the world, its making involved the engagement of bodies and the use of local materials in the landscape of a particular place. The site of its making was twelve miles south of present Dhaka city, along the Meghna and Sitalakhya Rivers. There were three possible reasons for this: the plant, the atmosphere and the engagement of human bodies. The plant, *Phuti Karpas* in Bengali, (*Gossypium Arboreum var. neglacta*) thrived only along the Meghna and a segment of the Sitalakhya (Islam, 2016; Anonymous, 1851: 11). It was a particular species of cotton that was dependent not only on the seasonal inundations of the monsoon but also on a number of other factors including the proximity of the sea, the rate of temperature change between warmer river water and colder sea water and the chemical composition of the sediments deposited during the seasonal inundations (Islam, 2016: 52-54). The harvest time of the cotton plant was April/May, and the making process started from May. June to September (*Ashar-Srabon-Bhadro*) was the monsoon season and the total making process, spinning and weaving, was highly dependent on the monsoon-fed landscape. Bamboo and wood were the most commonly used materials. All the devices (spindle, heed, loom etc.) were produced and prepared locally. Other materials used in the production process - the bone of *boal* fish, skin of *cuchia* fish, banana-coconut fibre, coconut shell, dry wild-grass, reed etc. were also sourced locally.

During the spinning process, the finest thread was spun in intensely humid conditions, usually in the early morning and evening, and only by young women with water bowls around them to moisten the air, or else beside the inundated areas or on moored boat. "Spinning was done in the misty conditions of early morning or by transferring the charka to a large boat... to ensure that the thread was kept moist by the ambient humidity" (Ibid.: 82). As the process was done entirely by hand, it required high precision to maintain the precise thinness of the thread. Without sufficient humidity (for example during the other times of the day besides morning or late evening and other time of the year besides the monsoon season), the thread could be easily damaged. Which also explains, why spinners often did the spinning process on moored or moving boats, to get extra humidity from the surrounding waterbodies. The wetness in the atmosphere brought by the monsoon was one of the reasons for the unique muslin produced in Bengal. This is evident in the naming of different types of muslin, like *Abrawan* (flowing water), *Shabnam* (evening dew), *Samander Laher* (wave of the sea), *Tanzeb* (the body), *Jamdani* (floating flower) etc. They captured and named different forms of wetness. There are several sequences in the weaving process that were done mostly in outdoor areas. These processes were highly dependent on the monsoon atmosphere. The third reason as to why this location was important in the making of muslin was the engagement of

human bodies with it. While the weaving part was mostly done by men, the spinning was done generally by women. The precise tension and moisture imparted by the fingers were necessary to carry out the spinning process (Anonymous, 1851: 18).

The colonial reading or what I call the 'linear model' compromised the climatological and cultural dimensions of the landscape necessary for the making of the cloth. In contrast with the linear model, in the what I call 'craft model', the different other layers - time/seasonal requirements, materiality, bodily experiences, sensory and spatial features described above, are brought into play to explore the complexities of the practice in this monsoon-fed landscape.

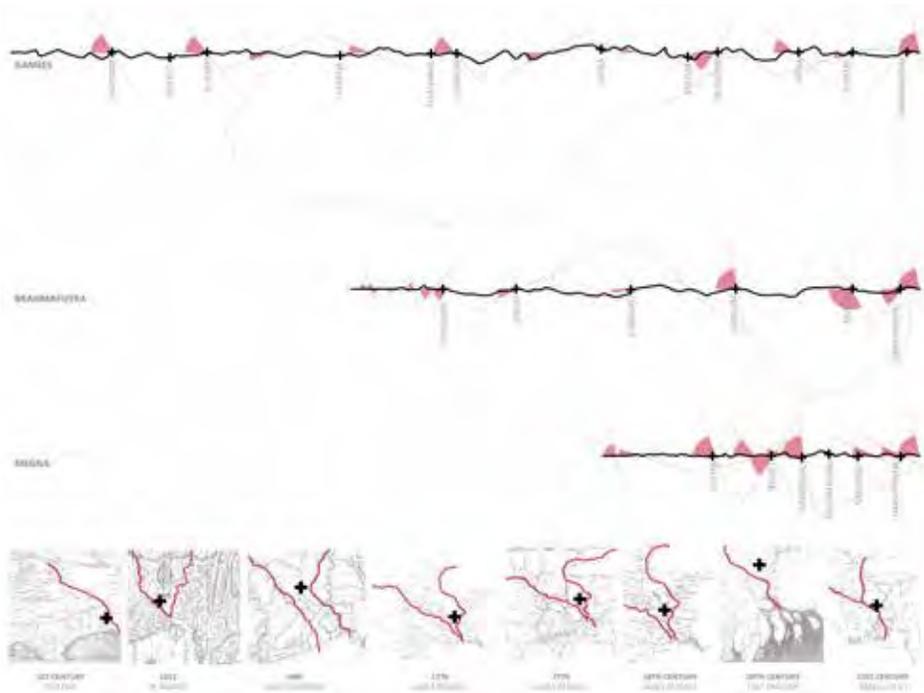
The linear model compromised the climatological and cultural dimensions of the landscape necessary for the making of the cloth. In contrast with the linear model, in the craft model, the different other layers - time/seasonal requirements, materiality, bodily experiences, sensory and spatial features described above, are brought into play to explore the complexities of the practice in this monsoon-fed landscape. This non-linearity works against the linear logic of the colonial reductive model and of colonial rationality. While linearity connected with industrial development, the non-linear approach or the craft model draws out the disorderly beauty of the weaving process and the monsoon landscape of Bengal. This disorderliness is associated with the dimensions of the landscape, time, its figures and the inter-relationship between them. The disruption of linearity contradicts the oppressive qualities of concrete reasoning and the logic of domination through colonial representation. However, this complex non-linear model or "fractal kind of reason" (Siddiqi, 2008: 153) was vulnerable under colonial domination, as Amitav Ghosh also argued in *The Circle of Reason* (Ghosh, 1986). It is no wonder that muslin weaving experienced a tragic end through the death of the cotton plant species used in its manufacture during the early to mid 19th century). The colonisers not only forcefully coerced the weavers and farmers to cultivate indigo and opium and imposed taxes and other administrative procedures on the muslin trade, they also re-engineered the landscape through different acts and laws, framing/controlling the rivers for the sake of dry and permanent land, thereby killing the valuable species *Phuti Karpas*, and with it the muslin practice in Bengal.

## ON PERMANENT SETTLEMENT AND DWELLING

Bangladesh is a low-lying country located in the world's largest delta. A *jon-jomi-jol* (people-land-water) relationship is evident there that has grown out of the unique, dynamic terrain that accumulated over thousands of years (Ghafur, Hossain, Sharmin and Jahan, 2015). Despite the influences in different periods, the ground is the unique feature of this delta. It is sometimes dry, mostly wet and sometimes submerged. For centuries, people have depended on this unique landscape for transportation, trade, and generating livelihoods. As evidenced in different historical accounts, before colonial time, a sophisticated artisan economy flourished in Bengal, based on this wet landscape (van Schendel, 1991).

At this point, it is noteworthy to mention Ranajit Guha's work (1982) on the intellectual origin of the permanent settlement in Bengal and the idea of physiocracy that was imported during the colonial times. He shows that British Administrators such as Lord Cornwallis and Phillip Francis were far more considerably influenced by the French physiocrats than by Indian conditions on ground (Guha, 1982). Robert Travers' (2007) and Richard Eaton's (1993) analyses of the historical political landscape of colonial India are also relevant to the issue of transported ideas/concepts in managing the colonial territory. Lahiri-Dutt and Samanta (2013) mention the difficulties faced by the British because of the transient nature of the Bengal landscape and their efforts to control the major rivers for the sake of permanent land to earn maximum revenues. Permanent Settlement Act of 1793 can be considered as the initial marker during the British Colonial Period in Bengal followed by different other interventions, like infrastructural projects (dams, embankments), mapping the colonial territory (surveys, maps, census etc.) and series of laws and regulations (Bengal Alluvion and Diluvion Act, Bengal Tenacy Act etc.) - all attempted to fix the landscape, frame the rivers and perceived the land as dry and permanent ground separated from water.

Muslin weaving in the monsoon landscape offers an alternative reading of human habitation, one that questions the dry and permanent ground. Spinners often sang while working on boats and if the weather was misty, passing travelers brought back tales of muslin being weaved by mermaids singing in the mist (Islam, 2016). The weavers often flooded the pit (where part of the loom is placed which is operated by feet) beneath their looms that originate the myth that the muslin was "woven under water" (Ibid.: 82). To Europeans, the plant, atmosphere and the engagement of human bodies in the making of muslin were esoteric and difficult to document and understand. To the people of Bengal, they were part of everyday practice. Is it possible that this practice is a mode of habitation? Can it be said, that the boat was an integral component of dwelling, given that the people of this part of Bengal spent months on them (during spinning). Perhaps moored, perhaps in movement, searching for the morning dew, for that extra humidity... Perhaps boats were not a mere part of dwelling, floating extension of firm ground; rather



boats together with firm ground if there was any, were a part of the milieu of wetness. In this monsoon landscape where much is submerged during the rain, when the lines of riverbanks are erased, when towns established by the European colonizers are washed away by the changing course of rivers, what is the point of reference? Does this open up a new imagination that shifts us from a divided landscape of contained waters to a ground of wetness, a ground that requires a new vocabulary of habitation (da Cunha, 2019)?

## CONCLUSION

This investigation into the practice of muslin weaving calls for a redefinition of the dwelling culture of Bengal and to see outside of the rigid dichotomy of rootedness and detachedness. It challenges the conventional view that the architectural culture of Bengal is naturally rooted in the ground or in fixed location. This investigation shows that the dwelling culture of this region is not only rooted in ground, but also woven' in a very complex way with the landscape. This study demonstrates alternative narratives of dwelling and addresses the emerging field of the history of environment and architecture. It highlights that environment is not only the techno-scientific construction and reconstruction of natural forces, but also a spiritual and philosophical way of defining our human position on earth, both economically and ecologically, by understanding the spirituality of human labour (i.e. the muslin weavers) and its social value as it was shaped by the environmental forces.

Fig.01. Conceptual straightening of the major rivers of Bengal during colonial time. The bottom series of historical maps show the changing courses of these rivers over time.

All images are by the author.

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## BEING AMPHIBIOUS IN THE BENGAL FLOODPLAIN

**Saif Ul Haque** is the Principal of Dhaka based architectural practice Saif Ul Haque Sthapati (SHS) and Director Research and Design Program at the Bengal Institute for Architecture, Landscapes and Settlements also in Dhaka, Bangladesh. He studied architecture at the Bangladesh University of Engineering and Technology and is involved in practice, research and education. His works include residential, institutional and industrial facilities at different locations in Bangladesh and have been published and exhibited in and outside Bangladesh. Some of the works have also received awards at home and abroad. His recent work Arcadia Education Project was the recipient of the Aga Khan Award for Architecture 2019. He has been a visiting faculty and reviewer at various institutions. His research interests include environment, architecture and urbanism and has written on these topics. He has also been involved in organising a number of exhibitions on architecture.

On October 14, 2011, I was taken to see a site for a prospective project of a preschool on the outskirts of Dhaka city. The project was an undertaking of Maleka Welfare Trust, a philanthropic organisation founded by Razia Alam, who also happens to be my aunt. After an hour's drive from the city, we reached the place and the car parked on a bridge. As we stood on the Northwestern side of the bridge, Razia Alam pointed towards the northern bank of the river and mentioned that the place indicated by her finger was the site. To my surprise, I could not see any land; rather what I saw was a flooded river bank. I kind of exclaimed "I don't see any land!" This, of course, can be considered a typical reaction of an architect who would expect to see a piece of land for a prospective project, not water. I was then assured that this was a seasonal phenomenon and that land would emerge within a couple of weeks. This was where my aunt wanted to build the school.

It is not that I was unfamiliar with this landscape but to consider it as a potential building site was something I was not prepared for. What I was looking at was a typical Bengal floodplain scenario. Near to 80 per cent of Bangladesh is made up of floodplains and parts of the floodplains are also part of the Bengal Delta. Geographers have classified these floodplains in two major categories - active floodplains and meander floodplains. The site I was looking at was in an active floodplain adjacent the River Dhaleswari and was subject to seasonal flooding, with the heights of the floods varying year by year. Settlements in these conditions are challenging. As the land that was submerged in water was already purchased and in order not to disappoint my aunt, I decided to study the challenge. I did not right away commit to a commission. Rather I sought time to explore the possibilities.

For us, any commission is a two-part activity – design and realisation of the design. In this case, as there was no strict deadline from the client, we could indulge in studies. In about a month's time after my first visit, land became visible and we could tread on it. The water had receded and was back in the river channel. We engaged a surveyor to do a topographical survey and established that the boundaries of the purchased land were in a continuum with the adjacent lands without any major physical features to demarcate them. The land was an irregular shaped one, elongated in the East West direction and trapezoidal in shape. We could make out a levee like form on the site that had been designated for the school. Henceforth we begin the study that was of two types, one being the observation of the place in different periods of the year but not at regular intervals and the other being the explorations of the design.

In the course of following three years this led to a design that became a unique example for inhabiting the floodplains and has drawn attention from different quarters including the prestigious Aga Khan Award for Architecture when it bestowed the honor of being one of the six award recipients in 2019.

## **DESIGN DEVELOPMENT**

The program for the school was quite simple - three classrooms, one office and toilets. We started with basic space calculations to ascertain the construction footprint and found out that a single-story structure could contain all the functions and leave some ground around it. It was the site condition that required a prolonged thinking process however. Our observations of the site during different periods of the year revealed a dynamic environment that varied with the seasons. Bengalis divide the year into six seasons - summer, monsoon, early autumn, late autumn, winter and spring (though some geographers have classified these as pre-monsoon, monsoon, post-monsoon and dry). We observed how the landscape changed in tune with these seasonal changes. These observations impacted the conceptualisation of the design. From the very beginning we were inclined to maintain the characteristics of the floodplain as they were an integral part of the river and ecosystems. In Bangladesh, the monsoon climate and the watershed function of the terrain needs to be considered in any design so as not to create any blockages affecting the flow of water.

In the process of deciding on a design strategy, we looked into several options before arriving at the final design. It needs to be mentioned that the work on the project was not carried out in a continuous sequence but with breaks in between. We begin with the option of the traditional approach in making floodplains suitable for human habitation and this was by way of raising the level of the land above the flood level.



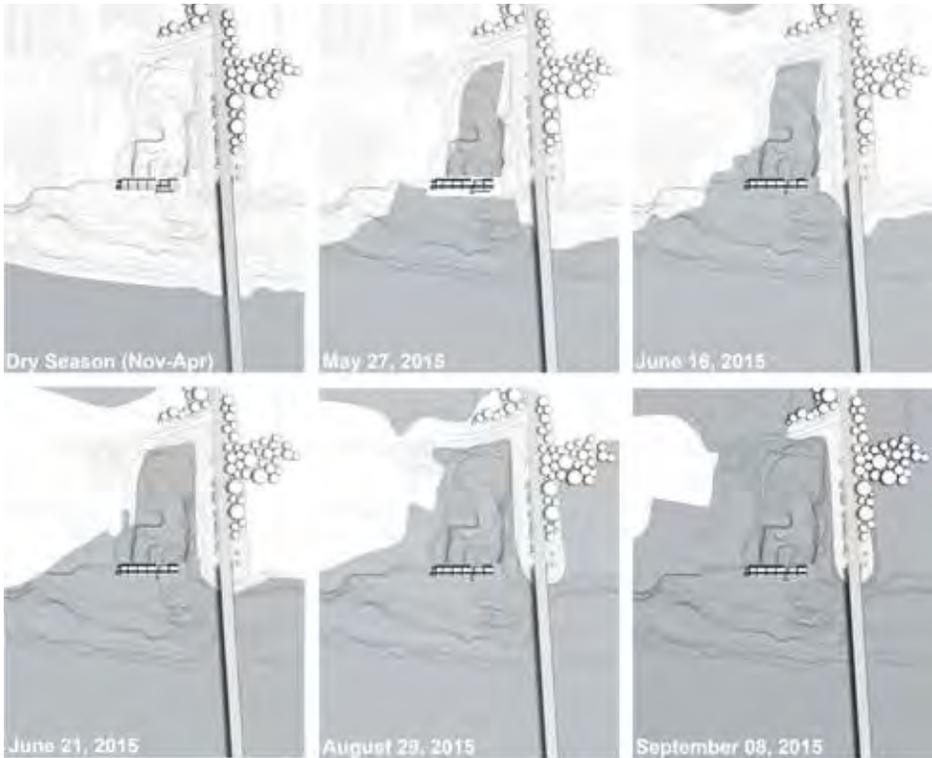
Fig.01. The school is located on a patch of land next to the Dhaleshwari River. The main idea of the project was to build a structure able to cope with the changing water level.

This is a method that is quite prevalent in the rural areas where the land for placement of a house or houses is raised by digging a pond or several ponds. A mound is created by the earth that has been dug and the top is levelled for the houses to be constructed. These houses or homesteads have two different appearances in the vast floodplain landscape during the seasonal variations. During the dry season they are like small hillocks and in the wet season like small islands. This settlement pattern allows for the storage and flow of flood waters in the wet season and rich agricultural potentials during the dry season. The land available to allow for the dig and mound making operation needs to be of substantial quantity to accommodate both the dig and the mound. In the site for the school, the land available was not sufficient for this operation and the soil had a heavy silt presence that would not have been suitable for the stable perimeter of the mound.

Although a mound could have been made of earth brought by boat or trucks, this option was not explored further because it would have totally altered the site and be contrary to our objective of preserving the floodplain as much as possible. We wanted to display a different way of inhabiting this type of terrain in view of the large scale filling up of wetlands in and around the major towns and cities of Bangladesh by way of pumping dredged sand into wetlands to create flood-free grounds for construction. This site was an opportunity that could be utilised to explore a different way of doing things.

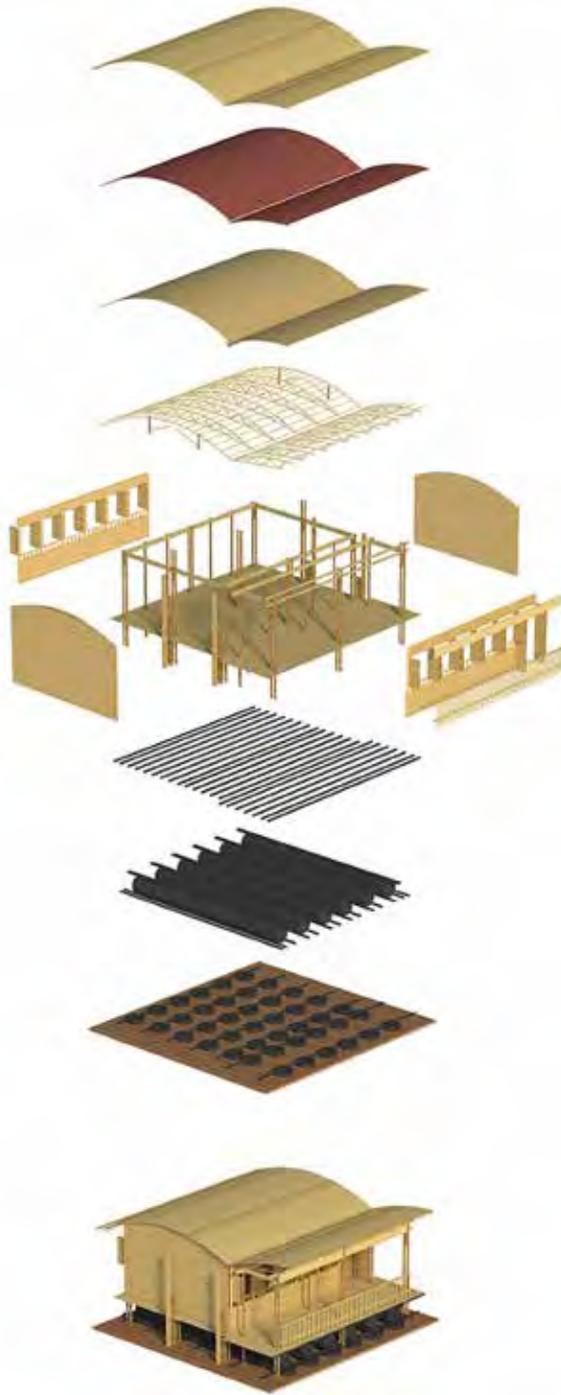
The second design option that was looked into was building the school on stilts. This was a common practice for building on the edges where land and water meet and a substantial level difference between the water level and the level of the land exists such as on levees, embankments, river or canal banks. The other places where this is common practice is in the hills of southeastern Bangladesh. At this particular site, the land was on the riverbank but it was a much shallower bank and to have a building on stilts would mean a ground floor level above the maximum flood level. While this would work well during the monsoon, in dry season the structure would hover about 3.5m above the ground level and be incongruous with the surroundings, as well as incurring additional cost for construction. Yet, we prepared a proposal for this option and worked out the cost and shared it with the client. The budget was too high, in addition to which the platform at this height would not be a desirable experience for the children.

At this stage of the work, we decided to pursue another option and this was the option of constructing an amphibious structure that would be stationary but would float when there was water and rest on ground in dry conditions. Unlike the other two options, this was a totally unfamiliar thing to do in the local context. Bangladesh, being a large network of rivers, streams and canals, boats and other forms of water



transport are a familiar sight but they are on water not amphibious. For us, this was a unique approach in design and we decided to develop a simple design for the school for an amphibious operation. Simple in the sense that we were not interested to adopt any industrial process for building, but rather a handcrafted one relying on existing knowledge with some innovations. The idea was to have a raft or pontoon like substructure supporting a pavilion functioning as a room. The raft needed to take the load of the pavilion with users and keep afloat or settle on level ground. The pavilion needed to provide comfortable interiors for the users considering the elements of weather. The raft was conceived as a platform made of bamboo and to facilitate buoyancy, upcycled steel drums were considered. In order to keep both the dead and live load low, the superstructure was considered to be made of bamboo. Bamboo was not only a lightweight material but also an easily available one and with simple treatment its life could be prolonged.

The design was conceived to be of a modular typed one so that a number of modules connected together would form the school. We decided to avoid a large structure whose behaviour during floods could be problematic in comparison with smaller units that could be better



managed. To keep the structure in place, guide posts were considered in the design. In this process a module comprising of a room and an adjoined veranda to function as a corridor for circulation was designed. Four identical modules were to be used for the class rooms and the office room while toilet was to be a smaller module with two other structures, one for an overhead water tank and the other a septic tank. We also added a platform open to the sky with a covered veranda for the purpose of providing a small play space that could be used during the floods. For the supply of water, a bore well was considered with the well pipe extended above the known maximum flood level. All together, the resulting schematic design proposal was shared with the client and it was enthusiastically received. This was followed by a preliminary cost estimation which was also shared with the client and received a go ahead from her. The estimates showed that the construction was one fifth of the estimate for the structure on stilts.

The schematic design was then developed and detailed into construction drawings that included drawings for site works and stage by stage construction. The client had assigned a carpenter to work and to oversee the construction, but because of his unfamiliarity with construction drawings we also needed to make models to explain the construction system. The design was based on simple construction system but had certain technical aspects that needed to be clearly communicated to the work force. A detailed estimation of the cost and procurement schedule with sources of procurement were also prepared along with a construction schedule.

## **CONSTRUCTION**

By autumn of 2014, exactly three years after my first visit to the site, we were ready to begin construction. The building ultimately took over a year to complete. The construction begin with site works as the site needed levelling and filling in places. Based on the topographical information a finished ground level was fixed that included cutting as well as filling for preparing the ground. This level was fixed with the idea that levelling would be done with the earth within the site and that no earth be brought from outside the site. The filling was done by layering of earth filled used cement bags and compaction with water.

In order to have the entire construction supervised by the architect's office, a full time staff member was assigned to the project. He not only communicated the design information but also participated in procurement and the making process. In addition, there was regular periodic inspection from the design team. Each and every step of work was preceded by the construction of a mock up to make the construction team familiar with the technique and to ascertain difficulties so that they could be overcome before starting the actual work. This also provided

opportunities for cross checking estimated material, labour and time requirements, which were updated according to the experience of the mock up construction. Improvisations were brought in to the construction system based on the suggestions from the construction team. Due to non availability of electricity on the site, the entire construction was done with human labour except for the use of two battery operated power drills that needed to be charged from a nearby bazaar. One of the challenges was to complete the construction of the substructure before the beginning of the monsoon, which was accomplished. The construction continued during the monsoon though the site was flooded. This was possible due to the availability of higher ground next to the construction site that was used as a yard for preparation of materials and their storage. The work was carried out both at the yard and on the structure. By autumn of 2015, when the water had receded from the site, the structure was also nearly complete. Remaining works were completed on the dry ground of the adjacent yard and the grounds of the school. In spring the construction was completed and it was ready for occupation.

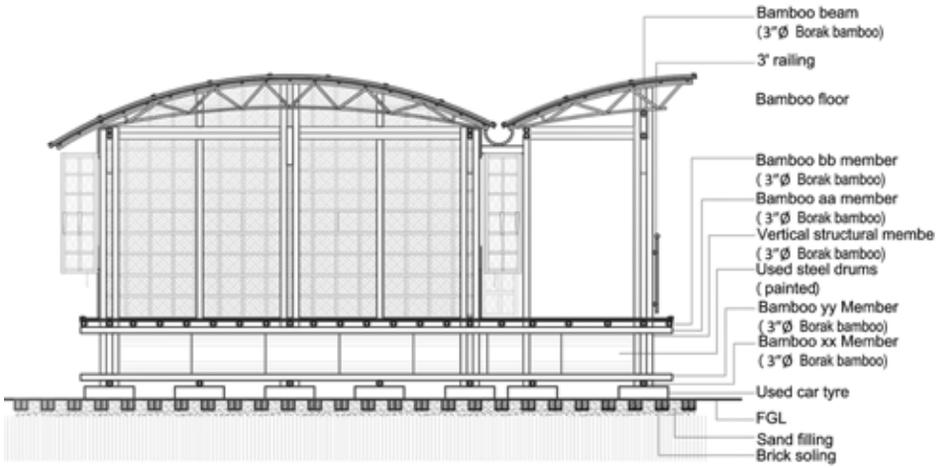
## **POST CONSTRUCTION**

Due to its experimental nature, the work did experience some problems since completion of construction. One major problem was the functioning of the septic tank as envisioned and this needed to be rectified. The wooden guideposts rotted very quickly and were replaced with bamboo guide posts that have performed better. Some of the roofs were affected by north-westerly storms and had to be rebuilt. The structure does require repair and maintenance, particularly in the pre- and post-monsoon seasons. The carpenter who oversaw the construction is now engaged by the school to carry out this activity and this has so far been done quite well. He now has an assistant who is getting trained up to look after the structure. The school has been in limited operation since its completion and is expected to go into full operation very soon. The children who are already attending love the school. The client has already planned other activities to take place during time of the day when the school is not in operation and is mobilising efforts in that direction. The architects have been engaged to design a residential facility on the adjacent land that was used as a construction yard. This has now purchased and a plant nursery has been established on it and is functioning well.

The landscape now is quite transformed by the school and the vegetation compared with the barrenness that existed at the beginning of construction, but it appears to have blended quite well with the environment. The site is flooded during the monsoon but the school continues unaffected. The performance of the school surely merits further passing of time when all the design assumptions are tested and the possibilities of deployment of similar models based on this experience are fully explored. The project has drawn the attention of many people



Fig.05. All the different modules are connected via a single corridor.  
Fig.06. Children attending class.



0 3 5

Section Showing Material Details



Fig.06. Material section through the classroom module.

Fig.07. The architect up-cycled 30-gallon steel drums to create the school's substructure, in order to get it to float.

and institutions who came to know about it at home and abroad. It has received coverage from the press and has also received quite a few awards that includes JK Cement Award from India, Aga Khan Award for Architecture and Fibra Award from France. The master jury citation of the Aga Khan Award for Architecture has quite aptly summarised the highlights of the project. Excerpts from the citation are shared here.

*At a time of rising sea levels, this modest bamboo school illustrates how to build an affordable and viable solution with locally-available materials.*

*The approach to building the three classroom preschool was to design a structure that rises with the river's water level and adapts to the surroundings - without altering the natural condition of the site and allowing for uninterrupted, year-long use of the building. Here the paradigm of the architect using his professional knowledge - yet thinking outside the box by adapting traditional methods - is remarkable, especially as the construction is modest and direct, without fetishising craft.*

*Site-specific in its technological approach yet global in its solution, this low-cost , low impact project was the outcome of teamwork between architect, client and builder, each of whom displayed resilience and innovation as they approached the social responsibility of building the school.*

*The modesty of the program, the use of materials and the construction method are all successful parts of building this amphibious school through experimental and collaborative teamwork. Though simple and compact, the project resolves complex issues - of buoyancy, anchoring against the river current and waste management.*

*The project strives to elevate people's lives, contributes to social and economic development and provides a pathway to solutions for the global issues of rising water levels and access to education in rural communities.*



As for the architects of the project, the awards have provided not only recognition of the efforts but also inspiration to continue work with a similar spirit and to take challenges of sustainable future living. Architecture is an essential human activity and in the rapidly transforming environment of the earth it is assuming newer meanings and forms in its role in fulfilling human needs by not jeopardising the sustainability of life on earth. Pluralistic in nature, architecture responds to diverse conditions but at the same time has to fit in with universal social and environmental aspirations. The Arcadia School is one of many solutions that can be worked out fulfilling the criteria mentioned above.

## IMAGE CREDITS

Fig.01. Aga Khan Trust for Culture / Sandro di Carlo Darsa (photographer).

Fig.02. Saif Ul Haque Sthapati.

Fig.03. Saif Ul Haque Sthapati.

Fig.04. Aga Khan Trust for Culture / Sandro di Carlo Darsa (photographer).

Fig.05. Aga Khan Trust for Culture / Sandro di Carlo Darsa (photographer).

Fig.06. Saif Ul Haque Sthapati.

Fig.07. Aga Khan Trust for Culture / Sandro di Carlo Darsa (photographer).

Fig.08. Saif Ul Haque Sthapati/Hasan Saifuddin Chandan.

Fig.09. Saif Ul Haque Sthapati/Sabber Ahmed (photographer).







Fig.01. The Rajapur Community Building for Women's Literacy and Healthcare: The Rajapur Centre completed and being used by the community.

## HOW DOES MONSOON GROUND SHIFT THROUGH THE SEASONS IN RURAL BANGLADESH?

**Tumpa Husna Yasmin Fellows** had over ten years experience working for London-based architecture practices, before co-founding the inter-disciplinary practice Our Building Design and the charity Mannan Foundation Trust. She was awarded the Royal Institute of British Architects (RIBA) Rising Star Award in 2017 and she has received a commendation for the RIBA President's Award for Research in 2019. She is a senior lecturer at the University of Westminster where she is also a PhD researcher undertaking practice-based research on architectural responses to climate change in Bangladesh.

### WHAT IS A MONSOON GROUND?

This paper explores the idea of monsoon ground through my experience of designing the Rajapur Community Building for Women's Literacy and Healthcare Centre in the Rajapur village, Bangladesh, simply known as the Rajapur Centre. Here I found that the characteristics of monsoon ground cannot be defined outside of its relationships with humans and non-humans, water, season, and climate.

It is not a norm to describe seasonal climatic changes by exploring how the ground behaves, unless you are in Bangladesh where the ground and the landscape are constantly shifting with the seasons. From the northern boundaries of the country, the freshwater rivers of the Ganges and Brahmaputra (born in the Himalayas) converge with the Meghna river, and constantly deposit their silt and mix with the saline water of the Bay of Bengal, (Sultana and Thompson, 2017). The rivers are constantly causing the ground to erode, deposit, sediment, compact, contract, evaporate, causing the shift of clay, silt, sand and gravel, which result in both loss and gain of ground (Bremner, 2019). Global warming and rising temperatures are causing an increased level of ice melt in the Himalayas, exacerbating this shifting of the ground. The low-lying ground of Bangladesh is broadly seen as a floodplain and the majority of the landscape shifts between water and land over the course of the year, as flood waters rise and recede. The ground is deeply entangled with these seasonal flows. Just as we define the seasons as having an annual climatic cycle, so too the ground has its annual seasonal cycles. Its behaviour is heavily influenced by the seasons and changes with the climate. The riparian areas are most vulnerable to this shifting landscape as its inhabitants face the unpredictable movement of the ground, influenced by changing climate head on (Hanlon, Roy and Hulme, 2016).

In Rajapur, the community's cultural practices respond to the seasonal ground and the movement of water across the grounds. The community's experience of the seasonal ground and its changes are marked through traces on the landscape, as they adapt to the seasonal



The Rajapur village boundary, two brick factories (shown in orange) and the river tributary



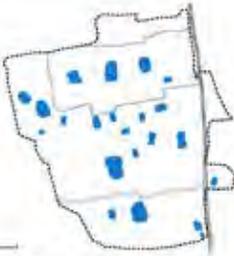
Ground raised for access roads and footpaths



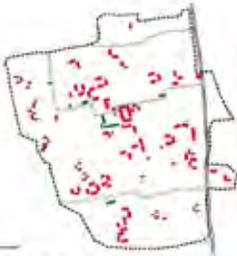
Outlines of vegetation



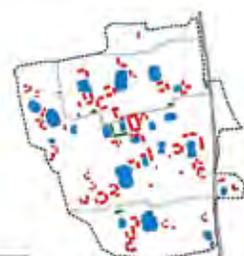
Agricultural fields



Ground excavated for pukurs, for rainwater collection and fish farming



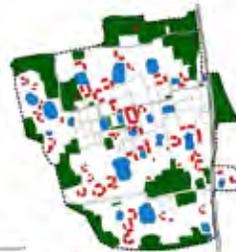
Residential buildings shown in red  
Public buildings shown in green,  
built on earth mounds



Pukurs surrounds residential buildings



Location of the Rajapur Centre  
(shown in red)



The Rajapur village and its land-use

shifting of monsoonal grounds. The author Sunil Amrith, in the book *Unruly Waters* (Amrith, 2018) explores the significance of the changes in the landscape due to human-made interventions. He argues that people mark the changes through traces on the landscape, through their memories of space and time.

## **NATURAL VERSES HUMAN-MADE SHIFTING OF THE GROUND**

The Rajapur village has two brick factories nearby which create seasonal employment for the youth in the community and attract seasonal workers to the village and the nearby neighbourhoods. Over the years in these brick factories, seasonal workers have hand-crafted millions of baked bricks with the vernacular soil. The bricks have been transported to the surrounding towns and cities to feed the demands of rapid urbanisation; the ground has been transformed into buildings.

It is not only the migration of people and the human shifting of the ground that is witnessed here but also the natural migration of the ground occurring during the monsoonal rainy season. One could argue the monsoonal shifting of the ground controls all migrations, as at each season the ground dictates the community's response to the ground and its seasonal conditions of the soil.

## **WHAT IS THE SCIENCE BEHIND THE GROUNDS OF RAJAPUR?**

Rajapur village is situated in the low-lying district of Chandpur, where ground level ranges between one and two metres above sea level. The Chandpur District's agroecological zones include the Lower Meghna Estuarine Floodplain and the Old Meghna Estuarine Floodplain, (Agricultural Research Council, 2015). Rajapur village sits on the Old Meghna Estuarine Floodplain and the village is in a deeply inundated area. It is situated within the Chandina Alluvium region with 80-100% tubewells having arsenic contamination; arsenic occurs within 2.5m of the ground surface. Groundwater from the Chandina Alluvium has amongst the highest concentration of these chemicals.

Rajapur village is located on the Tropic of Cancer. Therefore, it experiences extremely hot summers with temperatures often rising to 45-50o Celsius and the winter can be very cold and dry. The area is dominated by monsoon winds bringing rain in the summer and cold winters. The recent summers have been very hot with hardly any rain and the winters have been hot and dry. The unpredictable monsoon, lack of rain has caused droughts and disrupted farming practices and cropping patterns.



## HOW IS THE MONSOON GROUND CHANGING WITH THE CHANGING CLIMATE?

In Rajapur, the cropping pattern is influenced by irrigation sourced from the monsoon rain and surface water. During my annual visits to the village since 2011, I have noticed several changes to the cropping pattern in the village paddy fields and changes in the fish farming pattern. During the early years, through ethnographic storytelling from the village community members, I heard stories of families in the community forced to leave the village as they lost their livelihood along with their fish farming ponds that they were dependent on. The loss of fish farming in the village occurred gradually as the climate has become increasingly unpredictable and fiercer every year. In the recent years, some of the paddy fields have been converted to fish farming ponds to overcome the scarcity of rainwater, surface water and most of all the exhausted grounds from a continuous cultivation of crops. This year the villagers expressed reduction in rice farming due to the extreme heat leading to drought and that the grounds had dried up and cracked before the rain arrived. This has affected the farming of other food crops as well as rice. Several rice fields are now left empty and barren; rice farming was no longer possible on these grounds due to the increased level of salination in the soil, the ground has become infertile.

In the rural setting of Rajapur, the evidence of the ground not only changing with the seasons, but also responding to the changing climate, is present in the human practices that adapt to the periodic decline in rice and fish farming.



## WHERE IS THE GROUND?

The monsoonal ground in Rajapur is constantly naturally and artificially moving across the landscape. Both natural and human interventions on the ground makes it very challenging to define where the ground level is. Examples of human activities that respond to the seasonal ground impact the state and level of ground itself.

The Rajapur village community use the ground to manage floods and put strategies in place to respond to the seasonal ground conditions. Naturally the ground is constantly being moved around through flooding, rain, storms, river movements and artificially the ground is being dug down, carved into, piled on, raised up, built on etc. Historically, the rural communities adapted to the changing season by excavating the ground and creating a pond or a *pukur* (a ditch typically rectangular shape) utilised for rainwater collection for irrigation and fish farming. The excavated earth was used to create contours or earth mounds above the flood level to build on. Most importantly the footpaths for circulation in the village were strictly maintained and raised to be above the flood level. The residents of the village engage in an annual ritual to replace the earth to maintain the raised footpaths after the monsoon in order to restore the ground that has shifted with the season.

So it is difficult to identify where the ground level is; is it the footpath (which has been raised by human) or the ground floor of a house (mounds created by the excavated earth) or the ground which is constantly moving horizontally with the season and changing its level, is the ground?

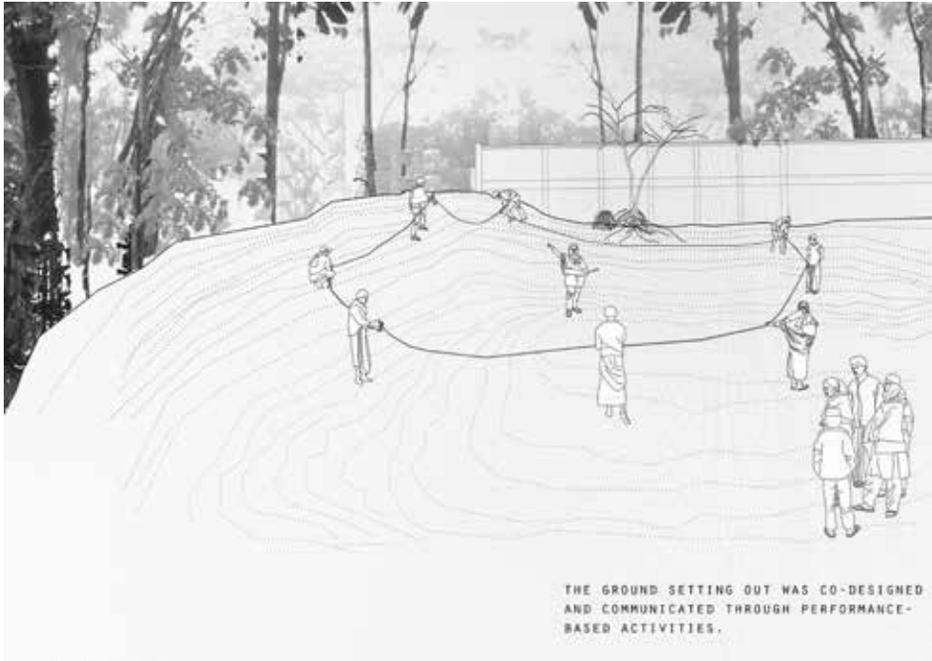
Fig.03. Photos taken over a period of time are of the same field and document human practices that adapt to the periodic decline in rice and fish farming as the ground responds to the changing climate in the Rajapur village.

## WHAT IS THE RELATIONSHIP BETWEEN THE GROUND, THE RAJAPUR CENTRE, AND THE BUILDING PROCESS?

As well as increasing environmental stress, the Rajapur community faces a lack of access to healthcare and education. The UK-based charity, The Manan Foundation Trust (MFT) was co-founded to address these issues. The Rajapur Community Building for Women's Literacy and Healthcare (the Rajapur Centre), was the self-generated, self-funded and participative, community-built project, to provide free healthcare and literacy classes. The project was developed as a series of inventive negotiations between the villagers and myself (an architect). This was an attempt to draw out local knowledge of adaptation to changing climate, seasonal ground, air and water and the community's response to these. Community workshops enabled me to understand local construction practices and skills of the communities to address climate calamities. It was revealed through the community's ethnographic storytelling of the site, that there is a relationship and connection between the seasonally shifting ground, the moving water, the migrating kingfisher and fish; illustrating the seasonal cycle of each to be intertwined with the climate, the landscape and each other.

During the wet season the site (the ditch) becomes submerged by water and during the dry season, the site dries out. In the dry season, we (community members and I) engaged with the ground, uncovering and reading watermarks on the ground that recorded how the flood levels rose. These marks were etched on the surface of the ground. As the site was a ditch, when we stood at the bottom of it (on the ground in this case), we could read a three-dimensional map of the rainwater levels, etched on the ground and leaving traces of watermarks within it. The incredibly rich depiction of the layers within the ground, the soil and the things which you would never know were going on under the soil, was made apparent to me, as the community members narrated stories about the site at different moments to describe how it changes throughout the seasons.

The migration is not just of isolated beings such as the kingfisher, the fish, the water etc. against a fixed ground, (Milligan, 2015), but the changing environmental conditions. Moving water, rain, air etc. are constantly facilitating the ground to migrate too. The collective migration of the ground, water, air etc. are patterned movement across space and time. The Rajapur community members have expressed that it is becoming increasingly difficult to predict this patterned movement, as the seasons, climate and the collective migration are now unpredictable.



## COMMUNITY ENGAGEMENT WITH THE GROUND, DESIGN PROCESSES AND THE BUILDING OF THE RAJAPUR CENTRE

My engagements with the community took the form of workshops, interviews, meetings and performance-based activities, and transforming this information to drawing, making and building with the communities of Rajapur village.

This research provided a valuable addition to the idea that has been explored in other disciplines but not so much in architecture, that human, non-human and the climate are entangled with each other (Ingold, 2015). The power of collective consciousness and the local understanding of the context lead to participatory architectural responses to the changing climate in the shifting grounds of Bangladesh.

With the community participatory groups, the design stage progressed during the dry season, through making physical prototypes, drawing sketches and by performance-based activities on site with ropes to co-design the spaces and demarcate the ground. Community members and I moved around the site and acted out a number of options for how the spaces in the building could be laid out. We performed architectural relationships with the ground as a way to communicate the design. Once we had decided on a layout, we had demarcated the spatial arrangement

Fig.04. Improvising performance-based participatory activities to communicate design on site and to engage with the monsoonal grounds.

by drawing on the ground, in space with a rope. The ground setting out was co-designed and communicated through on-site performance-based activities to understand the orientation of the sun, wind, direction of the cyclones and the driving rain, and also the community's social etiquette and gender segregation while using public buildings.

The design strategy that we agreed on was to raise the building above the ground to the footpath level. This would facilitate the continuation of the rich, collective migration of the seasonal shift of the ground, water, kingfisher, fish etc. to occur. This plays an important role in the village ecology. During the monsoon season, flooding is avoided as the building is raised and the rain is embraced and collected in the *pukur* below the building, to enhance the fish pond's eco-system.

Although the rich conditions of the ground in Rajapur village means that building with mud is the most appropriate building material option, this building practice is dying out and an old tradition observed by very few (mostly by low-income communities) in the village. However, the fertile ground also contributes to vast bamboo gardens in the village and all the bamboo used for the Rajapur Centre was sourced from a bamboo garden situated within 20 meters of the site. The transportation of the bamboo and sourcing this material was easy but convincing the village elders of the environmental benefits of building with bamboo was a difficult task. The elders in the community expressed that both mud and bamboo have a stigma associated with them; mud because it is seen as a material of the past and they felt it did not represent the future and bamboo because it is seen as a temporary solution as it rots fast in the humid conditions of Bangladesh. We found out at a community participatory meeting that a villager knew several methods of treating bamboo. Together we agreed on a method of treating the bamboo and hosted several bamboo treating workshops where a large number of villagers participated and were eager to learn how to ensure the longevity of the material.

At participatory workshops at an early stage of the project, we also discovered that the women in the village had the expertise to build with mud and understood the soil conditions, so they were invited to make the rammed earth bricks for the Rajapur Centre. However, due to cultural barriers to women working with men in public, the women's involvement at the construction stage was initially refused. To overcome the cultural barriers, we negotiated a system where the women made the earth blocks at home and the men working on site installed them. It was very important that the end-users (men and women in the community), participated both in the design and construction stage. Through the participation in the construction and the involvement in the design of the Rajapur Centre, the women and the community as a whole were empowered, and community-ownership was achieved.



Fig.05. Photo of a bamboo treatment and building workshop with the Rajapur community.

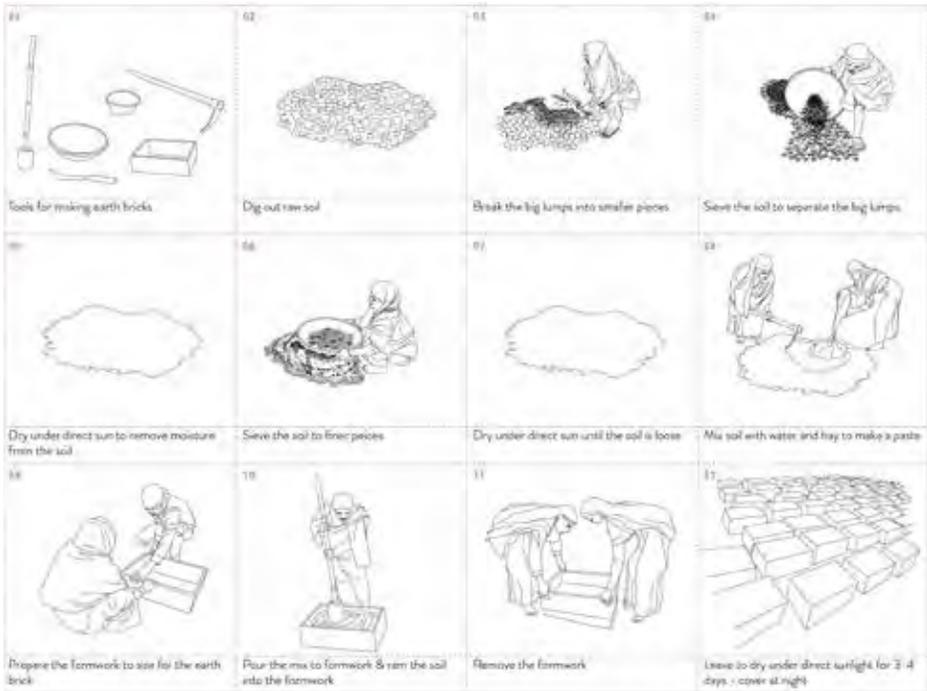


Fig.06. Diagrams of earth brick making process, led by the village women who have the expertise to build with earth.

Fig.07. The interpretations of the soil tests are driven mostly by local knowledge of the earth, the ground and by instincts of the women who engage with the ground daily and have a deep relation with it.

## GROUND TEST AND GROUND CONDITIONS

The ground in the Rajapur village needed to be tested for the suitability of the soil to produce the earth bricks for the building, to determine if the soil was the optimum condition and contained the correct balance of clay, silt, sand and gravel. As the ground is shifting with the season, the conditions of the soil is changes with it, therefore it is important to do the test just before using the soil for brick making. The timings of the brick making, and the soil test needed to be kept within the same season.

A simple test to evaluate the compressive capacity of the soil was undertaken at our earth brick making workshops, led by the women in the village. We used our hands, palms and fingers to press a small lump of earth, wet enough to be easily rolled on a clean surface. We were told that if the lump of earth required a lot of pressure to roll, it means the soil had a lot of clay and should not be used due to the potential risks of shrinkage. A medium pressure required to squeeze the lump of soil indicated adequate amount of clay and the soil was suitable for natural rammed earth bricks, while a very weak lump of soil indicated too much sand and very little clay, therefore unsuitable for use in natural rammed earth brick construction. The interpretations of the soil tests were driven mostly by local knowledge of the earth, the ground and by the instincts of the women who engage with the ground daily and have a deep relation with it.

The construction strategy we adopted for the Rajapur Centre, was to found the building on concrete stilts above the *pukur* and to construct the walls from rammed earth and bamboo, with a metal roof structure. This is one way that the villagers are now adapting to the changing climate (as the flood levels are increasing), by raising the ground level with manufactured bricks and building with mud and bamboo above the flood level.

The internal spaces in the Rajapur Centre, benefit from evaporative cooling through its special perforated bamboo and earth walls as it hovers over the *pukur*. Local materials utilised are intended to be resilient to the area's challenging climate; the high thermal mass of the rammed earth walls help combat extreme temperatures that can reach 45 degrees or above.

## CONCLUSION

As the ground is seasonal and shifting or migrating with the seasons, this means the balance of clay, silt, sand and gravel are constantly changing depending on the natural movement of the river-water which transports these elements. But there is also the human influence that shifts and forces migration of the ground. Human activities undertaken locally, such as the two large brick factories within a walking distance from the Rajapur village is an important influence, a control and intervention on the shifting ground. Can the human interventions of the monsoonal grounds of a small village in Bangladesh such as Rajapur, have a knock-on effect on the local climate (creating extreme micro-climates), the earth's physical process and the monsoon ecologies as a whole? The author Sunil Amrith describes the human local control measures to be not only leading to the alteration of the local, regional climate but having a global impact. The Asian monsoon is a complex global system and it is linked to other parts of the earth's climate; therefore, it is possible that aerosols over South Asia and China have global consequences (Amrith, 2018).

The situation in Rajapur highlights, the human, non-human and the climate are entangled with each other. Can it be assumed that it is not only the climate that influences the seasonal migration of the monsoonal ground, human and non-human adaptations to it, but it is also the human interventions and control of the seasonal migration of ground, that may be altering the climate itself? Therefore, the power of collective consciousness and local understanding of the context, through community participatory architectural responses to the changing climate, is of the most significant, especially in the context of the shifting monsoonal grounds of Bangladesh.

All photos and images are by the author.

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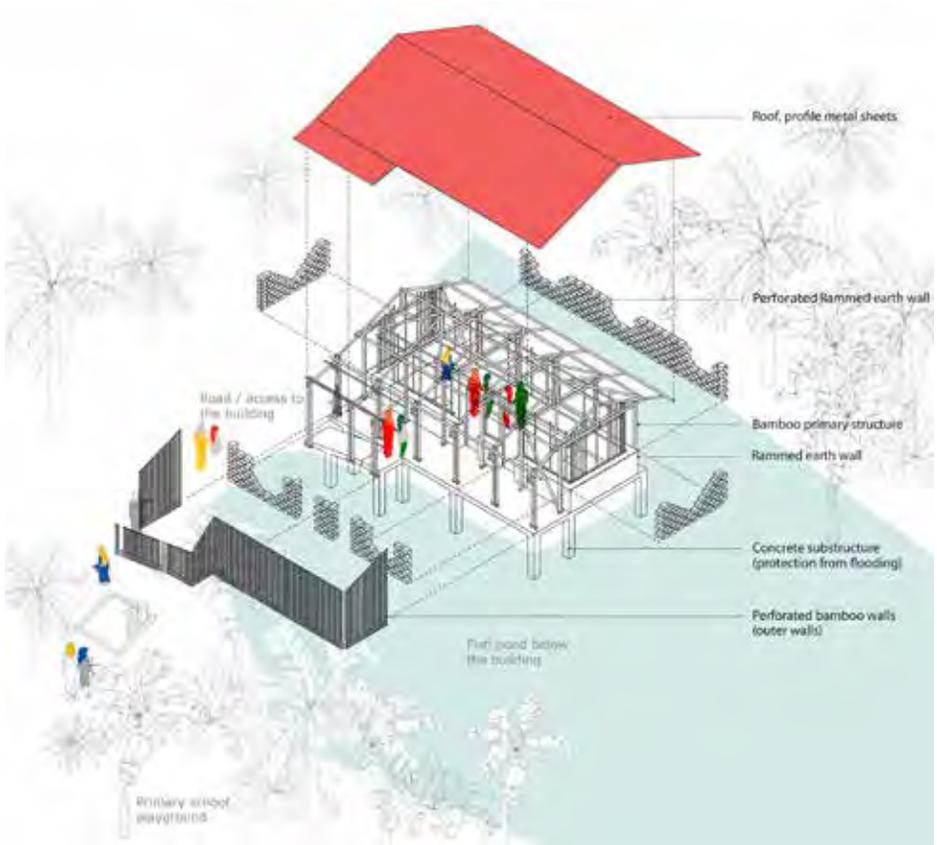


Fig.08. Exploded Axonometric view of the Rajapur Centre built above a *pukur*.



## MAKING GROUND AT CHAUNG GYI, MYANMAR

**Raymonde Bieler** was a MArch student at the University of Westminster (2017-2019). During her MArch studies she was a student in DS18, the studio aligned with Monsoon Assemblages. She was awarded the RIBA West London Architecture Prize in her first year for a project based in Bangladesh that examined the effect of salinity intrusion on the rural town of Mongla in the south west of the country. Making Ground at Chaung Gyi, Myanmar is her final year thesis project. She is currently working at White Arkitekter where she takes part in residential and urban realm projects with a commitment to environmental and social sustainability.

### PROJECT DESCRIPTION

At the centre of Myanmar flows the Ayeyarwady River from its source in the mountains of Kachin State to the Bay of Bengal. It is a river of high sediment transport, draining soft geological structures when the rains hit the mountainous rocks and transforming them into sediments deposited as silt along the river system. The settlement of sediments around the rivers is driven by the hydrological cycle of the monsoon and in turn influences the rock cycle and the land on which human non-human communities dwell.

Named by the local people the 'Dancing River', the Ayeyarwady is continually shifting, as sediment is transported during the monsoon season and land is lost due to erosion and deposited elsewhere. This movement of land is at the centre of the life of many communities living along the riverbanks. The fishing village of Chaung Gyi, situated where the river diverges into its delta, is particularly vulnerable to this process. At this point, the river speed slows down, causing erosion on one side of the river and depositing sediment on the other. In doing so, the river washes away the homes and infrastructure of the village; hence the community is continually rebuilding them. In this type of landscape, a riverbank does not exist as it is continually shifting. However, socially, the boundary between water and land has a lot of meaning for the everyday lives of those who live with its processes.

The aim of this project was to explore ways to accommodate the population of Chaung Gyi using the natural processes of the river, and to develop an institution to offer spaces for the community to take part in the planning, management and negotiation of the grounds they inhabit. The strategy was to harness and stabilise the transported sediment by anchoring it using retaining walls strategically placed in the river. The resulting new land is to be managed by a River Registry, a civic institution dealing with claims and negotiations over land. The Registry is located on the first island produced through this strategy and is a prototype to explore ways to build in this unstable terrain.

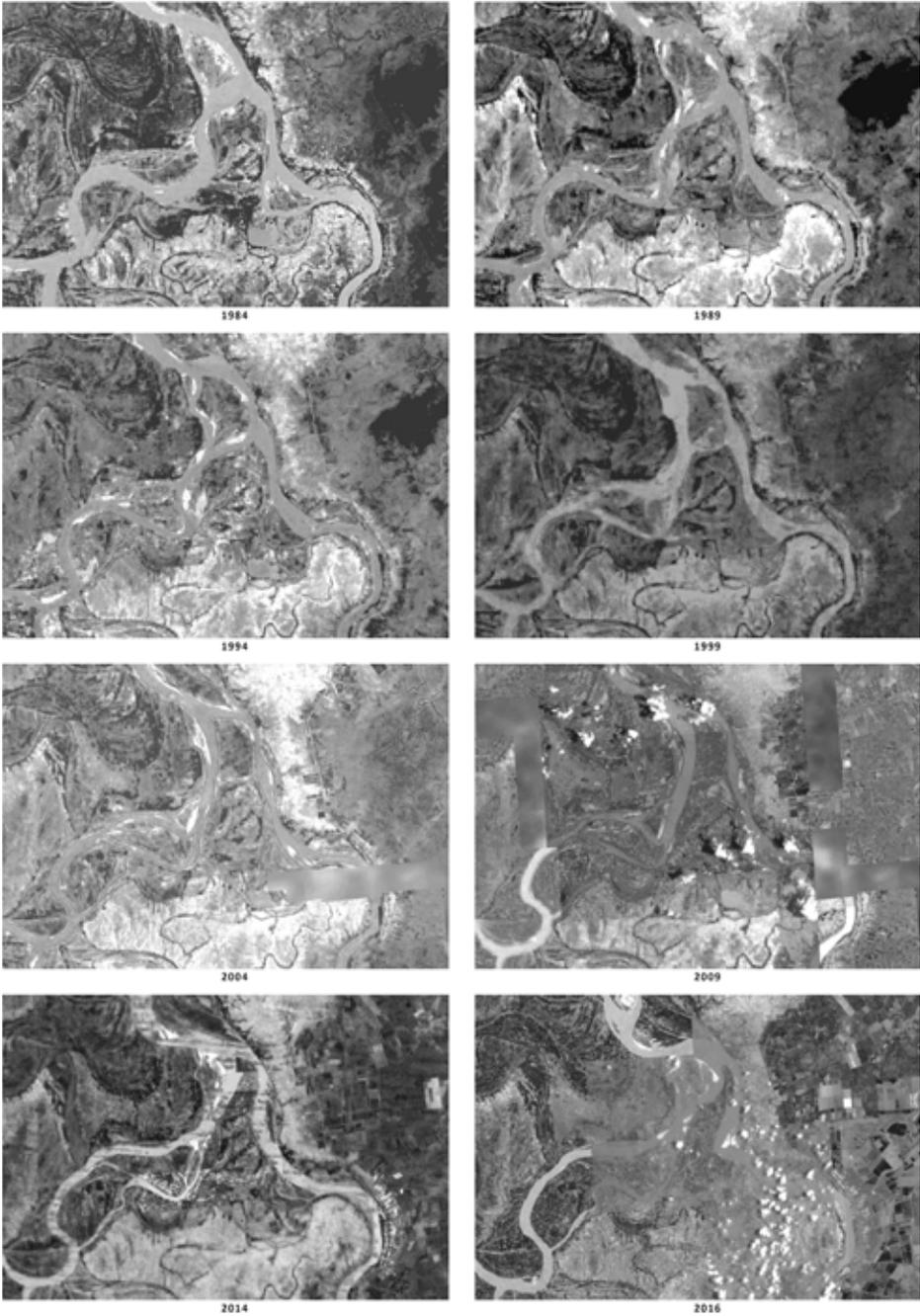


Fig.02. The shifting landscape of the village of Chaung Gyi. This collection of landsat imagery (1984 – 2018) shows the shifting of the Ayeyarwady River every year.

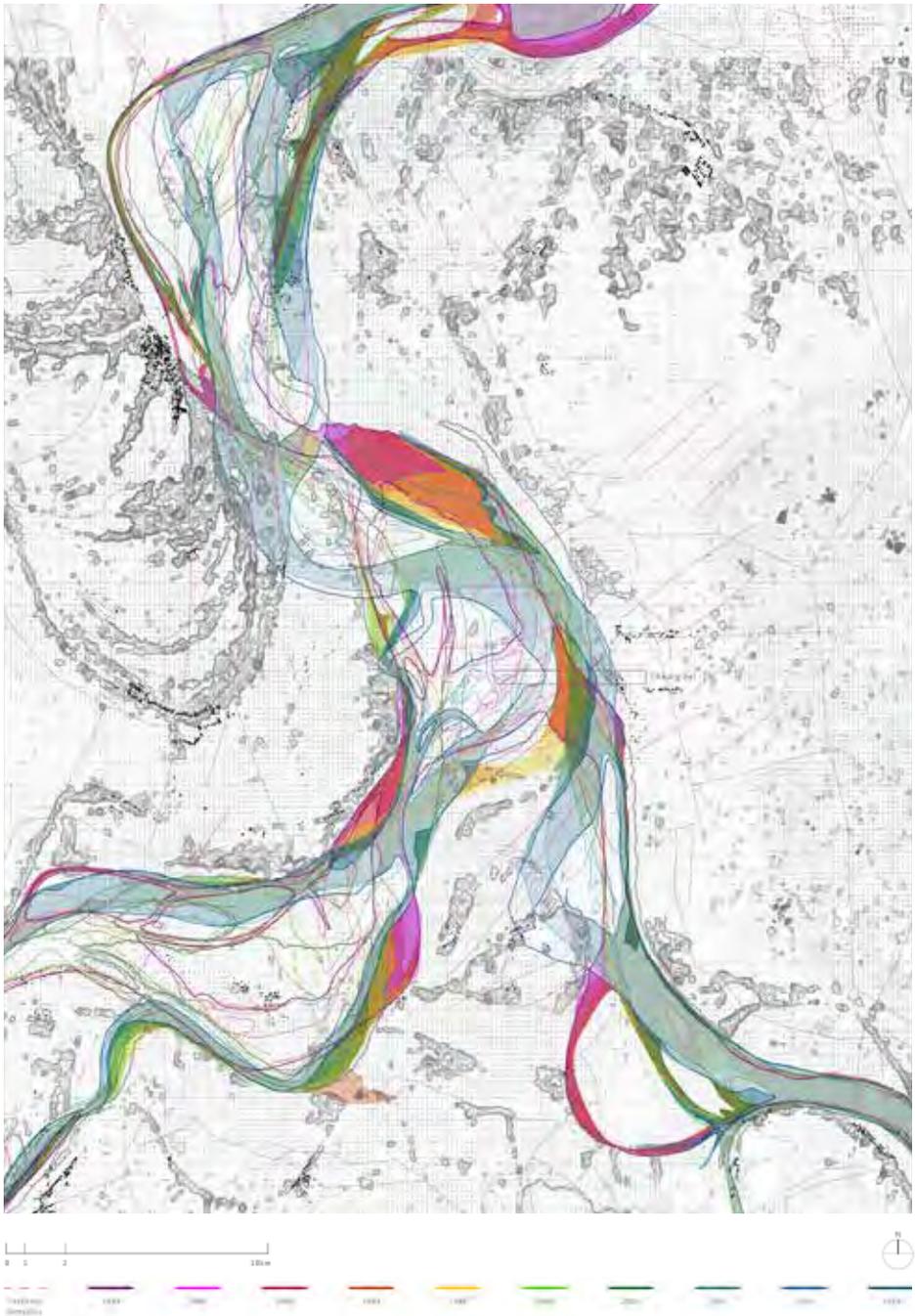


Fig.03. Historical trace of the Ayeerwady River.

The landscape around the village of Chaung Gyi is in constant state of change. The study of Landsat imagery (1984 – 2018) showed a loss of 0.7km of land, causing the village to regress further onto the land every year.



Fig.04. Marginalised communities, 2018.

The shifting of the river toward the village of Chaung Gyi and the use of the land for agriculture on the other side means those settlements do not have any more space to move on the land. This lack of space called for the exploration of new strategies to produce land for the affected communities. This became the central question of the design project.



Fig.05. River topography by the village of Chaung Gyi, 2018.

The topography of the river around the village of Chaung Gyi is highly dynamic. This map showing the river topography represents where the land is likely to grow in future years and sets sites for the implementation of the design strategy. The process of island formation occurs naturally in this part of the Ayeyarwady River. From 2004 to now, new islands have been formed. In a timespan of 10 years, the new land is used for agriculture and human settlements start occupying the islands.

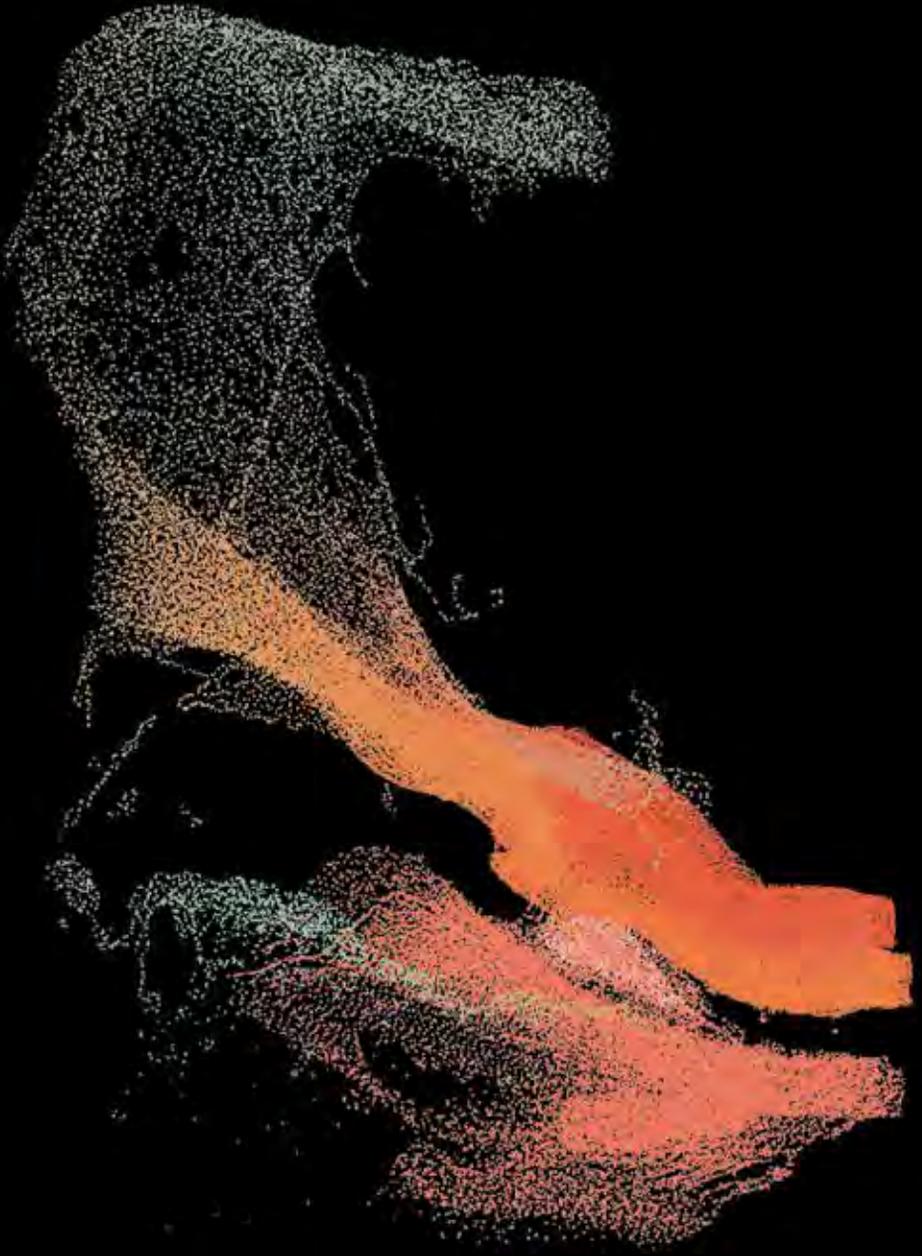


Fig.06. Simulation 1: Erosion  
Simulation of the movement of soil particles when hit by the  
water current. Software: Next Limit: RealFlow.



Fig.07. Simulation 2: Erosion + Deposition  
Simulation looking at the deposition of the soil particles after being transported by the water current. Software: Next Limit: RealFlow.



Fig.08. Test 1: Land Formation.

As a way of testing and developing an understanding of sediment/water/retaining wall relationships, I built a sediment box to model these relationships. The hypothesis was that obstacles alter the flow of the river, reducing its velocity and changing its direction, and that this enables the process of sediment deposition. The model allowed for the testing of different angled and sized obstacles and observing their effect on water flow and deposition. The result was photographed and digitalized for further analysis and used to inform the design.



Fig.09. Test 2: Creating the site.

The second test modelled the location of retaining walls in the flow of water to make ground to house a River Registry. This was done in three phases corresponding to the three components of the programme of the institution: the registry itself, a land archive and an assembly space. The process involved placing and clustering curved walls to protect areas of accumulated sediment and modifying the length of the walls in relation to the institutional programmes. Black sand was used to track the deposition of sediment.







Fig.10. (Previous) Fishing on the banks of the Ayeyarwady.  
Fig.11. The Chaung Gyi Archipelago Masterplan, 2045.

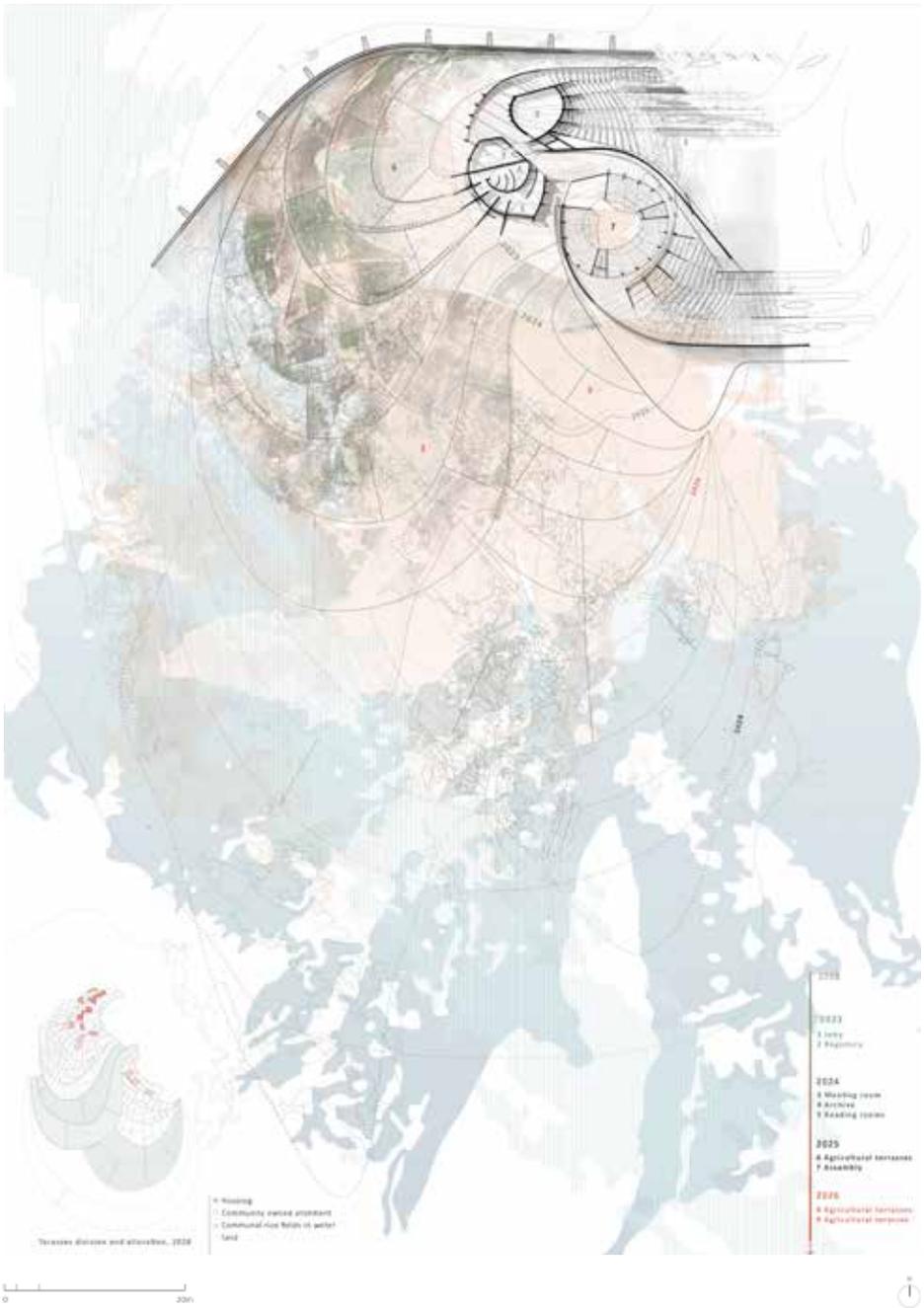
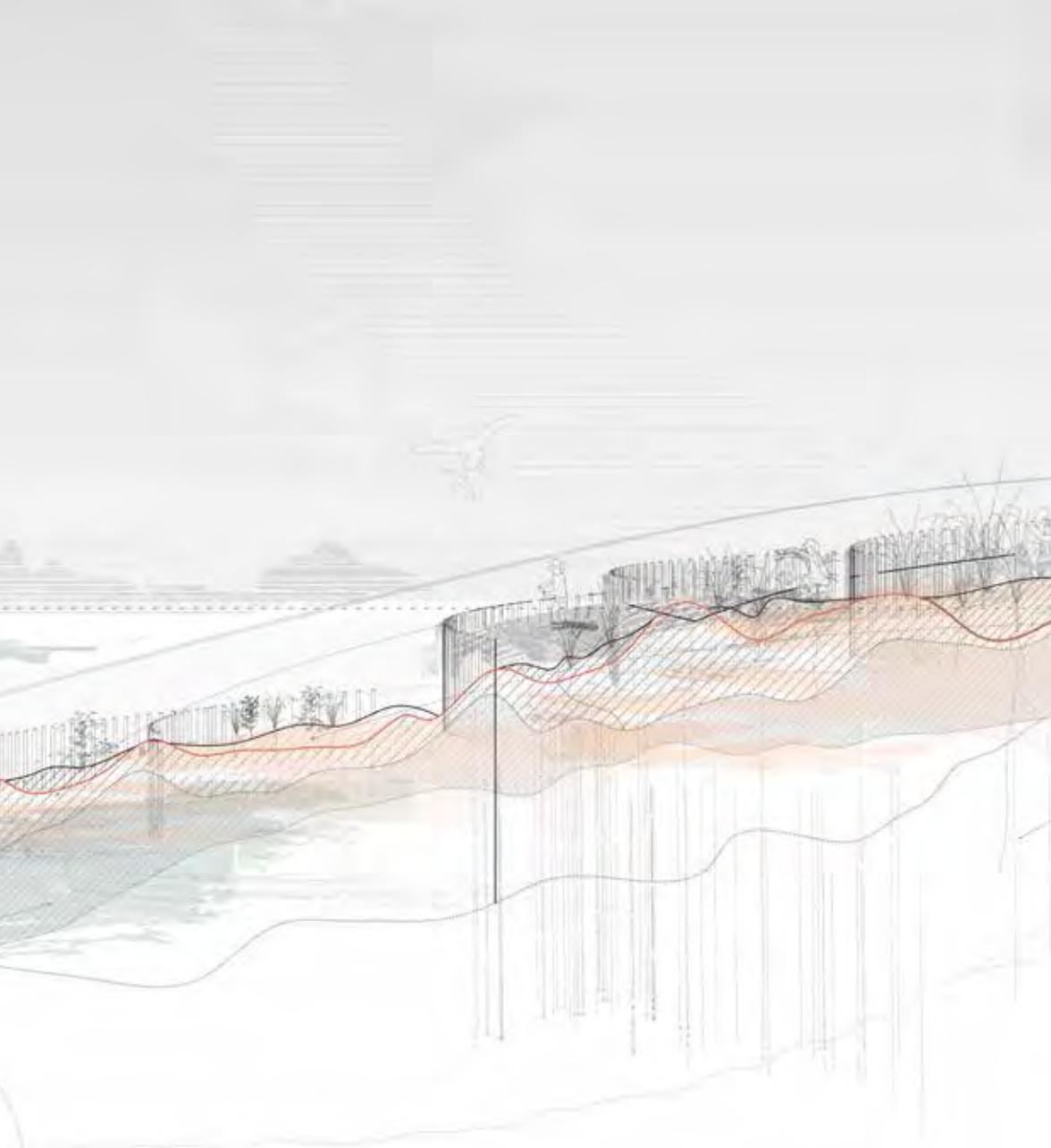


Fig.12. Plan of the Island of the River Registry, 2026.



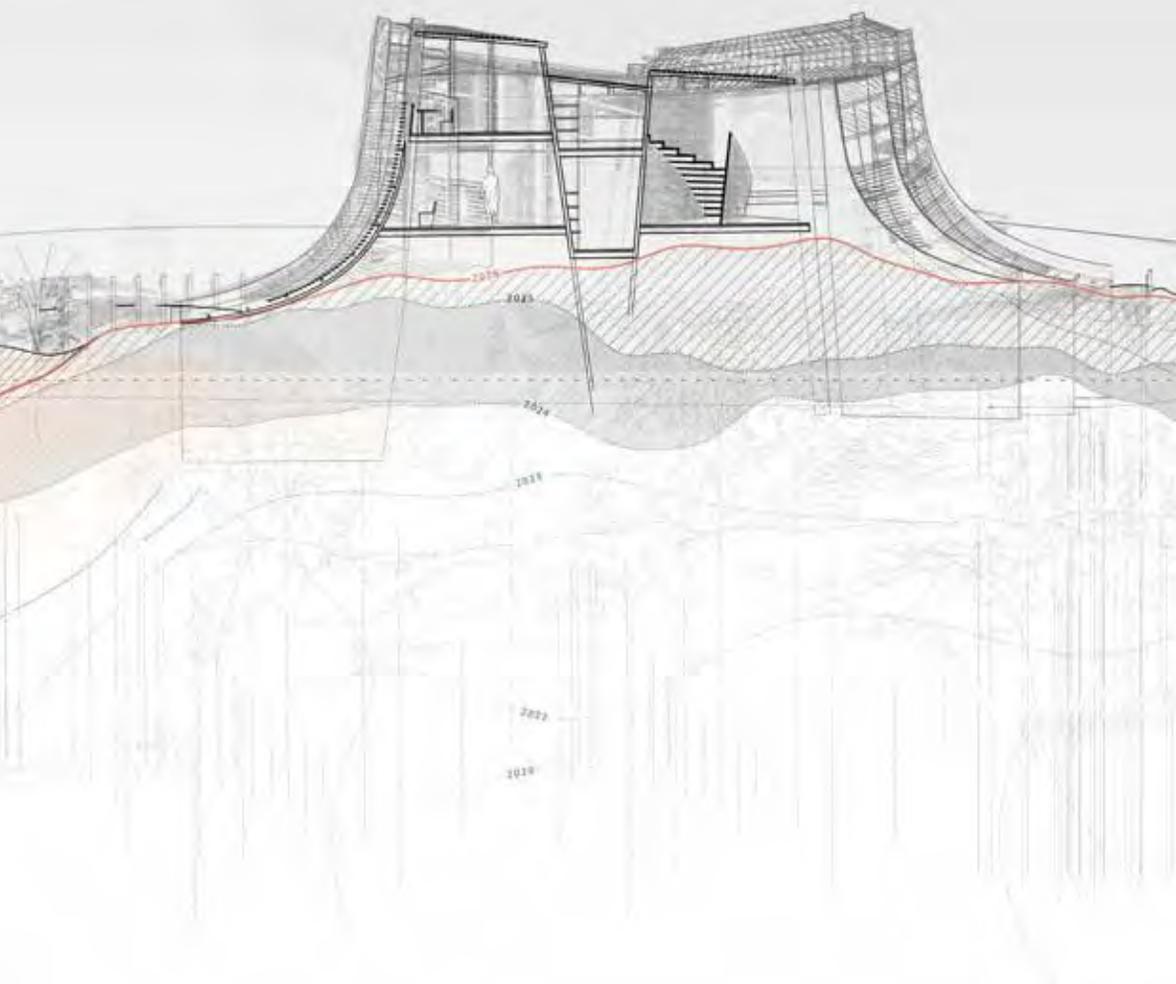
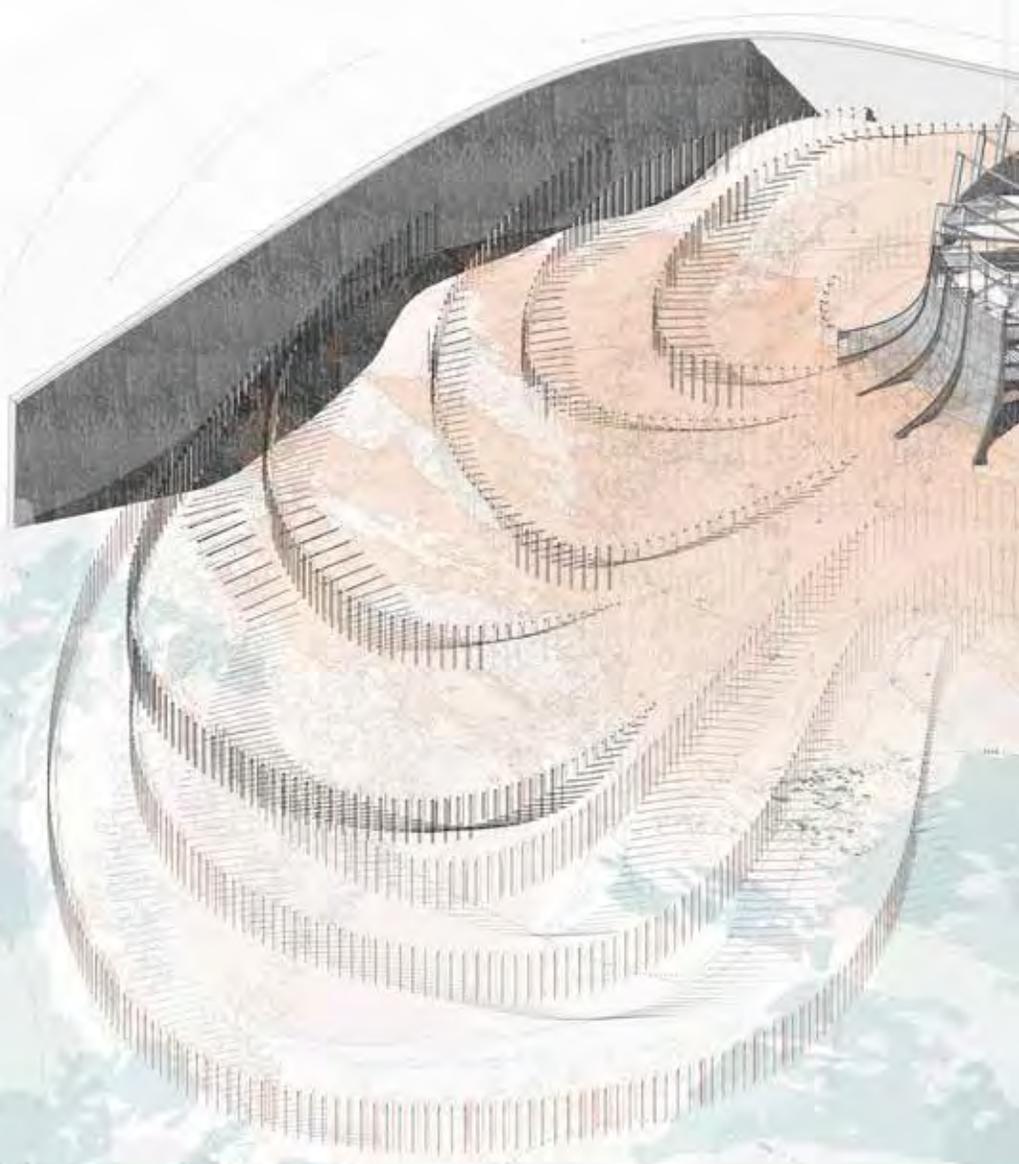
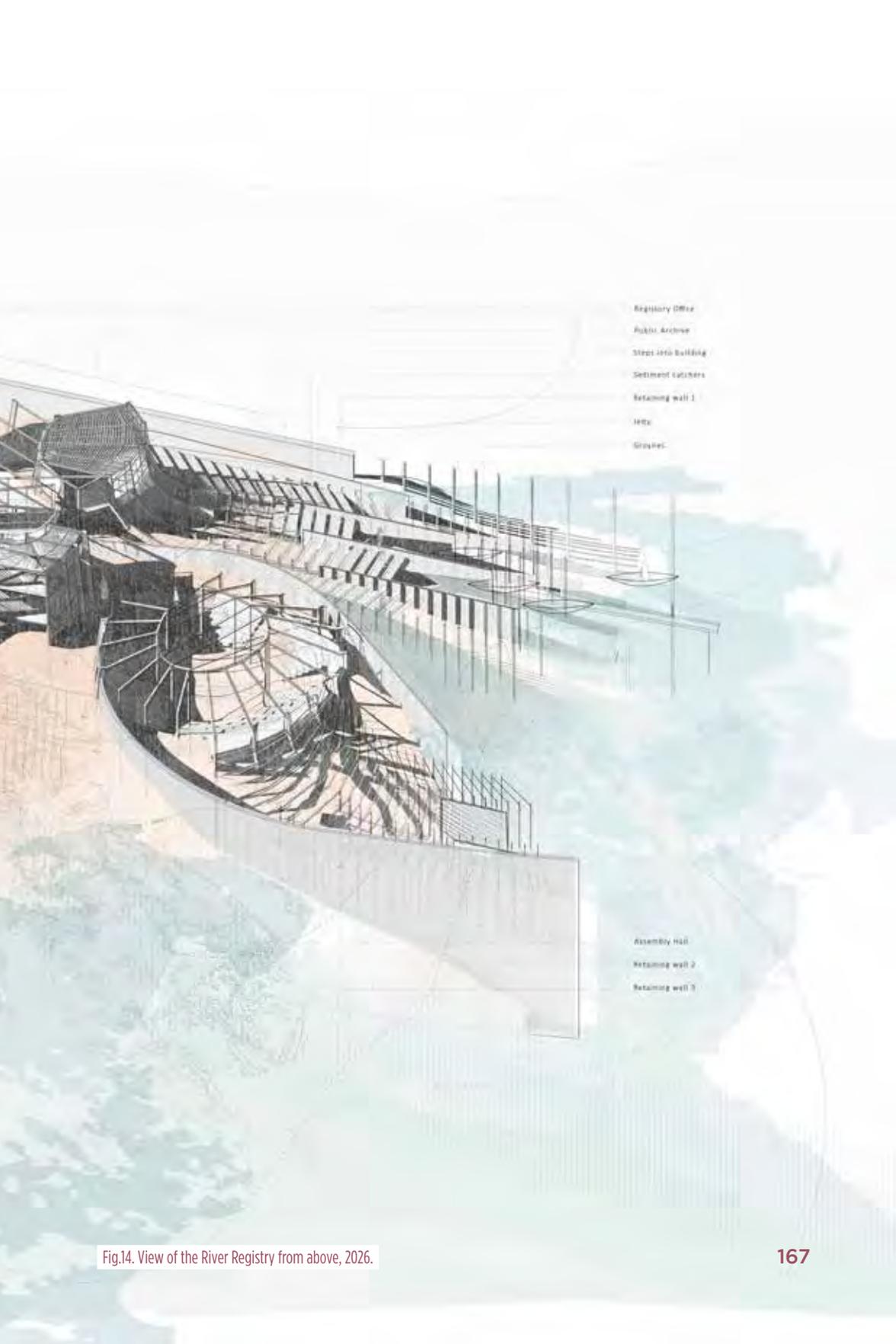


Fig.13. Section through the River Registry, 2026.



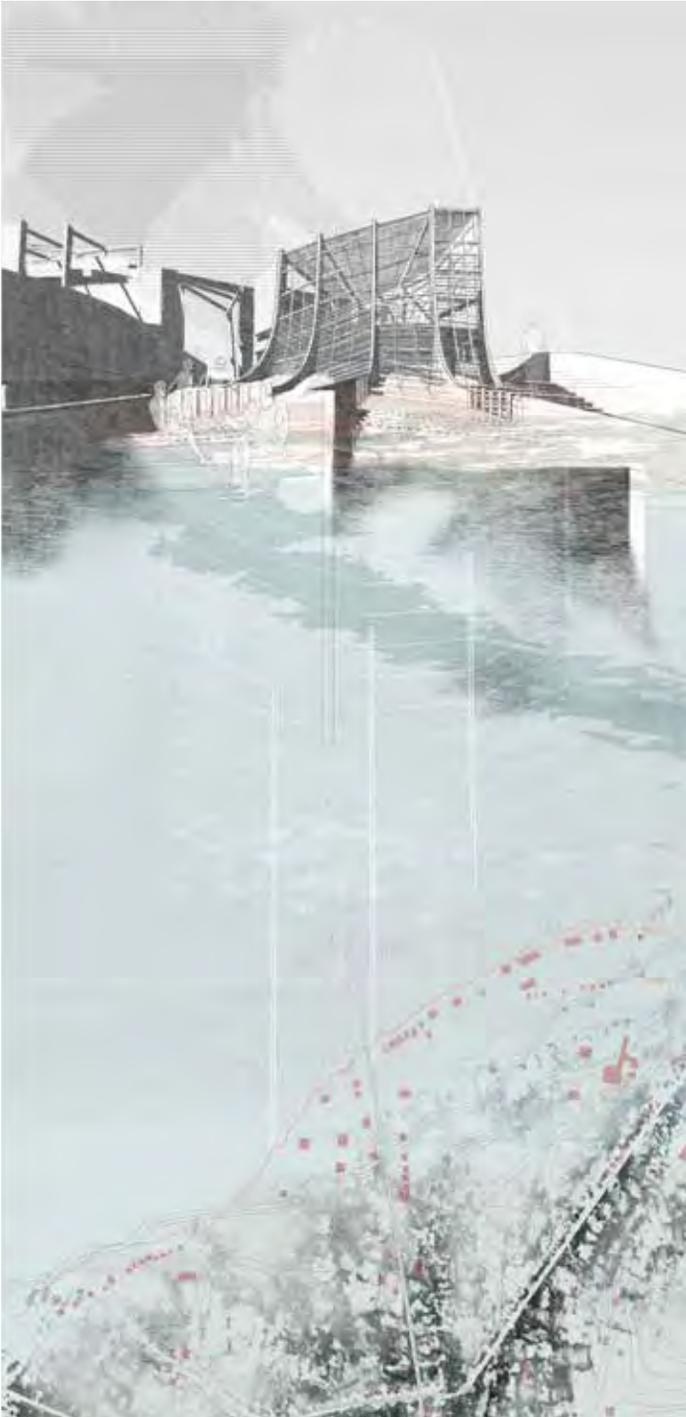
Agricultural terraces



- Registry Office
- Public Archive
- Steel Joint Building
- Settlement Catchers
- Retaining wall 1
- Jetty
- Groynes

- Assembly Hall
- Retaining wall 2
- Retaining wall 3

Fig.14. View of the River Registry from above, 2026.



## ACKNOWLEDGEMENT

This project was produced as part of the Monsoon Assemblages design studio at the University of Westminster in 2018/19. Monsoon Assemblages is a research project supported by the European Research Council under the European Union's Horizon 2020 research and innovation programme (Grant Agreement no. 679873).

All photos and images are by the author.

## IMAGE SOURCES

Fig.02. Google Earth. (2018). Myanmar 16.913858°N, 95.591094°W, 2D map, terrain imagery layer. <http://www.google.com/earth/index.html>

Fig.03. Google Earth. (2018). Myanmar 16.913858°N, 95.591094°W, 2D map, terrain imagery layer. <http://www.google.com/earth/index.html>

Fig.04. Google Earth. (2018). Myanmar 16.913858°N, 95.591094°W, 2D map, terrain imagery layer. <http://www.google.com/earth/index.html>

Fig.05. Google Earth. (2018). Myanmar 16.913858°N, 95.591094°W, 2D map, terrain imagery layer. <http://www.google.com/earth/index.html>





# **INFRASTRUCTURAL GROUNDS**



## BANGLA BRICKS: MAKING AND UNMAKING MONSOON GROUNDS

**Beth Cullen** is an anthropologist and Monsoon Assemblages Postdoctoral Research Fellow. Her work to date has focused on human-non-human relations using ethnographic and participatory visual and spatial research methods. Beth's research interests include environmental anthropology, more-than-human ethnography and transdisciplinary approaches for understanding and working with complex socioecological systems.



This photo-essay traces the life course of Bangladesh bricks to explore how the monsoon is enmeshed within built environments. It is based on ethnographic observations of brick making in Bangladesh, a terrain within which the monsoon is deeply implicated. Following the cycle of the brick from sediment to clay, from clay to brick and from brick to sediment reveals entanglements of weather, geology and human energies. The mobile materiality of the monsoon is entwined within the very building blocks of Bangladesh's cities and the infrastructures on which they depend.

## MONSOONAL BANGLADESH



In Bangladesh, and much of South Asia, brickmaking only occurs during drier months, the season of production being determined by the monsoon. In its simplest definition, the monsoon is a seasonally prevailing wind; in reality, a complex assemblage of air, humidity, pressure and precipitation. Nearly eighty per cent of Bangladesh's rainfall occurs during the monsoon, with little rainfall during the rest of the year, resulting in pronounced wet and dry seasons.



The oscillations between wet and dry seasons, caused by the movement of monsoon winds, have a profound influence on Bangladesh. Variations in rainfall create enormous hydrological fluctuations which periodically transform the environment. From November to March only a fraction of the land is covered in water, from June to September waters swell to cover almost half of the country. These monsoonal rhythms become entangled with social processes, materialities and practices, permeating and shaping ways of life and lived environments, as humans and nonhumans alike are caught up in the flows and fluxes of the weather-world.

## SEDIMENT TO CLAY



If we trace the brick to its material origins, we begin with weather. Brick making in Bangladesh is reliant on clay-rich soils extracted from the abundant alluvial floodplains of the delta. Clay, the essential element for brickmaking, is almost always formed through weathering. Largely found at the rock-atmosphere interface, most clay materials are the result of the erosive movements of wind, water and rain.



Much of Bangladesh consists of flat, low-lying alluvial plains, created by the gradual deposition of sediments by the mighty Ganges, Brahmaputra and Meghna rivers. These rivers are estimated to carry one billion tons of sediments to the Bengal Delta each year, most of which originate from the Himalayan mountains. Through their weathering by monsoon rains, Himalayan sedimentary rocks feed Bangladesh's humid floodplains and form the clay rich soils that become Bangla bricks.



The formation of clay soils is regularly interrupted by human interventions. Rapid urbanisation is contributing to soil loss as farmers sell their clay-rich soils to the brick kilns. The brick sector in Bangladesh consumes an estimated 45 million tons of clay every year. Due to the speed of urbanization, removal of topsoil for brickmaking is occurring at a rate that cannot compete with geological cycles. As a result, a renewable resource on human time-scales is becoming exhausted.

## CLAY TO BRICK



Brick making operates around a monsoonal cycle, beginning in November and ending in April before the first monsoon rains arrive. The monsoon creates a temporal structure as brick-making is timed to coincide with the driest part of the year. Brick kilns cannot operate during the wet season as frequent rain, high atmospheric humidity and reduced sunlight affects the drying and firing of bricks



During the monsoon waters rise submerging the brickfields, which are often constructed on low-lying land which is cheaper to buy or to rent because of the seasonal flooding. Brick fields become deserted as they transform into pools of water, the slumbering columns of chimneys reflected in their surfaces. The price of brick increases during monsoon months as brickfields splutter to a stop, reducing supply and stalling construction.



Clay soils are collected during the wet season in preparation for the dry season. Open-air stockpiles sit throughout the monsoon months, exposed to the action of the atmosphere. Rainwater spreads through the body of clay, diffusing and softening it. The action of wind, rain and air make it pliable for moulding, reducing human labour. Once the rains draw to a close, the water levels slowly start to recede, exposing the brick fields and allowing the brickmaking cycle to begin again.



Brick-fields churn relentlessly in the dry season. Bricks are made by hand, sun-dried, fired and then cooled. Balls of tempered clay are thrown forcibly into wooden moulds before being skilfully turned out onto sanded, levelled ground. Moulding is repeated through rhythmic replications producing endless rows of unfired, green bricks are left to dry in the sun until they are firm enough to be fired, the drying dependent on circulations of the atmosphere



Each brick is formed through heavy, repetitive work, coming into being through the respirations, pulses and circulations of the bodies that make them. Each brickfield a complex choreography between bodies and materials, within which multiple rhythms are interwoven. These rhythms include the movements of seasonal migrants on whose labour the brickfields depend. Migration being a response to a dynamic monsoonal environment that requires mobility for survival.



Brick production contaminates regional and urban atmospheres. Plumes of black smoke, blankets of thick smog and clouds of brick dust flux with the seasons. Concentrations peak during December and January, due to the slow-moving winds during these months. Particulate pollution causes respiratory conditions, hinders plant growth, pollutes soils and erodes building surfaces. Pollutants become entangled with atmospheric circulations, contributing to changing monsoon weather patterns, impacting the human and nonhuman lives enmeshed within them.

## BRICK TO SEDIMENT



After firing, bricks are classified and allocated for use in buildings and infrastructure. A large proportion are overfired so they are broken down into small pieces called pickets. Crushed bricks are used as fill material and form a base layer for nearly all paved roads in the country. Roads are typically constructed on top of embankments to raise them above wet season flood levels. Overfired bricks that have been subject to intensities of heating are used as aggregate to elevate roads and protect them against intensities of wetness.



Construction of all-weather roads is a priority for Bangladesh as they allow movement in all seasons, their presence, facilitating the movement of people, goods and materials. Although roads create new geographies and lines of relation, they can also contribute to unexpected and unplanned flows and resistances. The majority of roads in Bangladesh do not have adequate drainage facilities for flood water, meaning flows of water and sediment are obstructed. Road infrastructures, enabled by the brick, impose inflexible linear forms into a fluid landscape.



Most roads in Bangladesh experience regular deterioration during the rainy season. Seasonal fluctuations of wetness cause clay soils to shrink and swell, weakening road foundations. Cracks allow water to seep inside, small cracks become large potholes which are worsened by the pummelling of traffic, wind and rain. Through weathering and disintegration brick returns to sediment, creating seasonal cycles of maintenance, fuelling the never-ending demand for brick.



Following the materiality of the brick reveals the multiple ways in which the monsoon is enmeshed within lived environments in Bangladesh. Bricks come into being not through human agency alone, but through entanglements of geology, weather and human energies. Weather contributes to the emergence of bricks, their production, use, and dissolution. Far from being a disconnected backdrop to social life, meteorological forces are co-constitutive of social worlds, moving through them and the materials that compose them.

### **ACKNOWLEDGEMENTS**

This work was conducted as part of Monsoon Assemblages, a research project supported by the European Research Council under the European Union's Horizon 2020 research and innovation programme (Grant Agreement no. 679873).

All photos and images are by the author unless otherwise indicated.

## THE YANGON PIPELINE PROJECT

**Raphaël Monnier** is the co-founder of Blue Temple, an architecture and urban planning company based in Myanmar. Blue Temple has initiated a series of innovative public space designs intended for community development. Through participatory processes with local architecture university departments and communities, their projects propose incremental upgrades, exploring how architecture can provide a positive impact on the city and serve low-income neighborhoods. Starting as workshops that engage in critical and creative thinking, the initiative strives to push the ideas as far as possible, hoping to one day get built.

### CONTEXT

In 1940, during English colonial period in Burma, using British engineering and American technology, a new water distribution network was created for what was then Rangoon (Yangon). Starting at the water treatment centre adjacent the Gyo Byu water reservoir, a 60km long steel pipeline was built all the way to Yankin Township in Yangon. Along the pipeline, a 16m wide corridor was kept intentionally vacant to allow for potential maintenance and repair of the infrastructure. Originally dividing the landscape, the 1.6m diameter structure became an opportunity for informal settlers, evicted from previous parts of the city as it was developed, to seek shelter within the corridor, and in some extreme cases on the pipeline itself. The pipeline has become today a community centre, a landmark for the neighbourhood, a pedestrian walkway, a symbol of hope for a better future and an opportunity to develop a micro-economy.

Urbanism is a global phenomenon expressed differently across each country and city. There are no universal textbook guidelines, each context needs its own tailored strategy. Slums are a global phenomenon in the developing south, while some governments see them as a problem to be solved; community architects believe they are the starting point of people-led solutions to the housing crisis. Within the context of Myanmar, slums (*Kyuu Kyaw*) are repeatedly brought up as a major concern and prejudice stigmatises their contribution to the betterment of a neighbourhood and the city as a whole. One very unique slum formation in Yangon is located in Yankin Township north of Yan Shin Street along the pipeline. It caught our attention because it fundamentally questioned the generic urban layouts of cities, the role of architects and urban planners as technocrats or catalysts for change and the tendency to isolate land uses, such as residential, public infrastructure or commercial uses into well-established zones within the city master plan. Pushing for more porosity and malleability in the urban fabric, its unique condition allowed for more synergy between the different urban functions.



Having lived for a while in a colonial social housing building in Yankin Township right aside of the pipeline, I was always intrigued by the way the community was naturally gravitating around this industrial piece of infrastructure. When talking to the community, they would describe it as being an important part of the neighbourhood, almost like a civic centre. Every morning and night, I started taking the habit of walking on top of it; very quickly did I realize that many other people would also be walking on it, kids from the neighbourhood dressed in their uniforms to go to school, workers to head for the construction site, others would carry their groceries from the local market; at night time, couples would date, friends would gather to sing and play guitar. Even, one of the adjacent restaurants was named *Pyi Lon Gyi*, 'The Great Pipeline.' This really showed me the importance the pipeline played in the area. It started standing out to me as a landmark in the neighbourhood. Having walked on top of the pipeline all the way to the airport, I realised that the it goes through a very rich diversity of urban landscapes - middle class residential areas, schools, urban farming, industrialised area, slums, and many more. This walkway acts like a pedestrian highway that cuts through the urban fabric of the city. Seeing this pipeline as an artery streaming though the city tissue, the idea of urban acupuncture came in mind. Perhaps we could propose a series of temporary bamboo architectural interventions that could punctuate the linear narrative and respond to the different dynamics of their immediate context.



## UNIVERSITY DESIGN WORKSHOP

The project started with a two week long academic workshop in 2018. Participating students came from departments of architecture at Yangon Technological University (YTU), STI Myanmar University, Mandalay Technological University (MTU) and West Yangon Technological University (WYTU). The students were a mix of undergraduates and graduates, from Yangon and Mandalay. They were divided into five groups, each group designing a separate intervention in a different context along the pipeline. During this workshop, professionals (urbanists, landscape designers, architects, sociologists, designers, policy Think Tanks) came to give lectures and feedback during the daily group sessions. This was an opportunity to help bridge the gap between the academic world and the professional world of architecture in Myanmar.

Fig.02. Daw Khaing Moe Nyunt (Deputy Director, Urban Planning Division, Assistant Head of the Department, City Planning and Land Administration Department, Yangon City Development Committee) giving her feedback during the workshop's final presentation. Photo: Matias Bercovich.



## VISIT OF SAYADAW ASHIN OTTAMATHARA

Upon our invitation, Sayadaw Ashin Ottamathara, founder of Thabarwa Meditation Centre in Thanlyin came to visit the Gyo Byu pipeline in April 2019. We started by walking in the Kyuu Kyaw along the pipeline, talked to some home dwellers living there, getting to understand the situation. Then Sayadaw gave a dhamma talk that was followed by an open conversation at the local community center. Sayadaw He elaborated about more inclusive development, accepting low-income families into our communities and neighbourhood, building better relationships and making good deeds. Having this very influential figure come and physically walk on the pipeline was incredible. The stigmatised and marginalised communities had never received this kind of attention before. The point of the event was to give hope to these families that a brighter future was possible and to change the mind of the government that did not recognize them as an inherent part of the city. If the city government does not listen to foreign architects, they might listen to local Buddhist leaders, we hoped!

*The pipeline is the bloodstream of Yangon. It's beyond being valuable, it's too old. Everyone in the city uses water carried by the Gyo Byu pipeline. We welcome the idea of creating a green space along the pipe, and we should think of ways to welcome the Kyuu Kyaw rather than pushing them out.*

*(U Shwe, aged 72, who has been working as a barber in slum along the pipeline for nearly 40 years)*





Fig.04-07. Photos: Matias Bercovich.



## SCHOOL PLAYGROUND

The idea behind the design of the playground is to serve two different functions. On the one hand, it serves the school children as a play structure, on the other, it lights the Gyo Byu pipeline, making explicit that the pipeline is a public space and therefore requires public amenities such as lighting. The structure is an interactive surface over and under, a sort of ribbon that starts as a floor and morphs into a roof, along of which has been built a parkour circuit that will include, sitting, climbing, monkey bars, swinging ropes, hanging tires, and more. Following the curvature of the structure, the 6-meter high bamboo construction also supports LED lighting. Orientated towards the West, onto the Gyo Byu pipeline, this feature is a way to make the pipeline safer to use at night time and gives it an elegant touch as a distinct element along the linear corridor. Apart from creating a unique and beautiful environment for the children of the school, the playground acts like a showroom for the local community to witness and understand the scope and intention of the overall project. This support and trust will be greatly needed during further construction along the pipeline, getting the community more and more involved in the implementation of more public space. This bamboo landmark will also be able to provide the necessary public attention we need to go forward in the project and get the construction permits for the other modules.



## URBAN FARMER'S MARKET

This pavilion was designed by Kristof Crolla, Associate Professor of Architecture at the Chinese University of Hong Kong and director of the Laboratory for Explorative Architecture & Design Ltd. (<https://l-e-a-d.pro/>). Taking advantage of a thorough understanding of the structural and bending capacities of bamboo, it comprises a shell structure that Stretches 15m along the pipeline, providing shade and shelter from the sun and rain for a vegetable market. The implementation of the project is intended to push the boundaries of bamboo construction, mixing together high-tech design with local low-tech fabrication processes, the design is made in Hong Kong using high-performance parametrical tools to generate the 'bending active bamboo shell structure' and is intended to be built in collaboration with local bamboo technicians in a real context, supporting an actual program that functions within the social ties of the local community. The theory, prototyping and first experimented pavilions were developed during Crolla's (2018) PhD thesis, 'Building Simplicity: the 'more or less' of post-digital architecture practice.' The proposal not only supports local urban farming around the pipeline but also encourages it by promoting the benefits of farming for better urban resilience. During the wet season in Myanmar, flooding often occurs and instead of pushing away the water into the not so well-maintained drainage system of the city, farming rice or watercress is able to deal with the problem locally and relieve the pressure inflicted onto the drainage.



### **HOMELESS SHELTER / ZAYAT (TRADITIONAL BURMESE RESTING AREA)**

Designed by MLKK (<http://mlkk.studio/>), an architecture and interior design company in Hong Kong, the challenge of designing this pavilion was to create a single structure in which hybrid program intertwine coherently and harmoniously with each other. Located at the crossing of different pedestrian walkways, the pipeline and the road sidewalk, this structure will act as a needle in urban acupuncture, better connecting different networks and revitalizing the area. This shelter will not only provide more decent living conditions for the homeless family that has been staying under the bridge for the past 5 years, it will also provide space for a tea shop and a coconuts shop so that the family can make extra income. The passersby will be able to relax under the roof while looking at the pipeline that meanders into the landscape.

### **PLOT A,B AND C**

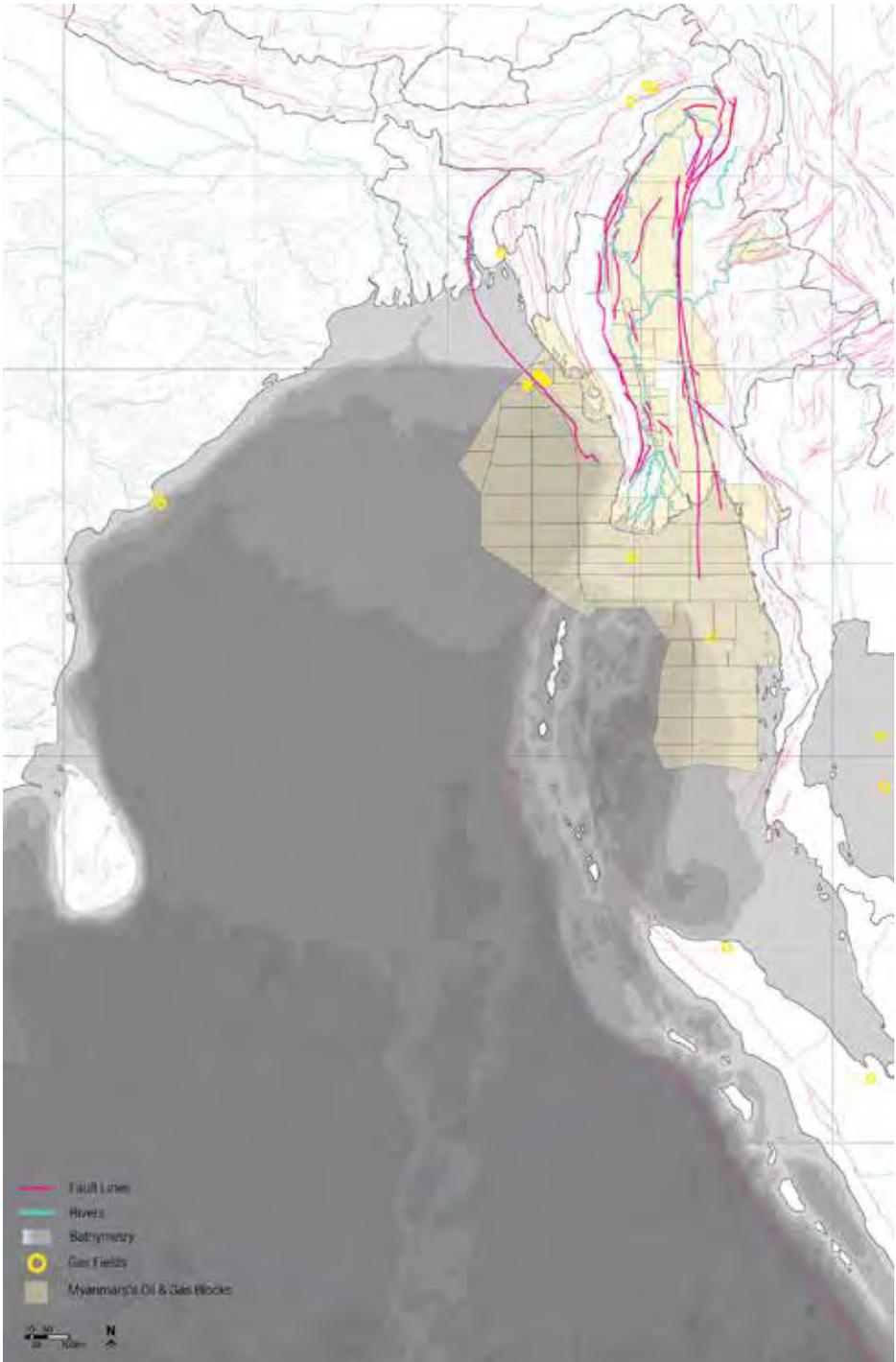
The future of the project today relies on this site, Owest of Golden City Condo, along a rainwater drainage canal. It was recently identified to merge with the Yangon Pipeline by the local community and government representatives to be developed as a public space using only bamboo as a construction material. Our students from the Master's Program Arch72009 'Design Studio II' course are currently designing the 'bamboo pavilions' for the site. Each plot of land has been allocated to a cluster of students, each cluster is led by a guest international architect.

All photos and images are by the author unless otherwise indicated.

### **REFERENCE**

Crolla, K. (2018). 'Building simplicity: the 'more or less' of post-digital architecture practice'. Unpublished PhD thesis. Melbourne: RMIT. <https://researchbank.rmit.edu.au/view/rmit:162514>





## THE SHWE RECUPERATION CORRIDOR

**Fiona Grieve** was a MArch student at the University of Westminster. During her MArch studies (2017-2019), she was a student in DS18, the studio aligned with Monsoon Assemblages. Through her studies she has developed an interest in social injustice, centring both her thesis design project, presented here, and her dissertation research on the changing conditions of the modern world and its impact on humans. She was awarded a RIBA Presidents Medal Commendation for her dissertation titled 'The Reception of Refugees in the UK.' She is currently working for Scott Brownrigg design practice as a member of their commercial team.

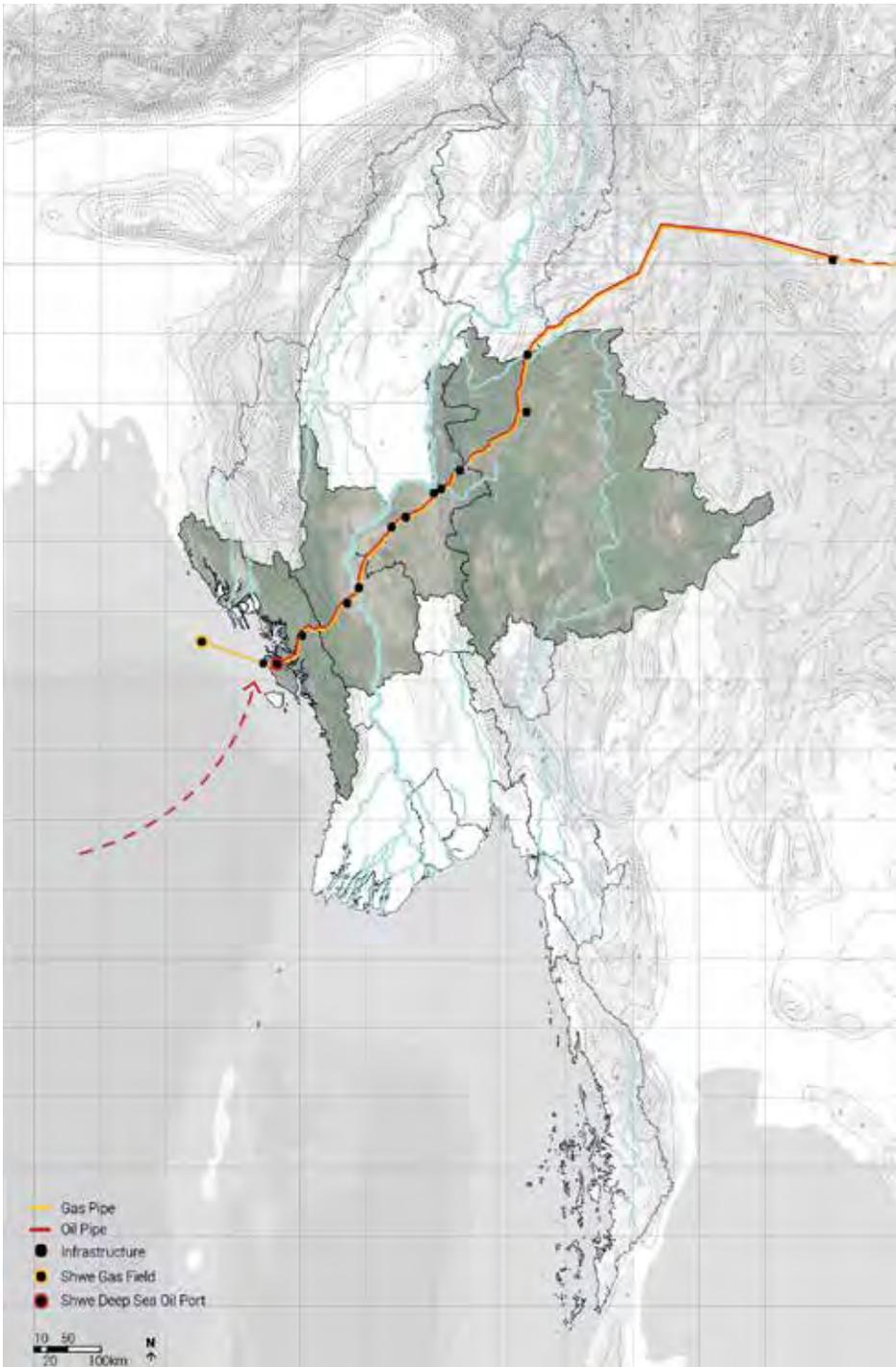
### PROJECT DESCRIPTION

Fossil fuels have long been a driver of the rapidly changing climate in which we live. The overwhelming human demand for them has led many countries, rich in natural resources, to sell huge areas of land without due consideration for the destructive consequences. The influence of fossil fuels is not only causing global warming and extreme weather events but is also shaping the land on which we live. A need to transport fossil fuels in the form of oil and gas, has seen whole countries pave the way to accommodate the infrastructure required to do so.

This project explores a pipeline traversing the breadth of Myanmar whose economic value has been deemed of more importance than its detrimental impact on the land and livelihoods of those who live alongside it. The Myanmar-China pipeline has warped the surrounding landscape on which millions of people have relied for hundreds of years. The need for fuel in China has created a huge pathway of deforestation, land erosion, blocked water sources and destroyed habitat in Myanmar.

Myanmar is situated on and in close proximity to clusters of geological fault lines in the Bay of Bengal, the Ayeyarwady River basin and the Shan Plateau. These fault lines provide Myanmar with a rich reserve of oil and gas that has formed the basis of one of the oldest petroleum industries in the world. Years of military rule deprived Myanmar's people of the benefits of its natural resources. With the 2011 reforms, President Thein Sein pledged to change the management of Myanmar's natural resources. Since the reform the auctioning off of oil and gas blocks both on and offshore have brought an influx of international investment in both extractive and transportation infrastructure.

This project explores the use of the pipeline as a tool for reform and compensation through a network of infrastructures that harness the waste energy of the fuel transportation process. The corridor provides a non-biased system that forces an interaction with the flows of fuel that is being pumped through the ground and provides a tribunal platform to see justice for the destruction caused in the quest for energy.



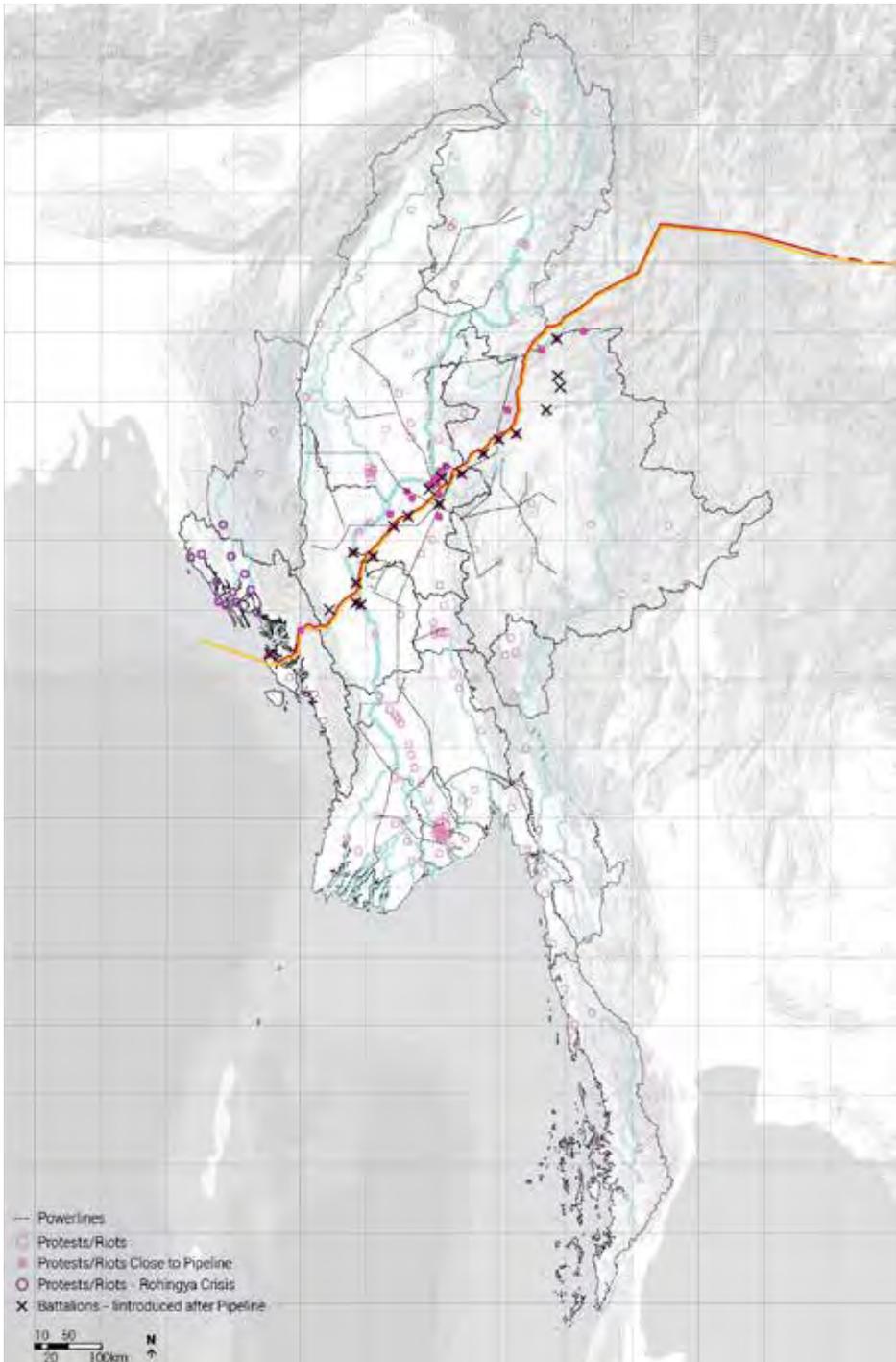
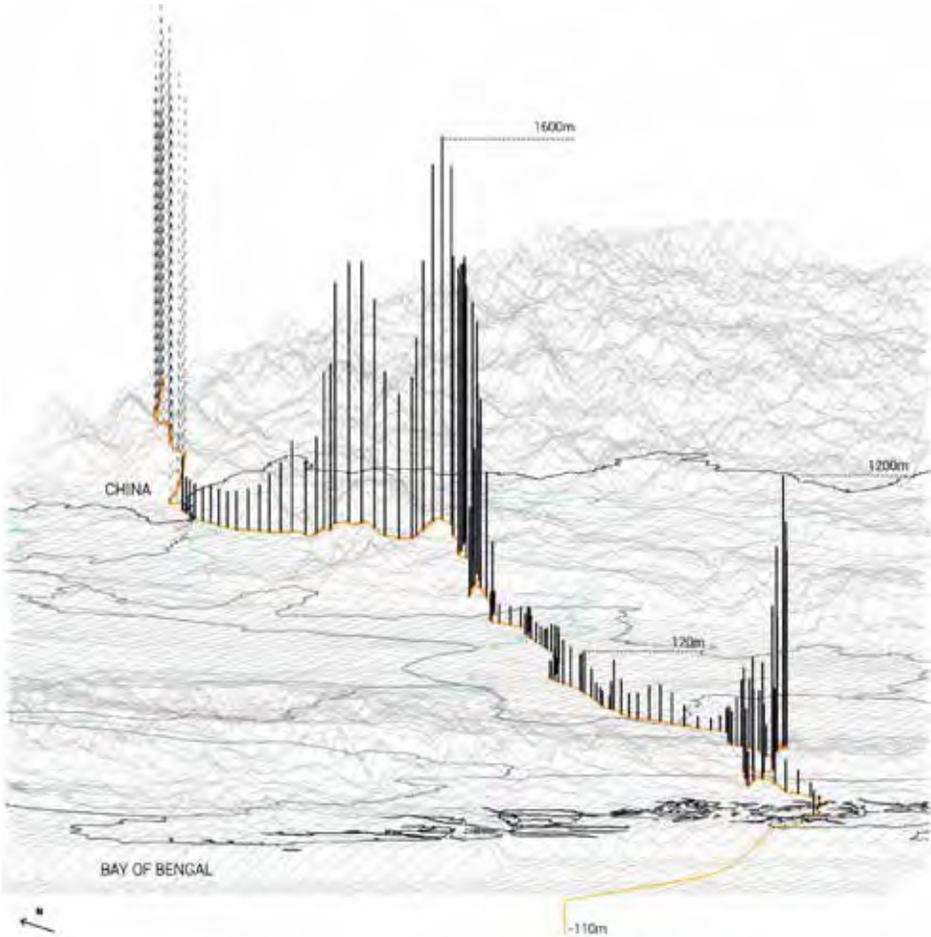
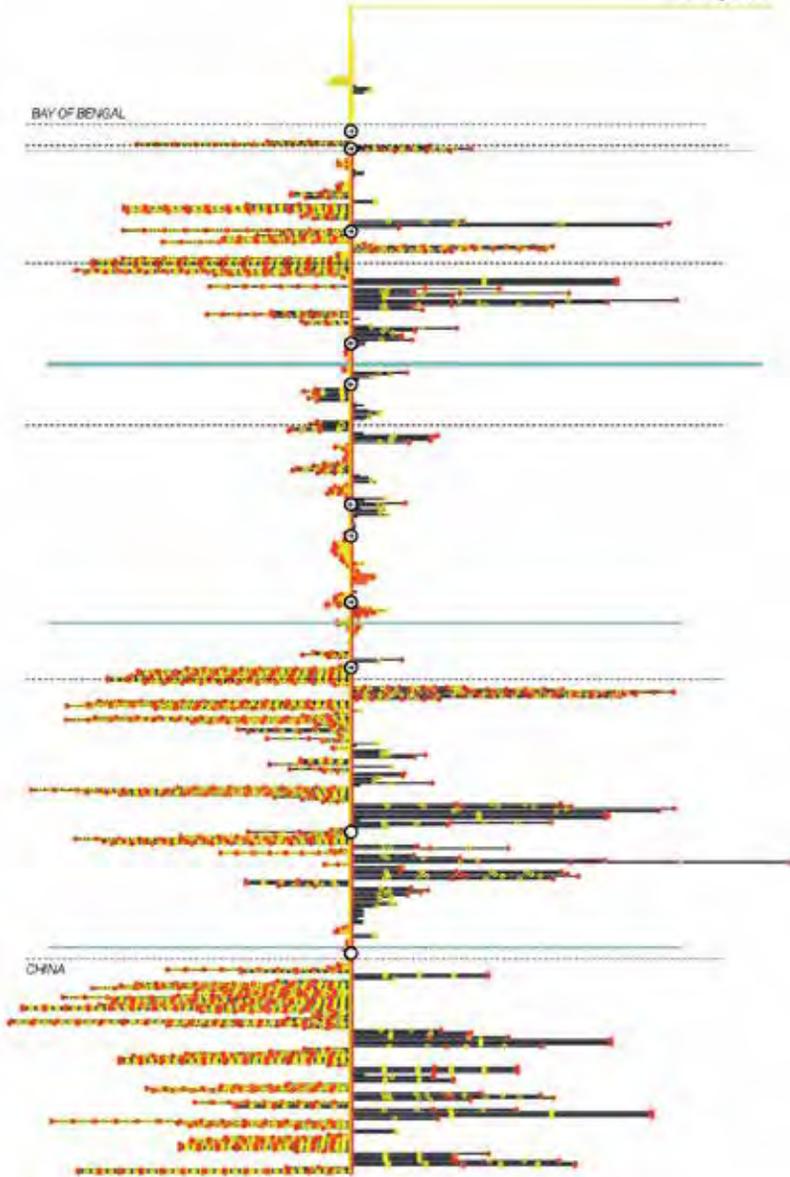


Fig.03. Understanding the changes caused by the pipeline.



The Myanmar-China pipeline is one of the first major pieces of energy infrastructure to be built in the country since the political reforms of 2011. The pipeline's disregard for social and environmental impacts sets an unhealthy precedent for Myanmar as foreign investment continues to increase across the country. The Shwe Recuperation Corridor explores how a fossil fuel pipeline could potentially be transformed from an object of destruction and loss to an instrument of social reform and compensation through architecture. It does so in the following ways:

Fig.04a and 04b. Using topographical data to depict the flows of fuel through the pipeline.



### The Corridor as a Compensatory System

The wider corridor provides a network of taps that allows those negatively impacted by the original pipeline construction to benefit from its transmission of fuel. Local communities will be able to harness the waste heat from the pipe for use in agricultural processes that help to mitigate the loss of arable land on community livelihoods.

### The Corridor as a pilot for Land Reform

The introduction of a large corridor of land that traverses the breadth of Myanmar, opens up the opportunity for a new land framework policy that focuses on rectifying laws that previously permitted the Government of Myanmar and the China National Petroleum Corporation from fairly compensating local communities for their land. The corridor land will be regulated through a registry system that is implemented through a network of Energy Tribunals in each state.

### Sustaining the Corridor

Key functions of the network are maintenance and monitoring. Through the use of a series of instruments, the tribunal governing body will be able to monitor the network to ensure its use is not detrimental to the pipeline's working, for both the benefit of the pipeline operators and those along the corridor reliant on its heat energy. Secondly, monitoring will act as method of metering the flows to ensure transparency around the economic benefits of the pipeline and its potential for public benefit for the Burmese people.

### The Energy Tribunal as a Hub of Advice

A key finding in Myanmar-China Watch Committee field research found that the reason so many people were improperly impacted by the pipeline was due to lack of knowledge and transparency during the pipeline's construction. Many local individuals were simply unaware of their lands rights and its value while others were misinformed of the project's location and proposal details. The Energy Tribunal hopes to prevent such circumstances from occurring in future through the provision of services that provide an openness and clarity about the industry previously not afforded to the Burmese people.

### The Energy Tribunal as a place for Social Justice

The key function of the Energy Tribunal is to provide an impartial judiciary to those negatively impacted by increasing foreign investments in Myanmar. In the current political climate, the people of Myanmar retain little trust in the government's ability to regulate and hold foreign investment accountable due to high levels of corruption and a long history of political imprisonment for speaking up. The corridor looks to provide a network of decentralised tribunals that operate under non-governmental international bodies to ensure that justice is available and accessible for those adversely impacted by foreign investment, beginning in this case, with the Myanmar-China pipeline.



150m N

**FOSSIL FUEL PRESENT - OIL & GAS**

- DIVING FISH
- AQUACULTURE
- GREENHOUSE
- DRYING RICE
- DRYING FRUIT
- DRYING GRAIN
- PROPOSED ENERGY TRANSMISSION LOCATION AND/OR ACTIVATION POINT
- VILLAGE
- INCREASED AIR PRESSURE / HEAT
- PIPELINE INFRASTRUCTURE
- GAS PIPELINE
- OIL PIPELINE

**LOW CARBON FUTURE - GEOTHERMAL**

- IDENTIFIED THERMAL SPRING

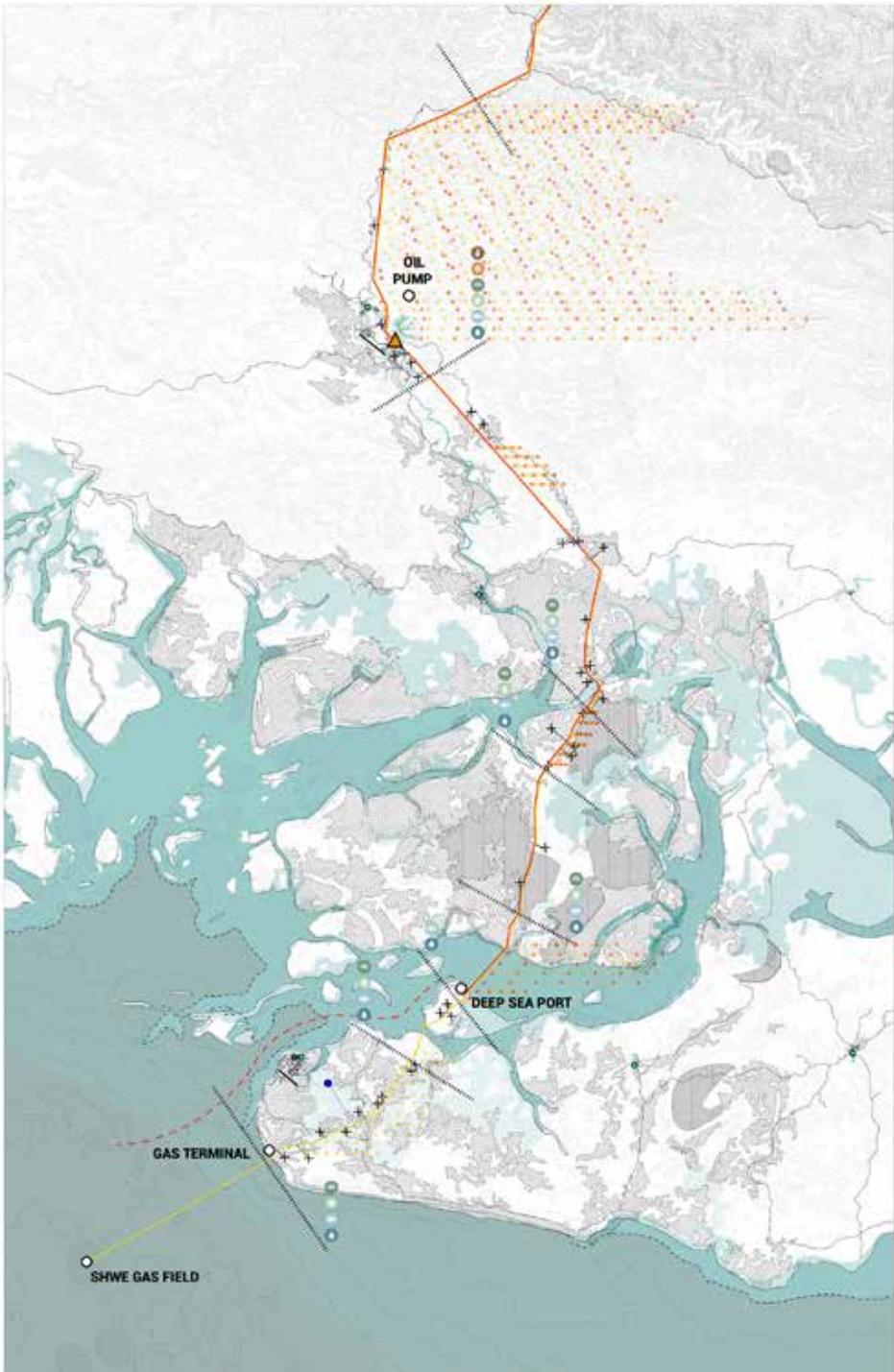


Fig.06. Rakhine State Corridor: a strategy for the state most affected by the pipeline infrastructure.

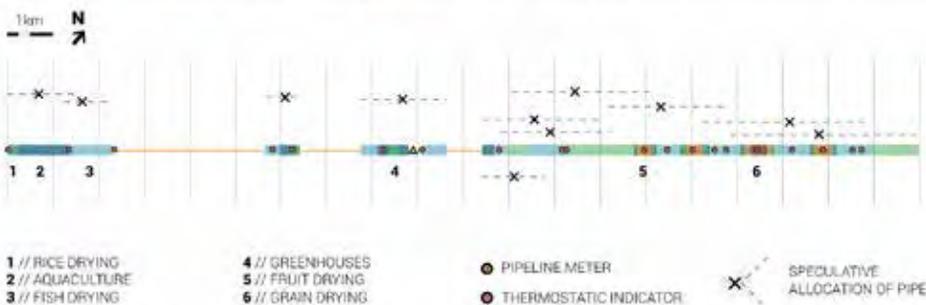
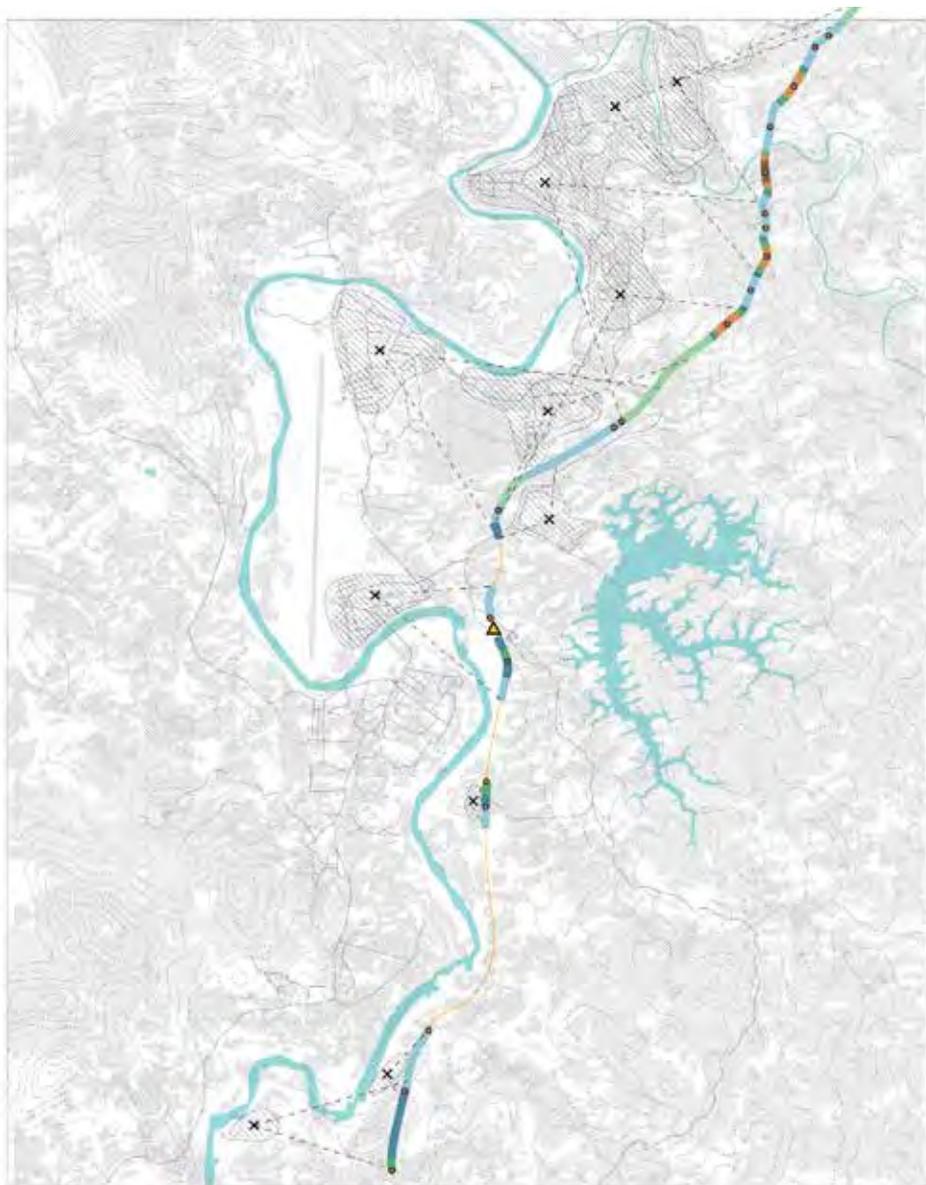


Fig.07. Ann Township Corridor: a closer look at the corridor.

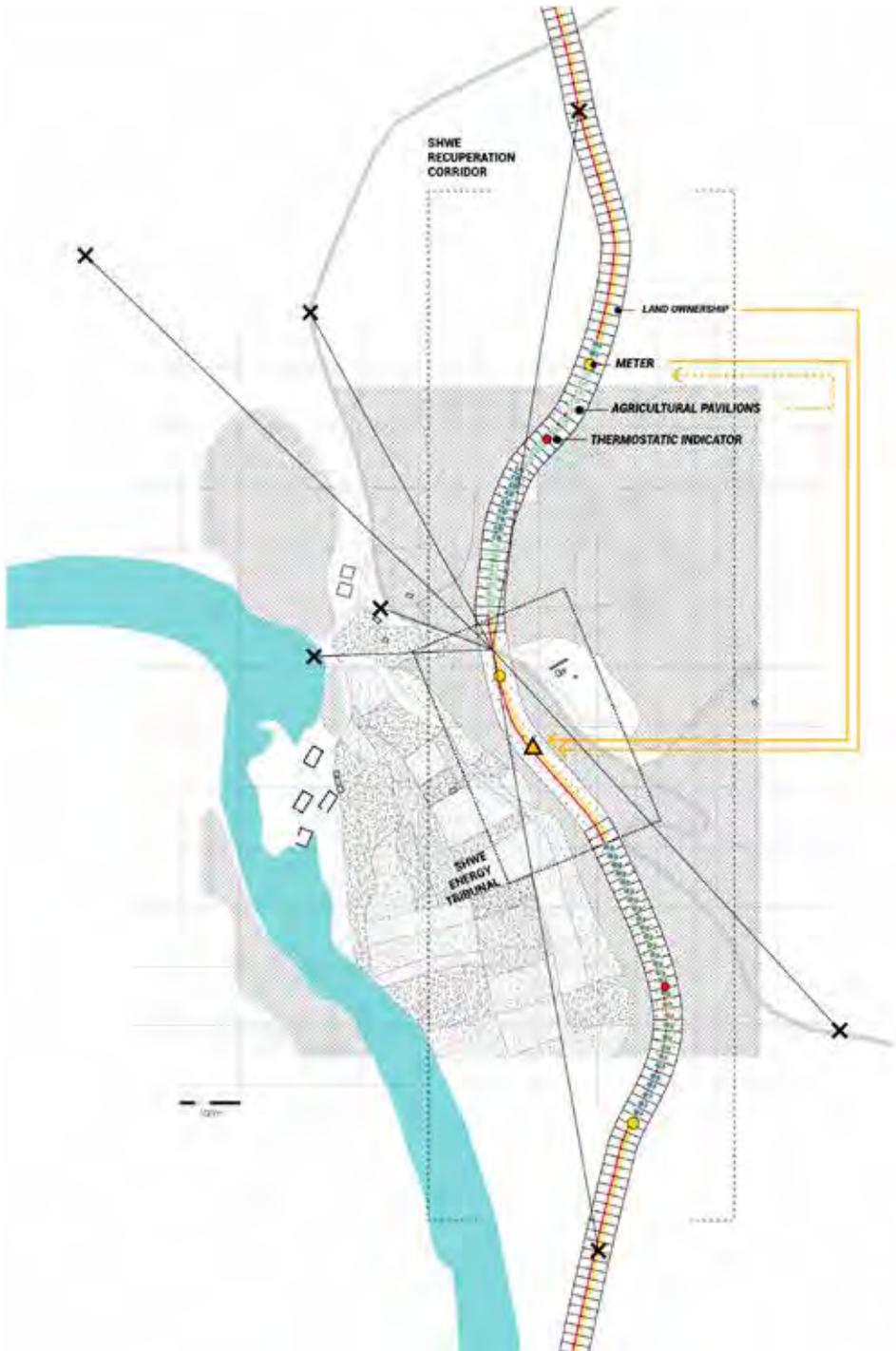


Fig.08. Ann Township Site Plan: monitoring, regulating and providing judiciary to the Rakhine State Corridor.

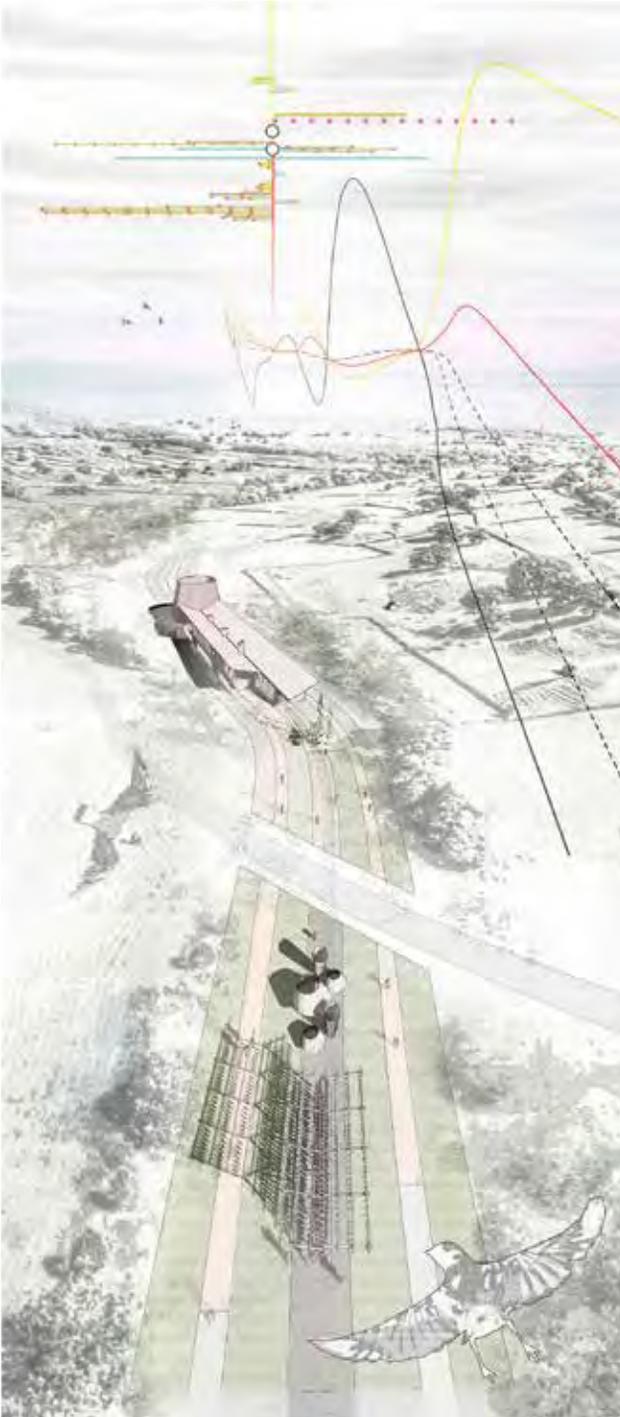


Fig.09. The Shwe Recuperation Corridor: transforming an object of destruction and loss into an instrument for social reform and compensation.

## **ACKNOWLEDGEMENT**

This project was produced as part of the Monsoon Assemblages design studio at the University of Westminster in 2018/19. Monsoon Assemblages is a research project supported by the European Research Council under the European Union's Horizon 2020 research and innovation programme (Grant Agreement no. 679873).

All images are by the author.

## **IMAGE SOURCES**

Fig.01. Feature Service, Esri, Gebco, OCHA, Myanmar Ministry of Electricity and Energy

Fig.02. Esri, Gebco, OCHA, Shwe Gas Movement, Myanmar Open Development

Fig.03. Esri, Gebco, OCHA, Shwe Gas Movement, Myanmar Open Development, ACLED Data for Myanmar, Offshore Technology

Fig.04. Earthdata

Fig.05. Myanmar Engineering Society, Myanmar Open Development

# ATMOSPHERIC GROUNDS



## UNJUST INTONATIONS

**Avi Varma** is an artist, researcher and PhD Candidate at the Center for Research Architecture, Goldsmiths, University of London. His research focuses on the relationship between ecological and epistemic violence, specifically along the Rio Grande River and the US-Mexico border. His background is in sound art and experimental music as a former student of La Monte Young and Marian Zazeela.

The conjunction of ecocide and epistemic violence has been a central matter of concern in my work at the Centre for Research Architecture (CRA), Goldsmiths, University of London. In this body of research, I am attempting to develop methodologies and conceptual frames through which to address often invisible forms of colonialism. In this paper, I will build upon the CRA's previous body of knowledge and my own research to investigate how specific cultural ecologies associated with the monsoon in India embody political and environmental transformations as much as does the built environment. I will offer a brief material history of the harmonium, its relationship to the ragas of North Indian Classical Music, and then problematise the two by considering them in light of ecological systems theory and the semiotics of human-nonhuman relations. Though what I am offering is necessarily provisional, I am working towards tracing the contours of a non-western epistemology of voice, sound, and testimony, and towards new forms of situated testimony they may indicate. Such a framework suggests that the sensorium (including sound itself) should not be thought of as natural. In fact, it is part of a political ecology of the senses. The sound of the harmonium both registers and testifies to a regime shift within material culture during colonisation. As Anibal Quijano describes, coloniality was never purely a matter of force. Rather, "repression fell, above all, over the modes of knowing, of producing knowledge, of producing perspectives" as well as over "modes of signification" and their "resources, patterns, and instruments of formalized objectivized expression" (Quijano, 2007: 169). Therefore, to begin, let us consider the physical and aural objects of concern around which I will build my theory of epistemicide: the monsoon raga and the harmonium.

In the North Indian Classical Music system, raga Mian Ki Malhar is the monsoon raga, sung during the rainy season. It is characterised by an extraordinarily unique movement around the third scale degree, 'ga,' representing the gathering of dark clouds on the horizon and the downpour of rain upon the earth. Yet, with the introduction of the harmonium, the western, equal-tempered tuning system was overlaid on top of the traditional forms of intonation used in raga, creating epistemic dissonances within the very materiality of sound itself. Because of this, the harmonium was banned from All India Radio between 1940 and 1971. In this context, the monsoon culture embodied in raga becomes itself an interscalar vehicle; its material changes register broader shifts in colonial

politics, environmental transformation and art practices. I argue that one can trace the convergence of ecocide and epistemic violence through the segmentation of a non-western aesthetic form (raga) that previously had been co-produced by monsoons and human artists.

In its very design, the harmonium was an ecological phenomenon. As the British presence in India increased, colonisers imported harpsichords and organs. However, these instruments, according to musicologist Matt Rahaim (2011) either broke on the long journey from Europe or “deteriorated quickly in the heat and humidity of the Indian summer and monsoon” (Rahaim, 2011: 662). By contrast, after its invention in the mid-nineteenth century, the harmonium was designed to withstand and, like a monocultural crop, be resistant to India’s environment. Portable and durable, it was used by chaplains, explorers, and traveling missionaries. Soon after its introduction, the harmonium was adapted by Indian musicians and by the early 20th century had achieved ubiquity. Typically, debates over the harmonium have been framed in Manichean terms: British/Indian, colonial/ postcolonial, elitist/ populist, conservative/Marxist, with the political and symbolic value of the harmonium falling variously to either side of these binaries. However, rather than considering its effect synchronically at various historical moments, I’d like to consider the harmonium as an ecological event. In so doing I will read its microhistory through the lenses of the aesthetic and social ecology of raga, the lens of ecological systems theory, and ultimately the legal architecture of ecocide. First, I’d like to consider what kind of body of knowledge raga constitutes.

My situated knowledge of raga comes from many years of advanced study with La Monte Young and Marian Zazeela. Two of the founders of minimalism as a musical and artistic movement and original artists of the Dia Art Foundation, my teachers were in their own right the first western students of Pandit Pran Nath, a master of the Kirana gharana (school) of raga singing. A raga, in this lineage, is defined as:

*A set of musical elements including a modal scale; characteristic ascending and descending versions of the scale; characteristic melodic phrases, motifs and patterns... characteristic ornaments; conventional pitches for beginning and ending phrases; special shrutis (microtonal pitch values); and surkans ... “subtle shades-‘note particles’ above or below the precise svara [pitch] line, subtler even than srutis or microtones but belonging to specific region within a pitch.*

*(The Just Alap Raga Ensemble, 2012: online)*

There are ragas to be sung in winter or spring, to be sung as the sun comes up or just after sunset, ragas about the desert and the long shadows of summer. Each raga has its own unique, nuanced and highly calibrated system of intonation. Within this finely articulated musical system, Raga Mian Ki Malhar is the monsoon raga. It is sung during the monsoon season and defined, once again, by its iconic movement around 'ga,' signifying the gathering of thick shadows of clouds around the sky and heavy rains on the earth.

Composed by Tansen in the 16th century, a series of mythopoetic narratives surround the raga. The following anecdote by journalist and scholar Marcus Boon about a performance by Pran Nath is paradigmatic:

*At the All India Music Conference in Delhi in 1953, attended by many of the giants of the classical music scene, Pran Nath's performance of the rainy season raga Mian Ki Malhar stunned the 5000-strong crowd. Singer and early disciple Karunamayee recalled that when he hit the 'sa' note, "He held the breath of us all, collected our breath through his own breath, held it at one pitch and then let go. When he let go, we also let go, all 5000 people in the audience. It was a shock to me. All this can be done with music! And when he ended there was torrential rain! Suddenly he got up, he was very sad and frustrated and angry and said, 'I'm not a musician, I'm only a teacher', and walked off.*  
(Boon, 2001: online)

Through this description one begins to encounter the unique epistemic terrain of raga. It is an episteme of reflexive animacy, one in which according to anthropologist Julie Cruikshank (2005), "humans and nature mutually make and maintain the habitable world" (Cruikshank, 2005: 3). Monsoon is in Mian Ki Malhar an animate and operative actor in establishing the very conditions of relationality and encounter. The raga constitutes an epistemic universe in which monsoon is a living, but non-organismic more-than-human entity. The meteorological and the social entangle. This fragile site of assembly is contained largely within the devotional treatment of that single pitch in Mian Ki Malhar. So how is it that the harmonium, utterly incapable of recreating these sounds, managed to be a vehicle participating in terraforming and epistemicide?



The introduction of the harmonium in India marks what in contemporary resilience theories of ecosystems is called a regime shift (Wakefield, 2018). The shift it marks is a transformation in the cultural landscape. In the adaptive cycles of ecological regime change, a mature system suffers a triggering event such as a forest fire, and then undergoes a transformative period of creative destruction, after which it cycles through phases of renewal, structural reorganisation and adaptation. In this sense, the harmonium was a triggering device, an indirect agent of crisis and creative destruction. As Agent Orange was the instrument of herbicide, and blankets infected with smallpox were instruments of genocide, so the harmonium was an instrument of epistemicide. As Dilip Da Cunha (2019) might frame it, with the harmonium, the sound of the monsoon shifted from being the sounded moment of reality, from being the central force and point of assembly, and from being at home, to being a guest within its own relational life-world. To study the harmonium after it attained cultural ubiquity, been reincorporated and adapted into musical practices, is to miss the crucial events through which the epistemic shifts of the colonial encounter are tangible.

The sound of monsoon in *Mian Ki Malhar* is not an index on the symbolic level, operating at the level of deferring chains of representations and significations. Rather, it is illustrative of what anthropologist Eduardo Kohn (2013) describes as the “ways in which the whole that is the

symbolic is open to those many other habits that can and do proliferate in the world that extends beyond us” (Kohn, 2013: 6). Conversely, the sonic representations of the harmonium, in which the sound of the monsoon raga is impossible, impose an architecture on sound that connects it not to such an extensive cosmology, but to an enclosed approximation of British colonial out-of-placeness in the climactic extremities of the monsoon and summer seasons. In Kohn’s human-nonhuman semiotics, this kind of segmentation not only dis-articulates a particular semiotic system, but also effaces the way the semiotics of raga points to the future and the past of an aesthetic universe. It attacks relationality and is structural in its violence. It is what Vandana Shiva (1993) describes as a monoculture of the mind:

*Over and above rendering local knowledge invisible by declaring it non-existent or illegitimate, the dominant system also makes alternatives disappear by erasing and destroying the reality which they attempt to represent. The fragmented linearity of the dominant knowledge disrupts the integrations between systems. Local knowledge slips through the cracks of fragmentation. It is eclipsed along with the world to which it relates.*

*(Shiva, 1993: 4)*

Therefore, an understanding of the type of knowledge embodied in Mian Ki Malhar, and the type of accidental systemic partitioning introduced by the harmonium, affords one a unique case-study through which to understand the types of shifts in ecological and social relations enacted in colonial encounters. I argue that the encounter between raga and the harmonium was an encounter between incommensurable relationships with sound and with what sound mediates: variously devotional relations, histories, or the monsoon. This balance was always already uneven, weighted as it was by systems of dominance, legibility and ultimately audibility. At this point, the question informing my research (one that remains unanswered) is how epistemicide may be evidenced, spoken for, mediated, seen as real and, therefore, acted upon through modes of care forming a political collectivity. To conclude my paper, I ask how epistemicide might be situated within a legal frame.

As I’ve suggested already, ecocide and epistemicide go hand in hand; in ecocide law one begins to see the reality of epistemic violence find veridiction. Since first theorised in international law, ecocide law has sought to mitigate excessive, inhumane harm done to ecosystems and to peoples’ relations with their environments. Emerging during the US war in Vietnam, ecocidal law sought to extend crimes against humanity to include forms of “high technology, counter-insurgent warfare” (Falk, 1973: 88) that perpetuated harm against the environment through 1)

the use of herbicides 2) the use of plows to achieve deforestation 3) bombardment or artillery fire that causes craterisation, indiscriminate destruction and severance of human and animal linkages to their habitats, and 4) weather modification (ibid.). Yet, embedded within this legal reappraisal of excessive military tactics in terms of environment, as the thinking around ecocidal law evolved, was a further extension of the registers of ecocide to include the psychological and social harm that occurs when devastating damage is done to an ecosystem. For example, Jim Glassman (1992) describes the destruction of rural areas in Guatemala by US backed militaries as a form of population control meant to drive both insurgents and indigenous Mayans from their land. This uprooting functioned to “undermine ... psychological resistance by breaking an age-old and symbolically loaded bond - based on the production and reproduction of life - between [indigenous] communities and the earth” (ibid.: 29). Therefore, if one thinks of social form as a kind of spatial and environmental organisation that is an emergent property of that society’s social relations and ways of being in the world, then ecocide is necessarily epistemicide. Very simply you might say that if you change the space you change the people in it; more provocatively, by reversing that perspective, you might say that if you change a people’s way of relating you change the space they live in.

In conclusion, one sees the raga and the monsoon-reality it sounds out as mutually animate and reflexively animating. Raga and the harmonium transversally cross colonial histories, ecologies, and the expropriation of raga’s episteme. My paper ends with a question for further research: though ecocide law opens the field of law to epistemic harm, is the field of law in its defining axioms and norms capacious enough to register, witness and hear testimonies of epistemic and ecocidal violence such that those declarations of violence-suffered can become collective and political. My suspicion is no; and as I iterated to begin my paper, the central claim for my next body of research and practice as it unfolds is that a non-western epistemology of voice, testimony and sound is necessary. Perhaps to hear it, an alternative, more situated form of testimony must be constructed.

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## HERE BE DRAGONS, OTHER GROUNDS

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*If you devote yourself to clouds and their study,  
you're lost.*

*(Völter and Beyer, 2014: 124)*

To tell what Aristotle terms a “general truth... about the human condition... one that makes drama of a higher order than the mere recounting of history” (Price, 2018: 57), people tell stories. Drawn out through words and symbols, shapes and patterns, enclosures and roadways, each a map of possibilities and impossibilities, both imaginary and real-stories, in various form, construct histories of where we’ve been and images of where we might go. Often imagined as constructs of the fiction novelist, or poet, stories, like architectures, are “always situational” (Desimini and Waldheim, 2016: 9); and, importantly, propositional. Parallels between architecture, cartography, and storytelling help to situate each as artistic practices beholden to both conventions and their consumers (Desimini and Waldheim, 2016; Robinson, 1952). Commonly, it is the product of each practice that is imbued with the power of engagement; however, each is constructed through a set of structural norms, procedures, and datums reflective of their own time, geography, and culture. It is within the determination of these boundaries, *these reference points*, that we are all engaged, regardless of the stories told.

In *The Great Derangement*, Amitav Ghosh (2016) outlines the problem of climate within fiction and nonfiction, or rather, the ambiguous position that notions of climate and climate change hold between worlds of imaginaries and knowns. He argues that our current precarious state requires us to acknowledge that the character, site, and setting of climate must be written into the textual stratigraphy of our time. Within the foundations of most cultures, languages, and religious traditions, across geographies and storytelling practices, we can find depictions of weather and climate woven into the fabric of histories and traditions, each one a reflection, a snapshot, of a particular awareness of a human existence teetering on the edge of comfort (Ghosh, 2016). Throughout history, from the Bible to the Quran, perceived environmental stabilities and instabilities have been given form in literature as a means of recording certain conditions and conditionalities of the human and nonhuman world, as well as drawing correlations between them. However, such

depictions of environmental safety and health were also drawn, or not drawn, into public imaginations and scientific records by other means.



Written and illustrated in 150 A.D., Ptolemy's *Geographia*, eight volumes of both textual and graphic representations of then-known geographies, was the most extensive world atlas to exist up to the Age of Discovery. Reproduced widely across Europe, Ptolemy's work, itself founded in philosophy, made lasting contributions to both cartography and science. Recurrent themes across Ptolemy's writings address two central issues: how do we, or rather how should we, acquire the best possible knowledge of aspects about the world around us, and how should we present this knowledge, whether in graphic or pictorial form or by other means (Erenow, no date). A preference for reasoning by mathematical deduction and a reliance on empirical data gave credence to Ptolemy's claim that the terrestrial globe and its features were to be understood through quantitative and spatial attributes. These measurements were to be taken against the earth's surface, as well as from astronomical observations the explored and peopled terrestrial within the hypothesised cosmological (Fig.01). *Geographia* provided its readers, or rather users, with a method for constructing maps of the world. Known locations were to be placed within a measured grid and unknowns were to be represented, both texturally and pictorially, as wonder and danger: *terra incognita*, or as it was often marked, *Here be Dragons* (Fig.02) (Ekman, 2013; Van Duzer, 2013). Within a singular term and its graphic representation, Ptolemy visualised the creatures that must live outside of the unknown world in two dimensions: of the earth and of the space beyond (Fig.03).

Fig.01 (left). Ptolemy's World Map, originally produced in  
Strasbourg in 1513 based on the work's of Claudius Ptolemy.

Fig.02 (right). *Carta Marina*, or Sea Map by Olaus Magnus in 1539.

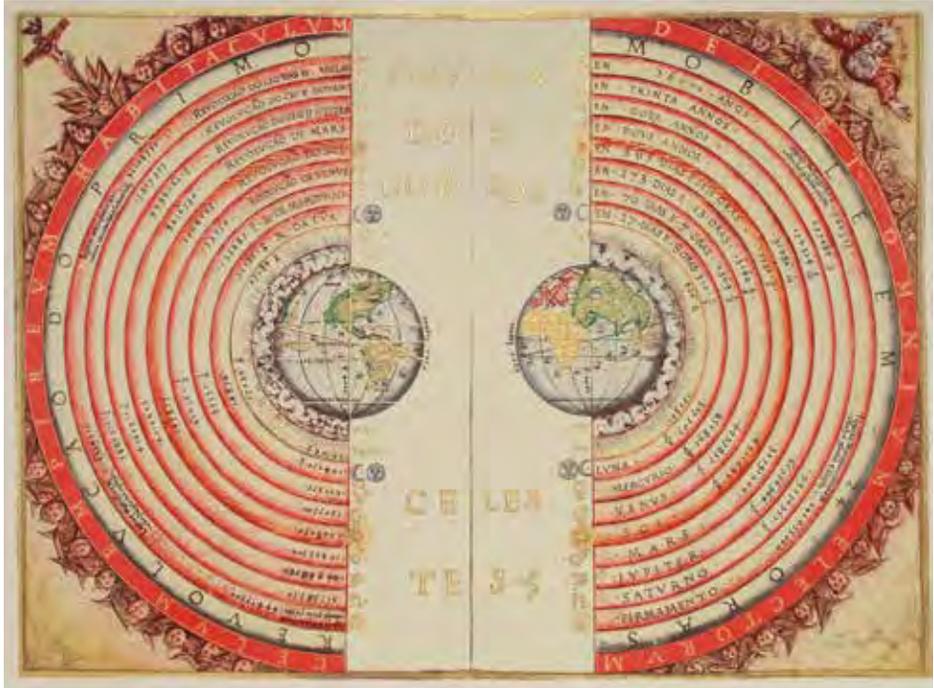


Fig.03. Figure of the Heavenly Bodies (1568) an illustration of the Ptolemaic geocentric system by Bartolomeu Velho, a Portuguese cosmographer and cartographer. Although superseded, the geocentric model which places the Earth at the centre of the Universe, was exemplified by the Ptolemaic system. This drawing is part of Velho's *Cosmographia*, published in France in 1568 and held at the *Bibliothèque Nationale de France*, Paris.



The authority of Ptolemy's maps rested on the use of coordinates and determination of datums taken from empirically collected data (Fig.04). There were, however, many unknowns about the earth, measured or not, and Ptolemy's cartographic system created a space for observational data, science, and depictions of mystery, or fiction, to sit side-by-side within a measured frame. Dragons and other creatures bounded the known world as it met the unknown; but once the Earth's surface had been adequately observed, measured, and drawn, those creatures were expelled from the frame (Fig.05). Dragons or otherwise, these creatures reminded the viewer of some thing, some place, some other that played a role in the dynamics of existence. Without them, only that which could be observed, measured, and modelled was drawn into the scientific imagination of the world, its histories and possible futures.

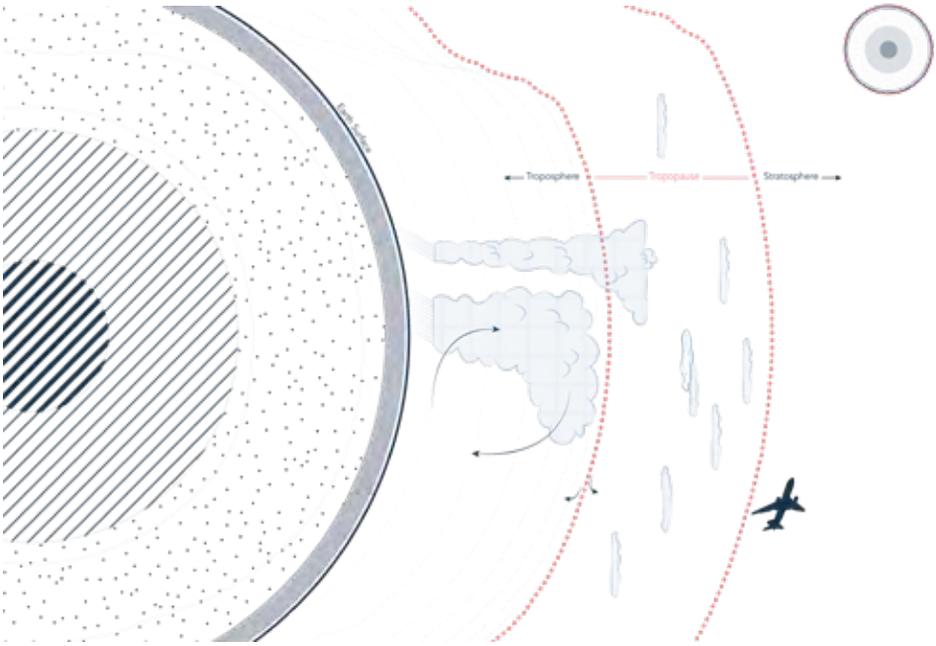
In 2019, Natalie Wolchover published an article in *Quanta Magazine* titled, 'A World without Clouds' in which she outlined recent developments by an international group of scientists who have been working to uncover the role of clouds in the earth's history. Climatic models of previous epochs have typically been formulated on material forms of evidence that remain, that can still be observed, measured, and modelled. However, "even after accounting for differences in geography, ocean currents and vegetation" that seemed to have occurred during past episodes of extreme shifts in global climates, paleo-climatologists had to admit that something, "an X-factor whose wild swings leave no trace in the fossil record," was missing (Wolchover, 2019: online). Recent developments in modelling technologies have opened new avenues of possibilities for climate scientists to address such questions and as Matt Huber, a paleoclimate modeler at Purdue University, states, "It's quite clear at this point that the answer is clouds" (quoted in Wolchover, 2019: online). Without representation, clouds just had not been included in the list of possible climate factors.

Fig.04 (left). The 11th Asian regional map, the Magnus Sinus or Great Gulf, from Ptolemy's *Geographia* (Herleian MS 7182).  
 Fig.05 (right). World map drawn as Ptolemy's second projection. From Leinhardt Holle's 1482 edition of Nicolaus Germanus's amendments to Jacobus Angelus's 1406 Latin translation of Maximus Planudes's late-13th century rediscovered Greek manuscripts of Ptolemy's 2nd century *Geographia*.

The rising importance of clouds in contemporary science, particularly regarding prescient models of potential climate trajectories, is a remarkable resurgence for a long-since concluded chapter in scientific history. In the early 19th century nephology placed significant value on the individual form of a cloud, albeit a form that can only be studied in a single moment and that foregrounds presence, the present-tense, and the beholder. These early investigations of clouds were performed by scientists, adventurers, and explorers who were devoted to the value of knowing the difference between individual forms of moisture and particulates in the air. As other scientific disciplines began to shift towards the study of mass movements, and technology evolved to allow meteorologists to observe entire global cloud systems at once, focus on individual forms of passing bodies of moisture quickly dissipated.

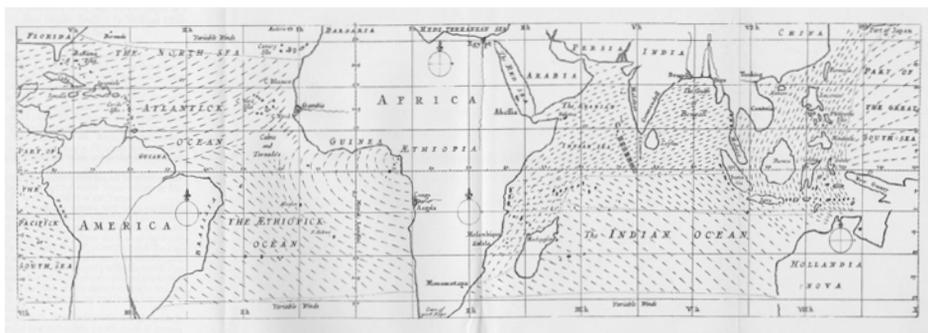
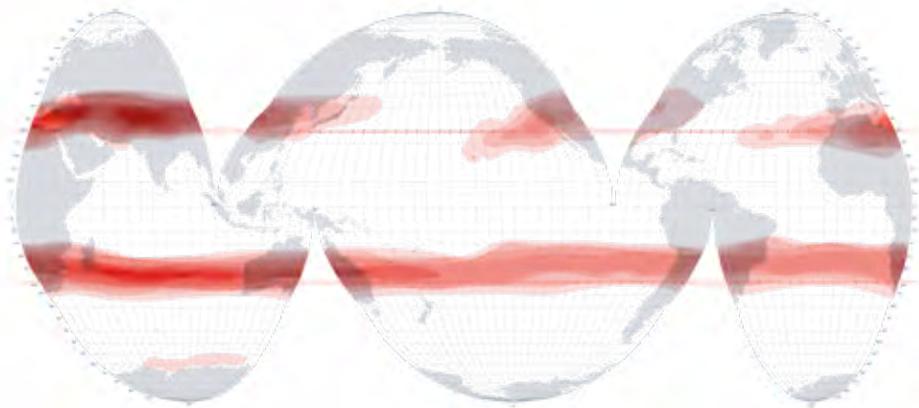
The nephrologist and the sailor had in common a yearning to know, to see, to touch something beyond current view. Either sailing to the edge of the earth or propelling themselves as far above the ground as a balloon might take them, these men endeavoured down a path of somatic observation that allowed an encounter with the unknown, not only an imagination of it. If a new layer of climatic stratigraphy is to be inked, perhaps it is through the act of encountering that a productive collaboration between the scientist, novelist, and spatial designer may take shape. Rather than imagining what may occur, or what may have occurred already, the creatures that had been expelled from the frame, that had not found representation, must simply be drawn. As Wolchover's (2019) article brings to the fore, character omissions in climatological models have helped to produce results that fall short in both uncovering the full magnitude of climatic episodes in the earth's history and their ability to predict future climate trajectories. If global coordinates, datums of reference and registers of time have prevented certain elements from entering the frame of accountability, then those regulatory systems must expand or be disbanded, so that climate models may ascertain just how hot the earth might get, how fast, and by means of which characters and interactions.

Two-thirds of the planet is covered by clouds at any given moment (Kiger, 2015). For decades, the variable and micro-scale of cloud molecules along with their rates of movement, morphology, and dynamic material evolution have evaded accurate computer simulation (LeMone, et al., 2019; Schneider et al., 2017; Siler, et al., 2017); however recent developments in computation have allowed scientists to see clouds within climate models in ways that were previously incalculable (Wolchover, 2019). Encountering the uncounted has allowed scientists to see that as the earth warms, clouds become scarcer; and with fewer white surfaces to reflect sunlight back into space, the earth gets even warmer which leads to even more cloud loss (ibid.). As this feedback loop spirals out of control, the tipping of the heat index generates a host of other relational impacts.



The group of scientists highlighted in Wolchover’s article modelled a particular cloud, the stratocumulus. Developing in higher altitudes, stratocumulus clouds are not icy and wispy like the cirrus variety (Zelinka, 2010); rather they are “low, thick, turbulent” high altitude clouds that form “bright-white sheets” that “cover a quarter of the ocean, reflecting 30 to 70 percent of the sunlight that would otherwise be absorbed by the dark waves below” (Wolchover, 2019: online). Specifically, this white sheet of stratocumulus clouds forms over and extends across the oceans in the tropical zone. In concert with their high-altitude position, they express the essential structure of the tropical tropopause layer of the earth’s atmosphere (Fueglistaler et al., 2009). The tropopause is the interface, a volumetric space rather than a boundary, between the troposphere and the stratosphere. Within the volume of the tropopause, the inhabited space of the earth and its relatively well-mixed airs are protected against the poorly mixed milieu of the stratosphere (Wu, et al., 2018). Variable by both latitude and season, the tropopause can be found as a global average between five and eight miles above the earth’s surface, and between eleven and twelve miles over the tropics (between 30N and 30S). Variable temperatures in the lower troposphere push and pull this volumetric barrier away from and towards the earth’s surface. Higher temperatures push the tropopause higher, while cooler temperatures pull it closer to the ground plane. On an average day, it is possible to see into tropopause. When a thunderstorm cloud flattens into an anvil cloud, it is

Fig.06. Diagram of Tropopause’s relationship to the earth’s surface at a vertical scale of 1:200 [central image].  
Diagram [upper-right] showing actual dimensions of the tropopause relative to the earth’s surface.



usually because the updrafts of the storm have reached the warmer air of the tropopause causing the clouds to stop rising and spread laterally (Fig.06) (Pan and Munchak, 2011). This constitutes the upper limit of the earth's weather as well as of data collection of the earth's atmosphere. In this way, the lower boundary of the tropopause layer becomes another type of ground, the thematic of this issue - the physical manifestation of a dialectical relation between temperature, moisture, and time relative to the earth's surface.

Another volume defined by and constituent of heat, moisture, and time is the monsoon, which can also be understood as a spatial dialogue between earth and atmospheric systems. The monsoon and the tropopause respond to one another in their volumetric makeup over the course of the year and across the earth's surface. As heat builds up over the Tibetan Plateau, calling the monsoon winds in from the Bay of

Fig.07. Tropopause folds during the summer monsoon (June, July, and August), average occurrences; fold frequencies shown at 7.5k intervals, from light to dark.  
 Fig.08. Sir Edmund Halley's Map of the Trade Winds, 1686.

Bengal, Arabian and China Seas, the height of the tropopause over the Plateau also rises. Effectively, this extends a volume of human-inhabited air, including the aerosols and particulates made airborne by human activities, further into the stratosphere. Although spatial and volumetric, the tropopause is not fully enclosed; the gaseous dynamics that separate and distinguish this pocket of air from that above and below contains perforations (Wu, et al., 2018). It leaks. Thus, as weather vapour is transported across the tropopause by strong convective storms (Škerlak, et al., 2015), these moist airs seep through cracks, depositing rains and other materials in sometimes surprising places. These barrier breaks also allow for stratospheric and tropospheric airs to mingle and to fold into one another (Wu, et al., 2018; Bogdan, et al., 2013). This introduction of cooler stratospheric air into the warmer, lower altitudes often induces convection (Antonescu, et al., 2013; Reid and Vaughan, 2003). During the months of June, July, and August, the summer monsoon season, tropopause folds occur with the most prevalence along the northern edges of the Indian monsoon (Fig.07) (Wu, et al., 2018).

In 1878, William Clement Ley delivered a lecture titled 'Clouds and Weather Signs' to the Meteorological Society in London (Ley, 1879). For Ley, the disastrous state of nephology relative to other branches of scientific study owed blame to the deficiencies of artists who had failed to portray clouds adequately enough to capture their significance and prove their legitimacy as characters worthy of scientific study. The science of nephology, as Ley had known it, had fallen further out of fashion by the mid-twentieth century, but recent decades have seen a resurgence of interest in clouds as a field of study for both the arts and sciences. Rather than a focus on individual form, cloud studies today tend to focus on the structures of entanglement and relational dynamics of clouds within environments (LeMone et al., 2019; Völter and Beyer, 2014). The lines of fold occurrences along 30N and 30S mark the general position of vertical drop in the height of the tropopause and the edges of the stratocumulus blanket over the topical region (Fig.07, Fig. 9). Marked changes in ocean currents also fall along these lines of latitude; known as the doldrums. The seas between 30N and 30S helped to lay the foundations of contemporary realities of geo-material and geo-political entanglement through their placid mirroring of seasonal wind patterns. In fact, it is the distinctiveness and navigational import of these waters that drew the first meteorological drawing by Sir Edmund Halley in 1686 (Fig.08). The pattern of ocean currents shown in Halley's map of the trade winds is the product of Halley's sensory experience of winds while in search for grounds (Halley, 1687). Yet drawn for the purpose of maritime navigation, a type of movement along a surface, and by nature of the convergence between atmospheric and oceanic activity, it is possible to consider Halley's map a portrait of a volume of grounds-on-the-move.

Beyond the registration of volumetric or atmospheric grounds, these currents, clouds, and folding events are intricately tied to a network of regional centres of atmospheric action that draw into being the nine different monsoonal systems that define climatic patterns around the globe. The near-constant low-pressure system over the middle latitudes – the doldrums – is tied to twenty-two different centres of atmospheric pressure that shift from high to low, or from one location to another, over the course of the year. This pattern of shifting pressure centres, as they are linked to other land-sea-air dynamics then determine the actions and regional extents of monsoonal systems. Importantly, the determination of a monsoonal system is set by quantities and rates of precipitation distributed over land. Moreover, the fact of their measurement is evidence of their role in the determination of the climatic realities that our world has engineered as constants. By drawing the globe through the lens of the tropical tropopause layer and the network of atmospheric pressure centres that it structures, another reality is drawn into the imagination (Fig.10). Heat exchange processes between land surface temperatures and atmospheric circulations lie at the heart of monsoonal dynamics. As the scientists in Wolchover’s (2019) article predict, the feedback loop between rising temperatures and decreasing cloud cover could result in a massive restructuring of moisture distribution across the globe.

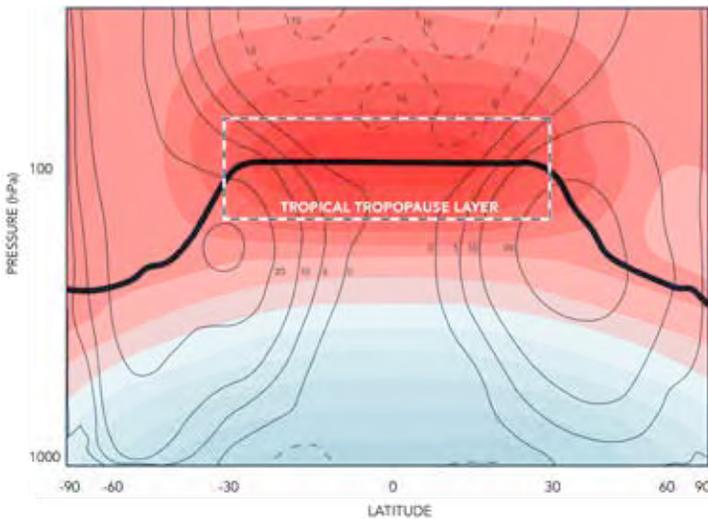
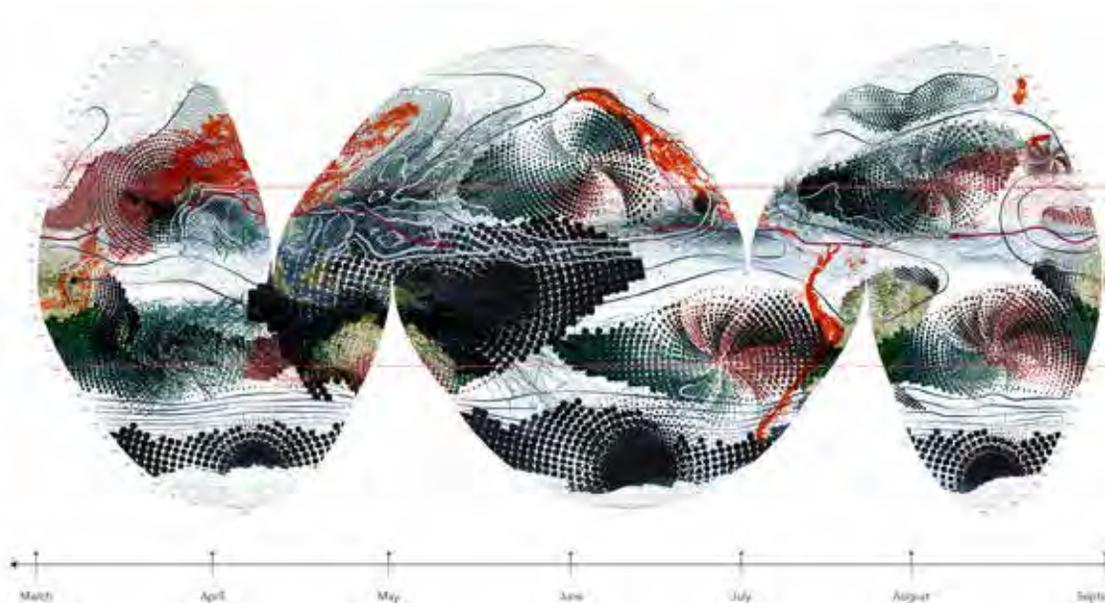
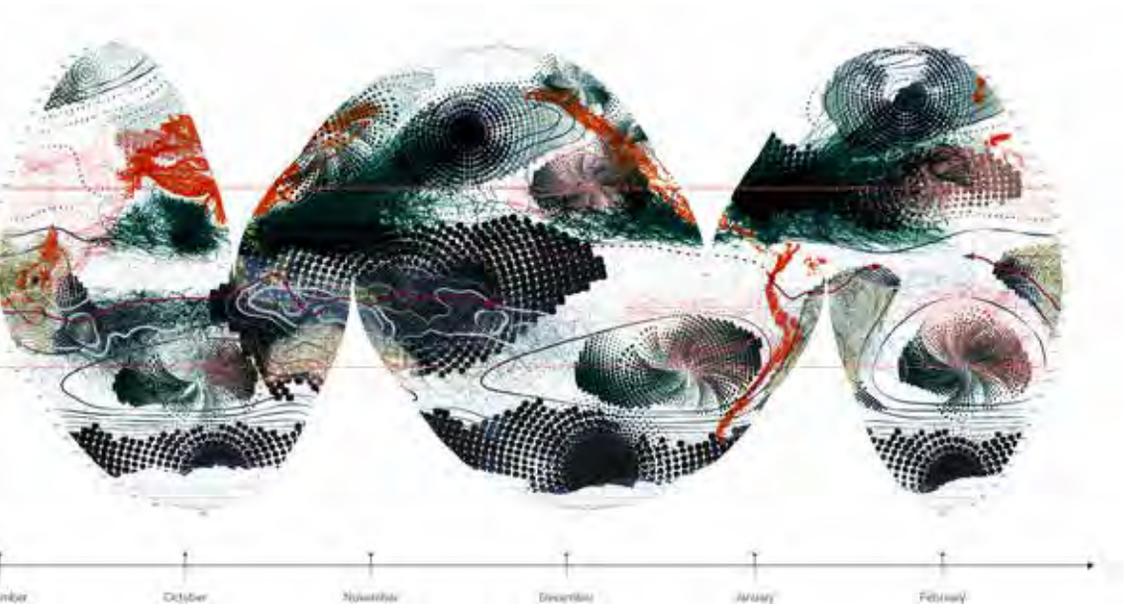


Fig.09. Graph showing the time-mean temperature and zonal wind structure of the atmosphere, together with the WMO lapse-rate tropopause.



When one turns one's head to the sky, a solid ceiling does not appear. Though planes regularly fly through the tropopause, its perforated barriers are only made visible by the behaviour of clouds. The clouds that meet this barrier make visible the vertical dimensions and boundaries of inhabitable space. Shifting in relation to temperature changes within the troposphere, the temperamental tropopause is a reminder of the interconnectivity of a sensitive system of life-sustaining elements. As the seas have long-mirrored the seasonal movements of these upper-grounds, the clouds have been working on another time-scale of changes and patterns. Today, encountering may not necessitate death defying journeys into unknown dimensions, but as Ghosh (2016) suggests, in writing our precariousness into stories of our times it is necessary that we encounter the unknowns, our dragons, at the edge of our maps.



## ACKNOWLEDGEMENT

This essay was written as part of Monsoon Assemblages, a research project supported by the European Research Council under the European Union's Horizon 2020 research and innovation programme (Grant Agreement no. 679875).

All photos and images are by the author unless otherwise indicated.

## IMAGE SOURCES

Fig.01. <https://prints.bl.uk/products/ptolemic-world-map-065696>

Fig.02. <https://fineartamerica.com/featured/sea-map-by-olaus-magnus-olaus-magnus.html>

Fig.03. Wikimedia Commons ([https://commons.wikimedia.org/wiki/File:Bartolomeu\\_Velho\\_1568.jpg](https://commons.wikimedia.org/wiki/File:Bartolomeu_Velho_1568.jpg))

Fig.04. Wikimedia Commons (<https://commons.wikimedia.org/wiki/File:PtolemyWorldMap.jpg>)

Fig.05. Wikimedia Commons ([https://commons.wikimedia.org/w/index.php?sort=relevance&search=Leinhart+Holle's+1482++ptolemy&title=Special:Search&profile=advanced&fulltext=1&advancedSearch-current=%7B%7D&ns0=1&ns6=1&ns12=1&ns14=1&ns100=1&ns106=1#/media/File:Ptolemy\\_map\\_15th\\_century.jpg](https://commons.wikimedia.org/w/index.php?sort=relevance&search=Leinhart+Holle's+1482++ptolemy&title=Special:Search&profile=advanced&fulltext=1&advancedSearch-current=%7B%7D&ns0=1&ns6=1&ns12=1&ns14=1&ns100=1&ns106=1#/media/File:Ptolemy_map_15th_century.jpg))

Fig.06. Drawn by the author

Fig.07. Drawn by the author

Fig.08. Wikimedia Commons ([https://commons.wikimedia.org/wiki/File:Edmond\\_Halley%27s\\_map\\_of\\_the\\_trade\\_winds\\_1686.jpg](https://commons.wikimedia.org/wiki/File:Edmond_Halley%27s_map_of_the_trade_winds_1686.jpg))

Fig.09. Feuglistaler et al. (2009). Image redrawn by the author

Fig.10. Drawn by the author

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## CRITICAL ZONE COSMOGRAPHY

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### WHAT WOULD A MAP OF CHEMICAL EVENTS LOOK LIKE?

Maps, and more broadly our cosmograms <sup>01</sup> are subordinate to the Cartesian grid applied to the earth, in the shape of lines of longitude and lines of latitudes. Such cartographic conventions perpetuate a static vision of the earth. It is not usual to visualise how chemistry shapes a landscape, how geological beings and living beings interact to eventually form the soil. The reason we are concerned with this today is that environmental disturbances caused by human activities are read through these biogeochemical markers: too high a concentration of nitrate that asphyxiates rivers, too much CO<sub>2</sub> released into the atmosphere, the creation of a flow of sulphur that acidifies all terrestrial layers and ends up in the ocean, etc.

This image shows the state of this research, the attempts, more or less fruitful, to design a visualisation of dynamic landscapes reconciled with the geosciences (the geology/life interface), with earth scientists involved in the Critical Zone study.<sup>02</sup> It shows recordings of the instruments of scientists observing these invisible phenomena; diagrams aimed at turning the earth around like a globe so as to place the atmosphere at the centre and trace the geochemical cycles passing through the various circles and strata of the soils; diagrams of an alternative geometric construction of the earth; drawings of the energy forces of the deep earth or the solar energy used by the living to incline the environmental parameters to their advantage.

The territory is not static; it is full of events. Chemistry redistributes the agents of the territory differently. It is this redistribution that this research aims to understand: Architectural Design at the time of Anthropocene: A Gaia-graphical approach to the Critical Zones. <sup>03</sup>



From the Globe...

...to the Critical Zone

1. REVERSAL

2. SPIRAL GRAMMAR

Open the globe

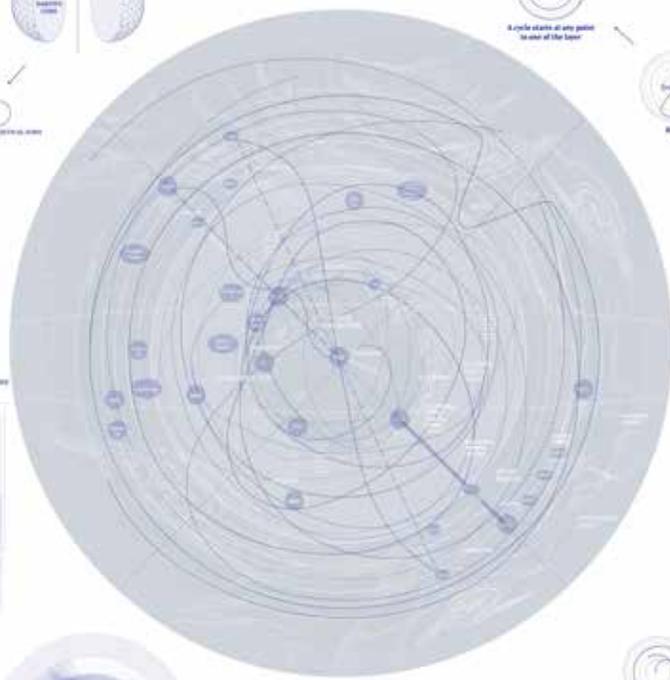


A cycle starts at one point to end at the same

Removal of the envelope



The globe operates more tactically



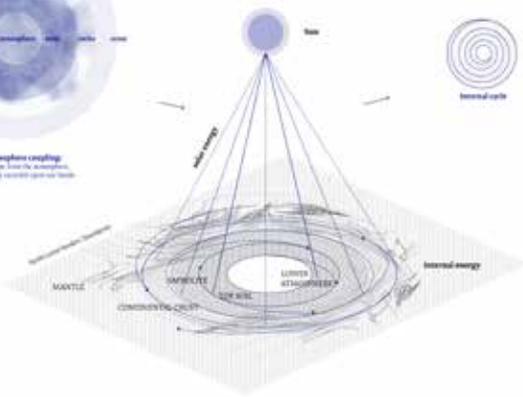
Velocity



Ways



Self atmosphere coupling  
we can't escape from the atmosphere, as it's primarily outside operation space.



Levels degree of importance



Deep Earth Energy



Solar Energy



## NOTES

01. For Tresch (2005) a cosmogram is the artefact that embodies the relations between humans, God and nature, according to the ontology of a society. Cosmograms materialise cosmographies through objects, texts or maps and result in concrete practices that allow humans to act accordingly to the community's world view, enabling people to bring themselves into agreement.
02. The Critical Zone Exploration Network (<https://www.czen.org/>) - known as OZCAR in France (<http://www.ozcar-ri.org/the-critical-zone/international-organisations/>) and the Critical Zone Observatories in the USA (<http://criticalzone.org/national/>).
03. This is the title of my doctoral research at the University of Manchester, UK.

## REFERENCE

- Aït-Touati, F., Arènes, A., and Grégoire, A. (2019). *Terra Forma. Manuel de Cartographies potentielles*. Paris: Editions B42.
- Tresch, J. (2005). 'Cosmogram.' In *Cosmogram*, Jean-Christophe Royoux and Melik Ohanian (eds.), 67-76. New York: Sternberg Press.

Fig.01. Critical Zone Cosmography, Terrestrial Cycle, by author.

Fig.02. Detail from Carte 1 SOL. In: Aït-Touati, F., Arènes, A., and Grégoire, A. (2019). *Terra Forma. Manuel de Cartographies potentielles*, 45-46. Paris: Editions B42.

Monsoons [+other] Grounds  
A Monsoon Assemblages Publication

Edited by Lindsay Bremner & John Cook.

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ISBN 978-0-9929657-1-6

The Monsoon Assemblies publication series are available to download as PDF's or from [www.monass.org/writing/](http://www.monass.org/writing/) or to purchase from online stores.

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European  
Commission

Horizon 2020  
European Union funding  
for Research & Innovation

Monsoon Assemblages, is a research project funded by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (Grant Agreement No. 679873).



*Monsoon [+ other] Grounds* is the final of three symposia publications by Monsoon Assemblages at the University of Westminster from 2017 to 2019. The others were *Monsoon [+ other] Airs* (2018) and *Monsoon [+ other] Waters* (2019). All three publications are available in print from online booksellers or as downloadable PDF versions here: <http://www.monass.org/writing/>. The symposia and publications are part of the agenda of Monsoon Assemblages to foster interdisciplinary conversations between the environmental humanities (anthropology, environmental studies, political ecology, cultural geography and philosophy), the natural sciences (meteorology, climatology and climate science) and spatial design (architecture, landscape architecture, planning and urban design). These are part of its objective to further understandings of the impacts of changing monsoon weather and rapid urbanisation in South Asian cities and beyond, and their consequences for the critical humanities and spatial design practice.

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