Clay Shapes the hand

By

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Author’s Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Clay is a ubiquitous and malleable substance that records history at the scale of geologic time. Present in creation stories and found to be one of the first human tools, clay runs parallel to humanity. Clay acts as a vessel, carrying information across vast time spans both physically and metaphorically. The physical permanence of ceramic objects and the chronological endurance of craft practice provide a unique window on objects and techniques across centuries, linking the contemporary world to past cultural contexts. But today, the scale of commercial use and mass mining distances clay from its meaningful link to place, time, and the human hand.

Through a careful analysis of clay and participation in the craft practice of ceramics, the intention in this thesis is to re-learn how to look closely, read material, de-centre human understanding, listen, and gather clay's story. Beginning with a review of mythical, historical, theoretical, and scientific literature, I attempt to unravel clay's interwoven path with the origins of humanity. The work then turns to site analysis and material experiments to gather information and form a picture of one of humanity's oldest functional materials.

Clay is the lens through which I study three sites, one in ancient Rome, the other in Qing dynasty, Jingdezhen, and a third site in Southern Ontario, where I locate, dig, harvest, and process wild clay. By writing the microhistories of these ancient and contemporary clay sites and engaging in production of two series of ceramic works, the thesis documents learnings about land, ownership, iteration, and consumption.

Contemporary craft practice is deeply connected to material questions, bringing up consideration of their extraction, transport, transformation, and significance. How do I interact with the materials I use to make work and make a living? How do I situate myself as a settler, architect, or potter? The journey of an intimate material relationship with clay becomes a means to think critically about materials, their place in the world, and our own.

Figure 1: Wild clay in all stages

Acknowledgements

I remember the first time hearing Dr. Anne Bordeleau speak at the School of Architecture. She had returned after a sabbatical to give a lecture on her newly published book, *Charles Robert Cockerell, Architect in Time.* I remember sitting in the lecture hall, my mind spinning from the new ways to think about time that she had introduced with such ease. I remember thinking: that is someone I want to learn from.

Anne, it has been such a privilege for that to come true over two years of working together. Our small research group in the Fall of 2019 opened my eyes to many new ways of thinking and seeing the world. I admire your depth of thought in every research area I have thrown your way throughout this research. I am especially appreciative of your continual ability to guide me back to the core of the thesis. Your belief and commitment to the idea that *clay* could be an entire thesis has been an inspiring force behind this work. Thank you for your friendship and patience during the early months of the pandemic and your trust that everything would come together in the end.

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Figure 2. Fifteen week old Mogo found the clay at Evergreen Brickworks while on a site visit.

am so grateful for your generosity in sharing your beautiful property and allowing me to come search for clay. Walter, your decades of observation showed me a real connection and care for land and place. Alison, your hospitality makes every visit so enjoyable, I hope to be back soon.

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Lastly, thanks to our puppy Mogo, who always knows where to find the best mud puddles. I have grabbed many a clay sample during our daily walks along the Yamaska River.

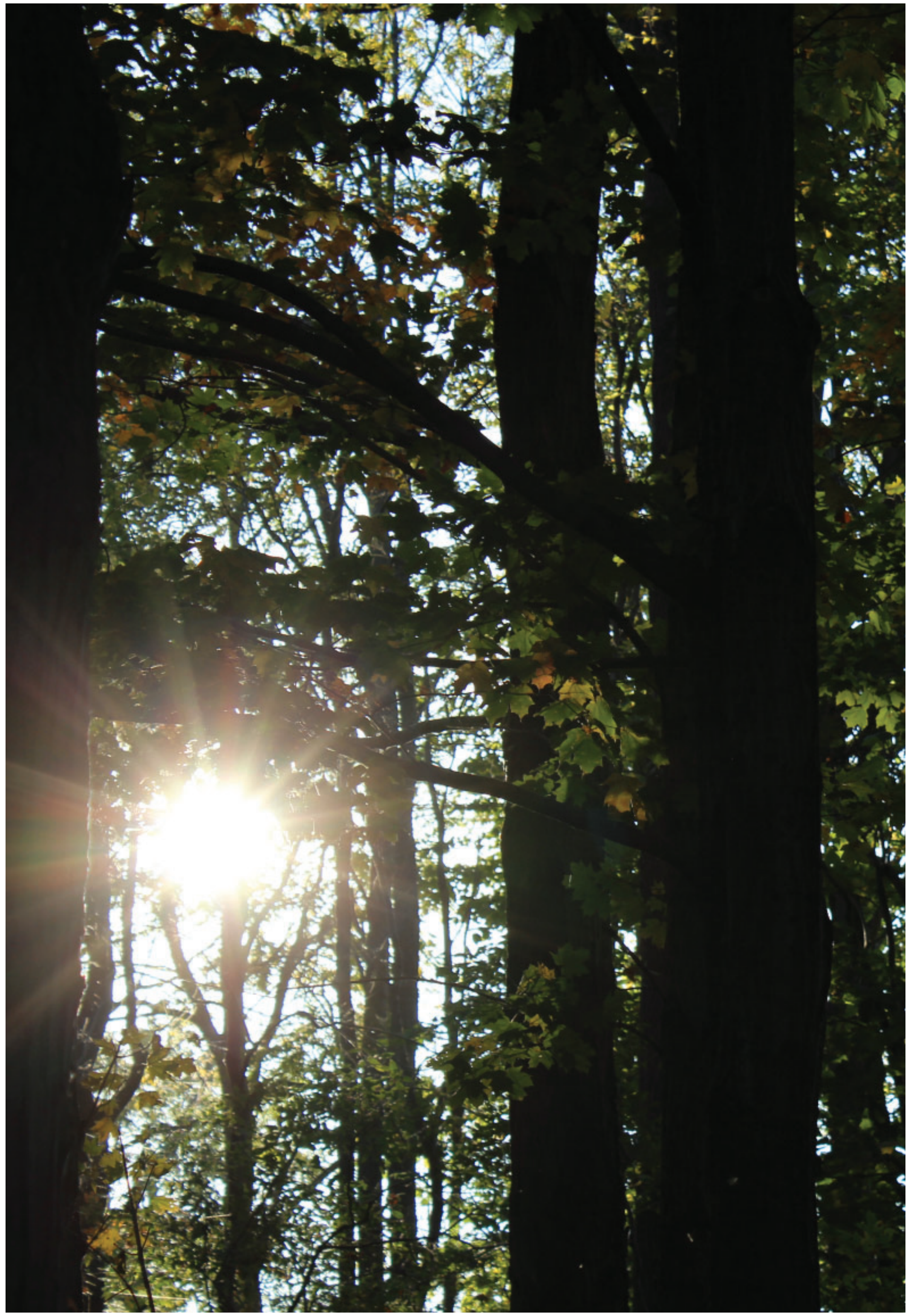

Figure 3. Light shining through the trees in Komoka, Ontario.

Land Acknowledgement

Potters tell one another that clay remembers. The material holds past experiences within itself, often cracking along the invisible remnant of some previous distortion. A potter begins to make something by wedging clay in circular, repetitive motions, preparing it for the wheel's rotation. However, with a broader view, we can see that the potter steps in at the very last. The hands that shape the clay are but a fleeting moment in the span of geological time.

The following work aims to view the larger world through the microcosmic lens of the geologic material, clay. As I walk the land in search of clay, I think about this material memory. I acknowledge that these lands have a history that long outlasts living human memory. We must act in concern for those human, and more-than-human beings who have carried this history across generations and genocide.

When I look around the forest, I see trees double the age of my oldest living relative. I see rocks lining riverbeds formed during the last glacial period. Here, I am small, young, and a perpetual student. I turn to clay as my most familiar teacher. Clay is old and has experienced all time and all places. Clay has sat patiently in the earth, part of a continuous process cycling from large granite boulders to broken down sediments of a riverbed, and now as clay, washed miles downstream and gathered by my hands.

I am grateful to have access to land and natural materials from which I can harvest to make work. I acknowledge the original caretakers of these lands on which I have gathered; the Attawandaron (Neutral), Anishnaabeg, Mississauga's of the Credit First Nation and Haudenosaunee peoples. I accept my role as custodian and advocate for sustainable land practices that will lift causes and amplify voices committed to Indigenous land sovereignty. In my gathering of clay, I remain conscious that my chosen materials are gifts, and that in turn, we must become today's caretakers in reciprocity.

Dedication

In dedication

to the students to come;

may you trust your hands.

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Photographs of ceramic practice in Jingdezhen were taken by Nicole Ratajczak during her travels in 2017, permission for use was given to the author. All photographic rights remain with Nicole Ratajczak.

Figure 4. The Waterloo Potter's Workshop, located in Waterloo Park in the Jacob Eby Farmhouse.

Preface

I started working with clay during the March Break holiday of my first year at elementary school. Along with my older brother, I attended a half-day children's camp at the Waterloo Potter's Workshop. Something we would do, joined a few years later by our younger sister, twice a year for the next seven years. It was the early 2000s, and I had just turned seven. The school curriculum had not yet fully integrated computer learning; my school had only eighteen machines to share between the eight hundred students.

Teaching methods used craft projects to learn about different subject matters. Teachers measured hand dexterity through the ability to trace letters and numbers. In contrast, the children's program at the Waterloo Potter's Workshop valued teaching the hand rather than the mind. This workshop was my first

Figure 5. The author hand building a pot inside the Waterloo Potter's Workshop.

experience where making was learning for its own sake.

In the hand-building class, I remember trying every tool, using my hands in different ways and becoming frustrated when I could not exact perfect control over the clay. A feeling I still experience after another twenty years of practice in the craft. The relief of this kind of learning was, for me, radical. It would also become an internal struggle over the coming years to allow for the education of the body and value the learned hand.

The yearning for this type of experience would lead me to various extracurricular pursuits, including sports and art classes. Making art for my portfolio eventually led me to architecture school, where the study of space was a fourth dimension added to body, mind, and material.

These are interests I have engaged with throughout my education. Amidst my third decade of schooling, I hope to investigate and credit my hands' education — as a potter and architect-in-training.

This education is rooted in the sensory experience of material. It is empiric knowledge that cannot separate itself from existence in the physical world. Verbal description can only get one so far when faced with the challenge of material properties. The senses are our transition from the inner to the outer worlds. The tuned body of the craftsman gains deep knowledge of their materials not through reading books but through sensing. The craftsman becomes aware of material limits through repetitive failure, measuring boundaries and properties with their eyes, ears and hands.

In Richard Sennett's *The Craftsman,* he writes the methods and recipes of four chefs completing the same dish. The directions vary wildly; one method technically details step-by-step directives that provide no explanation of the 'how' behind each step. Sennett explains the limits to this method by invoking relatable imagery of knife holding; there are many ways to hold a knife, but only one grip that would provide the precise control needed for boning a chicken.[1]

One recipe explains each step with common analogies to give a bodily understanding, using the example that snipping a tendon with a pair of scissors is "like cutting a taut string."[2] Sennett explains the surprising effectiveness of the version that comes from a lyrical Persian recipe interpreted entirely by metaphor, likening the chicken to "your dead son".[3] Sennett signifies the importance of Julia Child's innovation in the education of the home chef. Her ability to visually demonstrate in her TV cooking series opens a new door to at-home culinary instruction.[4] It reinforces that there

1 Richard Sennett, The Craftsman, (London: Yale University Press, 2008) 182-193.
2 Sennett, The Craftsman, 182.
3 Sennett, The Craftsman, 192.
4 Sennett, The Craftsman, 184-186.

Figure 6. a-d. Author throwing a pot on the wheel.

is a body of knowledge that cannot communicate linguistically.

I feel drawn to the idea of hands and materials communicating information along with our minds and words. This thesis is a research investigation of the experience held by clay as a material. One of humanity's oldest building materials, clay has been a bystander to human existence for over 25 000 years.[5] Present in all Abrahamic creation stories and discovered as part of the first human tools, clay runs parallel to humanity and the development of the human hand. Clay is the "impartial spectator" to the history of human handwork.[6]

Frank R. Wilson outlines the reciprocal relationship between the muscular development of the human hand and the growth of the human brain in his book *The Hand*. Tool use triggered dexterous evolution in the hand of prehistoric homo-sapiens, which then led to larger cranial cavities as we were able to conduct more complex exercises with our hands and our brains grew in accordance.[7] What we do with our bodies affects our minds. We mould clay, our hands imprinting its surface and constructing it formally, pushing and pulling. However, if we believe the effect the discovery of the tool had on the human brain, we must also consider that this engagement with material is shaping us right back.

Clay shapes the hand.

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5 Katie Treggiden, Urban Potters; Makers in the city, (Brussels: Luidon, 2017) xii.
6 Sennett, The Craftsman, 93.
7 Frank R. Wilson, The Hand: How its use Shapes the Brain, Language, and Human Culture, (New York: Pantheon Books, 1993) 18.

Figure 7. Clay earth in Komoka, Ontario.

The architectural process begins with site analysis. I started this research by looking downwards. I bent over to the ground beneath my feet and pinched a handful of earth between my thumb and forefinger. This small lump of clay became the site of this research.

I first met wild clay in the fall of 2019; it would be one of many encounters over the following two years. During this time, I sourced, gathered, and developed the clay bodies, culminating in two series of ceramic works. The clay vessels manifest material provenance, linking to the landscapes of their origin. Participating in the entire material lifecycle, from harvest to finished object, is analogous to mass resource harvest. Yet, this process occurs at the scale of the hand. This scale develops an intimate relationship with the land and the clay I pull from it.

The land-based learning of this thesis is threefold. I am a white settler residing in Canada. I live and work on disputed land. My chosen field of architecture is a land-based practice and inherently political. As a potter, my work joins thousands of years of ceramic tradition, and by working with clay, I am in communion with constant geological processes. This thesis is the beginning of an ongoing reconciliation of self and land through working with wild clay.

Questioning the disciplines of craft and architecture has brought me closer to the earth that I live and work upon; the traditional territory of the Attawandaron, Anishinaabeg, and Haudenosaunee. This thesis written about dirt has become a literal grounding. It has developed a way of seeing the world and a direction to live an attentive life.

Figure 8. Dry clay pieces snapped in half from Komoka, Ontario.

"Action...creates the condition for remembrance, that is, for history."

Hannah Arendt, The Human Condition, page 8.

Clay, Site & Architecture

The beginning of every architectural project starts with site analysis, in an academic setting, this usually begins with a site visit. Students will bring sketchbooks and create a full catalogue of an area and its urban or rural components. This process lasts for the first two or three weeks of the design process. After this students move into working on their preliminary design ideas in response to the site conditions they found. Towards the end of the design process an architect selects materials considered in relation to the final designs of buildings.

Like any architectural project, this research started with site analysis. I began by looking down at the ground, at the clay beneath my feet, and ended up staying there for the following two years.

I found that there was so much held within this very first architectural action of looking at site. In my past academic projects, I had used site analysis as a stepping stone though which to gather information to inform my larger goal of designing a building. So, for this project, I took a step back and tried to imagine the first act of looking at site as the entire design project. Working with wild clay becomes a means of positioning yourself within a place and a way to understand a location.

Figure 9. Searching for clay in Komoka, Ontario with Elizabeth and her father, Walter.

This thesis joins site to material. I regard them as two faces to one stone, rather than two entirely separate stages of a designers process. In the age of climate crisis where carbon emissions must be minimized, it is essential that architects become more conscious of the embodied carbon of the materials they chose. Materials that are shipped across continents will no longer make carbon or financial sense. Regarding materials that are local to the sites they are to be built upon is a future for sustainable resource use in Architecture.

Structure

Introduction

While the main aims of this research take place through material research in researching, finding, harvesting, processing and making with Wild Clay. The introduction to the thesis contains a small literature review of the material clay. This study is an overview of parallel paths of the geologic material clay and humanity. Clay's influence on contemporary life is immeasurably vast. Three essays pull from the mythological, historical, theoretical, and scientific literature to gather information about clay's cultural and functional presence in contemporary life. Clay and Creation begins by examining the role of clay in human origin stories. Clay and the Human examines humans' cranial and muscular development that led to tool use and societal functions such as farming and cooking. Clay and the City follows this narrative by expanding the role of clay in food storage and the development of agriculture, and the eventual foundation of cities.

Site

After researching clay's role alongside humanity through reviewing the literature in the introduction, I added the context of landscape into the research. *Site* attempts to understand how clay sits within the earth.

The onset of the COVID-19 pandemic affected my plans to travel for site research. Rather than conducting a distanced case study through my

Figure 10. Three pots made from wild clay; a pit fired bowl and two greenware vessels.

computer on these locations, I decided to pursue the site research using two unconventional methods. I use my experience travelling in Rome in 2018 and the second-hand experience of Edmund DeWaal's travels to Jingdezhen to draw an understanding of each ceramic landscape.

The first site, The Red Hill, is analysed through ceramic shards and displays of ancient amphorae seen during my travels in Rome in 2018. I chose to focus on aspects of this site that I had experienced in person. The ceramic series; Testae / Cocci responds to the site of Monte Testaccio in Rome. The second site, The White Hill, was analysed through a literature review of Edmund DeWaal's The White Road. Fellow UWSA alumni Nicole Ratajczak, who travelled there to Jingdezhen 2017, kindly provided the photographs for this section.

Forming

In part three, *Forming*, the research gathered in the introductory essays and site analysis takes shape. As I moved into material explorations I brought the mythical and historical literature and the context of the two ceramic landscapes.

This section documents the third site and researches ceramic landscapes of Southern Ontario. The term Forming identifies the process of how clay minerals come together to form a homogenous substance.

It also explains the process of hands moulding clay into physical form. In finding its permanent form, clay goes through a profound chemical change in its solidification to ceramic. After firing, it exists in a constant state of delicacy, forever on the precipice of shattering.

Forming encompasses the building of my own material intelligence as I narrate the journey to find wild clay. This section is image-based and documents the labour of harvesting, processing, and firing. Photographs show material explorations and tests from the locating, harvesting, and processing of wild clay. The wild clay is contrasted and combined with commercial clay to understand the differences between something pulled directly from the earth and a mined substance commercially mixed and produced.

Remembrance

Part four, *Remembrance*, reflects and concludes the historical and site research undertaken in parts one, two, and three. Remembrance culminates in a final series of ceramic works and an essay that examines the role of this ceramic work in the world and my own actions upon the landscape. I reflect on how and why to use the materials from our local landscapes. Ceramics' material properties condemn them to a vast temporal existence, usually in scattered fragments. Nevertheless, ceramics endure, invoking Hannah Arendt's concept of Remembrance.

Figure 11. Searching for clay along the banks of the Grand River in Cambridge, Ontario.

1. Introduction

And so we're clear,
in the beginning
there was nothing.

Just the water.

Okay, so there were water birds
and some water animals as well.
Okay, and the Turtle.
Okay, okay, and the light in the western heavens
that was not a star
but a falling woman
slicing through the sky
like a bright knife.

Thomas King, Fragment 4.[8]

Figure 12. on left, wet shovelful of wild clay from Komoka, Ontario.

8 Thomas King, 77 Fragments of a Familiar Ruin, (Toronto: HarperCollins, 2019). 4.

Figure 13. Wild clay rich in iron from Komoka, Ontario.

"What we call life is fundamentally a product of catalytic laws acting in colloidal systems of matter throughout the long periods of geologic time."

Leonard Troland, 1917.[9]

Clay and Creation

The presence of clay in the earth is continuous. Its occurrence is strewn across the globe at an unimaginable spatial and temporal scale. Over fifty per cent of all sedimentary rocks can attribute their material properties to clay.[9] Clay particles, which make up five per cent of all minerals found in the earth's crust, are a crucial element to life as we know it.[10] Held within the earth's crust for centuries, this mineral has existed. Clay patiently records geologic time.

The *clay hypothesis* is a term for research that shares a base assumption that *life* arose from clay. In this context, '*life*' qualifies as the very first organisms to come into existence. The work contributing to the clay hypothesis concentrates on understanding

9 Cairns-Smith and Hartman, Clay Minerals and the Origin of Life, 11.
10 Sepp, Siim. "Composition of the Crust." Sandatlas, 2012. https://www.sandatlas.org/composition-of-the-earths-crust/.

the origins of those very first organisms. This research includes the exact climactic and material surroundings necessary for life to arise. Today's definition of life traces the journey of evolution over millions of years from these very first organisms.[11]

Within the clay hypothesis are divergent ideas that all start with clay at the centre of life. Different schools of thought question how the actual life-origin moment came to be. Chemist Dr. A.G. Carins-Smith, the co-author of *Clay Minerals and the Origins of Life* and Earth Scientist Dr. H. Hartman, explains these as falling into three categories. There is the biblical, the idea that a piece of clay somewhere, sometime, was suddenly imbued with life and from this, all life as we know it has followed. The chemical, which suggests clay was a catalytic assistant to an ongoing process of chemical evolution. Furthermore, there is the clay-locale theory, where the natural properties of clay provide the precise environment for the creation of life.[12]

A study by Arizona State University subscribes to the clay-locale theory. Lynda Williams, a professor studying earth and space exploration, led the research. Her team found that volcanic vents on the ocean floor had interior chambers coated in clay.[13] Due to their naturally high heat capacity, these clay-coated volcanic wombs provided the ideal protective

11 Cairns-Smith and Hartman, Clay Minerals and the Origin of Life, 13.
12 *Clay Minerals and the Origins of Life* documents the proceedings of a conference on this very subject that gathered scholars from all over the world to a hotel in Glasgow, Scotland, for a weekend in 1983. The scholars gathered to contemplate the origins of the first organisms and their relation to clay.
13 Ravilious, Kate. "Was Life on Earth Born in a Clay Womb?" The Guardian. Guardian News and Media, November 2, 2005. https://www.theguardian.com/science/2005/nov/02/uk.highereducation.

environment for organic molecules to evolve into all life forms on earth.[14]

In *Clay Minerals,* Carins-Smith authors an explanation of his peer J.D. Bernal's theory. Bernal hypothesized combining the clay-locale and chemical-evolution theories, stating that the crystalline structure of clay particles provide opportunities for ongoing catalyst reactions as the clay fluctuates in hydration.[15] In Carins' opinion, Bernal's combined theory of chemical evolution and the clay-locale theory of a perfectly suitable material environment is one of the most credible theories for the origins of life.

The material properties of clay are specific; it can absorb moisture and soften, becoming plastic and pliable. It can also dehydrate. As the clay dries, its pH level becomes more acidic as the water evaporates and concentrates hydrogen ions in the clay particles. In a dry state, the clay will shrink and become brittle.

The earth's natural freezing, thawing, and drought cycles are countless when considered at the enormous geologic time scale. The cyclical processes of hydration and dehydration create a perpetual flux of alternating pH levels within the clay.

Clay particles can absorb and hold organic molecules that release at different pH levels. These timed releases create instances of crossover for different molecular species. This theory suggests that

14 Brack, A. "Clay Minerals and the Origin of Life." Developments in Clay Science. Elsevier, April 30, 2013. https://www.sciencedirect.com/science/article/pii/B978008098258800016X.
15 John Desmond Bernal was an Irish scientist known for his pioneering work using X-Ray technology in crystalline molecular analysis. This field, called Structural Crystallography, led him to theories on the origins of life as he studied complex molecules found in liquids and proteins in the 1950s.

Figure 14. Clay found during an foundation excavation in Komoka, Ontario.

life originated from the many interactions between other organic molecules over the centuries and millennia of Earth's evolution.

In summation, this theory suggests that the first organism formed from a release of various organic molecules when the clay particles reached a certain pH level. When these organic molecules were released, they collided and sparked the first instance of life.[16]

The science-based life-source origins of clay continue to develop. New technologies and research bring about different perspectives each year. However, no scientific theory can compare to the prolific acceptance of religious concepts of creation. As old as human speech itself, creation stories eclipse all other origin theories in their commonality.

16 Cairns-Smith and Hartman, Clay Minerals and the Origin of Life, 136.

Across cultures throughout the globe, the origin stories of humans recount differing combinations of three elements; a breath of life, a touch of warmth, and a lump of mud. The stories of clay carrying life are as ubiquitous as the material itself.

The life-blood origin of clay is an embedded practice in human narratives. It is as old as the first recorded stories of ancient societies. The author of the *Epic of Gilgamesh*, the world's earliest known work of literature, inscribed the myth on clay tablets. Clay is also present in the tale itself. The Goddess *Aruru* shapes a clay monster, Enkidu, to be a lesson giving second half for the unrelenting King.[17] In the mythology of ancient cultures, origin stories weave with a common thread; Gods shape humans from wet earth.

The transformation from clay to flesh is common in many religious texts. The Bible's clay-based origin narrative in Genesis 2:7 states that "*the Lord God formed man of the dust of the ground and breathed into his nostrils the breath of life; and man became a living soul*." This man born of clay is the biblical figure, *Adam*. His name originates from the Hebrew "*Adamah*", which translates to, son of the red earth.[18]

The Quran describes a similar event in 15:26, "*Behold! Thy Lord said to the angels, 'I am about to create man, from sounding clay, from mud moulded into shape; When I have fashioned him (in due proportion) and breathed into him of My spirit, fall ye down in obeisance unto him.*"[19] In religious texts, a greater being bestows the gift of life and

17 Stephen Mitchell, Gilgamesh: A New English Version. (New York: Simon and Schuster, 2013) 74.
18 https://www.etymonline.com/search?q=adam
19 The Quran, Surah 15, Ayah, 26-29. In the translation by Abdullah Yusuf Ali, (1987, Elmhurst, NY), verse 26 records the creation of man. To explain what sounding clay means, in footnote 1966, Ali states that it is "dry clay which produces a sound, like pottery." Taking verses 26 and 29 together, I understand the meaning to be: That man's body was formed from wet clay moulded into shape and then dried until it could emit sound (perhaps referring to speech); That it was then further fashioned and completed; that into the animal form thus fashioned was breathed the spirit of God, which gave it a superiority over other Creation: and that the order for obeisance was then given."

a
b
c


Figure 15. a-c. Hands grasping clay pulled from the ground during a clay harvest in Komoka, Ontario.

sets up the hierarchical relationship of humans to the natural world.

In creation stories of ancient societies, a lump of clay is ever-present. The Greeks told the story of *Prometheus*, who modelled men of earth and water. In an act of compassion, Prometheus gifted his creations with the godly secret of fire. This act ensured his punishment in perpetuity as the price for the survival of humanity.[20]

Ancient Egyptians looked to the god *Khnum*, often depicted using a potter's wheel, moulding children out of clay and baking them in their mother's wombs.[21] The mother goddess *Nüwa* of ancient Chinese mythology shaped humans from yellow earth. With her love, she gave them life as she set them down upon the banks of a river to warm in the sun. In Hindu culture, the god *Ganesh* went through a transformation from clay to flesh.[22]

The prevalence of mud and clay is also common in indigenous creation stories. One version of the Maori creation story speaks of an effort by multiple gods to create the first human. God *Tāne* goes on a journey gathering the necessary elements to shape limbs and organs out of the red earth found at *Kurawaka*.[23]
The origin story of the Haudenosaunee people, upon whose traditional territories this research takes place, shares common elements with many other origin stories across Turtle Island.

20 Dryden, Garth, and Samuel Garth. Metamorphoses, Ovid. New York, London: Garland, 1976. Book 1, Line 112.
21 The Editors of Encyclopaedia Britannica, "Khnum." Encyclopædia Britannica. Encyclopædia Britannica, inc., February 13, 2020. https://www.britannica.com/topic/Khnum.
22 Qu, Yuan, and Gopal Sukhu. The Songs of Chu: an Anthology of Ancient Chinese Poetry, Chapter Three, Asking Heavenby Qu Yuan and Others. New York: Columbia University Press, 2017.
23 Hiroa, Te Rangi. "The Coming of the Maori." New Zealand Electronic Text Collection. 2016. Accessed May 05, 2021. http://nzetc.victoria.ac.nz/tm/scholarly/tei-BucTheC-t1-g1-t4-body1-d2-d6.html. Māori Purposes Fund Board, 1949, Wellington.

The Woman Who Fell From the Sky
sits on the back of the Turtle
and looks down into the water.

The first thing we need, she says,
is dry land
and to make dry land
we need mud
and the mud we need
is down there.

Thomas King, *77 Fragment 28.*[24]

The *Skywoman* creation story is familiar to First Nations across the Great Lakes area, and it, too, tells of a fistful of earth.[25]

In the fall of 2020, I took an elective course taught by William Woodsworth titled *Twelve Architectures*. He began the first lesson with two orations: the *Thanksgiving Address* and *The Creation Story*. Bill recounted Skyworld as a place "lit by the glimmering leaves of a towering sycamore tree."[26] He began his story with Skywoman's spiralling descent. Noticing the woman's shape tumbling through the sky, the geese below rose to break her fall. Their wings knitted together to guide her to safety on the turtle's back gently.

Bill described the trials of the animals as each species tested their limits to bring Skywoman a handful of mud from the ocean floor. The attempts end with a tiny, clenched fist of mud and the muskrat's sacrifice. Bill grew animated as he described Skywoman's

24 King, 77 Fragments of a Familiar Ruin, 32.
25 Robin Wall Kimmerer, Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants, (Minneapolis: Milkweed editions, 2013) 4.
26 Woodsworth, William. "Creation." Lecture, School of Architecture, Online Lecture, October 2020.

The first animal to dive
into the water
is Duck.

Duck is gone for a long time
and when she floats to the surface,
she doesn't have any mud.
It's dark down there, she says,
and cold
and lonely

Okay, says the Woman Who Fell From the Sky,
who wants to go next?

Thomas King, *Fragment 44.*[27]

relief and gratitude as she held the soil to the turtle's back. Her happiness turned to dance, and the mud began to flourish and sprout life all around. In time, Skywoman's daughter would give her own body to the turtles back from which corn, beans and squash grew, nourishing the Iroquois for all further generations.

In origin stories, it is common to find the first humans baked in a Goddesses' womb or warmed to life with the sun's touch. The transformative life source of clay is humanity, explained through persistent themes of shaping and natality. A common perspective in these stories is one of a gift given from a divine source. In the

27 King, 77 Fragments of a Familiar Ruin, 48.

Figure 16.A fistful of wild clay during the wedging process.

tales with Gods and Goddesses, it is clear that gods bestow the gift of life. It is a gift given by a being that is far greater than the human form they mould. Humanity is forever indebted.

The origin story of the Haudenosaunee offers a different view of creation. These stories place humans in plurality with animal kin, encouraging gratitude towards animals. Without the help from the geese, Skywoman's fall would have ended in disaster. Without the appreciation shown by Skywoman, the growth and bounty that resulted from her joy would not exist on Turtle Island. Thus, the animals show gratitude in return, continuing the cycle. The Haudenosaunee creation story is a model for living in reciprocity and thanks with all other world beings. It is a reminder that even the meek muskrat's life has significance.

As a craftsperson working with material from the earth, I keep the sentiment of the Haudenosaunee creation story in the forefront of my mind. Human supremacy is a construct taken from the original narratives that have shaped human cultures worldwide for millennia. Still, many cultures with creation stories shape a life where humans, the earth, and animals exist in reciprocity. In her telling of the Potawatomi Skywoman creation story, this is an element that Robin Wall Kimmerer emphasizes.

As a Western-trained biologist and an enrolled member of the Citizen Potawatomi Nation, she shares that there are many ways of knowing. Often one person holds contrasting worldviews concurrently. Wall-Kimmerer begins her book, *Braiding Sweetgrass*, with the Skywoman creation story. She, too, speaks of Skywoman's fall to earth, where she started her new life with a gift to the world.

Naming Skywoman as her 'ancestral gardener', Wall-Kimmerer reminds us of the bountiful garden Skywoman created to sustain

Figure 17. A handful of sandy wild clay
during a clay harvest in Komoka, Ontario.

and give pleasure to all animals and humans.[28] She then compares the story of Skywoman's garden with the biblical version. God punishes Eve for tasting the fruit of the garden of Eden. God declares an immediate banishment, "in order to eat, [Eve] was instructed to subdue the wilderness into which she was cast."[29] Through this comparison, it is easy to see how our current societies practice the ideas of supremacy and hierarchy taught to us in creation stories.

Wall-Kimmerer states it clearly; "and then they met, the offspring of Skywoman and the children of Eve—and the land around us bears the scars of that meeting."[30] William Woodsworth left the class with a similar closing comment after retelling the Skywoman creation story, "This is the first story. This is the nature of beauty in the world. This is why we are always grateful and aware of the balance of the spirits held everywhere as we walk about here so respectfully on Turtle Island."[31]

In working with clay, I am conscious of these creation stories. As I shape and mould wet earth, I enact these first moments of creation time after time. I feel this deeply when working with wild clay gathered with my own hands from the riverbanks I grew up beside. I recognize philosopher Hannah Arendt's definitions of *plurality* and *freedom* in these actions. Freedom is one of the base elements in her assessment of the human condition; she proposes it as *freedom of conception*, the possibility to conceive, create and begin anew. In our global understanding of human conception, whether through the origins of the human form, the chemical evolution of organic molecules, or the

28 Kimmerer, Braiding Sweetgrass, 7.
29 Kimmerer, Braiding Sweetgrass, 7.
30 Kimmerer, Braiding Sweetgrass, 7.
31 Woodsworth, William. "Creation." Lecture, School of Architecture, Online Lecture, October 2020.

“When we say that someone crafts an object, we mean that they put their whole self into it, body and mind alike, drawing on whatever skills they have acquired over the course of their lives.

This is a deeply meaningful human activity.”

Glenn Adamson, Fewer, Better Things.[32]

creation of our built environment, clay is central to each narrative.

The industrial-scale of mass manufacturing is abstract and mechanical and severs the intimate connection to the material of human nativity. The metal claws of an excavator replace the hand that shapes the clay. This thesis proposes a re-introduction to the life source of clay. Working at the scale of the hand combats the overwhelming magnitude of material extraction and processing by developing a personal relationship between maker and material.

In harvesting clay, the process becomes an individual act upon the landscape. One person is responsible for the entire material life cycle of clay, from extraction through to production. It requires an unlearning of Eve’s original instructions to dominate the earth. The unlearning changes our relationship to consumption by making tangible the knowledge and labour held within turning matter to material and recognising the agency of the material itself.[33]

Material intelligence is essential for architects who wish to build and design materials in an aware and respectful state. It is a crucial skill set for an architect who wishes to understand the relationships materials have with each other, their extraction site, and their use over time. By engaging with the ceramics process, I am developing my material intelligence. This learning encompasses the knowledge needed for locating, harvesting, and processing clay and the know-how for the making and chemical transformation to ceramic objects. The material choice of clay is self-referential to the site from which it originates. Clay is an opportunity for self-examination. In it, we can see the material of humanity. Clay is the site, the earth, and life source.

32 Glenn Adamson, Fewer, Better Things, (Oxford:Berg, 2007) 16.
33 Glenn Adamson, Fewer, Better Things, 16.

Figure 18. Pointing out wild clay in Komoka, Ontario.

"As much as our ability as a species to tell stories about ourselves, we have the ability as a species to look at ourselves and present ourselves to ourselves, in such a way that we may actually reveal things that are essential... Mimesis, imitating, is natural to human beings; it is part of our essential nature. We are imitators, we make imitations of things to learn, and we get pleasure from imitations."

Rick Haldenby, Lecture: Imago, January 26, 2021.[34]

Clay and the Human

Ceramicists working today join the unbroken chain of craft practice. Pottery has been an active human pursuit from the earliest recorded interaction between hand and clay over 30,000 years ago.[35] Mirroring elements of familiar creation stories, ancient people shaped clay figurines in the image of their makers. The famed Woman of Dolní Vestonice, found in the Czech Republic, dates at 25,000 –28,000 BCE.[36] A similar figure, the Woman of Willendorf, now housed at the Naturhistorisches Museum, Vienna, dates from a comparable period.

34 Haldenby, Eric. "Imago." Lecture, Imago Lecture, School of Architecture, Online Lecture, January 26, 2021.
35 Treggiden, Urban Potters; Makers in the city, 5.
36 Suzanne Staubach, Clay: The History and Evolution of Humankind's Relationship with the Earth's Most Primal Element, (Hanover: University Press of New England, 2013) 49.

“Imitating is natural to human beings from childhood onwards: man differs from other animals in being extremely imitative; his first steps in learning are made through imitation, and all people get pleasure from imitations.”

Aristotle, Poetics, Book 4[35]

As soon as hands could shape, prehistoric humans began creating objects in their image by making figurines from clay. Scholars assume this was an accidental discovery. Perhaps, a clay figure rolled into a fire one evening. Or possibly thrown in an offering dedication, or even tossed into the embers out of frustration.[38] By the following morning, the clay figure had transformed into hardened ceramic.

This replication of the human form occurred long before the thought to use clay for practical use such as cooking, storing food, or holding water. As soon as human hands learned how to pinch, hold, and shape, some of the first objects made were images of their makers. The human condition has always questioned the self and identity, evident in the things we make.

The act of making is a reciprocal relationship between mind and body. In psychologist Frank Wilson’s book, *The Hand*, he poses a ‘chicken or egg’ scenario about prehistoric human development. He asks, did our brains begin to grow, creating the ability to make tools and use them? Or did our hands lead the way to the first uses of crude tools? Was it this development that began to shape and grow our brains as our hands opened new ways of thinking?

Wilson outlines the direct connection of the Homo-Sapien’s cranial development to tool use and intricate hand movements throughout the

37 Aristotle, Poetics, Book 4.
38 Staubach, Clay, 6.

Figure 19. Excavating pots from a pit fire in Kitchener, Ontario.

text. As hand dexterity increased, so did the size of the human brain.[39]

Cognitive function is a foundational element to contemporary human activity; the capacity to process information and the size of our brains set humans apart from any other species. Wilson developed this elementary theory of hand-mind connection through his experience as a musician and neurologist. His research informs his neurology practice, where he works with musicians disabled by crippling hand injuries. From these experiences, he realized that the hand is not only an extension of the mind. The hand is a

39 Wilson, The Hand, 123. 18.

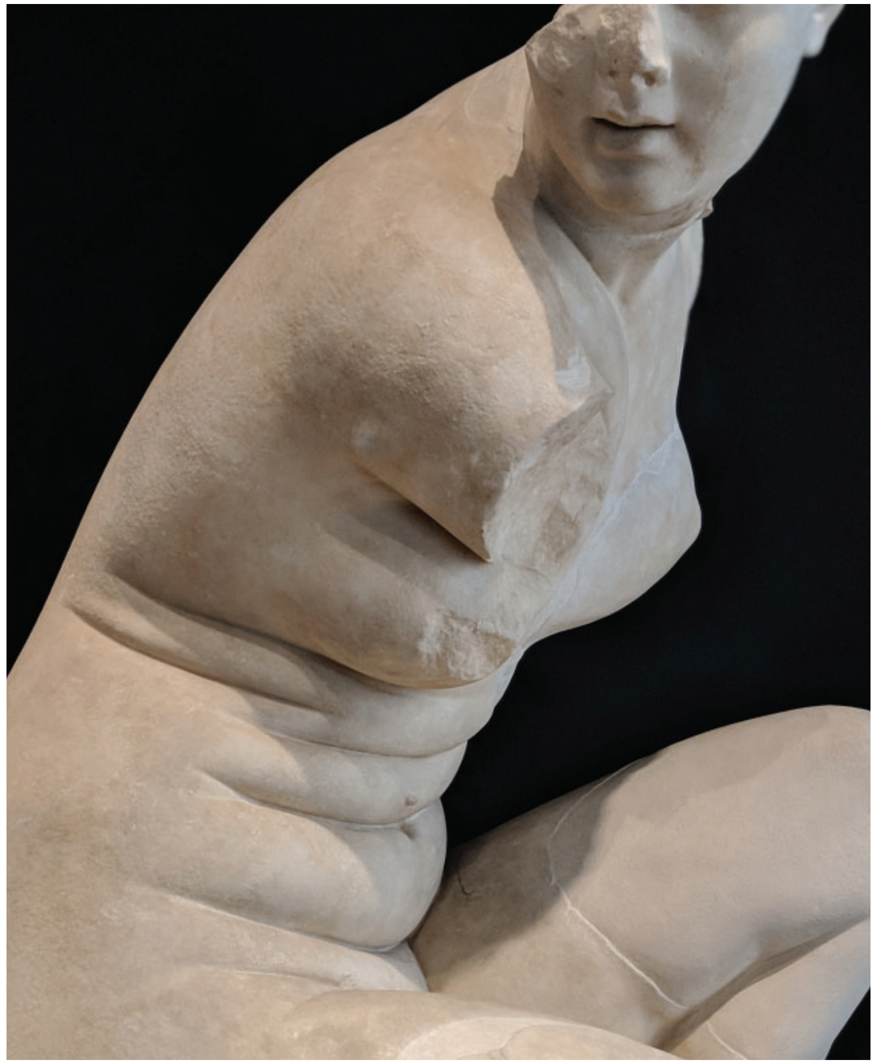

Figure 20. Crouching Aphrodite bathing, marble sculpture from the second century CE, seen in Museo Nazionale Romano Palazzo Massimo Alle Terme.

direct foundation of our identity as individuals and as a society.[40]

The oneness of mind and body is a question many have grappled with throughout history. Greek Philosopher Aristotle also considered that humanity finds its nature through a reckoning of the mind and body. He questioned how we, as humans, can reconcile the carnal and the spiritual nature of our two halves. Aristotle considered that the soul must embody both mind and body but stipulates that neither impresses

40 Wilson, The Hand, 35-60.

Figure 21. Collapsed 3D printed clay vessel, folded upon itself. Printed in the fall of 2019 as part of the Material Syntax elective at the School of Architecture in Cambridge, Ontario.

itself upon the other.[41] Aristotle's concept of soul acts as one being, with distinct levels of awareness to one's interior and exterior environments.[42]

The act of imitating the human form aids individuals in reconciling mind and body. Through this replication of human form, one can place oneself inside another body, examining and reproducing an image

41 Haldenby, Eric. "Imago." Lecture, Imago Lecture, School of Architecture, Online Lecture, January 26, 2021. Many thanks to Rick Haldenby, without whom this subject would have remained unclear

42 Amadio, Anselm H., and Anthony J.P. Kenny. "Philosophy of Mind." Encyclopædia Britannica. May 27, 1999. Accessed May 05, 2021.

of oneself. The human condition of considering one's place within their own body and then extending oneself to the exterior world is as prevalent today as in ancient societies. It is for this reason that artists study the human form and have for millennia. It is also why human figures are some of the oldest discovered handmade objects.

However, the Jomon people, who lived in Japan from 14,000-300 BCE, are exceptions.[43] The earliest representation of a ceramic human figure found in their society dates to 1000 BCE, a time at which they had already been making ceramic cooking vessels for nearly 15,000 years. This astounding feat is in great contrast to other Neolithic societies. Communities in Thailand and China would not make functional ceramic vessels until 7500 BCE and 4500 BCE.[44]

Jomon Pottery originated in Japan with the Jomon people, a semi-nomadic fishing society. Their livelihoods centred around the nearby waterways. Their earliest surviving ceramic work dates 14 000 BCE.[45] Due to the corded indentation on Jomon pottery, historians assume that their ceramic vessels originated from woven reed baskets. Anthropologists believe they lined their reed baskets with mud to improve their ability to hold water.[46][47] Then one day, someone left a reed basket too close to the fire, and they discovered that the mud had hardened, and the reeds had burned off, leaving a ceramic shell.[48]

43 Glenn C. Nelson, Ceramics; A Potter's Handbook, (Orlando:Holt, Rinehart and Winston, Inc., 1960) 19.
44 Nelson, Ceramics, 24.
45 Treggiden, Urban Potters; Makers in the city, xii.
46 Nelson, Ceramics, 20.
47 Dawn Whitehand, Pit Firing Ceramics; Modern Methods, Ancient Traditions, (Atglen:Schiffer Publishing Ltd, 2013) 14-15.
48 Staubach, Clay, 5.

The burned reeds left their impression on the clay, marking a corded texture on the exterior of the pots.[49] These reed impressions became singular to individual Jomon communities. They decorated their pot surfaces with designs so intricate that these unique markings trace back to specific places and eras on surviving pots. With particularly individual specimens, it is even possible to identify localized family groups.[50]

The decoration of Jomon Pottery reveals much about their making process. The black surfaces of the Jomon pots indicated that they covered the fire pit after firing the pots, resulting in a reduction atmosphere and the shiny black surfaces.[51]

Aside from the aesthetic discoveries, Jomon Pottery is also significant for the evidence of its use as the first cookware. Jomon people used these pots to make the first stews and potages, marking a massive leap in development for a pre-Neolithic civilization. The cooking jars had round or pointed bottoms so they could nestle into the sand or ash of a fire.[52] With vessels sturdy enough to withstand flames, the culinary world of the Jomon people expanded. Stone-Age meals of cooking fresh meat or fish directly over a fire evolved to combine different elements. Herbs, spices, and grains mixed with water formed hearty and long-lasting cooked meals, rudimentary bread, and baked grains. These are vital developments for any society facing drought or food scarcity.

49 Nelson, Ceramics, 20.
50 MacGregor, Neil. "The History of the World in 100 Objects: Episode 10 Jomon Pot." The British Museum (audio blog), January 29, 2010. Accessed February 2020. https://www.bbc.co.uk/programmes/articles/L8SjTFqQbnJzgcVW767GwM/episode-transcript-episode-10-jomon-pot.
51 Reduction pit-firing is still a widespread practice used today to fire pots of the Pueblo communities in the Southern United States. See: Whitehand, Pit Firing Ceramics, 27.
52 Staubach, Clay, 7.

Figure 22. On left. Various drawings of the ceramic's collections in the museums of Rome from my sketchbook. Drawn in the Fall of 2018.

Figure 23. Above. Pots fresh off the wheel marked with the throwing lines from the process of their making.

Figure 24. Stoneware hand built storage vessel coated in wild clay slip and marked with a corded texture.

Clay and the City

The Jomon people were migratory before they began making ceramic cooking vessels. A hunter-gather society, they moved along the waterways finding the most plentiful fishing grounds. When they used ceramic vessels for cooking and storing food, they transitioned from a migratory society to a stationary community that developed preliminary agricultural techniques.[53] Towards the end of the Jomon period they achieved consistent cultivation of rice and millet.[54] The development of ceramic cookware, jars, and baskets were an essential catalyst to moving from a hunter-gatherer to an agricultural society.

Post-greenware societies are classified as those to have discovered the ceramic properties of clay though placing the greenware, or raw clay, into a fire where it changes chemically and turns to ceramic. With the introduction of ceramic cookware, cooking methods expanded to include steaming, baking, stewing, and boiling. This discovery led to the culinary invention of cooking porridges by boiling grains in water.[55]

This process of cooking dried grains removes the immediacy from food preparation. Rather than immediately needing to cook a fresh kill, cooking with grains allows for a food source that can be dried, stored, rehydrated, cooked, and eaten later. Removing immediacy from food preparation inserts the concept of food security into a society's culture. It then follows that a community with food security feels less need to continue migratory routes searching for new food sources. Adapting from a nomadic to a stationary way of life creates the time to invest in agricultural practices that further increase food security.

An agricultural society has two main requirements; fertile land to farm and individuals to work the land. A transition to stationary culture benefits domestic tasks such as child-rearing and cooking. In a stationary society, women could more easily share childcare and

53 Whitehand, Pit Firing Ceramics, 15.
54 Staubach, Clay, 7.
55 Staubach, Clay, 5.

Figure 25. Various drawings of the ceramic's collections in the museums of Rome from my sketchbook. Drawn in the Fall of 2018.

culinary work amongst family groups.[56] The sharing of domestic tasks increased the ability to raise more well-fed children. This cycle of food cultivation and storage is directly related to population increases of successful ancient societies. The children of a food-secure society are more likely to survive and grow into strong adults who can aid in agricultural tasks, furthering the community's food security and the ability to increase their population.

In her book *Clay*, Susanne Staubach, a clay-based artist, researcher, and author, proposes that ceramic craft would have easily slotted in amongst the domestic duties of an ancient civilization. She

56 Staubach, Clay, 4.

explains how most archaeologists are confident that Neolithic ceramic craft was a pursuit of ancient women. [57][58] This is true for the Jomon potters; Staubach imagines women to have shaped pots in the spare moments between minding children and processing the rice and millet grains for their diets.[59]

To practice agriculture, societies had to put down literal roots in an area. The metaphorical roots that followed tied societies to places and locations, developing regional cultures. Ceramic practice became common in preliminary agricultural communities where settlements established more permanently.

In stationary societies, family groups increased in size and required more significant amounts of food. As the agricultural practices of an ancient community expand, their storage needs require larger ceramic vessels.

Making larger ceramic storage vessels requires investment in infrastructure to support the building, firing and use of these larger vessels. This work requires areas to prepare the clay, sites and equipment to make the vessels and larger firing areas to turn the clay into ceramic. All these tasks lead to a further establishment of a community in a particular place. Through thriving agriculture and food storage, a settlement expanded into a village that transformed into a town that then spread into a city. Ceramics began to develop regional characteristics that followed the specificity of the area and the culture of their makers.

As ceramicists established themselves and began to build their kilns, the city formed around them. The first kilns were invented in Mesopotamia during the Hassuna period in 6000 BCE.[60] As populations grew, so to did the kilns. Ancient ceramicists built more extensive and efficient kilns to accommodate larger jars and fire them to higher, more robust

57 Staubach, Clay, 4.
58 This theory is seconded by Whitehead, in her book where she summarizes C.P. Garraty's article on the subject. See: Whitehead, Pit Firing Ceramics, 15-17.
59 Nelson, Ceramics, 20.
60 Treggiden, Urban Potters; Makers in the city, 5.

"If you haven't got something to put it in, food will escape you — even something as uncombative and unresourceful as an oat. You put as many as you can into your stomach while they are handy, that being the primary container; but what about tomorrow morning when you wake up and it's cold and raining and wouldn't it be good to have just a few handfuls of oats to chew on and give little Oom to make her shut up, but how do you get more than one stomachful and one handful home? So you get up and go to the damned soggy oat patch in the rain, and wouldn't it be a good thing if you had something to put Baby Oo Oo in so that you could pick the oats with both hands? A leaf a gourd shell a net a bag a sling a sack a bottle a pot a box a container. A holder. A recipient.

The first cultural device was probably a recipient.... Many theorizers feel that the earliest cultural inventions must have been a container to hold gathered products and some kind of sling or net carrier.

—Ursula K. Le Guin, *The Carrier Bag Theory of Fiction*.[61]

temperatures.[63] Kiln technology grew in its intricacy and efficiency. Kilns became harder to take apart and move to different locations.

A prosperous agricultural society operates with a surplus of food and requires storage jars to hold the excess. Times of significant excess allows for the keeping of larger groups of people in one place. The shared use of clay links food storage and ceramic jars to the birth of the first cities.

The cycle of requiring food stores to feed a growing population perpetuates as the agricultural practice expands and becomes more efficient. Eventually, the ever-increasing needs of an

61 Ursula K. Le Guin, The Carrier Bag Theory of Fiction, (UK:Ignota Books, 2019), 28-29.
62 Many thanks to Jessica Hanzelkova for sharing this quote during her Architecture 192 lecture; *Site*, on November 1, 2021.
63 Staubach, Clay, 51. See Appendix C.

Figure 26. Various drawings of the ceramic's collections in the museums of Rome from my sketchbook. Drawn in the Fall of 2018.

expanding population require the infrastructural support of a city. For what is a city if not storage of goods and people? The ceramic walls of moon jars and amphorae hold the city's food stores, and walls of clay bricks hold the city's people.

Pottery originated as an urban pursuit to provide wares and building materials for a civilized area. In their workshops, ceramicists pulled up the walls of the storage jars as they threw them on the wheel. Elsewhere in the city, bricklayers built up the city walls brick by clay brick. The city pulls up from the earth. The city is *clay*— shaped and moulded by hands making vessels, bricks, homes, pipes, and roads.

With the pulling up of the city walls, the delineation of inside and outside of city limits began. One of the main themes of the *Epic of Gilgamesh* battles the construct of defining urban human life and the acceptable behaviour of citizens and government within the limits

Figure 27. Roman bricks photographed near the roman forum in 2018. An example of Opus Quadratum brick style.

of the city.[64] The King of *Uruk* represents the city. The spiralling bad behaviour of the King describes a broken social contract of living in the city. There are conditions of being within the city walls, where things are refined, civilized, and ruled with strict order. Outside the city walls, there is danger, wild beasts, natural phenomena, and the unknown. When the King oversteps his power and acts like a feral beast within the city walls, it is unacceptable to the people and the Gods. Gilgamesh is configured through Godly intervention to go outside the city limits, where he is then "tamed" by the wilderness and his quest.[65]

The city's infrastructure was the primary device that provided citizens with the civility that urban life promised, including sanitary infrastructure such as access to clean water, removal of waste, and maintenance of roadways. The city also enforced social infrastructures, including citizens' rights, participation in governing systems, and the upholding of laws.

The city walls became a symbol of civility, determining the difference between society and barbarism. In the first century of the common era, the building of walls was a political pursuit during the rule of Roman Emperor Hadrian. Ever-expanding the realm of the Roman empire, Hadrian pushed the construction of walls to the furthest extent of roman control, determining who was inside and outside of Roman society.

Prolific in creating structures, Hadrian heavily invested in infrastructure, including roads and walls made of ceramic bricks. Rome was not built in a day; it was built brick by brick by the hands of the enslaved population. Citizenship was a commodity held in the highest regard in ancient Rome and available to only the privileged. To be a citizen was exclusive and highly desired. Scholar Alison Burford explains that, "citizenship embodied the right to live as a free man within the bounds of the community, and to own

64 Mitchell, Gilgamesh, 8.
65 Mitchell, Gilgamesh, 7.

Figure 28. Roman brick example of type Opus Reticulatum. Photographed in Pompeii, 2018.

Figure 29. Roman brick example of type Opus Latericium. Photographed in Pompeii, 2018.

Figure 30. Hadrian's Wall photographed in the Fall of 2018.

property."[66] In the ancient-western world, If one was not free, they were not a citizen and considered to exist outside of society.[67]

In Greece, craftsmen lived among the categories of free-noncitizens and the enslaved. Free craftsmen could live according to their own will but could not participate in city life and public affairs.[68] In Rome, citizenship was distributed more widely, with any freed enslaved person given the option to become a citizen.[69] Previously enslaved people carried the title of libertinus, while freeborn men and the children of freed enslaved people held the title of ingenui.[70]

The enslaved workforce made bricks in vast quantities, developing the technology to an extremely high standard. No brick manufacturer could replicate their quantity or accuracy for nearly 1000 years until the industrial revolution and the introduction of machinery.[71] Many types of bricks developed during this period of heavy infrastructural investment. Roman architectural texts, including Vitruvius's Ten Books of Architecture, go into detail to describe the applications and techniques of each type.[72] Brick technology incorporated casting concrete and plaster into brick surfaces to create multilayered facades that allowed material quantities to stretch further and cover larger surfaces.

Hadrian's Wall was a fortification that spanned a defensive barricade

66 Alison Burford, Craftsmen in Greek and Roman Society, (London: Thames and Hudson, 1972) 31.
67 Burford, Craftsmen in Greek and Roman Society, 28.
68 Burford, Craftsmen in Greek and Roman Society, 33.
69 Burford, Craftsmen in Greek and Roman Society, 37.
70 Burford, Craftsmen in Greek and Roman Society, 38.
71 Burford, Craftsmen in Greek and Roman Society, 136.
72 Burford, Craftsmen in Greek and Roman Society, 133.

Figure 31. Paestan Vase with Lid, Asteas, 340 BC. Terracotta Red Figure, Orestes about to slay Clytemnestra. Painted in watercolour.

over 100 kilometres in length across the North of the United Kingdom.[73] This wall provides an example of the ancient delineation of civilization and barbarism that is still standing today. Archaeologists have discovered ancient Roman bricks which bear marks of the makers throughout the Roman empire. In a society that valued extreme uniformity in its building materials (and the dehumanizing anonymity of its slave workforce), these minuscule marks nod to the trained

73 Information gathered from my notes taken during Rick Haldenby's lecture when touring Hadrian's Villa in the Fall of 2018 outside of Rome, Italy.

Figure 32. Red Figure Volute Cratere, with Singular Palm Leaf Frame. Painted in watercolour.

hands and individual expression of unknown craftsmen. In Sennett's words, ancient maker's marks "declare, 'I *exist*,' rather than 'I *resist*.' But 'I *exist*' is perhaps the most urgent signal a slave can send."[74]

The differences in the western and indigenous worldviews compound with this statement, "I exist." Romans used clay bricks as a way to claim land; the bodies of the anonymous enslaved craftspeople were the backs upon which the empire built itself. Repetition and

74 Sennett, The Craftsman, 135.

Figure 33. Photographs of museum collections and watercolour vase sketch on my studio wall.

uniformity were tools used to erase identity and expression and aid in conformation to the Roman ideal. In a vastly different approach, the Skywoman creation story tells of clay used not to claim land and build walls but instead to grow a garden that all human and animal life can benefit from. In his expulsion from the Garden of Eden, Adam tames the earth with a conquering attitude. He becomes its master as leader of the hierarchy of Gods' Kingdom.

This attitude of dominance directly relates to the ideas of mass consumption in Ancient Rome. The empire expanded beyond its reach, consuming people and materials at an unprecedented rate to push the extents of the empire further and further. It is a mindset mirrored by the european decendants whose own visions of expansion started in the

15th century and produced the concepts and effects of colonialism that contemporary societies grapple with today. Settlers first arrived in what is now called Canada in the 17th century, bringing with them disease that devastated Indigenous populations and attitudes that continue to plague this country with racism, bigotry and white supremacy.

Defining an in and out of the cities in the ancient Roman Empire, it followed that cities began to specialize in specific goods and skills. Defining the space of a city creates the condition for recognizing the terroir of an area. Environmental characteristics that develop goods such as oil, wine create regional products with differing values. When a city develops a good or service, such as vase painting, they can export it in times of surplus. Greece became known for its beautiful cultural objects. These Greek painted vases became the standard of beauty and were highly sought after by ancient Romans.[75]

Roman craftsmen adopted the styles of the Northern Etruscans and the Southern Greeks.[76] They never fully invested in developing their ceramic style. Instead, craftsmen focused on other arts such as architecture and sculpture.[77]

The popularity of Greek vase painting led to the import of goods and skilled workers, as Greek vase painters were brought into Roman cities to create their wares.[78] In the town of Paestum in Southern Italy, two Greek temples stand in almost perfect states of preservation. The Greeks who lived in this area were talented vase painters. Paestum became a centre for decorative vase painting within Italy as the Roman Empire expanded southward.[79]

Both Greek and Roman societies also produced utilitarian

75 Nelson, Ceramics, 44.
76 Nelson, Ceramics, 50.
77 Nelson, Ceramics, 50.
78 Burford, Craftsmen in Greek and Roman Society, 67.
79 Nelson, Ceramics, 50.

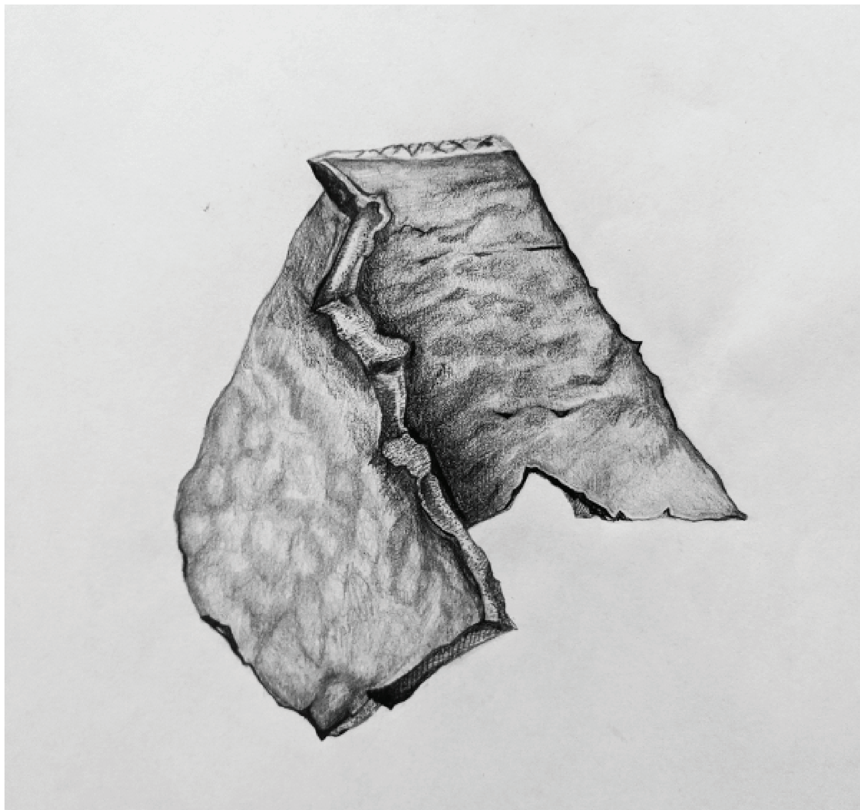

Figure 34. Pencil sketch of a fragment from a broken ceramic vessel.

vessels used to store and transport goods in and out of cities.[80] Potters crafted large amphorae from local red earthenware clay. Due to the material properties of earthenware clay, these jars were able to keep goods cool and dry in the vessel's interior, as any moisture would sweat through the porous material.

These shipping container jars were pointed on the bottom to nestle into the sand. They would have lug-shaped handles on the sides and neck so they could be tied up in the berth of a ship as it travelled from port-to-port trading goods.[81] Ancient

80 Staubach, Clay, 13.
81 Staubach, Clay, 14.

They say
that every piece
of clay
is a piece of
someone's
life.
They even say
it has
its own
small voice
and sings in
its own way.

So
the children
touch
the pieces
carefully
as they
kneel there
in the hot
dry sand
listening
for whatever
voice
a broken pot
might use—

—Byrd Baylor, *When Clay Sings*.[83]

amphorae have been discovered in shipwrecks with their contents undisturbed, preserving ancient oil, wine, and honey stores.

Exporters encoded Amphorae with a shipping label, a *Titulus Pictus* in Latin. This label was very similar to what is required on custom forms of our mailing system today. The producer's name, importer destination and contents were stamped or painted onto the side of the jars.[82]

These shipping labels help archaeologists identify clay types, craft

82 Staubach, Clay, 14.
83 Byrd Baylor, When Clay Sings, (New York, USA: Aladdin Paperbacks, 1972) 3-4.

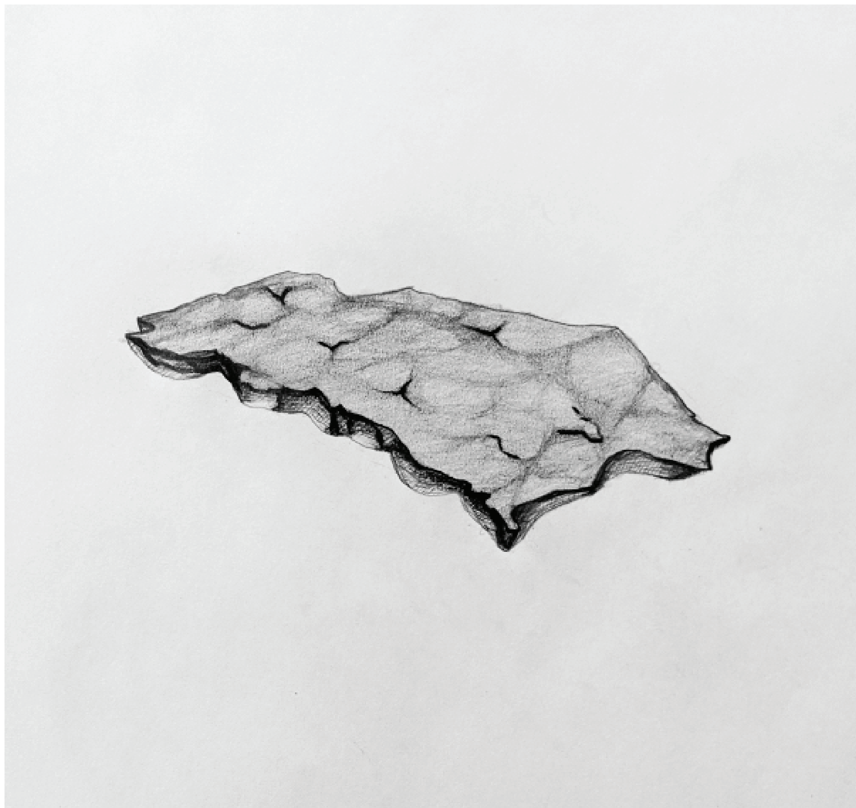

Figure 35. Pencil sketch of a fragment from a broken ceramic vessel.

techniques, and regional characteristics of pottery in specific world areas. A tiny fragment or shard can identify specific settlements and groups of people. Ceramic fragments are essential puzzle pieces in determining the trade relations of ancient societies.

Ceramic shards are often the first clue to the presence of past civilizations. Scattered fragments are little more than shapeless objects within space, irrational in their form, quantity, and dispersion on site. However, they hold immense power to translate ideas, techniques, customs, and cultures when collected and studied in larger groupings.

It is these small remainders of human activity that begin to give shape to an archaeological excavation. The fragment's first significant role disregards itself as an object, signifying instead to the imagined whole. Fragments are a method of temporal translation; people were here. The

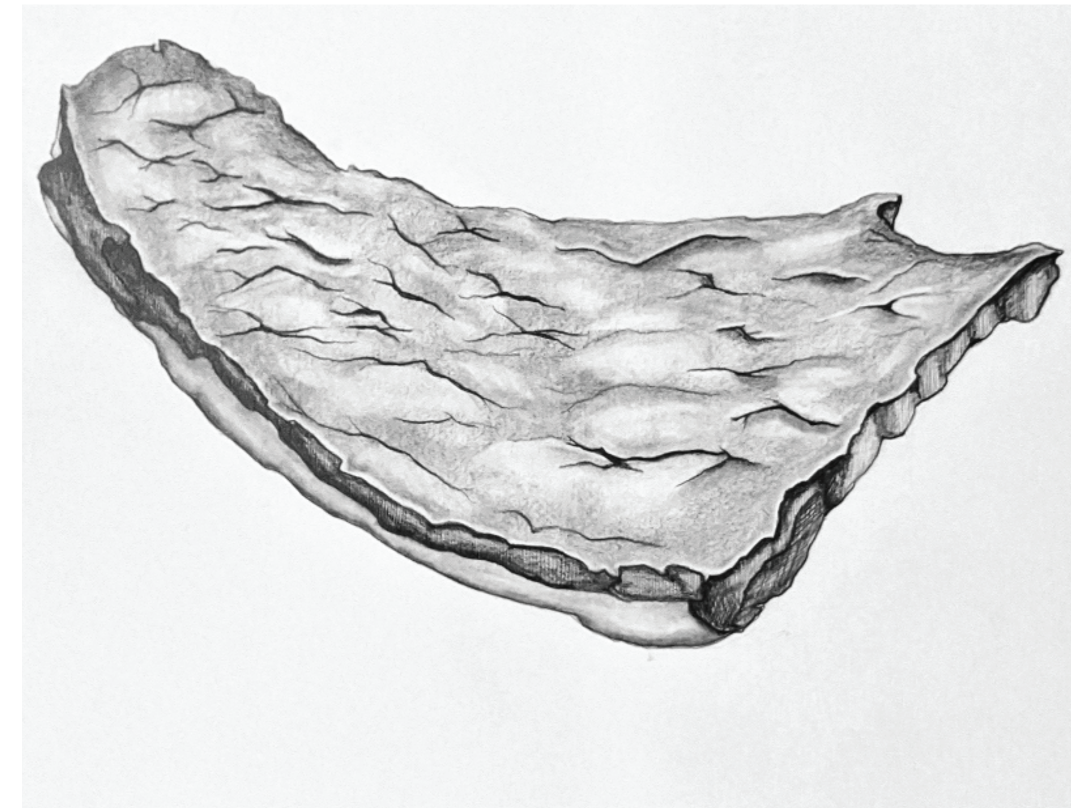

Figure 36. Pencil sketch of a fragment from a broken ceramic vessel.

fragments are material representations of the presence of human life; they are direct connections to the hands of the past. Shards exist in a dual timespan between the hands of the maker and the conservator. They are tied together through the material natality of clay.

Archaeologists gather fragments to reconstruct vessels and discover lost information. As they unearth clues, an image of the past society materializes. Ceramic shards are vital for establishing chronology; firing clay captures a snapshot of the geological context within the material fabric of clay. Fragments piece together different aspects of societies; one shard may tell the technological advancement reached based on the evidence used. Other fragments provide evidence of trade, diet, and rituals. A culture becomes ingrained in objects, able to communicate values, technology across centuries.

Figure 37. Various drawings of the ceramic's collections in the museums of Rome from my sketchbook. Drawn in the Fall of 2018.

Figure 38. Chunks of dried clay harvested from Komoka, Ontario.

2. Site

Ceramic Landscapes

The onset of the COVID-19 pandemic affected my plans to travel for site research. Rather than conducting a distanced case study through my computer on these locations, I decided to pursue the site research using two unconventional methods. I use my experience travelling in Rome in 2018, and the second-hand experience of Edmund DeWaal's travels to Jingdezhen to draw an understanding of each ceramic landscape.

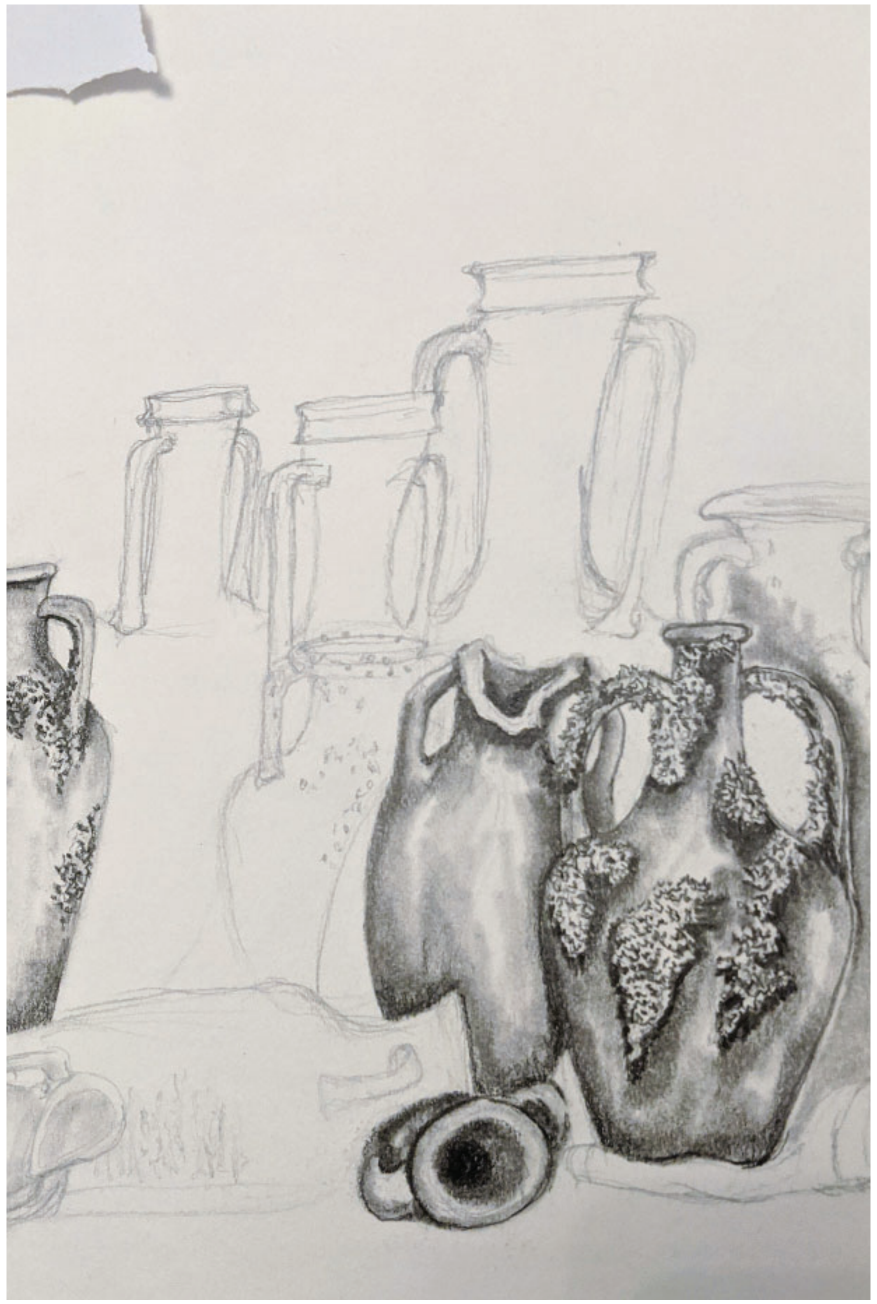

Figure 39. Sketches of amphorae in Rome from my sketchbook. Drawn in the Fall of 2018.

The Red Hill

In the fall of 2018, I was living and studying at the University of Waterloo Rome campus. One Friday morning in early September, we spent the day touring museums in the city. The class travelled from our studio in Piazza Santa Maria in Trastevere, over the Ponte Garibaldi bridge, walked past the Torre Argentina and its occupant stray cats, soaking up the waning autumn sunshine. We gathered outside on the Via Delle Botteghe Oscure before entering the Crypta Balbi. It would be a significant event for me that would generate the initial inspiration for this thesis research.

In the middle of the displays on the second level, there was a large glass case filled with sand, plate shards, and reconstructed amphorae. The glass was very reflective, bouncing the shadows of my classmates as they passed by and reflecting my figure in front of the ancient

Figure 40. Display of ancient ceramic amphorae at the Crypta Balbi in Rome.

pots. As I held my hands up in the air to take a photo, their reflection obscured the curvature of an amphora, and I could almost feel the cool, rough surface of the earthenware pot in my hand.

The display was a reconstruction of vessels recovered from a shipwreck, and although the pots were not all whole, it highlighted how much information each shard contained. Trade routes mapped lines of connection behind the glass of the display. Lines connected ancient societies, tracing trade routes and economic partnerships.

I could see the whole of an ancient world in the shards of these amphorae. It is easy to become numb to the relics of the ancient world after three months of living amongst them. The surviving Roman ruins are remnants of the grandeur of the ancient displays. The highly skilled carvings in perfectly pristine marble look as if their craftsmen made them to be kept in museums and private collections. The display at Crypta Balbi of broken amphorae was unpolished. The contrast stopped me; the pots were utilitarian and crafted for strength and efficiency rather than beauty. They were cracked and broken, covered in barnacles and damaged from spending time underwater. The roughness caught my attention. It was a window to the materials and textures of the everyday. I spent most of the morning there, sketching in front of the shards covered in sand and barnacles and ended up rushing to make it to the other museums before closing.

Figure 41. Testae / Cocci series of ceramic works, completed by the author in the Fall of 2020.

Monte Testaccio

Monte Testaccio in Rome is an artificial mountain of built-up layers of ceramic amphorae shards. Located in Rome, Italy, the mountain is an ancient garbage dump. The etymology of the mountain comes from the Latin term testae and the Italian translation, cocci, or shards.[84]

Ceramic amphorae were filled with goods and shipped into the city. The emptied amphorae were sent on to Monte Testaccio for disposal. The amphorae that make up the shards of Monte Testaccio transported olive oil. The amphorae were shattered and dusted in lime or vinegar to mitigate the coating of olive oil from becoming rancid then stacked in shingled layers.

This mass movement of products between the Roman Empire, African coasts, and Mesopotamian world travelled on ships stocked with ceramic jars. The 20 000 cubic meters of shards show the economic power of the empire. The remnants of this mass economy created a ceramic landscape.

84 Rodríguez, José Remesal, Dr, and Blázquez Martínez, Dr. The Mount Testaccio in Rome. Proceedings of Exhibition Mount of Amphorae, Italy, Rome. January 15, 1997. Accessed August 27, 2021. https://web.archive.org/web/20050302200446/http://ceipac.gh.ub.es/MOSTRA/u_expo.htm.
I used the exhibition website for the conference to gather information about Monte Testaccio.

Testae / Cocci Series

Artist Statement

While studying abroad in Rome during my undergraduate degree, I became fascinated by ancient Greek and Roman ceramics seen in museums during my travels. This inspiration led to combining my experience as a ceramicist and architectural education for my graduate research. My craft practice focuses on gathering local materials and processing them to use in ceramic sculpture. The harvested materials become analogous to the architectural 'site', recording their geologic permanence. I use traditional forms and methods to place the research within a larger historical context. The work re-imagines archetypal forms to exist in contemporary space and time.

It seemed every museum had a display piled high with broken amphorae from the ancient world. After a while, the shards seemed to combine into one large form in my mind. The mountain of broken pots represented centuries of trade, economy, craftsmanship, and technology of the ancient world, and it was all packed into one display. Archaeologists examine each shard to find unique information about where and how they were made, their makers and purpose, what they carried, and trade route travel patterns.

Despite this highly detailed information held within an individual shard, history seems to be collapsing on itself, artisans and technique lost to time, blanketed in anonymity. Time accelerates, the broken pile of pots grows, and the tension between known and lost information increases. This series speaks to this tension; through repetition, reconstruction, and recreation, ancient forms are piled once again, balanced upon one another. The series creates an image of accelerated time, a growing mountain of pots consuming one another.

On left:
Figure 42. Testae / Cocci Series.

The Capacity of clay to evoke land, water and knowledge coalesces in historian Christine De Lucia's concept of "memoryscapes."

DeLucia defines memoryscapes as "constellations of spots on the land that have accrued stories over time, transforming them from blank or neutral spaces into emotionally infused, politically potent spaces"

Anya Montiel, and Sequoia Miller.
Form & Relation: Memory Landscape Knowledge, 2020.[85]

[85]*Testae/Cocci:* The Italian and Latin words meaning broken fragments or shards also relate to a specific location; *Monte Testaccio*. An artificial geological formation consisting of over 500,000 cubic meters of broken amphorae shards from the ancient Roman world. My sculptures examine how individual pots join together and amass into gathered formations over time, such as the broken amphorae amassed into Monte Testaccio.

Pots are thrown individually on the wheel and then attached in a careful composition that excites tension between pots and brings balance to the whole. The stoneware vessels are thrown with proportions reminiscent of ancient archetypal forms, paying close attention to Greek principles of symmetry and balance within each pot. The individual pot is reimagined as they are brought together into a mountain of pots. Bases and necks melt into one another, making it hard to understand where one pot starts and another begins.

85 Montiel, Anya, and Sequoia Miller. Form & Relation: Contemporary Native Ceramics: Memory Landscape Knowledge; The Clay Practices of Indigenous Artists. Edited by Jami C. Powell. (Hanover, New Hampshire: Hood Museum of Art, Dartmouth, 2020,) 27.
This quote refers to Christine DeLucia's article "The Memory Frontier: Uncommon Pursuits of Past and Place in the Northeast after King Philip's war," found in Journal of American History 98, no. 4 (March 2012): 977.

Figure 43. Testae / Cocci Series.

Figure 44. Photograph of a fragment from a broken ceramic vessel.

Figure 45. Photograph of fragments from a broken ceramic vessel.

Figure 46. Testae / Cocci Series No. 2.

Figure 47. Testae / Cocci Series No. 2.

Figure 48. Testae / Cocci Series No. 3.

Figure 49. Testae / Cocci Series No. 3.

Figure 50. Testae / Cocci Series No. 3.

Figure 51. Photograph of fragments from a broken ceramic vessel.

Figure 52. Testae / Cocci Series No. 4.

Figure 53. Testae / Cocci Series No. 4.

Figure 54. Testae / Cocci Series No. 5.

Figure 55. Testae / Cocci Series No. 5.

Figure 56. Photograph of fragments from a broken ceramic vessel.

Figure 57. Photograph of fragments from a broken ceramic vessel.

Figure 58. Testae / Cocci Series grouping.

Figure 59. Artisan working in ceramic production in Jingdezhen, China. Photographed by Nicole Ratajczak.[86]

The White Hill

<u>On Shards</u>

In 2018, I moved to San Francisco for eight months, where I joined a pottery studio. My meagre salary from my co-op placement was devoted to rent and studio membership fees.

Our instructor issued a warning on my first day of class before anyone sat down at the wheel. What you put in the kiln becomes permanent; it will outlast you, consider each piece you make and ask if you can be responsible for its care and lifecycle on this earth. You can recycle clay until the point of firing, but it becomes much more difficult after that. What you fire in the kiln is here to stay.

I imagine this warning came after many class cycles, and forgotten items were left to collect dust on shelves. Every year, the studio has a fundraiser to sell off the unclaimed pieces for charity; the staff try to

86 Photographs in this section of ceramic practice in Jingdezhen were taken by Nicole Ratajczak during her travels in 2017, permission for use was given to the author. All photographic rights remain with Nicole Ratajczak.

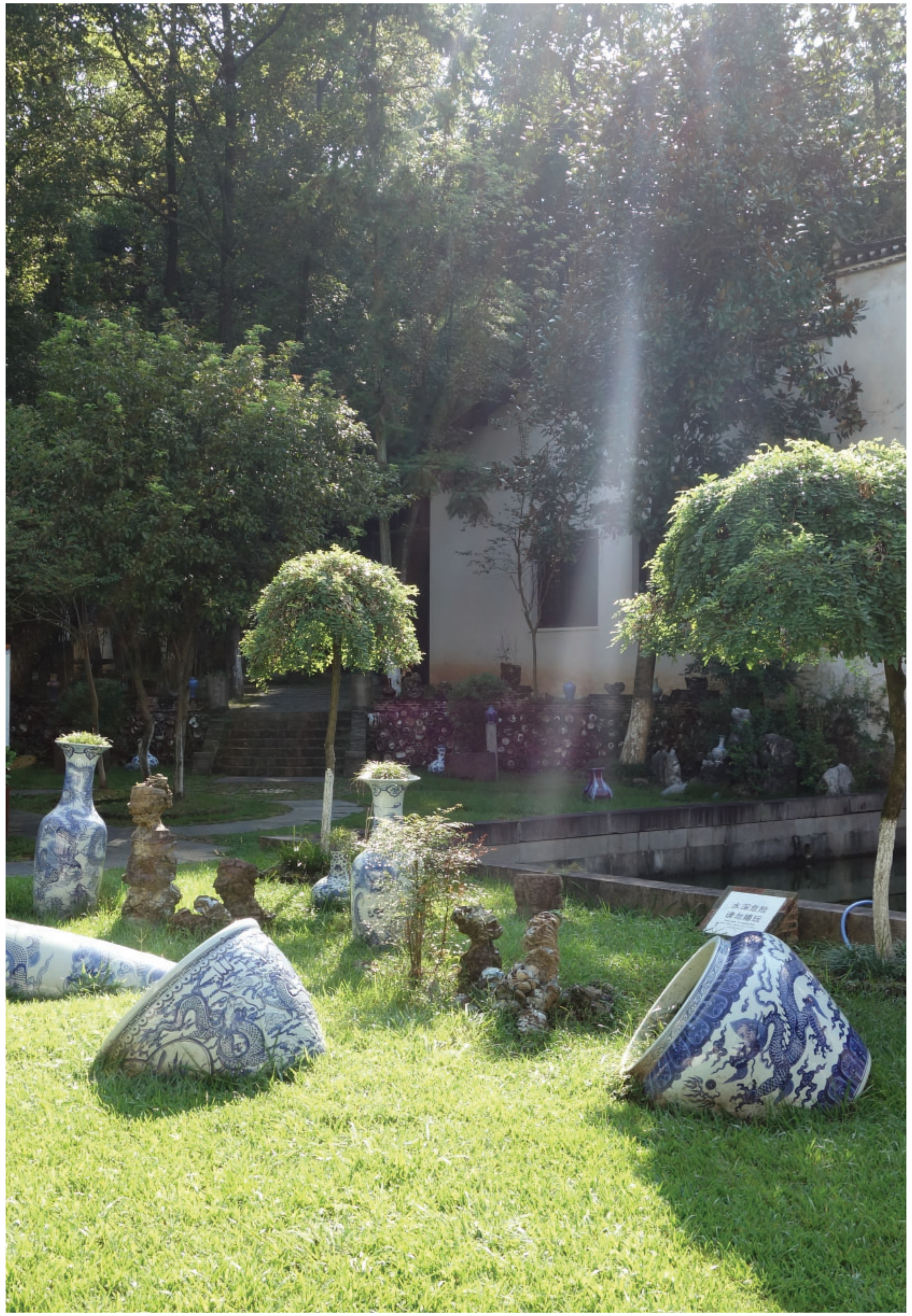

Figure 60. Porcelain ware embedded into the landscaping in Jingdezhen, China.

give these permanent objects a second chance at life. After the sale, the instructor has to collect all the unclaimed work, smash it, and throw out the fine ceramic shards. I imagine his frustration at the unclaimed work and the garbage he must create. His statement was a small attempt to break the cycle of using, consuming, forgetting, and wasting.

Destruction & Permanence

Smashing unclaimed work is a ritual steeped in ceramic tradition. It is the unseen facet to the production of successful wares. Edmund De Waal, a British author and ceramicist, embarked on a pilgrimage for his second book. He undertook a journey to one of the oldest origin sites while trying to understand his chosen sculptural material, porcelain. His book, *The White Road*, *Journey into an Obsession,* is aptly named for the detailed documentation of the material, economic, cultural, and colonial aspects of porcelain's process, production and export across the globe.

The book is an intimate portrayal of artist and material; the relationship between De Waal and porcelain unravels layer by layer in his writing. De Waal attempts to understand the mystery of porcelain's place in the world by travelling to different geological locations. His findings continue to deepen as he learns more about its persuasive and elusive material qualities. In Jingdezhen, China, De Waal enters a "landscape of porcelain," shards upon shards of porcelain fragments that over centuries have accumulated to form the smooth undulation of the surrounding hillsides.[87] He describes the city as densely packed. Everywhere he looks, there is economy and culture derived from hundreds of years of ceramic practice.

Looking at the mounds of shards, He imagines the misstep on a tight alleyway leading to a board of smashed tea bowls. Yet, as the journey into knowing porcelain unravels, he realizes that only a tiny percentage

87 Edmund De Waal, The White Road; Journey into an obsession, (Toronto: Alfred A. Knopf Canada, 2015) 24.

Figure 61. Porcelain bowls sitting on ware boards after throwing.

of these thousands of shards would have been the result of an accident. It is more likely that potters smashed almost all the shards through acts of purposeful destruction.

Destruction has long been a part of ceramic tradition. Any work found with fault, no matter how small, must be destroyed so as not to tarnish a craftsperson's reputation. Ideas of recycling and consumption have become more prominent in contemporary culture, so today's studio potters usually offer a line of seconds rather than smashing their work. These pieces are not good enough to be sold at full price but not blemished enough to be smashed. Built into the price of the final object is the cost of all the failures that the process has consumed along the way.

Figure 62. Porcelain bowls sitting on ware boards after decoration.

In Jingdezhen, shards of failures are embedded in the landscape. These smashed lessons impated their learnings upon the muscle memory of the craftsman's hands. The hillsides of stacked shards are memories of thousands of hands flitting from pot to pot, painting, pinching, brushing. The landscape is built of thousands of moments of precision just slightly nudged out of focus. Looking at the wall of shards, one can imagine the missteps; pinching the forefinger and thumb too tightly when pulling up a wall, trimming a pot too thin, and there, on the lip of a cup, the oils of an invisible fingerprint causing the glaze to pull away.

De Waal points out how failure was economically enforced on the craftspeople of Jingdezhen. They were paid by each finished item, known

a
b
c


Figure 63. Ceramic production practice in a pottery workshop.
- a. Throwing off the hump
- b. Shaping the rim of a bowl
- c. Glazing the interior of a foot rim

as a piecework model, rather than by the hour or salary.[88] This pay scale puts a direct cost on failure and increases the pressure of perfection.

To operate at the scale of perfection, the factory process of Chinese ceramicists had to be highly efficient. The *Tao Lu*, a 19th-century guide complete with woodblock illustrations, documents the making of porcelain works.[89][90] De Waal points to how the role of perfection drove the craft of porcelain works into fragmented production by quoting the Tao Shu. This text is a 19th century Qing Dynasty porcelain manual, which records that each ceramic work passes through seventy different pairs of hands.[91] Humans can perfect small, individualized tasks yet struggle for precise replication when various skills must be combined.

The *Tao Lu* provides a guide for defining every step of the process into one task per individual. A workshop may employ a grass painter, a petal shaper, a kiln loader, a kiln starter, a kiln unloader. Each task became so specific that no one person in the workshop could make a pot from start to finish; the work became an entirely collective effort.[92]

The callous use of materials is a symptom of a capitalist view of land and natural resources. This viewpoint contends that the earth and all contained minerals are resources there for the taking. This mass consumption leads to overrun landfills, the exact image the instructor was picturing as he issued his warning about the permanent nature of ceramics. Exacerbated by the increase in productivity since the industrial revolution, mass consumption is not a new concept.

In Jingdezhen, the drive for both mass production and perfection has altogether changed the landscape. The sea of shards is a physical manifestation of a cultural practice that took place over centuries.

88 De Waal, The White Road, 48.
89 De Waal, The White Road, 44.
90 A similar craftsmanship manual can be seen in the Encyclopedie by Diderot. Published in 1751, the book catalogued the practices of various crafts, including ceramics in France.
91 De Waal, The White Road, 63.
92 De Waal, The White Road, 44.

a

b


c

d


Figure 64. Places of ceramic production in Jingdezhen.
a. Ware drying in the rafters
b. Bowls drying in the sun
c. A kiln with two smoke stacks
d. Ceramic roof tiles in the foreground and a catenary arch kiln in the background

The left-behind remnants of the age of porcelain are not going anywhere, and they are here on this earth to stay. The manufactured landscapes of mass material movement from depleted mines to built-up urban centres are products of industrialization over the past five hundred years. The movement of material from places of production to places of consumption is as old as humans themselves. Ceramic shards identify trade routes and cross-cultural influences.

The amphorae collection at Crypta Balbi identifies clay types, markings, and vessel shapes to determine the makers, locations, and export and import routes. This information is further analyzed to understand which groups of people had good and bad relations, material and produce rich, exporting to cities of lower production, what people were eating and trading.

Permanent change to landscape is a symptom of ceramic production; mining depletes resource stores formed during the glacial melting of the last ice age. These mined materials combine to make the ready-to-use clay found in ceramic shops. Although mined landscapes usually transform through subtraction rather than the addition of material, Jingdezhen has the complex relationship of both; the mines emptied of Kaolin as the hillsides filled up with thousands of scattered shards.

Orders for ceramic services sets by the imperial courts developed large-scale porcelain production in China. Starting during the sixteenth century, Dynasties placed orders for 30,000 identical settings at a time.[93] The precision required to fulfil these orders, combined with the naturally delicate beauty of porcelain, thrust Chinese wares onto an international stage.

As demand increased, the process left the hands of craftspeople during further mechanization in China's industrial revolution. The Kaolin mines depleted and the hillside so corrupted that mining became impossible.[94] These ceramic communities were

93 De Waal, The White Road, 151.
94 De Waal, The White Road, 35.

Figure 65. Porcelain bowls wheel thrown off the hump, drying in the sunlight.

left with little economic vitality, swimming in the waste product of a booming age gone bust. However, the skills passed down through generations also have a long duration in the world.

Ai Weiwei went to Jingdezhen to commission his sunflower seed project, where over 150 million seeds were press moulded and hand-painted.[95] Workers in Jingdezhen returned to a piecework model and paid for their completed seeds by weight. The project encapsulates the thousand-year-old history of China's relationship to porcelain and the complex nature of mass-production methods. The Sunflower seed project injected life into the ceramic economy of Jingdezhen but also pointedly exemplified its downfall. De Waal notes that almost every hand in the village contributed their handiwork and that you could still purchase the rejected seeds in the antique markets years after the 2010 installation at the Tate Modern.[96]

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95 De Waal, The White Road, 65.
96 De Waal, The White Road, 66.

Figure 66. Display of ancient ceramic amphorae at the Crypta Balbi in Rome.

Figure 67. Chunks of dry clay harvested in Komoka, Ontario.

3. Forming

Forming defines the qualities that are lacking in shape. It is the action of taking shape. Again, rooted in natality, it is full of possibility. The choice of forming is the action of applying human agency. The craftsman takes the position of the sculptor, putting a hand to clay and forming, the architect, pen to paper. This interaction is the direct relationship of the maker to material. The skin to clay connection holds ingrained bodily knowledge.

The craftsman can sense intrinsic factors that will determine the materials use on a particular day. Temperature, humidity, pliability is immediately known through direct material connection. It is through determining boundaries that forming something requires a body of knowledge to drive decisions. The craftsperson's hand is engaged and thinking; they have trained muscles and tendons and physically hold the knowledge of their craft.

They know
the moulding of
a lump of clay
has always been
a slow
and gentle
work.
No hurrying.
No rushing.

Hands that
shape
the earth
this way
have time
to know
the cool
touch
of the sand

Women then
must have
spoken
to the earth
as they took
its clay.
They must have
sung special
songs

for shaping the bowl,
for polishing it,
for baking it
so it would be
strong enough
to last
long after
that tribe
was gone.

Byrd Baylor, *When Clay Sings*[97]

97 Baylor, When Clay Sings, 9-10.

Figure 68. Granite rock from an island in Georgian Bay, Ontario.

The Rock Cycle

Geology, landscape, rock, and clay are fluid. It is humans who project permanence on geology with a limited understanding of time. When examined at the scale of deep time, rock is a liquid flowing continuously between the earth's surface and interior. Clay is formed through the slow degradation of sedimentary rock as it erodes and crumbles into fine-grained particles.[98] Over the 50-million-year existence of our surface rock, the 500 years of industrialized human mining means both nothing and everything.

Without human interference, rocks would take thousands of years to degrade. It would take hundreds of thousands of years for the rock debris to migrate its way down from the mountains. Human activity has led to a faster progression of natural erosion. Sediments eventually deposit onto the ocean floor, compacting under immense pressure and turning into metamorphic rock.

As this rock compacts over millions of years, it descends to the earth's interior, where it melts into magma. Finally, the magma is reborn as volcanic rocks after spewing to the earth's surface in a volcanic eruption. The lava flowing from the volcano cools, creating a new mountain and continuing the cycle. The scale at which we consider manufactured landscapes is so incomparably minuscule to the life cycle of geologic formation. Despite every consumptive act human industry enacts upon the earth's matter, when examined at the geologic time scale, the unending rock cycle of geologic absorbs all into the fluid process of rock and magma.

98 Bernard Leach, A Potter's Book, (Great Britain: Transatlantic Arts, 1973) 44.

Figure 69 a. Pink granite in Georgian Bay.

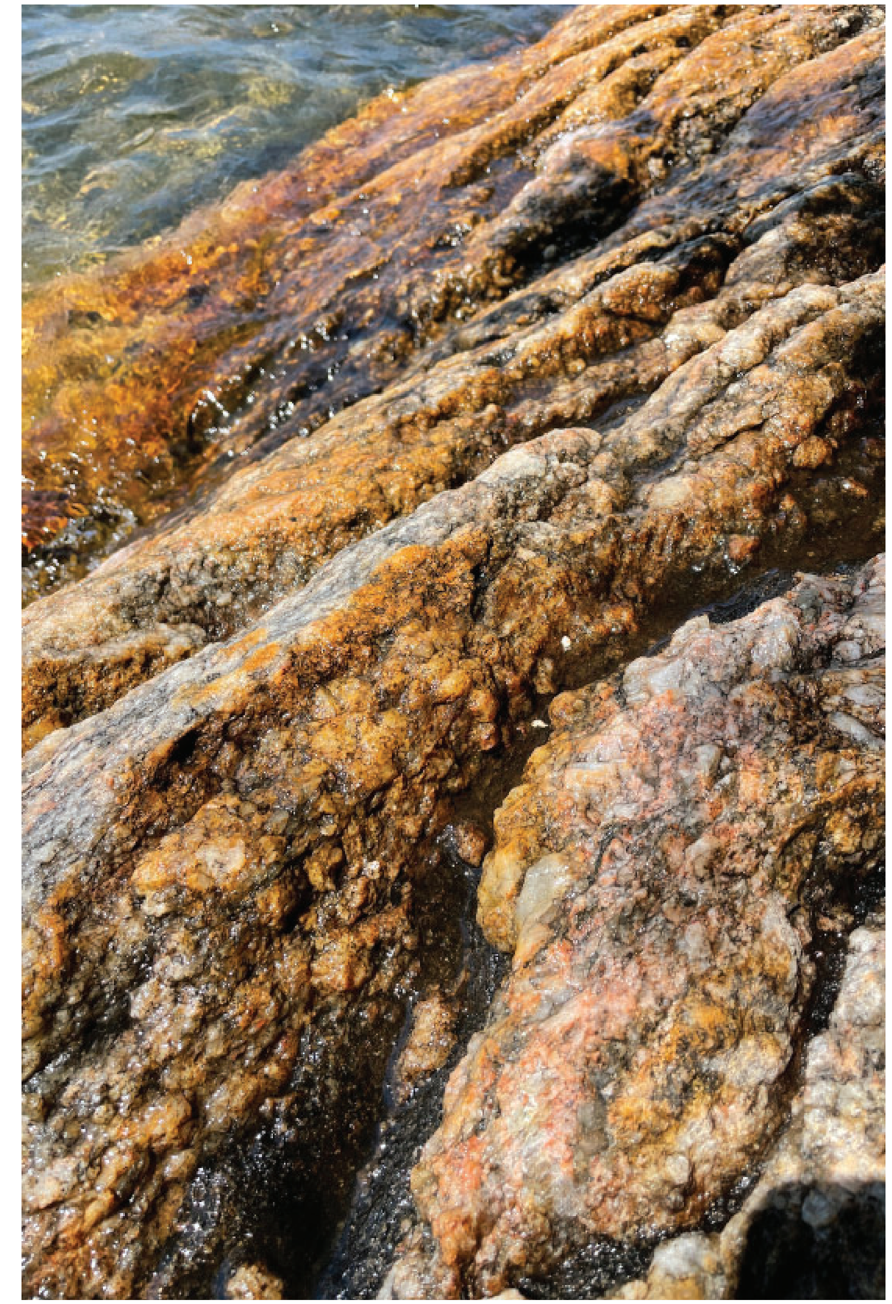

Figure 69 b. The rocks and waters of Georgian Bay.

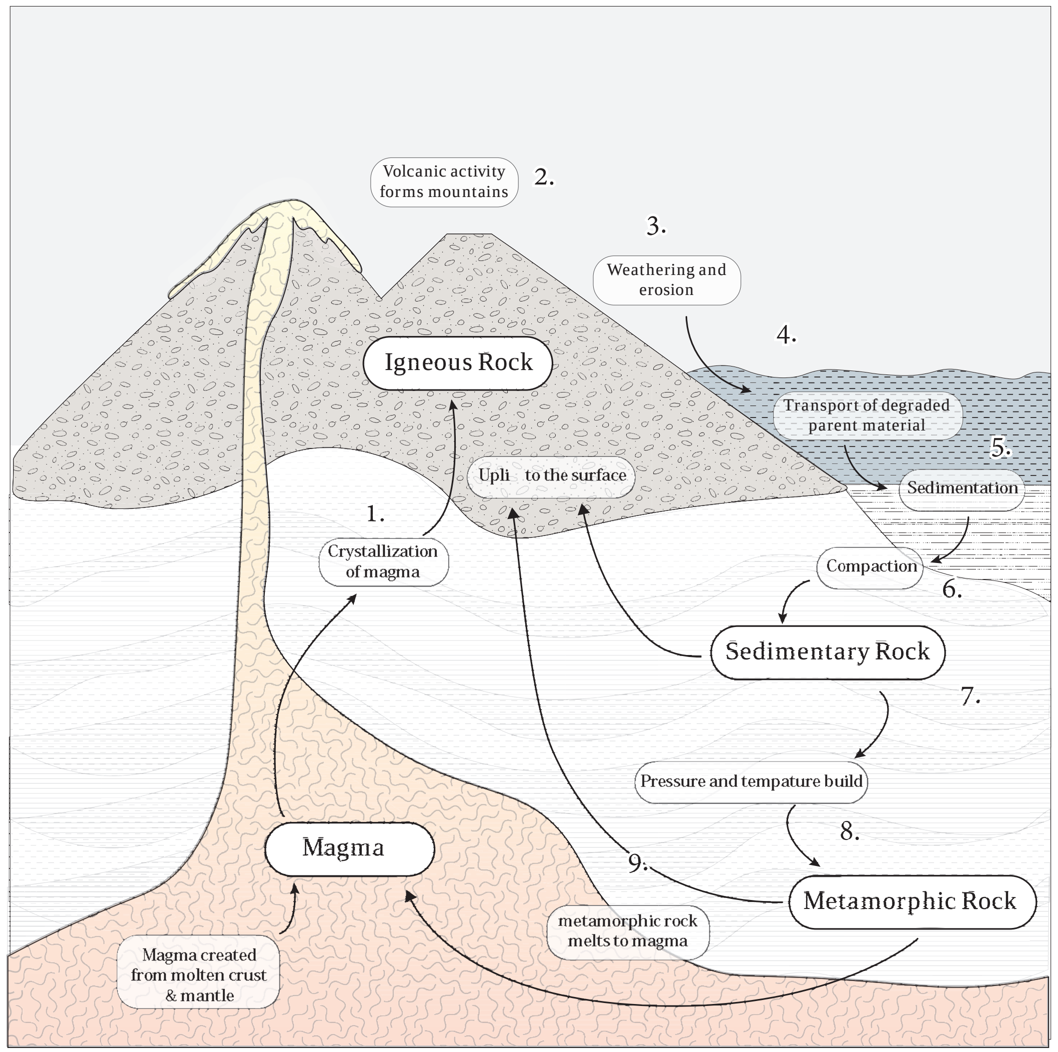

Figure 70. The rock cycle diagram, illustrated by the author.

Rock Cycle Diagram

1. Magma crystallizes and forms igneous rock.
2. Igneous rock forms mountains.
3. Mountains erode.
4. Boulders break down.
5. Sediment decays into minerals and small particles.
6. Clay is the decay of rock.
7. Sediment and rock decay is compressed and sent further into the earth.
8. It is compressed into metamorphic rock.
9. It melts and becomes magma or slowly uplifts to the surface.

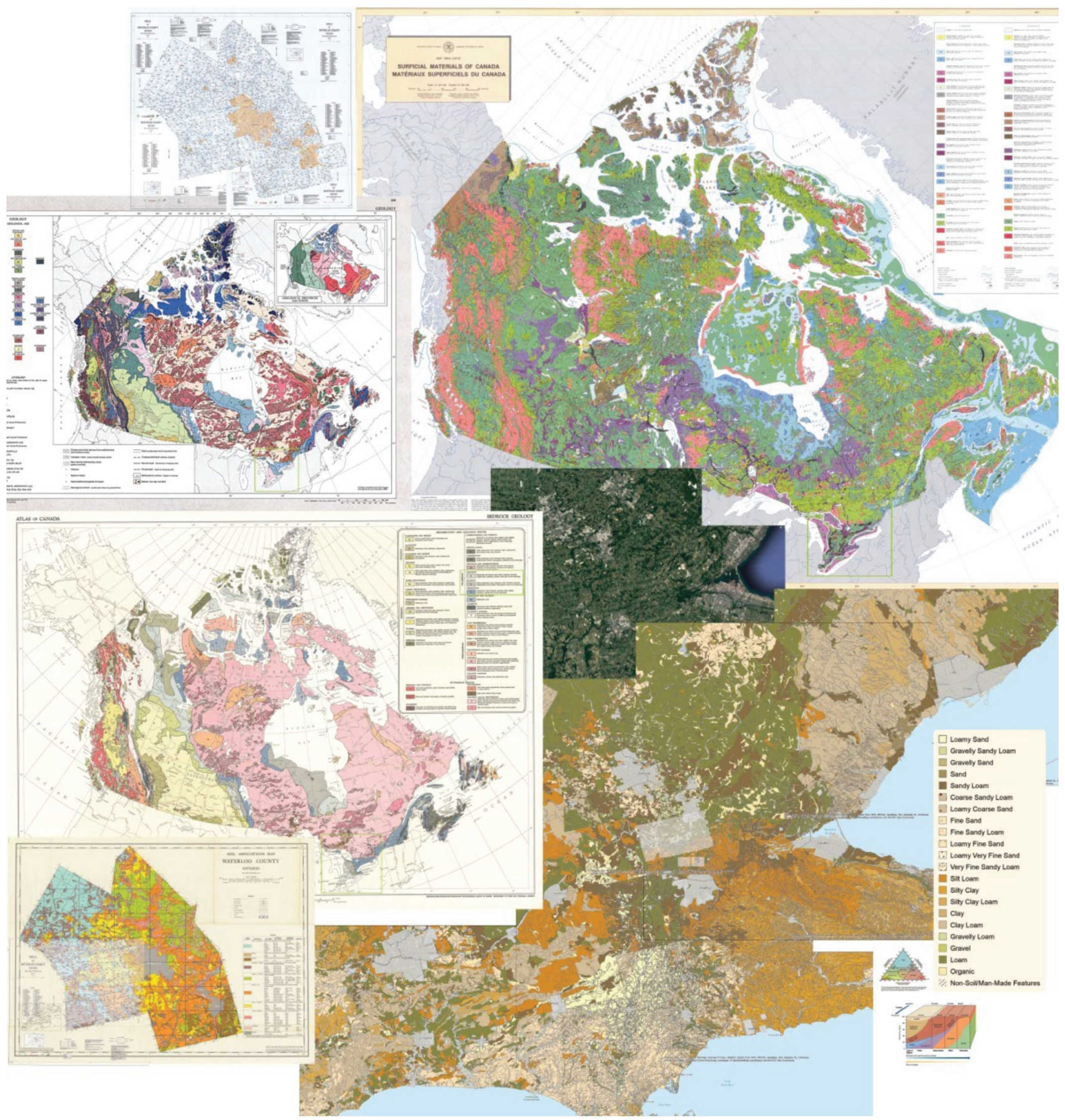

Figure 71. Compilation of maps used when searching for clay, collage by author.

Finding Clay

To begin looking for clay, I started with my local soil maps and the bedrock geology of Southern Ontario. This is an excellent place to start for anyone looking for clay. You can track different rock types from the bedrock geology maps of your region and see how they align with the soil maps. Usually, clay soils will end up downstream from waterways near granite bedrock. I looked at many maps for many months. To eliminate the bulk of that research from this thesis's main body, I documented the most significant maps in Appendix D.

Figure 72. Scenery along the Grand River during a clay harvest in the autumn of 2019.

Finding Clay

October 4th, 2019

Cambridge, Ontario 43.344158, -80.316094

It is twelve degrees today and overcast. Parts of Canada have snow right now. I have my recording equipment, borrowed from the media department at the school of architecture, in the trunk of my car. The shovel I bought for $20.00 at Canadian Tire is jammed in horizontally across the back seat.

I drive over to where the bike path starts, down Water Street, out by the brewing company. The clay deposits line the river on the geology maps I have gathered online, so I start close to the water and work my way up the hill.

I remember walking along this river three years earlier. As part of the design-build studio, we worked on the Six-Nations reserve in partnership with Kayanase, an ecological restoration initiative focusing on bringing native plant species to the Grand River. An employee at Kayanase told us about clay shards that line the Grand River, centuries-old and left by Indigenous People who lived along its banks. These shards are everywhere along the river but remain undocumented. Only uncovered during construction or while a surveyor spot tests the intended areas. A complete archaeologic survey of the Haldimand tract does not exist. As with most of Canada, there is too much land to cover and not enough interest.

I drag my shovel down to the bank and set up the tripod. No luck; it's all sand. I move further inland to a grassy patch. Too many rocks, I cannot dig very deep. It seems like someone had dumped debris there a while ago; plastic and garbage fill a natural valley in the hillside.

I find an uprooted tree, and it has pulled up a large void in the earth,

Figure 73. The Grand River in Cambridge, Ontario.

allowing me to see other dirt underground. There is nothing worth collecting, but the sand from near the riverbank is gone. I wander through some tall grasses. I fall over, one boot sinking into the mud. Luckily, I am not too wet, saved by the dense and tall reeds lining the edge of the water and providing enough resistance to keep from falling into the Grand River. I inspect my footing where I fell, and there is a patch of soft silky dirt. I dig a large hole and mark my coordinates. This dirt sticks together and is very malleable, but it cracks when bent

Figure 74. Plants along the Grand River.

around my finger in a quick clay-finding test I read about somewhere in a book. I do not think this is pure clay; it might be slate or shale and partial clay bits. I can rinse this with water, remove the dirt and see what is left. I make a small collection; we will see how the processing goes.

Figure 75. Digging a hole in search of clay in Kitchener, Ontario.

Finding Clay

October 5th, 2019

Kitchener, Ontario 43.447444, -80.479445

The earth was hard; each shovelful only brought up a small amount of dirt. 'That's because it's clay', the owner of the lot said. I have not found any clay, just sandy shale—heavy dirt. Well compacted over the 100 years, it has sat undisturbed. I know there is clay here. I am in downtown Kitchener, the red bricks of the houses surrounding me tell me that, all various shades of the same colour. Their material must come from this land.

We are still within six miles of the Grand River, on the Haldimand land tract. As I dig, I hear the land acknowledgement repeated at the beginning of University functions rattle off in my head, "land that was promised to the Haudenosaunee of the Six Nations of the Grand River and is within the territory of the Neutral, Anishinaabe, and Haudenosaunee peoples." I am thinking of land ownership. Who owns the resources we pull from the earth of disputed lands? Whose land is it that I am digging into? Who has lived on it, off it, travelled over it? What stories does this earth hold? Just because I have dug it up… is it mine? And what about the objects I make from this disputed dirt? The site is political, and so are its products.

I dig the hole, getting invested as it grows. Maybe the next heave of the shovel will unearth a deposit. I picture finding a rich clay vein coursing through the dark dirt, red, like the brick houses surrounding me. My hands imagine the dull 'thunk', feeling the texture of the earth change as I slice into its smooth buttery surface with my shovel. I picture it soft as it comes in the bag, plunging my fingers into it, cool and smooth, grabbing handfuls and shovelling it into my garbage bags. Excitement comes with digging; I can feel the anticipation of what I could find running through my body.

Nevertheless, this is hard work, the dirt is very heavy, and I am not finding anything. The hole is probably 3 feet deep, and I give up; I take a small sample. Maybe if I dilute it through water, I can make a liquid clay slip.

Figure 76. Clay loam found in Kitchener, Ontario.

Finding Clay

October 10th, 2019

Komoka, Ontario 42.9806710, -81.4316300

I am outside of London at a friend's family farm. She said she remembers playing in the creek as a child and making shapes out of the mud, "it must be clay," she told me. It is the middle of fall, Thanksgiving weekend. The air is crisp, and the leaves are turning colours. It is one of those days where the wind sounds like an ocean, rustling through the trees. It creates an acoustic background energy that amplifies the sounds of the forest. Autumn is nostalgic, full of lasts. This is the last weekend we can still dig before the ground starts to freeze. I want to get my hands on some clay.

It is morning, and we grab gloves, a bucket, and a bunch of shovels. We have on light jackets and rubber boots. My friend's father leads us out across the property, chatting excitedly, happy to be painting a mental sitemap for someone new. He lists off information gathered over years of quiet observation, watching, and learning about his immediate natural surroundings. His indexical practice of cataloguing the world around him has developed over a quarter-century of life on this land. He knows every inch of the property, every tree, rock, and ecosystem surrounding them.

On the ground, he has marked out potential areas that may hold veins of clay. He says these sites are his best guess, found over years of watching the earth flood, dry, and crack. Observation of where trees grow quickly, tall, and strong, their roots dive deep into the earth with no restrictions. His analysis covers the places where roots struggle—as if the ground is dense and thick, clogging up and containing the root systems. He leads us to one of these.

The first sign is the cracking of the earth. The mud has dried out after a thorough rain, but instead of drying evenly, it cracks into sections. This is evidence of clay. My hands get a little bit sweaty; I want to dig. We are in a patch of forest, surrounded by fields of corn and grazing grounds for some neighbouring ponies. The walnut trees soar, tallest among their

Figure 77. Clay unearthed in Komoka, Ontario.

Figure 78. Clay unearthed in Komoka, Ontario.

Figure 80. Water pooling in clay soil from an underground water source.

fellows. We make our way down to the riverbed that has inspired this visit. It is dry now, with no running water, but we see a few remaining pools on the surface. Held as if in a bowl, the water is not absorbing into the dirt. Another sign! Clay! We start digging. The water is pooling, springing up from some underground stream coursing through the property.

The clay is wet but distinct; dirt that surrounds the deposit falls away when brushed. The clay only clings to itself. It is pliable and light grey in colour, changing to a yellow-brown as we get a bit deeper into the

On left:
Figure 79. A crack in the earth reveals the presence of clay in the soil.

Figure 81. Gathering clay in a pail to take back to the studio for processing.

Figure 82. Autumn sun hitting a clump of clay.

riverbed. You can see differences in depth based on the colours we are unearthing. There is a streak of red, exposing iron content.

My friend's father is talking about the neighbourhood, how past residents built their farmhouses with yellow brick—it must be from around here. The clay is surprising in its texture, almost perfect, and you can mould it straight out of the ground. It bends around my finger, no cracks. I will need to process the clay to rid it of sticks, rocks, and leaves. It will need to mature, sitting peacefully in hibernation this winter, kneaded into soft spheres. The wild clay will need to be fire tested to determine its heat capacity. My best guess is earthenware, but I will need to determine at what temperature it will vitrify and go through quartz inversion – turning to ceramic.

a

b

c

Figure 83. a-c. Gathering clay with Elizabeth and her father, Walt on their property in Komoka, Ontario.

Figure 84. A handful of wild clay.

The objects and the sites are the same when working with clay. I am conscious of pulling earth from the ground, forever marking the landscape, and changing its ecologies. What can I leave in return? I am conscious of my breath as we dig the hole. Steady and even, our lungs filter the air of the forest. My presence here also affects the ecology of the area. I am thinking about what I am bringing here. Do I have any positive effects? My hands cut into the earth, but my breath gives life. With each shovelful and each quickening exhale, the carbon dioxide feeds the trees around me.

We are excited, showing each other our handfuls. We pull it from the ground, forgetting our shovels; we want to grab the clay from the earth. We compare colour and porosity, watching the water fill

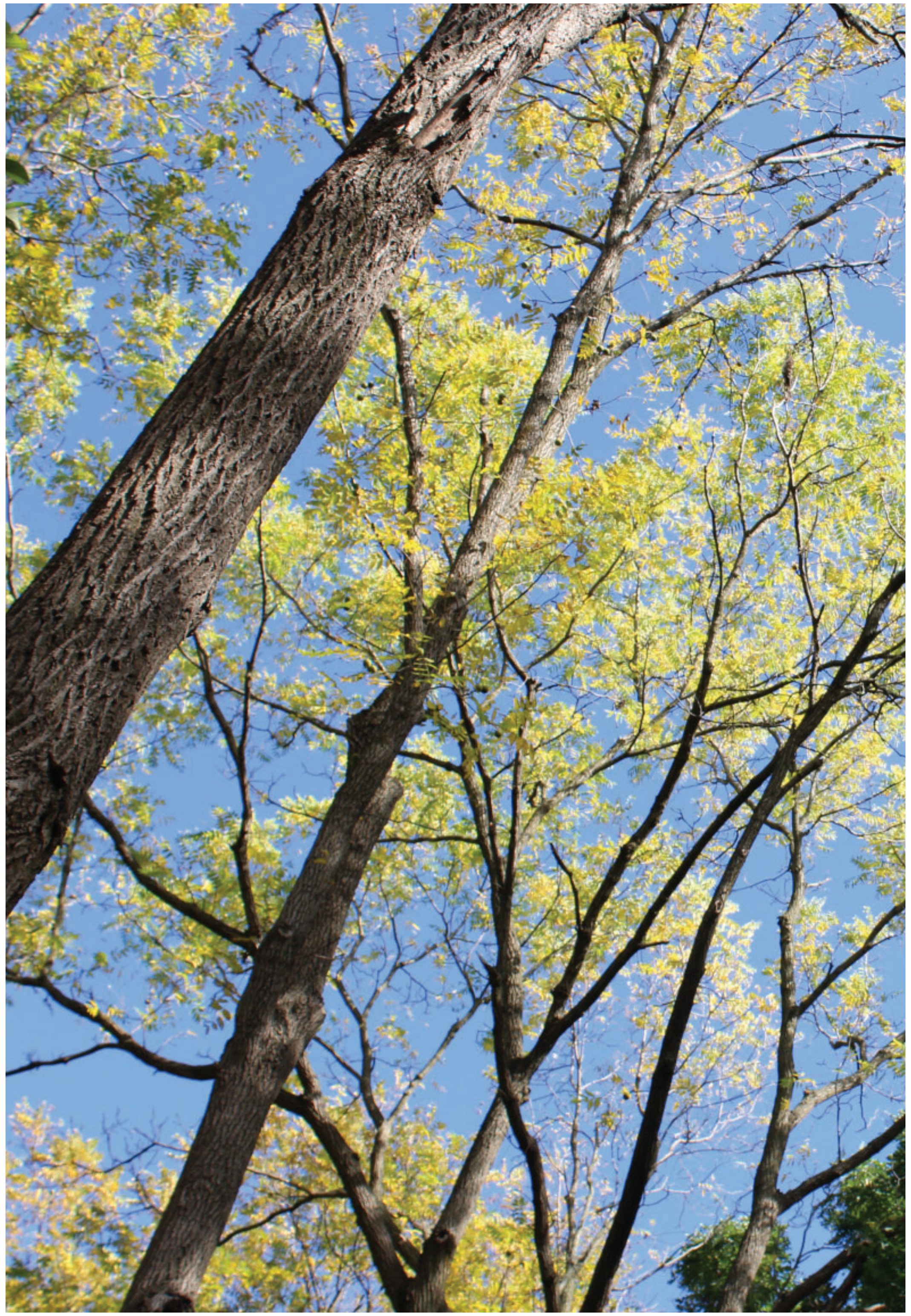

Figure 85. The clear sky and falling leaves of the trees during the clay harvest.

Figure 86. A shovelful of dirt revealing the different layers of clay as we dig deeper.

our clay bowl from an underground water source springing up in the dry riverbed. Birds are chirping, and the wind is loud, whistling through the remaining leaves, sending them to the forest floor. The warmth of the sun hides the seasonal coolness from us.

We pack up the bucket. It takes the two of us to carry it back up to the house and put it in my car. We are tired and happy. Finding this clay is the beginning step along the process to become ceramic. It is also the beginning of a personal, intimate relationship with materials as old as the earth. We have found clay—and it feels precious.

Figure 87. Pulling earth from the ground in Komoka, Ontario.

Figure 88. Digging for clay.

Figure 89. Iron rich clay coloured red.

Material Testing

Figure 90. A handful of wild clay.

Clay Composition

What is Clay?

The decomposition of feldspathic rocks creates clay. *Hydrolysis* is the process through which feldspar turns to *kaolinite*, a type of clay mineral.[99] Rocks with feldspar make up approximately sixty per cent of all rocks within the earth's crust. In the pink granite rocks of the Canadian Shield, the feldspar shows itself in the white crystalline structures of the rocks. When the feldspar decomposes, it loses its alkaline content and results in the powdery white substance named Kaolin. Kaolin is the component responsible for the white colour

99 Mitch Iberg and Zoe Powell, "Clay Processing Workshop Guide" (Online Lecture, January 8-9, 2021) 3.

in porcelain and white stoneware clay bodies. Its composition is 39.45% alumina, 46.64% silica, and 13.91% water, in its most pure form.[100] The purity of kaolin depends on the purity of the feldspathic rocks and how closely they degraded from the parent-rock source.[101] Contaminations can occur from the degradation of other rocks mixing or through travel within the water cycle to secondary locations. Clay is found directly from the parent rock at the site of erosion. Most commonly named Kaolin or China clay, primary clay is highly refractory and usually light in colouring.

Primary Clay

One can dig primary clay from areas rich in feldspathic rocks such as granite. The granite rock is called the parent-rock and has eroded, weathering into sediments. The parent rock goes through natural decomposition, freeing feldspar particles to further degrade into what is known as clay. Pieces of the original rock may remain and give character to the clay. Primary clay tends to fire at higher temperatures ranging from 1350°C-1500°C. Porcelain is a type of primary clay that vitrifies at 1350°C. Another type of primary clay is ball clay, which has a more extensive range of colours and slightly lower firing temperatures.[102] Mined ball clay is the most significant component of commercial stoneware temperature clays. Due to contamination of potash or soda from organics, ball clay is still light in colour but is more plastic and less refractory than china clay. A historical example of primary clay is found in Jingdezhen, China. Mount Gaoling is the mountain from which the main component of porcelain, kaolin, sources its name. In Ontario, primary clay is more common in northern areas where the granite of the Canadian shield is present.[103] I have dug

100 Leach, A Potter's Book, 44.
101 Mitch Iberg and Zoe Powell, "Clay Processing Workshop Guide," 3.
102 Leach, A Potter's Book, 45.
103 Mitch Iberg and Zoe Powell, "Clay Processing Workshop Guide," 3.

primary clay near Georgian Bay from degraded pink granite rocks common to the area. The Great Clay Belt is a region in Northern Ontario with clay deposits that fire to higher temperatures.[104]

Secondary Clay

The water cycle deposits secondary clay away from its origin source. Travelling through waterways, the wind, glacial movement, massive erosion, or the water cycle brought the clay to these areas.[105] Various colours and firing temperatures ranging from earthenware to stoneware clays result from various impurities picked up through its travels.[106]

Secondary clay is common to find almost anywhere in the world other than desserts. It is clay that has broken down from parent-rocks and travelled through the water cycle to secondary locations. Areas rich in secondary clay are easy to find by looking for shale or similar sedimentary rocks on geological maps. The clay is less pure as it has picked up organic material through its movement down waterways. Secondary clay typically requires heavy processing to remove the rock, sand, dirt and organic debris. It usually contains more iron and fires at lower temperatures because of this. Earthenware clay is a type of secondary clay that matures at 1000°C.[107]

An example of this is clay found around the lakes in Southern Ontario. Receding ice during the last glacial movement carved out the lake beds; the ice pulled the igneous rocks along as it receded, leaving igneous sediment far from its origins as it melted.

Commercial Clay

Mines across North America specialize in specific mined components which move in large bulk shipments to clay mixing facilities. Each mixing facility combines ingredients in different

104 "The Great Clay Belt of Northern Ontario," Toronto, Canada: Temiskaming and Northern Ontario Railway Commission. 1913. See Appendix B.
105 Mitch Iberg and Zoe Powell, "Clay Processing Workshop Guide," 5.
106 Leach, A Potter's Book, 45.
107 See Appendix C cone chart.

ways to create its clay bodies. Canadian ceramic suppliers typically use materials mined from the United States. It is typically too expensive to mine the same materials in Canada due to winter conditions and less established mined areas in Northern Ontario.

In 1940, Bernard Leach wrote *A Potter's Book*. Potters celebrated this widely circulated book and labelled Leach as the 'Father of Studio Pottery.' According to Michael Cardew in the introduction of Leach's book, a studio potter is a "one-man studio or small workshop."[108] In the 1970s, studio potters operated with minimal margins to make a living from their work. They based aesthetic decisions on the cheapest materials. However, all of this changed with the beginning of the hobby potter movement. The cheapest materials available for sale fired to cone ten and looked the best in a reduction atmosphere. These materials were cheap because the clay required less flux material which is the most expensive component of a clay recipe. Flux materials are melting agents added to a clay body to bring down the firing temperatures. In the 1970s, pottery developed as a hobby, and potters became less concerned with cost and more interested in the ability to fire in their home kilns.

This trend increased the popularity of firing to cone six because the power required could fit into a home electrical system. This trend led to developing clay bodies for lower temperatures. Hobby potters practised a craft that encouraged testing, one-offs, and experimentation rather than repeatability of a craftsperson. This influenced the ceramic suppliers to develop more glaze options with brighter colours and required expanding the mines they worked with to bring new minerals and mined components for new products.

108 Leach, A Potter's Book, xxiii.

a

b

c


Figure 91. Commercial clay from the Pottery Supply House.
a. PSH 415 red earthenware clay.
b. PSH 522 white stoneware clay.
c. PSH 505 brown stoneware clay.

Figure 92. Wedging clay using ram's head technique.[93]

The clay arrives tightly sealed in a cardboard box, taped up, wrapped in plastic. It has freshly gone through the pugmill, and is a beautifully consistent texture, like hard butter that has just softened enough to spread. There are no rocks or bits of grass. There is no trace of the ground it has been pulled from. It is easy to think of this slab of earth being quarried like marble.

An efficient mechanical process that slices into the earth and removes this chunk that now sits before you, just as it is. But that is not the typical manufacturing process of clay produced today. For PSH clay, one of the largest brands serving Canada, materials are pulled from the earth, mined in different locations across North America and brought together in a production facility in Oakville, Ontario.

Figure 93. Clay soil found in Komoka, Ontario during a foundation excavation.

Wild Clay

The term 'wild' carries many connotations. What does it mean to be wild in a time when human impact has touched every corner of the earth? Is anything wild in the Anthropocene? Colonial connotations of wilderness are carried within the term wild, especially when considered in context with nature. This thesis considers the phrase, wild, in terms of its antonym – tame. To tame clay is to dismantle it from the landscape of its origin and manufacture its parts into a new *product*. Commercial clay has been domesticated. Commercial clay is a manufactured mixture of many different mined components transported from different mines.

In contrast, wild clay exists as a whole, sitting within the earth on its own within a landscape. Wild clay has been foraged and gathered. Some wild clay does require processing and additions to make a workable body. I believe it is up to each artist to determine for themselves what intentions, methods, or percentages make a wild or domesticated clay body.

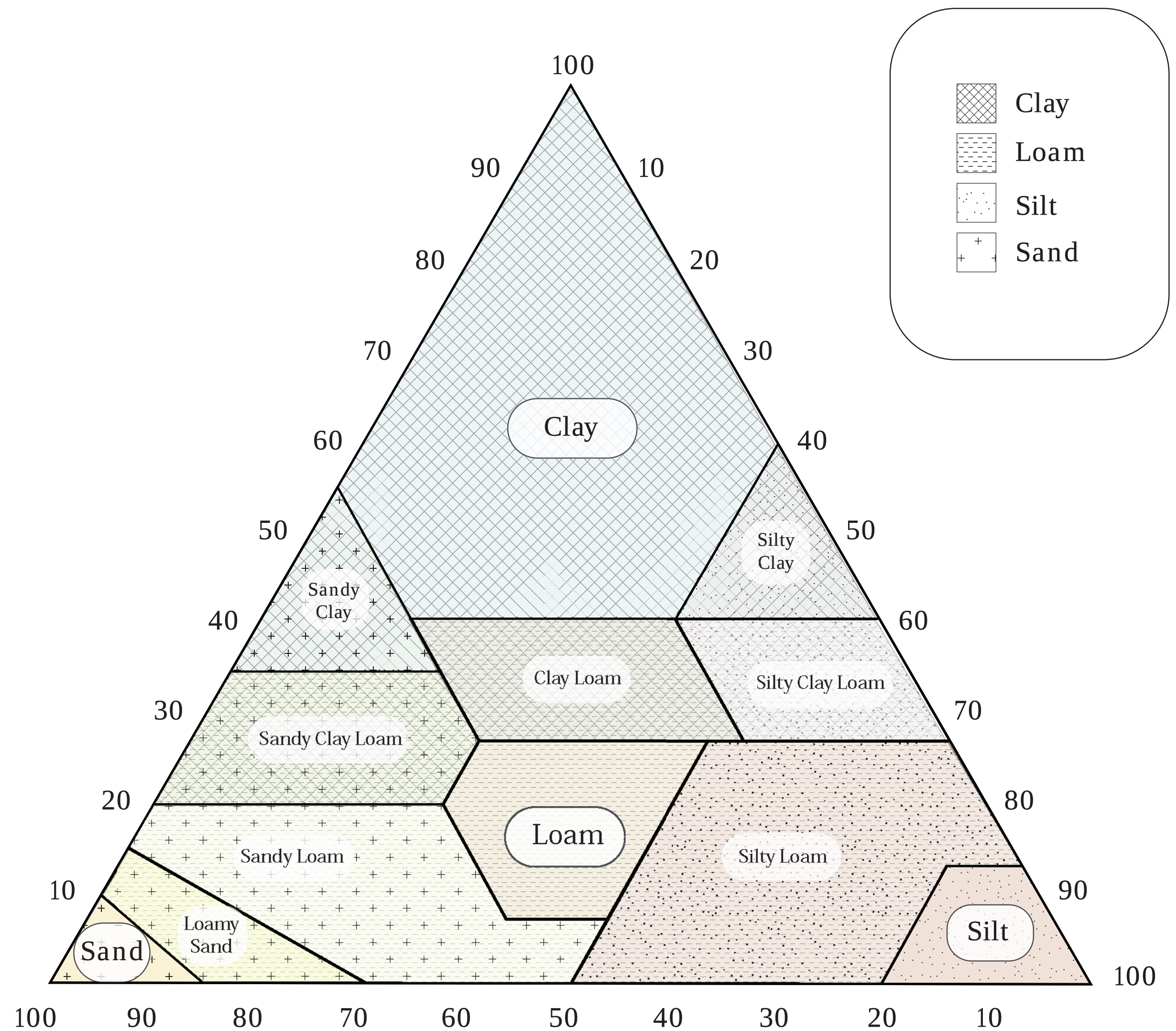

Figure 94. Clay soil diagram, illustrated by the author. Information gathered from soil diagrams online under creative commons usage rights.

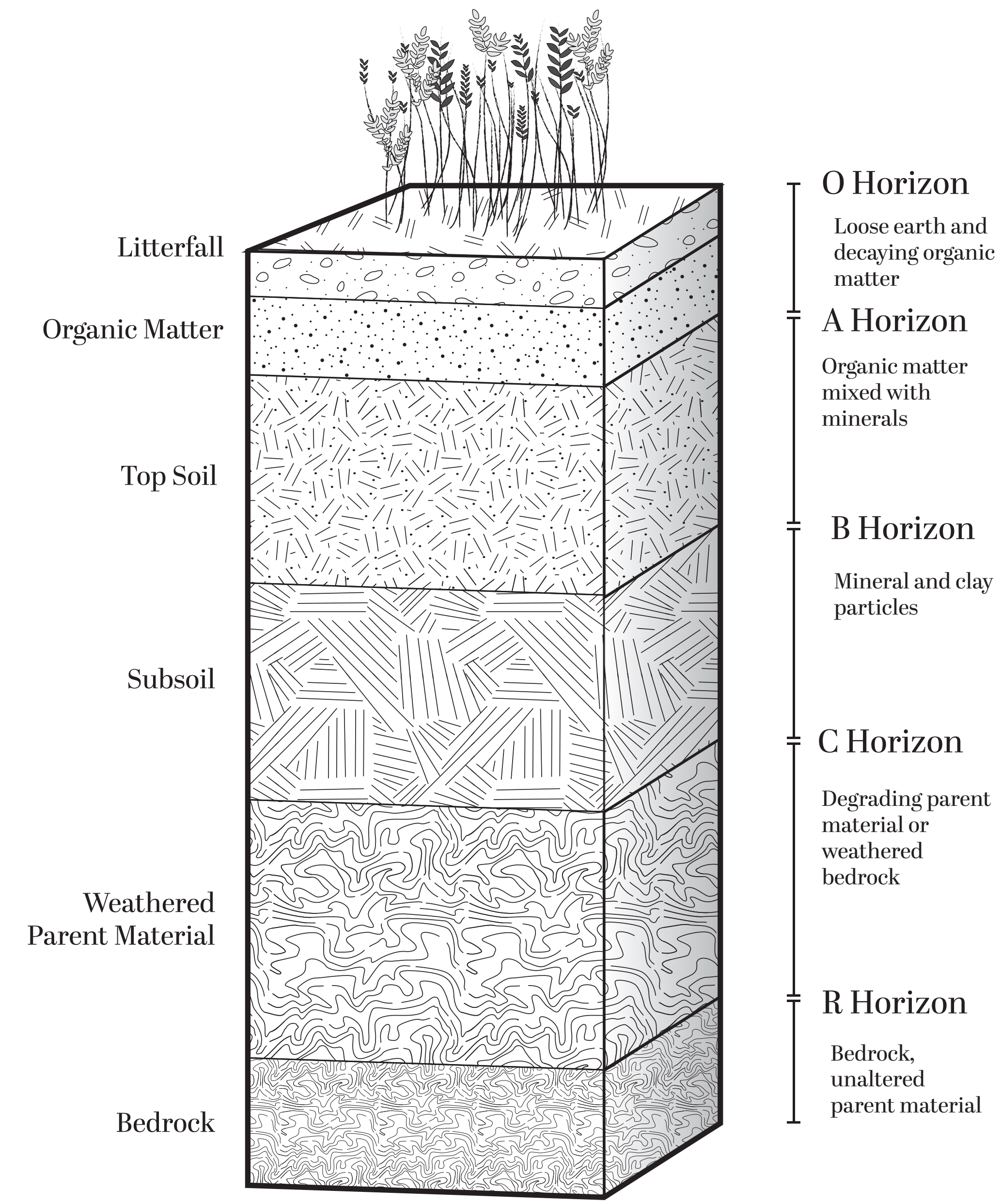

Figure 95. Soil horizon diagram, illustrated by the author. Information gathered from soil diagrams online under creative commons usage rights.

Figure 96. Chunks of dry clay harvested in Komoka, Ontario.

Clay Identification

Figure 97. Snapping a chunk of dry soil to test if it will break along angular lines and reveal itself to be clay.

Figure 98. Dry clay with sharp edges mimics the shape of clay particles which are aligned in platelets.

Angular Fissures

Identify dry clay by snapping a piece, and if you see sharp edges along the breaking edges, it is likely clay. Dry clay chunks will be slippery and waxy when wetted and rubbed between fingers.

Figure 99. Clay cracking along a tire track in Komoka, Ontario.

Figure 100. The dry farmland cracks and reveals clay in its soil.

Surface Cracking

Clay soil will show surface cracking as it drys out in summer heat. Clay particles will shrink and expand as they hydrate and dehydrate. Each clay soil will have different moisture absorption and shrinkage rates.[109]

109 Prepared under the Joint Auspices of the International Labour Office and the United Nations Industrial Development Organization, comp. Small Scale Brick Making, (New Zeland: International Labour Organisation, 1984). 35-38. https://open.unido.org/api/documents/4794028/download/SMALL-SCALE%20BRICKMAKING.%20UNIDO-ILO%20TECHNICAL%20MEMORANDUM%20NO.%205%20(13731.en)

a b c d

Figure 101. a-d. Images of a coil test on wild clay from Kitchener, Ontario. This clay does not crack when bent around a finger indicating it has the properties that are appropriate for throwing on the wheel.

Coil Test

1. Form a coil by rolling a small portion of clay between your hands.

2. Bend the coil around a finger.

3. Inspect the coil for cracking or breakage.

4. If coil cracks and breaks, it may not be worth collecting.

5. Coils that do not crack will be an appropriate level of plasticity to handbuild and throw on the wheel.

6. Cracking may indicate a mainly sandy or silty clay that will require much processing.

7. If the clay is light in colour and cracks when bent around a finger, this indicates a highly refractory clay body with a high kaolin content. This clay will not be workable on its own and must be formulated to make a high-fire clay body or mixed with a low-fire body.

Short Clay

Short clay will crack. It will not be pliable enough to throw. Try to add a smaller particle size like a fine-grained clay; this will usually occur when the clay is heavy with kaolin, so add a lower firing clay. Adding malleable earthenware will help with plasticity and also bring the temperature down. Add cone ten porcelain throwing water if you do not want to alter the temperature. The tiny particles suspended in the throwing water will help lower the particle size of the clay. Screening the clay by sieving particles to a smaller mesh will remove coarser particles like sand and increase plasticity. If altering the body does not help, try to change how you work with this clay. In ancient Greece and Rome, non-malleable clay bodies were used in moulds rather than thrown on the wheel. [110]

Plastic Clay

Sometimes clay is too plastic, meaning it is so malleable that it cannot support its weight. It can be too sticky to work with. More plastic clay is likely to fire at a lower temperature due to its higher iron content. To decrease the plasticity of clay, add in larger particles with additives such as sand or grog, which is crushed ceramic pieces. You can also mix a plastic body with a short body. To create a mid-fire temperature clay, combine an earthenware plastic red clay with a short refractory white clay body that contains higher amounts of kaolin or ball clay. Try using a larger mesh size when screening to add in larger particles. Adding refractory sand such as silica sand will also increase the firing temperature of the clay. Adding grog will also help minimise the clay's shrinkage by adding a material that does not shrink.[111]

110 See Appendix C for cone chart.
111 Mitch Iberg and Zoe Powell, "Clay Processing Workshop Guide" 31.

Weathering Clay

Clay needs to age to become entirely homogeneous as a mixture. Clay that has not been adequately aged will be short and hard to work. Clay that has been aged will be more plastic and pliable.[112] After ageing for three weeks, I found improvements in my clay body and significant improvements after ageing the entire winter season. Nelson writes that in traditional ceramic production in China, clay harvesting and ageing was an intergenerational task. Clay would be dug, processed and put back into the earth. It would be stored for two generations. The grandparents would prepare their grandchildren's clay.[113][114]

112 Mitch Iberg and Zoe Powell, "Clay Processing Workshop Guide," 21.
113 Nelson, Ceramics, 13.
114 This description of generational clay has stuck with me as it reminds me of stories of my paternal Great-Grandfather, Bert Scott, who drove a brick truck for Domtar Brick on Mavis Road, in Mississauga during the 50s, 60s, and 60s. He delivered bricks produced from clay mined from the quarry, often with my Father in tow. 70 years later I trace these same paths searching for the clay of the closed quarries surrounding the city.

Figure 102. Rocks screened out of the wild clay from Kitchener, Ontario.

Processing Clay

Most wild clay bodies require processing in order to become workable.[115] If working with a primary clay body, it may require little to no processing. Some ceramicists will process their clay to sort and select the organic materials they wish to keep and incorporate it into the clay body. This results in varied and interesting surface textures.

Processing wild clay includes the removal of organic debris such as leaves and sticks so they do not burn off and leave holes in the ceramic work. It also includes removing all forms of calcium carbonate, which is most often in limestone rocks incorporated into the clay. It is also present in animal bones and shells. It is essential to remove calcium carbonate or else suffer the consequences of lime pop-outs.[116]

115 See Appendix A.
116 Information on clay processing gathered through material experimentation as well as participation in two wild clay processing workshops.
1. Mitch Iberg and Zoe Powell, "Clay Processing Workshop" (Online Lecture, January 8-9, 2021).
2. Richard Zane Smith & Museum of Ontario Archaeology, "Natural Clay Pottery Course" (Sponsored by FUSION: The Ontario Clay and Glass Association and The London Clay Art Centre, Online workshop series, Summer 2020).

a
b
c

Figure 103. a-c. Lime Pop-Outs visible in two wild clay pinch pots made of clay from Kitchener, Ontario,

Figure 104. Lime Pop-Out tearing apart the neck of a vessel made of Komoka wild clay.

Lime Pop-Outs

Lime pop-outs can tear apart ceramic as the calcium carbonate turns into calcium oxide in the kiln.[117] When the calcium oxide is exposed to oxygen, it will expand and turn to powder, cracking and pulling apart your vessel. Often they do not appear right away but show up over weeks and months of slow exposure.

This is true for any form of calcium carbonate, including bones and shells. It is important to avoid gathering clay near construction sites where they are digging up or pouring concrete.

117 Mitch Iberg and Zoe Powell, "Clay Processing Workshop Guide," 31.

Figure 105. Testing for the presence of limestone in wild clay with vinegar and water.

Lime Test

1. Take small pieces of wild clay

2. Place in a clear jar

3. Fill jar with vinegar

4. Watch for fizzing and bubbling

5. Stones that cause fizzing contain lime

6. Screen the clay to remove limestones

Figure 106. The many-bucketed system for processing wild clay in Kitchener, Ontario.

Screening Clay

1. Mix dry clay with water to create a slurry.

2. Let settle.[118]

3. Pour off water on top of slurry.

4. Pour clay mixture through a screen to remove rocks and debris.

5. Select mesh size based on particles you wish to keep.

6. Wash screened rocks and store.

7. Let clay settle.

8. Pour off water on top of slurry.

9. Dry clay to workable consistency on plaster slabs.

10. Wedge clay.

11. Age clay at least two weeks, preferably three months.

118 Mitch Iberg and Zoe Powell, "Clay Processing Workshop Guide," 17-20.

a b c d

Figure 107. Processing wild clay.

a. Strain the watered down wild clay through a mesh screen
b. The organic material left after screening
c. Deposit organics in a bucket
d. Wash organics and rocks and set aside.

a b c d

Figure 108. a-d. The processed wild clay is free of organics and very liquid.

Figure 109. The clay must be dried on a plaster slab to a workable consistency.

Figure 110. When the clay has dried, it must be wedged into a homogenous mixture.

a. The wild clay before wedging
b. Foot wedging is easy on the wrists.
c. A fistful of wedged clay.
d. The clay after wedging is rolled into balls to be stored and aged.

Figure 111. Three wild clay vessels sitting in the sun.

Making

Figure 112. Wild clay vessels are shaped with moulds.

Figure 113. Two clay balls are pinched into half sphere shapes against a form of a bowl and then attached together.

Figure 114. Necks and feet are added to the bowl formed vessel bodies.

Figure 115. Wheel thrown pots are combined into sculptures using hand building techniques.

Figure 116. Wild clay pots buried in the embers of a pit fire.

Pit Firing

Figure 117. A wild clay pot glowing red in the heat of a pit fire.

Information used to pit fire in this section was gathered from two texts, *Pit Firing Ceramics* by Dawn Whitehand and *Mastering Kilns and Firing* by Lindsay Oesterritter .[119] [120]

119 Whitehand, Pit Firing Ceramics, 20-53.
120 Lindsay Oesterritter, Mastering Kilns & Firing; Raku, Pit and Barrel, Wood Firing and More, (Beverly: Quarry Books, 2020) 91-123.

Figure 118. The process of building a pit fire.
a. Make a brick 'house' to protect the pots and insulate them, ensure air flow in the cracks between bricks and lay the bed with sawdust.
b. Gently place pots into the structure and layer with pigments and organics such as onion skins, Epsom salts, and coffee grounds.
c. Cover the pots with bisque shards to protect from falling logs during the fire.
d. Build a fire around the pots.

Figure 119. The pit covered in ash from the fire the night before.

Figure 120. The pots need to be washed after coming out of the pit fire.

Figure 121. Wild clay test tiles.

Making a Clay Body

Figure 123. Wild clay surface after firing, various rocks within the clay body have melted on the surface.

On left:
Figure 122. Wild clay test tiles in ceramic ‘boats’ to protect kiln shelves from accidental melting.

90g Wild clay +
10g Stoneware

50g Wild clay +
50g Stoneware

10g Wild clay +
90g Stoneware

Figure 124. Making line-blend test tiles.
a. Weigh out 100g balls in descending percentages to combine two different clay bodies.
b. Combine the balls together.
c. Wedge the two clay bodies until homogenous.
d. Wedged balls of clay lined up in order of percentage change.

Figure 125. Coil wedging eases strain on wrists when wedging small amounts of clay.
a. Roll ball of two clays into a long coil.
b. Spiral coil up into a cinnamon bun shape.
c. Roll out spiraled coil.
d. Continue until ball of clay is homogeneous.

Figure 126. The line blend balls of clay rolled out into test tiles and pinch pots. They are marked with their percentage information.
Information on line-blends gathered from Mitch Iberg and Zoe Powell, "Clay Processing Workshop Guide," 15.

Figure 127. Detail of the test tiles.

Figure 128. Test tiles and pinch pots after firing to cone 6.

Figure 129. Test tiles lined up in accordance with their line-blend percentages.

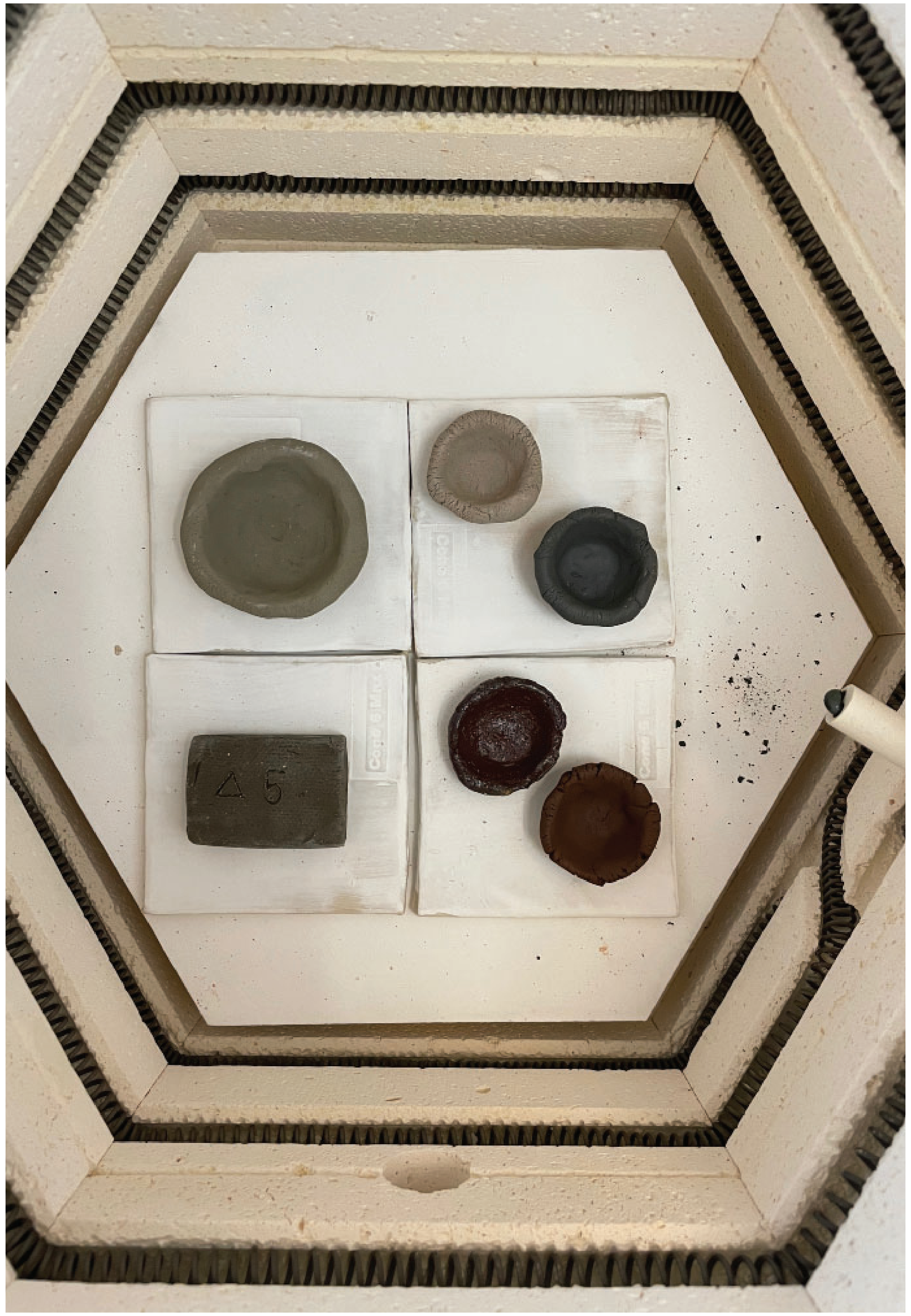

Figure 130. Wild clay tests ready for a cone 5 firing in the small test kiln at the School of Architecture in Cambridge, Ontario.

Figure 131. The Kitchener clay melted at cone 5, but the Trafalgar clay held its shape.

Figure 132. Trafalgar clay pictured in its raw unprocessed state.

Wild Clay Bodies

Komoka Clay

Figure 133. Komoka clay sitting raw in the earth during harvesting.

Figure 134. Komoka clay fired to cone 2, reveals speckling from small rocks in the clay body.

Trafalgar Clay

Figure 135. Trafalgar clay gathered in Oakville, Ontario.

Figure 136. Top: 50% Trafalgar clay, 50% porcelain fired to cone 5. Bottom: 100% Trafalgar clay fired to cone 5.

Kitchener Clay

Figure 137. Kitchener clay harvested in November, 2020.

Figure 138. Melted test tile and pinch pot made from Kitchener clay when fired to cone 5.

Figure 139. Various rocks pulled from the processing of the Kitchener clay.

Clay Additions

Figure 140. Rocks caught in the clay processing screen.

Figure 141. Various rocks pulled from the processing of the Kitchener clay.

Figure 142. Calcine rocks to negate the effects of limestone by firing them to 1000°C. Make sure rocks are entierly dry before putting them in a kiln so they do not explode.

a. Build a clay 'boat' to place rocks in for bisque firing.
b. Rocks and boat post firing to 1000°C.
c. Rocks can be easily crushed into powder after calcining.
d. Mix limestone rock powder with water to form a quick setting mortar.

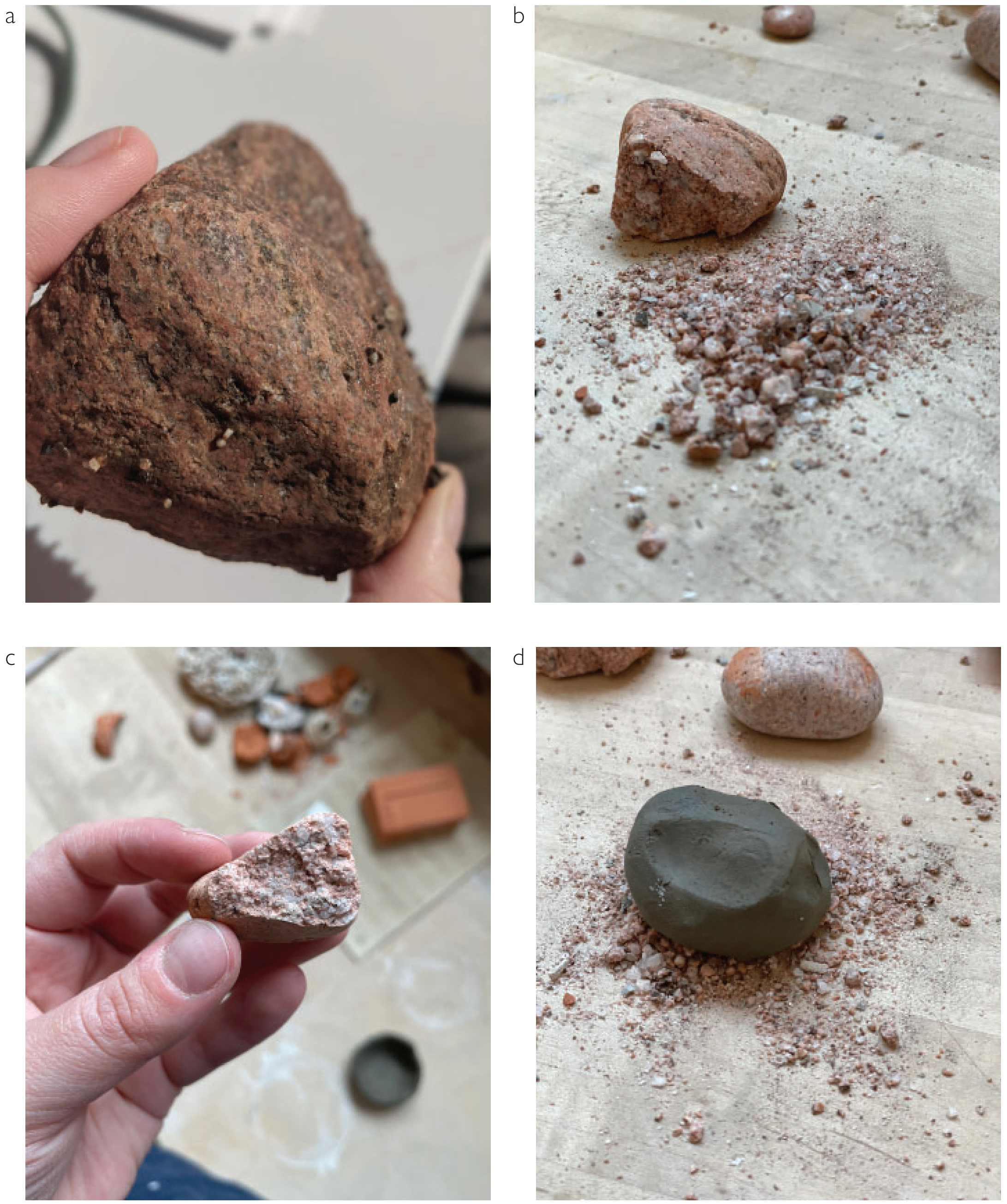

Figure 143. Adding calcined granite to clay

a. Pink granite rock found during the Kitchener clay harvest.
b. The rock after calcining.
c. Crushing the rock into smaller pieces is easily done by hand.
d. Adding the crushed granite into ball of wild clay.

Information gathered from Mitch Iberg and Zoe Powell, "Clay Processing Workshop Guide," 30.

Figure 144.
a. Unfired clay test tiles with embedded calcined granite rocks.
From top to bottom: Control tile with no additions, 15% granite addition mixed into the clay body, 15% granite addition added to surface of tile, rock embedded in the clay tile.

Figure 144.
b. The test tiles after firing to cone six.

Figure 145.
a. Clay test tile sitting within the cookie cutter used to shape the tile showing the shrinkage.
Information gathered from Mitch Iberg and Zoe Powell, "Clay Processing Workshop Guide," 16.

Figure 145.
b. Marking a uniform dimension on raw clay test tiles allows for the calculation of the shrinkage rate post firing. This line measured 3" before firing and 2.5" post firing. By dividing the two measurements, I found this clay shrinks by 17%.

Figure 146. Documentation of the firing procedures and clay content values on the test tiles.

Figure 147. Neck of a vase poking out though the extinguished embers of a pit fire.

4. Remembrance

Ceramic objects embody qualities of remembrance; they are tangible artefacts that have endured from antiquity to the present day, holding the history of human production within. Clay acts as a vessel, carrying information across vast time spans both physically and metaphorically.

The term remembrance refers to Hannah Arendt's three conditions for objects that are outside the realm of labour. To be worldly, they must consider; location, function, and length of stay in the world. Durability and permanence are conditions of mortality.[121] Both a beginning and an end are necessary to create something that endures. It is the contrast of disappearance that allows for remembrance. Remembrance creates the conditions to sustain history. It is the carrying on of tradition through the reification of speech and actions into objects. Remembrance is reification into either tangible objects or the practice of ritual.[122] The practice of remembrance becomes part of culture and way of life. Remembrance has a purpose; objects made with remembrance outlast their makers. Remembrance signifies the past to continue the future.

121 Hannah Arendt, The Human Condition, (Chicago: University of Chicago Press, 1958) 9.
122 Adamson, Fewer, Better Things, 137.

Figure 148. Photographing the Land Marks series of vessels.

Figure 149. Arranging flowers in the Komoka vessel.

Land Marks Series

Artist Statement

My craft practice focuses on gathering local materials and processing them to use in ceramic sculpture. The harvested materials become analogous to the architectural 'site', recording their geologic permanence. I use the tools of an architect on my surfaces; mapping, tracing, and drawing. I use traditional ceramic forms and methods to place the research within a larger historical context. The work re-imagines archetypal forms to exist in contemporary space and time.

I made the Land Marks vessels in the summer of 2020 in response to a prompt put forth by an exhibition run by students at the school of architecture. These vessels analyze how we divide and mark the land. These pots treat clay as a site, and I marked them using various mapping methods and farming land. Cutting straight lines of ownership through a landscape is a practice of Western rationalization. The process is one of many layers and uses tape, wax, and glaze. Tracing these lines on the curved surfaces of pots revealed the conflict and irrationality of cutting land.

Figure 150. The smoke records its movement in the pit fire on the surface of the pots.

Figure 151. Two pit fired wild clay vessels.

Figure 152. Group shot of the pots shaped using the same bowl moulds with two halves attached in the middle.

Figure 153. Smoulder vessel small and large.

Figure 154. From left to right:
Chasm vessel, Litterfall vessel, Waffle Garden vessel, Red Smoulder vessel No. 1.

Figure 155. Smoulder vessel with neck No. 3.

Figure 156. The complete Land Marks series of vessels.

Figure 157. Chickadee vessel, the decoration was inspired by the two bird-stones in the Haudenosaunee creation story, as told to me by William Woodsworth.

On Harvest

It has been two years since I started my research by finding, digging, and processing clay. During this time, I have become more conscious of my feet upon the earth, looking downwards and scanning what lies beneath as I walk. On these daily walks, I sweep my eyes across the ground and take a rapid geological inventory. This practice has evolved into a habit, as my senses have opened to the ubiquity of clay's presence. There is hardly a walk where I cannot see how clay has shaped my environment.

Usually, this is an internal game I play with myself. I will pause here and there, upturning a rock or picking up a chunk of dirt already uprooted by some animal or other. I will look at the grain, the texture and how easily it breaks apart; what is the density or porosity, if it falls apart in a bit of water or becomes slimy like a used bar of soap. I focus my senses to gather information about what I find, and sometimes, despite all this searching, clay is closer than I imagined.

In the middle of October 2020, a landscaping company came to my family home in downtown Kitchener to dig a hole for a tree my mother had purchased for the backyard. I eagerly followed the landscape team around the side of the house, interested to see how far down they

Figure 158. The author digging clay from the pit dug to plant a tree.

would dig with their industrial auger. Indeed, they would dig further than I had been able to with just a shovel when planting tomatoes.

The hole they dug was about four feet deep and three feet across. As the broad metal planes of the auger hit the three-foot mark, the texture of the digging changed. The metal now scraped against the side of the hole. You could tell by the sound of the machinery, suddenly straining, there was a difference in the dirt flung from the hole. No longer was it powdery, light, and easily removed. Now, flying out of the hole were chunks of dirt clumped together; the earth would not lift easily from the ground and was instead pulled reluctantly out by the spinning machinery.

It was not a gentle process. Cutting the earth was still a violent act, even if the planting of the twenty-five-year-old maple was well-intentioned. I was struck by how the earth pushed back against the auger, jostling the operator standing on the machine's back. I wondered what kind of fight the earth put up against a mining operation at one-hundred times the scale.

While the landscaping team returned to their truck to bring the tree, I quickly jumped into the hole with my bucket and a small trowel. I gathered enough dirt to fill my bucket, and I could tell that there were parts of clay in the dirt I gathered because of how the chunks had broken along angular fissures. Nevertheless, the dirt looked quite sandy, silty, and strewn with rocks despite this good sign. It would require much processing.

While I had seen the reluctance of the ground to give space to this new tree, I knew the addition of shelter in its branches would be beneficial for the birds of the downtown core. When prospecting for clay, I try to maintain a high level of consciousness for my surroundings. I was wary of not taking too much and trying to have minimal impact on the surrounding ecosystems. I gathered the second harvest of clay from Komoka during an excavation for a new foundation. I collected the Oakville clay from the construction site of a fire hydrant repair. The Kitchener clay came from this hole dug to plant our new tree. Finding ways to access wild clay while maintaining minor ecological impacts is part of my practice of respect and gratitude in harvesting resources.

Continually, clay humbles me through searching for it. I no longer rush to gather the clay up in my hands, to collect it with hundreds of ideas for its transformation. Before taking out my trowel for a sample, I am patient, looking, touching, trying to grasp its context and the greater ecological systems I may be disturbing. I do not rush to fill every bucket I own and take just what I alone can carry.

Acknowledging your surroundings is one of the lessons of an honourable harvest imparted by Robin Wall Kimmerer, a member of the Potawatomi Nation and professor of biology, botany, and ecology.

Figure 159. Planting the orange maple in our backyard.

Kimmerer is known for her approach in bridging her two ways of knowing to open eyes to a greater worldview understanding of land, culture and ecological systems using traditional knowledge and western science. In her book, *Braiding Sweetgrass*, she speaks poetically of plants as our oldest teachers. She explains how all Indigenous and western research is based on watching, listening, and recording. The results may appear in peer-reviewed published works, or the passed down knowledge of oral tradition. Both systems have validity and are grounded in observation, as is the process of prospecting clay.

Kimmerer's guidance for practising an honourable harvest advises passing over the first of something that you see, in case it should be the last, and always asking permission before harvesting. I have

thought a lot about how this might apply to *winning clay*.[123][124] Clay, with its ever-present ubiquity, was everywhere once I knew how to look. I do not worry about taking the last of the clay. However, asking for permission did not come easily to me. There is asking permission of the land 'owner' before digging a hole, but this was not the sort of permission Kimmerer meant. She asks for a decolonized approach to understanding and listening in all research and actions upon the land.

Learning to respond to the land is a skill that still feels far away to me, one that will require practice and patience. During my first clay harvest, I felt guilty for taking something without anything to return. It was only after a few weeks of reflection that I could see my role of reciprocity in the forest. We impacted the ecologies of the area in which we dug, with our breath replenishing carbon dioxide and our footprints clearing dead scrub from the brush. Through thinking in this way, I began to regard the forest and its earth more holistically.

Clay minerals can be identified by their very fine particle sizes, under two microns.[125] The particles are tightly packed; only when saturated with water do they expand and relax into the familiar substance of malleable clay. The lack of porosity in clay soil prohibits the flow of water and blocks air, negatively affecting the growth of surrounding vegetation. In the forest of the first clay harvest, we traced the veins of clay running under the soil by following the areas where the thick clay soil stunted tree growth. Clogged arteries of clay were working underground, prohibiting root development, and opening the canopy above. The overlapping ecologies of our world are complex but somehow work together in perfect unity.

During my second clay harvest, I thought about my shifting perspective.

123 An old potter's term for prospecting for clay. Most commonly used in the context of brickmakers harvesting clay from quarries. See Appendix A.
124 Prepared under the Joint Auspices of the International Labour Office and the United Nations Industrial Development Organization, comp. Small Scale Brick Making, (New Zeland: International Labour Organisation, 1984). 35-38.
125 Cairns-Smith and Hartman, Clay Minerals and the Origin of Life, 15.

We dug the hole for a purpose; the tree would flourish and grow with our care, supporting the birds and squirrels of the neighbourhood. Compared to the enormous acts of machinery upon landscape at the scale of industrial mining, the harsh actions upon the earth as we dug the hole were only temporary. The scale of the hand brought an intimacy to understanding forceful actions upon the earth.

Through this year of digging and gathering clay, the harvest process has evolved past the initial triumph of a material jackpot. Initially, when finding a vein of clay, I was overcome by the capitalist mindset to harvest and consume. Free clay? What a gift! As I spent more time with the material, I began to dwell on this concept. The clay I had gathered was a gift.

Kimmerer's book explains the complex web of relationships bestowed along with gifts through reciprocity. Her analogy is simple; when a loved one gives you a gift, like your grandmother offering cookies, you reciprocate with thanks and express your delight. Should you react oppositely, the gift may not come again. The gratitude and debt one feels after receiving a gift immediately creates a reciprocal relationship with the gift giver. When thinking about our grandmothers, it is common sense to act in a way that ensures the gift is given again. Thus, supporting the reciprocity of a gift economy.[126]

But what if the earth offers the gift? What does it mean to enter into a reciprocal relationship with clay? Veins of iron-rich clay course through the earth and connect a web of material kin across continents, North America, and worldwide. Clay has been vital to the development of human civilisations, providing the first opportunities to store water and cook meat. Humans are already indebted.

126 Kimmerer, Braiding Sweetgrass, 25.

Commercial clay manufacturing in North America is an industrial process of shipping minerals in their pure, dry, milled forms from mines across the United States and Western Canada. Once at the processing facilities, these mineral powders are combined with water and kneaded into one consistent substance. The mined powders arrive in tidy white paper bags, properly labelled and sealed.

It is a far cry from scarring the earth yourself–developing blisters as you dig or falling into a river as a boot gets stuck in the mud. The industrialisation of material harvest has created the opportunity for development and use at a scale that is impossible to imagine as one single person. The clinical manufacturing process removes all visible traces of organic debris from the clay to distance the material from its context. After processing, we view clay as a commodity to be bought and sold. Pristinely wrapping the mud in plastic creates a *product* and entirely removes it from the shared childhood experience of hands in squishy mud.

Material intelligence has little to do with commodification. Defined by Glenn Adamson in his book, *Fewer Better Things*, it is about thoroughly reading, with both body and mind, the workings of a material system and then having the ability to work with and improve upon it. Adamson also speaks of reciprocity, saying that it is from the composition of the material landscape we occupy that we learn. By studying materials, we begin to understand how to put things together and make something.[127] It is a concept that requires listening and learning from something considered inanimate. Even the word material implies an action; it has yet to fashion itself into a final composition. The materially intelligent craftsperson has a personal relationship with their chosen material. For me, this required finding clay in-situ and scarring the earth myself.

127 Adamson, Fewer, Better Things, 9.

Figure 160. Three pinched pots made from unprocessed clay straight from the ground in Kitchener, Ontario.

The familiar greeting of finding clay takes place along riverbanks, suburban sidewalks, downtown construction sites, backyards, and the freshly upturned soil of farm fields in Southern Ontario. While locating and recognising clay happens often, it is no less of an exciting experience. In any clay harvest, I feel the rush of finding materials straight from the earth. It is inspiring to see the landscape transform beneath my fingers as I shaped pots from the ground. This is the gift I receive. So often, objects come into our lives with unknown origins; knowing the entire lifecycle of something is a new experience.

In accepting the gift of clay, I become an actor in its depletion or survival and therefore am responsible for its continuity. When digging for clay, the Anthropocene is directly at work. I merge my lifecycle into the scale of geologic time. I enter the geologic cycle of clay at the point of harvesting it from the earth, intending to alter its chemical composition permanently. This is my action upon the land.

The consideration of how our lifecycles merge led to questions about how they diverge. How do the pots I make finish their cycle of use? What use are the pots that do not survive the fire, cracking into shards? Or the pots that I smash on purpose, after some misguided adjustment that ruins them. The incredible endurance of ceramic requires a thoughtful end-of-life process. Ceramic shards will outlast anyone reading these words. Yet, clay and ceramics are never entirely removed from the rock cycle.

If one can imagine these materials at the scale of geologic time, then clay is the combination of degraded rock particles suspended in just the right amount of water. These particles wash down a decaying mountain, gathering into secondary clay deposits wherever the water has wound its route, collecting along riverbeds and eroded hillsides. Ceramic shards will degrade and disintegrate just as the mountains do, weathering back into small rock particles and eventually becoming clay once again.

With this perspective, the web of reciprocity gains a third dimension as my understanding of human impact scales to geologic time. I buried a shard of my work next to the tree. A small insignificant act, but meaningful in its intention. A gift in return for the gift I have taken. It is the recognition of the currency in a gift economy; gratitude and debt. It also recognises the material itself. Clay is in constant metamorphosis from rock to clay, to ceramic, and back again. I gathered clay from this spot, and eventually, this shard will disintegrate through weathering and time, returning the clay to the earth. I create a constellatory-web between the buried shard and the rest of the clay I have dug from this spot. The network of fragments

Figure 161. The waves of Twelve Mile Bay washing up onto the black mica sand at at a family friend's cottage.

grows, radiating out from its place of origin, as pots crafted from this clay join the gift economy and find new homes with friends and family.

Regarding clay as a gift has become the most important guiding principle of any of my material harvests. Moreover, who is not excited to receive a gift? Especially one so thoughtfully presented in a beautifully crystallised package, crafted into the exact chemical composition I require, held within the earth just waiting for my grateful hands. Through the labour and patience of the long and arduous process, I earn my gift to turn this earth into malleable clay. Nevertheless, my yearlong endurance of harvest and processing seems minuscule compared to the timespan of geologic time.

Clay nestles itself in the crevices, creeks, valleys, and riverbeds of the world. Consulting geologic survey maps can only lead you to the correct area; finding actual clay requires quite literally getting into the weeds. The real work is done by patiently combing riversides, walking along favourite paths with newly opened eyes, and most importantly, looking downwards.

I have practised observation by paying attention to what lies beneath you and tracing the pattern of your feet. I have spent many hours on this hunt throughout my research. All of which has shown me that finding clay is not my discovery. It is the land revealing itself to me in recompense for my patience and watchful eye.

Open your eyes while walking along a creekbed; a glimmering grey patch in the shallows will catch a sliver of sunlight, reflecting the clay's presence. Clay pulls you in, brings you towards it and asks for your respect. Clay will only offer itself to you if you pay with your patience and time. You show your gratitude for the gift by giving back beauty to the world.

Figure 162. My current studio space located in Griffintown, Montreal.

Conclusion

Gathering clay's story was a long process of learning how to listen and look closely at material. I pulled clay to the center of each investigation in an attempt to recalibrate my human-centric world view. The body of work represented in the thesis is a portion of the bodily knowledge gained through working with my hands directly with material. By engaging with clay in a multi-tiered method involving both intellectual and manual labour, I developed my own material intelligence.[128] Slowly, I found the skills to analyse and act upon clay as it taught me how to shape and trust the knowledge that was gathered by my hands and mind.

Everything, even something as simple as the dirt on the bottom of your

128 Adamson, Fewer, Better Things, 16.

Figure 163. Digging Lakeshore clay in Oakville, Ontario.

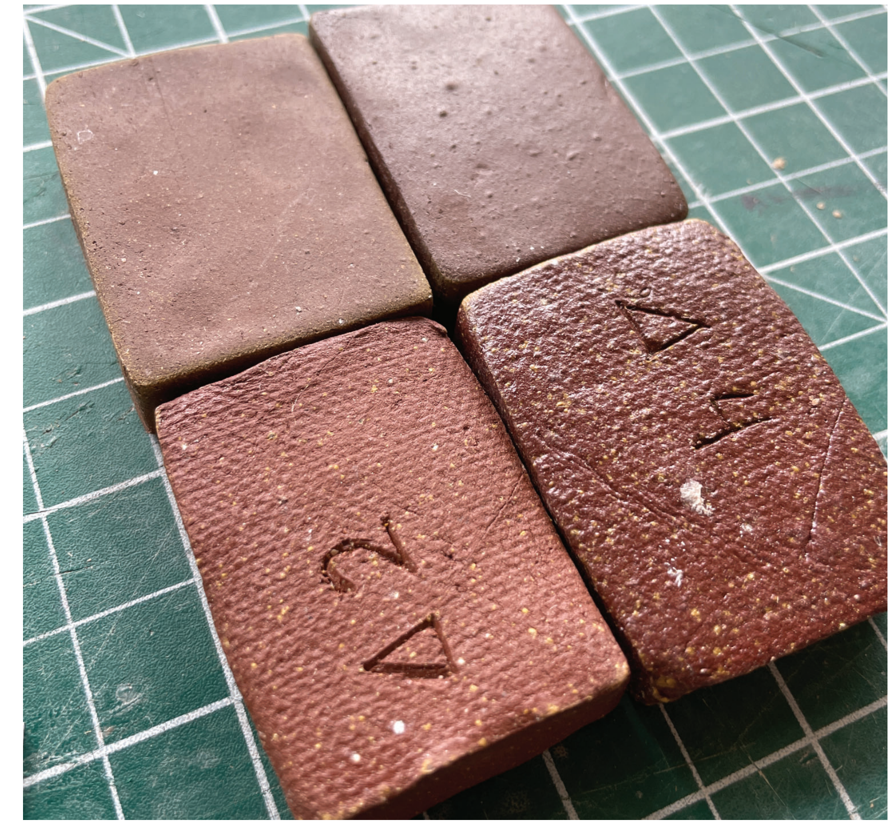

Figure 164. Test tiles of Komoka clay fired to cone 2 and cone 4.

boots has multiple facets and exists in plurality with the human and more-than human world. Drawing the web of clay's relations through mythical, historical, site and material research has imparted on me to think more fully about the bigger picture, my own actions, and the actions of the complex ecosystems of our world I cannot perceive.

The mind and hand work simultaneously, each pushing the other forward and each necessary to the other for a full understanding of fabrication in a contemporary world.

Clay shapes the hand, hand shapes the clay.

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Appendix A

This document aided the author in understanding the prospecting and processing required when working with clay. Relevant sections are added to the following pages.[1]

1 Prepared under the Joint Auspices of the International Labour Office and the United Nations Industrial Development Organization, comp. Small Scale Brick Making, (New Zeland: International Labour Organisation, 1984). 35-38. https://open.unido.org/api/documents/4794028/download/SMALL-SCALE%20BRICKMAKING.%20UNIDO-ILO%20TECHNICAL%20MEMORANDUM%20NO.%205%20(13731.en)

II. TYPES OF CLAY

It is essential that the raw material used for the production of bricks contains the following elements:

- sufficient clay fraction to ensure a good plasticity of the clay body, thus allowing the latter to be formed and retain its shape. The material is described as 'lean' or 'short' if the fine fraction is insufficient. The clay element should not exceed a certain limit which will render it too sticky for working. Furthermore, the dried bricks are liable to cracking due to high shrinkage if too much clay is present in the body. In this case, the material is described as 'fat'. Some clay types with the above characteristic have high shrinkage rates;

- sufficient unreactive coarser grained material such as sand to mitigate the potential problem described above;

- proportions of silica and alumina in the clay from which the strong durable glassy material may be formed on heating to approximately 1000^{0}C;

- alkalis or iron to assist in the formation of glassy compounds;

- constituents which do not produce excessive deformation or shrinkage at the firing temperature in the kiln;

- no impurities or inclusions which will disrupt the structure of the brick.

The size of particle present in the clay body affects the cohesiveness, forming characteristics, drying and firing properties of a clay.

II.1 Particles sizes in brickmaking soils

The various fractions of particles in soils are usually denoted by their size as given in Table II.1.

Table II.1

Definition of particle sizes in brickmaking soils

Fraction		Size range (mm)
Sand	Coarse	2 - 0.6
	Medium	0.6 - 0.2
	Fine	0.2 - 0.06
Silt	Coarse	0.06 - 0.02
	Medium	0-02 - 0.006
	Fine	0.006 - 0.002
Clay		less than 0.002

In practice, a raw material for brickmaking should contain some clay fraction (say 10 to 50 per cent) together with some silt and some sand. Depending upon relative proportions of various elements in the raw material, the latter might be described, for example, as a silty clay or, if containing some clay and similar proportions of silt and sand, as a loam. Since the presence of both clay and a good range of other particle sizes is desirable, loams are particularly suitable for brickmaking.

II.2 Clay minerals

Materials for brickmaking range from soft muds through the partially compacted clays or muds and highly compressed shales. The fine particles in the clay fraction may consist of various mixtures of some 12 different groups of clay minerals. These groups are briefly described below.

The kaolin group is common and might be regarded as a typical clay mineral. In its molecular structure thousands of alternate flat layers of silica (silicon oxide) and gibbsite (aluminium oxide) occur, and give the particles their typical hexagonal plate-like structure. They are up to 0.002 mm across and can be seen under the electron microscope. This mineral presents no particular problems in brickmaking.

mullite, may crystallise from the liquid at temperatures which may reach approximately 1,100^{0}C for some brickmaking clays. In these ceramic reactions, a long firing time at a low temperature can have the same effect as a shorter firing-time at a high temperature. As cooling commences, the liquid solidifies to glass, bonding other particles together. The cooling rate should be slow to avoid excessive thermal stresses in the bricks, particularly once the quartz inversion temperature (573^{0}C) is reached, since shrinkage occurs in the presence of quartz.

The inevitable firing shrinkage should be fairly small, otherwise it would be difficult to maintain the stability of the bricks in the kiln.

II.6 Other basic requirements

High technology tends to limit the range of clay types acceptable for a particular process machine, and is less versatile as regards the type and grade of fuel. On the other hand, a wide range of materials and fuels can be used with less sophisticated technologies. Fuel, whether oil, gas, coal, wood, scrub or plant wastes, must be available for the brickmaking process and may be regarded as a raw material. Electricity may be advantageous for ancillary purposes. Water is also necessary and, for highly plastic clays, sand may also be required.

III. CLAY TESTING AND SIGNIFICANCE OF RESULTS

Although highly sophisticated clay testing methods have been evolved, very simple tests can also give useful information. The former may be necessary for large turnkey projects, where equipment is often adjusted for specific raw materials characteristics. However, they require skilled staff not only to carry out tests, but also to interpret the results. On the other hand, simple tests may often be carried out on site, by less qualified personnel. Yet, the results may be more easily related to the use of the raw material than those obtained from more sophisticated tests.

The most direct test method used successfully for thousands of years involves visual inspection and the feel of the soil, and the carrying out of brickmaking trials

Tests to investigate various aspects of a soil's suitability for brickmaking are given below, starting with the most basic field test methods. Simple, intermediate technology tests are described next. Finally, a brief description of the more sophisticated tests which might be employed if adequate facilities exist, is provided at the end of this section.

III.1 Particle size

A visual inspection of the raw material will show whether the soil contains sand; a magnifying glass may assist in this operation.

The 'feel' of a soil in the hand will give an indication of the proportion of different particles sizes. When dry, a sand constituent gives a sharp gritty feel. A piece of the hard soil rubbed with the back of the finger nail cannot be polished. When wetted and broken down between the fingers, the sand particles become more readily visible.

If there is a high proportion of clay the dry soil will feel smooth and powder may be scratched off it. Furthermore, a surface of a small lump can be polished with the back of the finger nail. Damp soil can be worked into any shape, but will tend to stick to the fingers. The more clay in the soil, the more difficult it will be to remove it from the hands by wiping or washing.

A suitable brickmaking soil will have a high proportion of sand, so that it may not take a polish. High clay content soils may need addition of sand to make them suitable.

An estimate of the proportions of the various size fractions can be obtained using the sedimentation jar test. Any straight-sided, flat-bottomed, clear jar or bottle may be used. An approximately one litre capacity jar will be adequate (figure II.4). One-third of the jar is first filled with broken-up soil. Clean drinkable-quality water is then added until the jar is nearly full. The content of the jar is next mixed up, one hand covering its mouth to avoid spilling. The soil is then left to settle for an hour, shaken again and allowed to settle a second time. An hour later, the depth of the separate layers can be seen and measured. The bottom layer consists of sand and any coarser particles. The medium layer consists of silt and the top layer of clay. Often, the top two layers will merge together. The settlement of the clay fraction may be slow with some soils. The use of salty water for this test will flocculate the clay and help it to settle, thus giving a clearly defined level in the bottle which can be measured more easily.

Where laboratory facilities exist, a wet sieving process may be used to estimate the quantities of various sizes of sand. The soil is first washed through a nest of sieves of increasingly fine mesh, and the quantities retained on each sieve are dried and weighed. The difference between the weight of these fractions and that of the initial sample is then equal to the weight of silt and clay. Further information about the composition of these finer materials can be obtained using a sedimentation method (the Andreason pipette) or a hydrometer method. Details of these and other methods are described in British Standard Methods of Test for Soils for Engineering Purposes - BS 1377:1975 (18).

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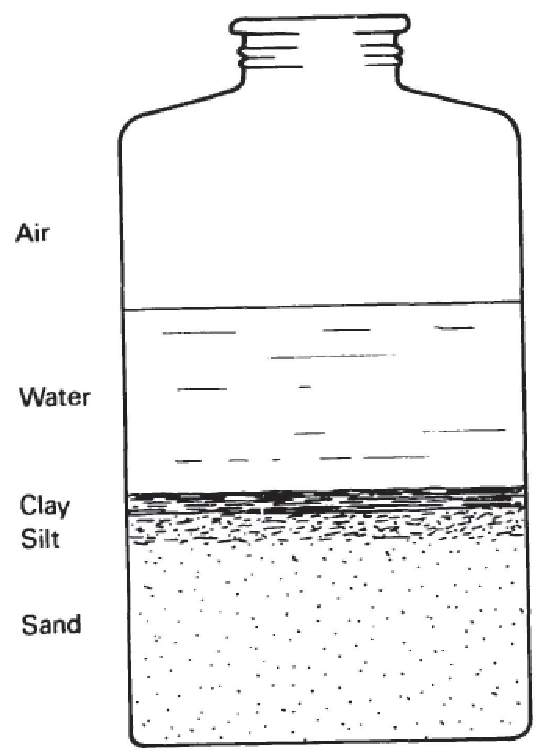

Figure II.4

Jar test

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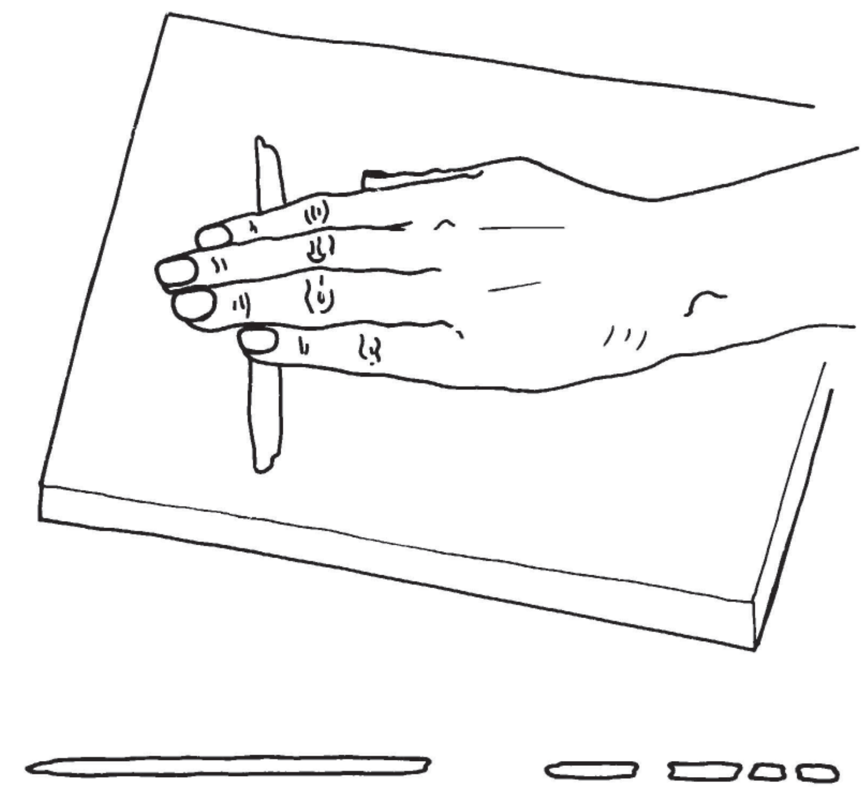


Figure II.5

Plastic limit test

III.5 Drying shrinkage

High clay content (recognisable in wet conditions by the stickiness of the soil) is in dry weather, recognisable by the presence of shrinkage cracks in exposed soil, in either vertical or horizontal faces (see figures II.6 and II.7).

To obtain a measure of the shrinkage of a moist soil, which may seem suitable for brickmaking, the most simple method is to mould a few bricks from the soil and allow them to dry thoroughly. The length of the dried bricks and of the moulds are then measured in order to obtain an estimate of the linear drying shrinkage. The latter may be obtained from the following formula:

$$\text{Linear drying shrinkage (per cent)} = \frac{\text{(Mould length - final dry length) x 100}}{\text{mould length}}$$

The appearance of the test bricks will give some indication of the suitability of the soil for brickmaking. It is suitable if no cracks appear on the surface. If some slight cracks appear it would be advisable to shorten the soil by adding 20 per cent sand or grog. In case of extensive cracks, 30 per cent might be mixed in. Soil too lean for moulding will have to be made more fat with other clays, or ant hill soil.

Generally, up to 7 per cent linear shrinkage may be tolerable, depending upon the nature of the material and the rate of drying. If linear shrinkage is more than 7 per cent shortening is advisable(22). In any case, it is necessary to know the linear shrinkage in order to determine the exact size of moulds needed for producing bricks of given dimensions.

If more organised test facilities are available, it would be advisable to prepare special shrinkage bars. For this test, an open-topped wooden mould, approximately 300 mm long by 50 mm deep and wide, should be made up by a carpenter or a sufficiently skilled handyman (figure II.8). The soil used in the test should be dried, if not already so, and broken down. Large stones should be removed. It is then mixed with just sufficient water to bring it near the liquid limit (i.e. pieces of the soil should be deformable yet retain their shape). If time permits the soil should be covered, left overnight, then mixed up again. The mould should be lightly greased inside to prevent the soil from sticking. Some moist soil is then laid in the bottom, and the mould tapped on the bench or ground to cause entrapped air bubbles to escape from the soil. The mould should be filled in the way described above in several stages, and excess soil struck off the top to leave a surface level with the surface of the mould. The soil should be dried slowly at first, at room temperature. Once shrinkage appears to have stopped, it may be tipped out of

Figure II.6

Clay shrinkage on a vertical face

Figure II.7

Shrinkage cracks in clay pit bottom

one face and sand or sandy clay from another. This has often been done as, for example, near Mombasa in Kenya, where material from two faces has been mixed in the pit bottom prior to use. If the material varies horizontally (i.e.from one place to another) two separate faces in the pit, or two separate pits, might be worked simultaneously. If the material varies vertically (i.e. at different depths), two faces can be operated by benching (see section II.2).

Record-keeping

For later reference, a note-book should be kept for recording progress, and any significant happenings in the quarry. A map should be made of the quarry, showing the position of original test holes or pits, the depth of clay, and other major features such as streams, tracks, large trees and the brickworks if adjacent. The position of the clay-pit face should be drawn on the map every few months, and the date written on the line representing the face. If the floor of the pit is dug a second time or if benching is used, a second colour could be used to update the map. This will assist in an orderly exploitation of the reserve: haphazard digging is wasteful of material and effort(27). The rate of ingress into the reserve should be clearly visible, and if problems or complaints arise with the finished bricks, the fault may be traceable to a cause in the pit. The extent of any problem materials in the pit should be marked on the map. The supervisor should check constantly the work at the clay face and inspect the material being won to ascertain that it is suitable and does not contain deleterious materials.

II. METHODS OF WINNING THE CLAY

Two basic methods are available : mechanical winning and hand-digging. These are briefly described below.

Mechanical winning

Mechanical methods such as the use of the drag-line and multi-bucket excavator are mostly appropriate for the largest-scale brickmaking operations. It is most unlikely that even a face shovel (figure III.1) could be justified in works of the size considered in this memorandum, unless it is available on hire from a nearby depot for a short period of time each year, (e.g.in order to build a stock pile). It seems unlikely that mechanical winning could be economical for output of less than 14,000 bricks per day(22).

On the other hand, the more commonly available and versatile bulldozer could have a place in the laborious task of clearing overburden on infrequent occasions. It might be brought in on hire, or when available from nearby road construction or other civil engineering works (e.g. against payment of a fee).

Most of the clay resources utilised by the small-scale manufacturer are likely to be of the soft plastic type. In some areas, when only hard shales are available, blasting might be undertaken occasionally to loosen material from the quarry face.

II.2 Hand-digging

Hand-digging has been widely used even for medium-size production plants, because of its versatility in dealing with all clays from soft muds to shales or even with ant hills. Hand-digging can also be adjusted to various types of work, and allows workers to sort out unwanted stones, limestones, roots, etc. It also avoids large amounts of capital investment, the stocking of spares and the organisation of maintenance of machinery. In many situations, hand-digging may be the only possible means of winning clay.

The rate of winning clay will depend upon the type of clay, the nature of the pit and the productivity of labour. Productivity rates for one man digging enough clay for the production of approximately 3,500, 1,500 and 4,000 bricks per day have been estimated(5,25,8). However, these estimates are not strictly comparable as some of them include an element for the transport of clay over a short distance. Measurement of shovelling rates in the American mines(29) indicated an optimum working day of 6.5 hours. Longer working hours result in lower outputs.

Once clay has been dug, there will be a natural reluctance to reject any which may prove unsuitable, especially after the hard work of winning it. In particular, the workers paid according to quantity excavated may be reluctant to reject unsuitable material. Hence the importance of supervision, inspection and quality control.

If the face is benched, the separate levels need be only 1 m different(25) and 0.5 m wide(5), especially if materials from two or more levels are to be mixed. This can be done by throwing all materials down to the lowest level for mixing, and subsequent transportation away to the works.

The details of working the pit must be decided locally. For example, at Asokwa in Ghana (figure III.2) the clay was hand-dug from a face which was approximately 2.5 m high in places(30).

Steel bladed, medium-weight spades are well suited for digging plastic clays. Preferences in blade design vary from country to country. It is, Efflorescence on bricks made from clay containing high concentrations of soluble salts is shown in figure IV.3 In some circumstances, salts crystallise beneath the surface, buidling up stresses which can force flakes to spall from the surface as shown in brickwork in a boundary wall in India (figure IV.4).

I. MAIN CLAY PREPARATION PHASES

Clay preparation includes the following operations:

- sorting (or picking) and washing;
- crushing or grinding;
- sieving or screening;
- proportioning;
- mixing, wetting and tempering.

A whole range of motor-driven machines is available for these operations, including belt-conveyors, jaw-crushers, kibblers, hammer mills, grinding pans (both wet and dry), rolls, de-stoning machines, vibrating wire screens, proportioning feeders, double-shafted trough mixers, and pug mills. However, few of these capital-intensive items will be appropriate to the type of production described in this memorandum. In a labour-intensive set-up, a mixing machine may be the most useful piece of equipment if diesel or electric power sources can be used. Animal power may also be worth considering.

It is best to prepare clay in a very dry or a very wet condition. Damp clays are difficult to crush, they stick on sieves, are awkward to handle and require much power to mix.

II. SORTING

An essential part of clay preparation is that carried out in the pit. This includes the discarding of unsuitable pockets of soil, roots, stones, limestone nodules, etc. and the winning and preliminary mixing of clayey and sandy materials. Visual inspection of the clay in the works is not easy to carry out or enforce, but is done on a routine basis whenever the clay can be moved on a narrow conveyor belt past workers who pick off any unwanted material. It is advisable to have the supervisor check the clay coming into the works from time to time. Unwanted materials detected at this or any subsequent stage should be removed.

Where stones or limestone nodules constitute a particular problem they can be removed in a washmill (see Section IV.3).

III. Crushing

In the tropics, clay will generally be dry when won from the pit. Thus the centres of large lumps will be difficult to wet. Non-uniform material is likely unless the dry clay is first crushed to less than a few millimetres across. Where capital cost is justified by a sufficiently large production scale, and where power sources are reliable, crushing rolls may be useful. Figure IV.5 shows crushing rolls in Ghana.

III.1 Manual pounding and the hammer hoe

Manual pounding with a hammer or punner may be used in small works but is very laborious. There is a tendency for already broken pieces to be compacted again, forming a hard lump which prevents the tool from breaking fresh material. It is thus necessary to clear away material as soon as it is broken. In favourable circumstances, two tonnes might be prepared per day by a team of four men (e.g. enough for 1,000 bricks).

The hammer-hoe (figure IV.6), which is used in Malawi, is a useful dual-purpose tool, having special uses not only in the works, but also in the clay pit. Material can be won, turned over, and mixed with the hoe. If hard lumps are found in the mix, it is not necessary to exchange tools as a half-turn rotation of the handle will bring the hammer into position for breaking the lumps.

III.2 The pendulum crusher

A labour-intensive crushing machine has been developed by the Intermediate Technology Workshop in the United Kingdom especially to meet the needs of the small-scale brick-maker as identified in an earlier survey(10). It is easily built from mild-steel sections, and works on the pendulum principle. The soil, which is placed in a feed hopper at the top of the pendulum, comes into contact with a static grinding head and a curved moving grinding head. The latter is attached to the top of the heavy pendulum which is kept swinging by two people (figure IV.7). The moving head is studded with protruding bolt heads which entrap and crush clay as the head rotates in a downwards direction. Ground clay falls through by gravity on to a built-in sieve which can be of any desired mesh size. On the upward return move, any remaining clay is cleared from the grinding surfaces prior to the next downward swing, so that a slight dampness of the clay is not a great problem. Figure IV.8 shows details of the components of the crusher.

To operate the machine, two men start the pendulum swinging. Once the latter has reached a maximum angle, a third man starts feeding material. If exceedingly hard pieces are encountered or if, for example, a steel tool is mullite, may crystallise from the liquid at temperatures which may reach approximately 1,100^{0}C for some brickmaking clays. In these ceramic reactions, a long firing time at a low temperature can have the same effect as a shorter firing-time at a high temperature. As cooling commences, the liquid solidifies to glass, bonding other particles together. The cooling rate should be slow to avoid excessive thermal stresses in the bricks, particularly once the quartz inversion temperature (573^{0}C) is reached, since shrinkage occurs in the presence of quartz.

The inevitable firing shrinkage should be fairly small, otherwise it would be difficult to maintain the stability of the bricks in the kiln.

II.6 Other basic requirements

High technology tends to limit the range of clay types acceptable for a particular process machine, and is less versatile as regards the type and grade of fuel. On the other hand, a wide range of materials and fuels can be used with less sophisticated technologies. Fuel, whether oil, gas, coal, wood, scrub or plant wastes, must be available for the brickmaking process and may be regarded as a raw material. Electricity may be advantageous for ancillary purposes. Water is also necessary and, for highly plastic clays, sand may also be required.

III. CLAY TESTING AND SIGNIFICANCE OF RESULTS

Although highly sophisticated clay testing methods have been evolved, very simple tests can also give useful information. The former may be necessary for large turnkey projects, where equipment is often adjusted for specific raw materials characteristics. However, they require skilled staff not only to carry out tests, but also to interpret the results. On the other hand, simple tests may often be carried out on site, by less qualified personnel. Yet, the results may be more easily related to the use of the raw material than those obtained from more sophisticated tests.

The most direct test method used successfully for thousands of years involves visual inspection and the feel of the soil, and the carrying out of brickmaking trials

Tests to investigate various aspects of a soil's suitability for brickmaking are given below, starting with the most basic field test methods. Simple, intermediate technology tests are described next. Finally, a brief description of the more sophisticated tests which might be employed if adequate facilities exist, is provided at the end of this section.

III.1 Particle size

A visual inspection of the raw material will show whether the soil contains sand; a magnifying glass may assist in this operation.

The 'feel' of a soil in the hand will give an indication of the proportion of different particles sizes. When dry, a sand constituent gives a sharp gritty feel. A piece of the hard soil rubbed with the back of the finger nail cannot be polished. When wetted and broken down between the fingers, the sand particles become more readily visible.

If there is a high proportion of clay the dry soil will feel smooth and powder may be scratched off it. Furthermore, a surface of a small lump can be polished with the back of the finger nail. Damp soil can be worked into any shape, but will tend to stick to the fingers. The more clay in the soil, the more difficult it will be to remove it from the hands by wiping or washing.

A suitable brickmaking soil will have a high proportion of sand, so that it may not take a polish. High clay content soils may need addition of sand to make them suitable.

An estimate of the proportions of the various size fractions can be obtained using the sedimentation jar test. Any straight-sided, flat-bottomed, clear jar or bottle may be used. An approximately one litre capacity jar will be adequate (figure II.4). One-third of the jar is first filled with broken-up soil. Clean drinkable-quality water is then added until the jar is nearly full. The content of the jar is next mixed up, one hand covering its mouth to avoid spilling. The soil is then left to settle for an hour, shaken again and allowed to settle a second time. An hour later, the depth of the separate layers can be seen and measured. The bottom layer consists of sand and any coarser particles. The medium layer consists of silt and the top layer of clay. Often, the top two layers will merge together. The settlement of the clay fraction may be slow with some soils. The use of salty water for this test will flocculate the clay and help it to settle, thus giving a clearly defined level in the bottle which can be measured more easily.

Where laboratory facilities exist, a wet sieving process may be used to estimate the quantities of various sizes of sand. The soil is first washed through a nest of sieves of increasingly fine mesh, and the quantities retained on each sieve are dried and weighed. The difference between the weight of these fractions and that of the initial sample is then equal to the weight of silt and clay. Further information about the composition of these finer materials can be obtained using a sedimentation method (the Andreason pipette) or a hydrometer method. Details of these and other methods are described in British Standard Methods of Test for Soils for Engineering Purposes - BS 1377:1975 (18).

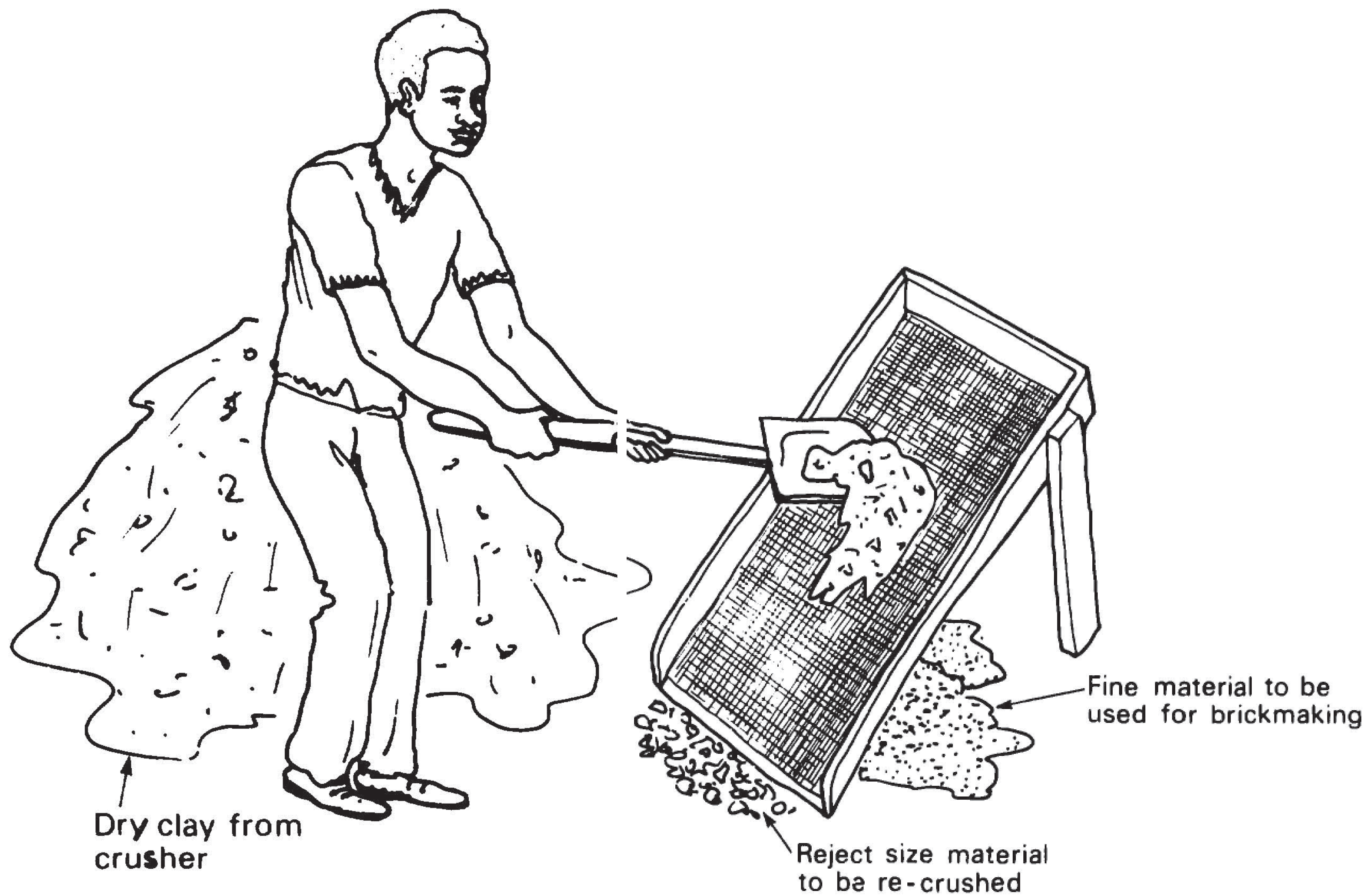


Figure IV.9

Sieving

- 52 -

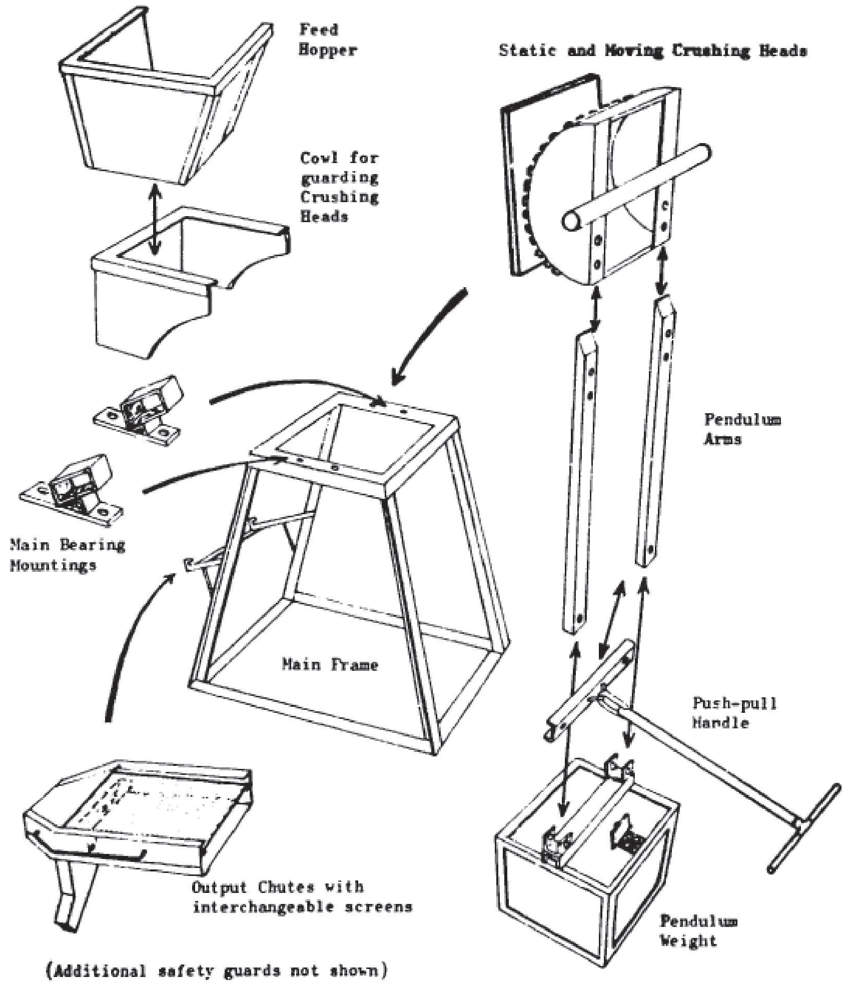


Figure IV.8

Manually-powered pendulum clay crusher-
detailed drawing of parts

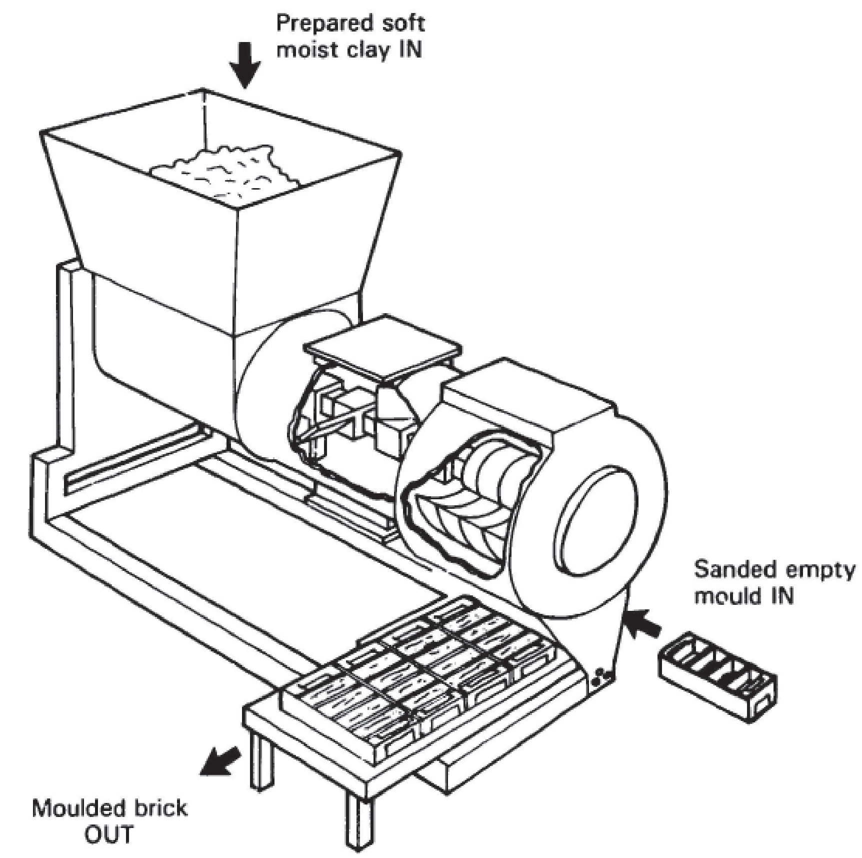


Figure V.5

Soft mud brickmoulding machine

Appendix B

This document aided the author in understanding settler relations in Canada at the beginning of the 20th century.[1]

1 "The Great Clay Belt of Northern Ontario," Toronto, Canada: Temiskaming and Northern Ontario Railway Commission. 1913.

The Great Clay Belt

OF

NORTHERN ONTARIO

PUBLISHED BY

Temiskaming and Northern Ontario Railway Commission

OPERATING

Ontario Government Railways

Sir James P. Whitney, Premier

T. & N.O.R. COMMISSIONERS

J. L. Englehart, Chairman

D. Murphy Frederick Dane

A. J. McGee, Sec.-Treas., Toronto

The Great Clay Belt of Northern Ontario

Twenty Million Acres of Virgin Soil Await the Farmer's Plow and Reaper.

In New Ontario's Great Clay Belt All Can Strike it Rich. Available Farming Lands are Being Rapidly Settled.

Where men with Determination, Good Health and Strength need have No Fear of Failure. Forest Line Rapidly Receding from Onslaught of Settler's Axe. Experiences of Settlers Who Have Made Good, as Related, by Themselves. Some of Their Hardships in Days of the First Settlement Before Building of Government Railways and Construction of Colonization Roads. The Life of the Average Settler and the Many Advantages the Natural Conditions of the District Afford as Compared With the West. Timber for Building and Nearness to Market Are Big Advantages.

New Ontario—the name sounds familiar, quite familiar indeed, for one can scarcely pick up a newspaper that does not contain news of some kind or another from that district. Yet, well known as is New Ontario, how many have any idea of the vastness of this new territory, with its wealth of timber, its healthful climate, and a soil capable of producing grain and vegetable crops surpassed nowhere in agricultural Canada? It is the heritage for the man with ambition and courage who wants to shuffle off the yoke of the wage-earner, the under man, and gain a living of independence. One must actually visit New Ontario before he can form any idea of its possibilities. He must go there to see for himself the great opportunities that exist.

Desirable Settlers.

In all of the more recently settled districts of all Canada it is doubtful if in any one section of this country can a more desirable class of settlers be found. About ninety per cent. of

5

them are English speaking. The greater part of them are from Old Ontario, but there are a great many from the United States as well, and the greatest part of the remainder the pick of the immigrants from England, Scotland and Germany. It must not be inferred that all have come to New Ontario penniless. Hundreds of cases could be cited where well-to-do farmers, owning large tracts of land in the older settled parts, have disposed of their holdings and moved to New Ontario. In most of these cases the resolve was made during or after a visit to the new district, showing that rich and poor alike have seen where they could better their conditions. The rural population of New Ontario also represents people of many callings. The draft is made from field, office, factory, and even from the ranks of the seamen. The North has a fascination that attracts alike the peaceful homeseeker and the adventurer. One has really to visit New Ontario to experience this feeling. It grips like a vice. It is a feeling that gets into one's veins and cannot be shaken. The enchantment of silent forest and broad expanse brings to life the spirit of remote forefathers. But it is the business side that compels action. It is the business side that the visitor and prospective settler places before all else. Records of 105 bushels of oats per acre; hay at 3 tons per acre, the latter this year selling as high as $18 per ton; milk at 14 cents a quart, and an adequate supply unavailable even at that price; eggs selling as high as 75 cents a dozen in winter and a market that is never satisfied—all this does not fail to awaken the business instincts of the visitor and illustrate what the possibilities really are. It is common to see truck loads of cans of milk at the stations of Latchford, Cobalt, Haileybury and even New Liskeard and Porcupine that had been shipped all the way from Toronto to supplement the local supply. Think for a minute what would be the possibilities of a farmer with a herd of high producing cows.

New Ontario's Future.

It is interesting to think what the future of New Ontario will be when these twenty million acres have been put under cultivation. There is no place in Ontario where bigger crops of hay, roots, barley, peas, oats and wheat can be grown. Alfalfa, too, is quite at home on New Ontario soil and record crops are being grown. Corn, too, can be grown, although it has been tried by only a few as yet. One farmer near New Liskeard this year had as fine a field as one would see anywhere. It matured well and grew to a height of 8 feet, despite the decidedly unfavorable weather conditions that prevailed all over Eastern Canada, destroying the corn crop in many outside sections. The cutting of three crops of alfalfa is regarded as a matter of course in New Ontario. The writer a couple of weeks or more ago had the pleasure of helping Mr. E. F.

Stephenson, one of the oldest settlers of the New Liskeard district, to tie up a sheaf of the third cut of alfalfa to send as part of an exhibit in a section of the New Ontario exhibition car now touring Ontario in charge of Mr. George Palmer, of Englehart.

A Dairy Country.

Where clover, alfalfa, field roots, barley and other grains can be grown with such phenomenal success, it at once suggests to the farmer who knows the practical and business side of farming that truly ideal conditions exist for dairying and beef cattle raising. It is almost a safe prophecy that there will come a day in the not distant future when New Ontario will be as a prairie dotted over with cheese factories and creameries, and be known as one of the foremost dairy districts in the world.

No Stones.

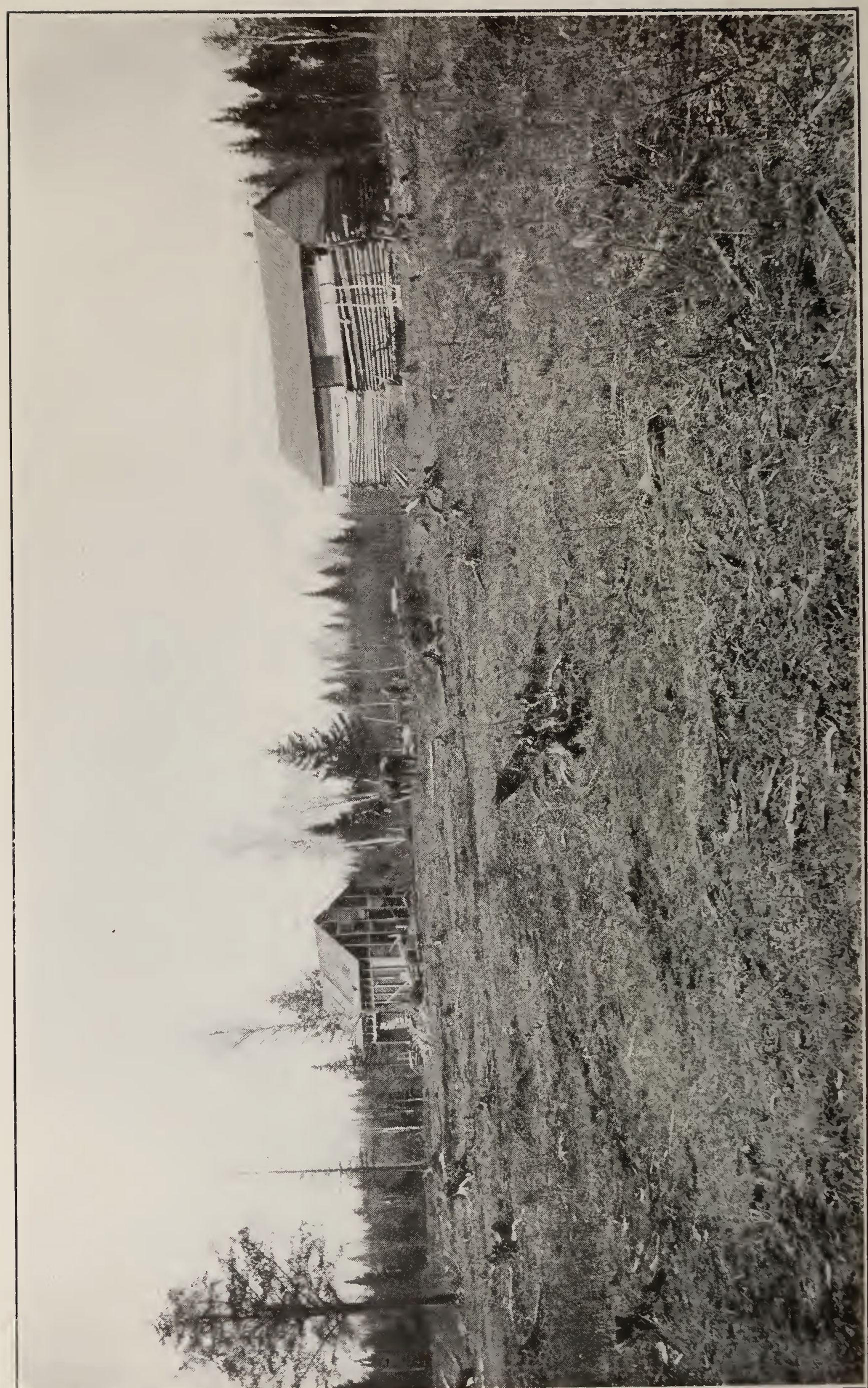
One of the first things that impresses the visitor to New Ontario is that there are no stones. In a clay belt it is difficult to find a farmer who will not make a bet, on a hundred-to-one chance, that one stone, no matter how small, cannot be found on his farm. The land is, as a rule, perfectly level, with just enough of the gradual slope to allow for good drainage.

The Climate.

Owing to the long days and greater number of hours of sunshine, crops mature very quickly in New Ontario. The air is dry and healthful all the year. To spend a September in the North is a delightful experience. The air is usually warm, hazy and invigorating. In winter, while the mercury sometimes touches a lower notch than at Ottawa or Montreal, the cold is not felt nearly so much as at either place, owing to the dryness of the air.

The Second Year.

Picture in your mind the average settler who has had a start of two years and has become fairly well established in his new home and new surroundings—a man of ordinary judgment. He has no worry. Should his crop fail he has another big account to draw from—the timber and pulp wood; or should he choose to work out he may do so and receive the best of wages. Contractors and lumbermen are always bidding for his time and that of his team. Fear of the landlord putting him and his family out of their abode for non-payment of rent does not concern him; he is his own landlord. His features are not marred by "worry lines" from fear that the interest will not be met and the mortgage foreclosed. The



Farm of one of First Settlers Near Lake Sesekinika

the return from the sale of pulp wood pays for the total cost of clearing the land ready for the plow and leaves a profit of about $50 besides. Where the timber is light no attempt is made at saving the wood. The trees are piled in tight wind-rows and cut in the fall or winter and burned in the early summer. If the weather is dry the settler gets a good burn and the work of logging is then reduced to a minimum, for practically nothing is left. The roots of the stumps do not go deep into the ground in the clay belt, usually not more than six inches, and the year following the chopping the greater part of them can be pulled out by hand or with a single horse.

How to Obtain a Free Farm.

Any person over eighteen years of age is eligible to locate a farm in New Ontario upon payment of the sum of $10 to the Government, whose agents are located at convenient points throughout the district. The regulations state that the applicant must reside on the lot at least six months in the year or provide a substitute. He must erect a habitable house sixteen feet by twenty-four feet and must clear at least two acres each year for the first two years, and at the end of three years have sixteen acres, one-tenth of the area of his farm, under cultivation. By making a declaration at the end of the three years he is entitled to his title or patent to the lot. In some sections a fee of 50 cents an acre is charged, to be paid in instalments of $20 down at the time of application and a similar amount each year until the total amount, $80, has been paid.

The Model Farm.

New Ontario, like other new countries and new districts, has problems of its own and the establishment of a model farm was one of the wise moves of the Ontario Department of Agriculture. The farm, which comprises in all eight hundred acres, is located at Monteith, 218 miles north of North Bay, the southern terminus of the T. and N. O. Railway. Close on one hundred acres has already been cleared and experimental work is being carried on to ascertain what crops are or are not suited to the district. The work is under the direction of Mr. C. A. Galbraith, a graduate of the Ontario Agricultural College at Guelph, and a man with the right balance of initiative, energy and good judgment to fit him for the position. A *bona fide* farmer of New Ontario could not spend a more profitable half day than in consulting with Mr. Galbraith concerning farming operations.

New Ontario.

New Ontario proper contains the districts of Nipissing, Sudbury, Algoma, Thunder Bay and Parry Sound, but in this article conditions in the Nipissing district only have been dealt

CONE	TEMP AT 27°F/ H	TEMP AT 108°F/ H
019	656°C	678°C
018	686°C	715°C
017	705°C	739°C
016	742°C	772°C
015	750°C	791°C
014	757°C	807°C
013	807°C	837°C
012	843°C	861°C
011	857°C	875°C
010	891°C	903°C
09	907°C	920°C
08	922°C	942°C
07	962°C	976°C
06	991°C	999°C
05	1021°C	1031°C
04	1046°C	1063°C
03	1071°C	1096°C
02	1078°C	1102°C
01	1093°C	1119°C
1	1109°C	1137°C
2	1112°C	1142°C
3	1115°C	1152°C
4	1141°C	1162°C
5	1159°C	1196°C
6	1185°C	1222°C
7	1201°C	1239°C
8	1211°C	1249°C
9	1224°C	1260°C
10	1251°C	1295°C

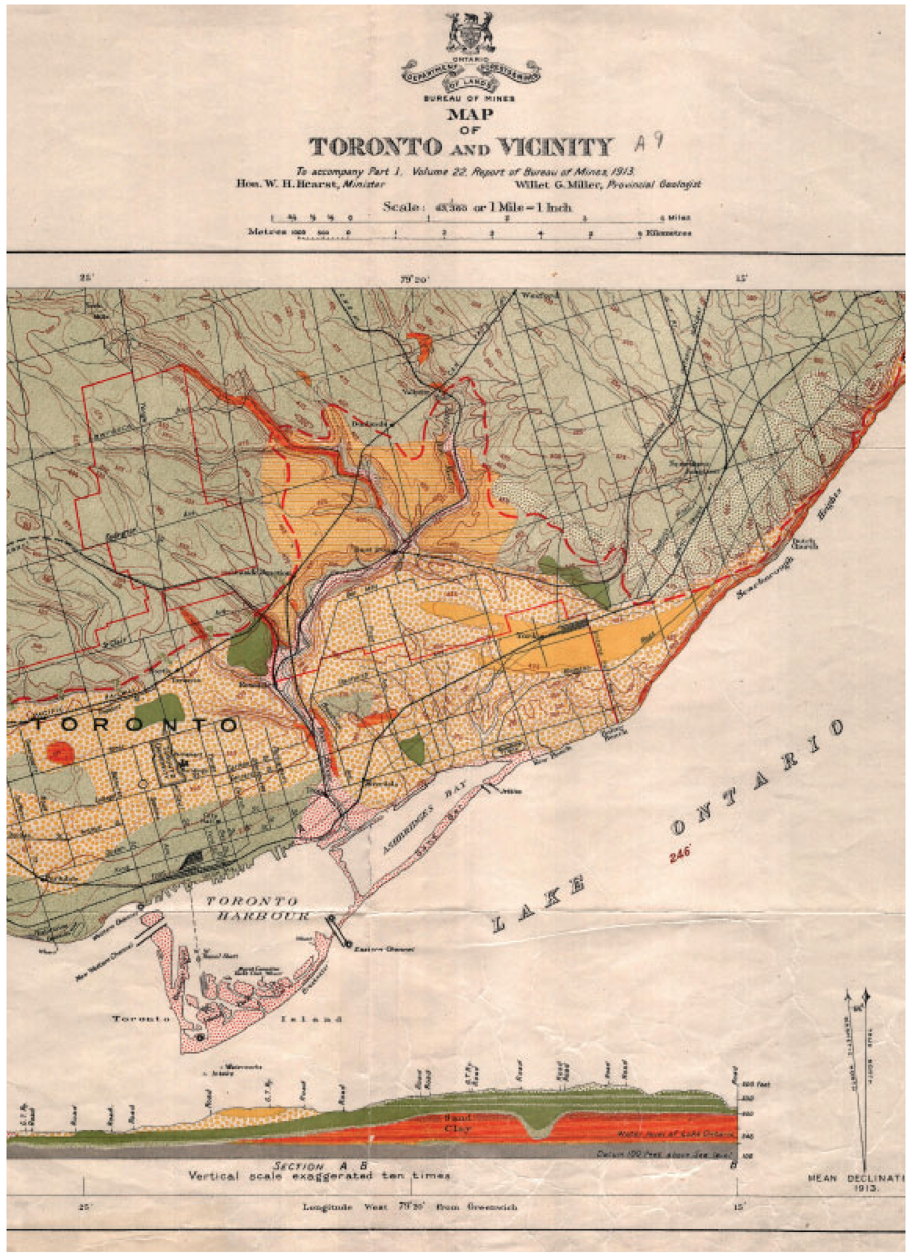
Appendix C

This document aided the author in understanding settler relations in Canada at the beginning of the 20th century.[1]

1 Information gathered from pyrometric cone charts online under creative commons usage rights.

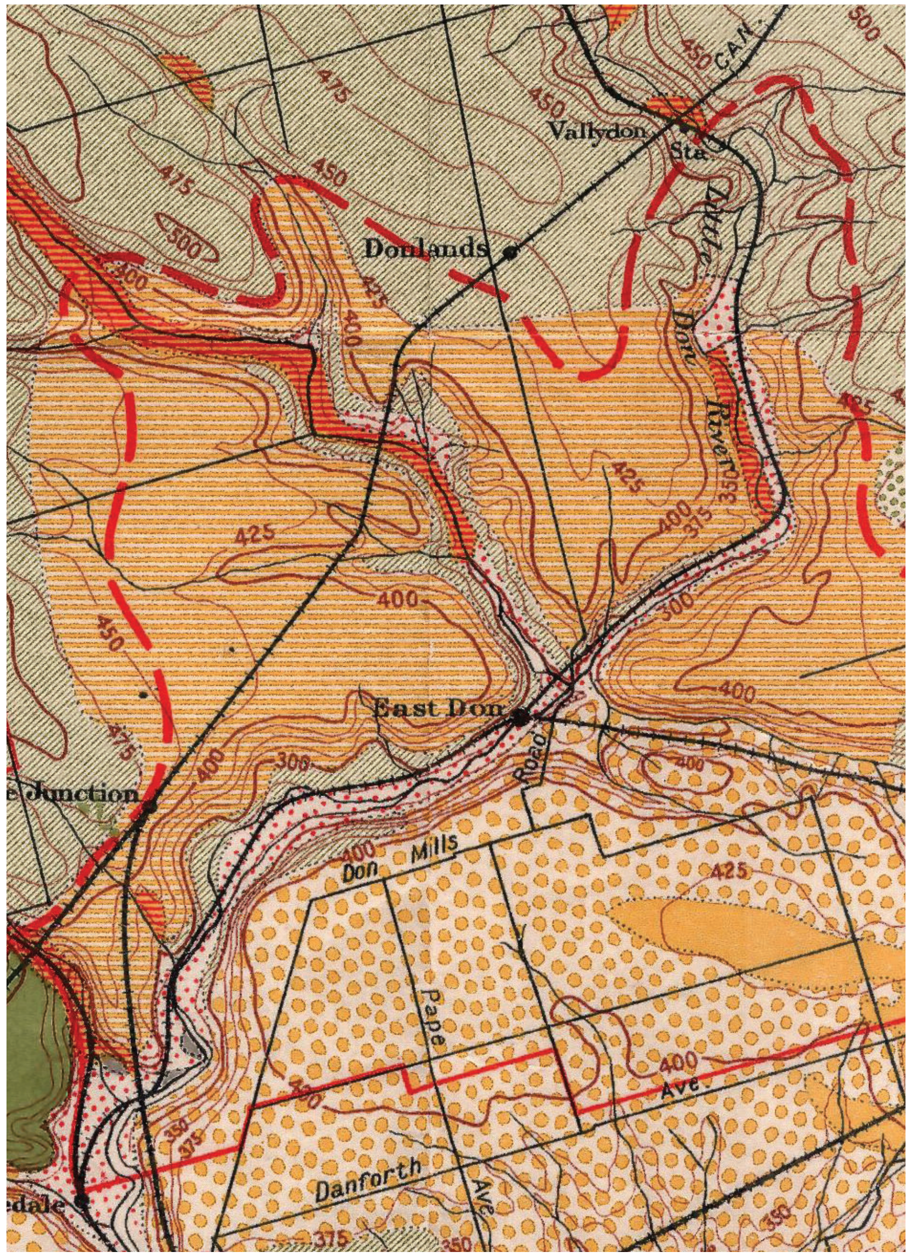
Appendix D

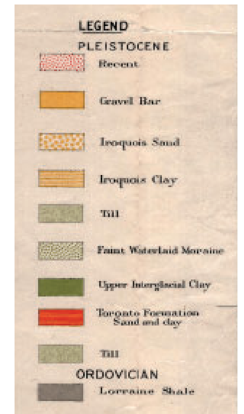
Soil diagrams and maps.



Soil map of Toronto, 1913. Found under commons license online.

Bricks at the remaining factory buildings in Evergreen Brickworks park.

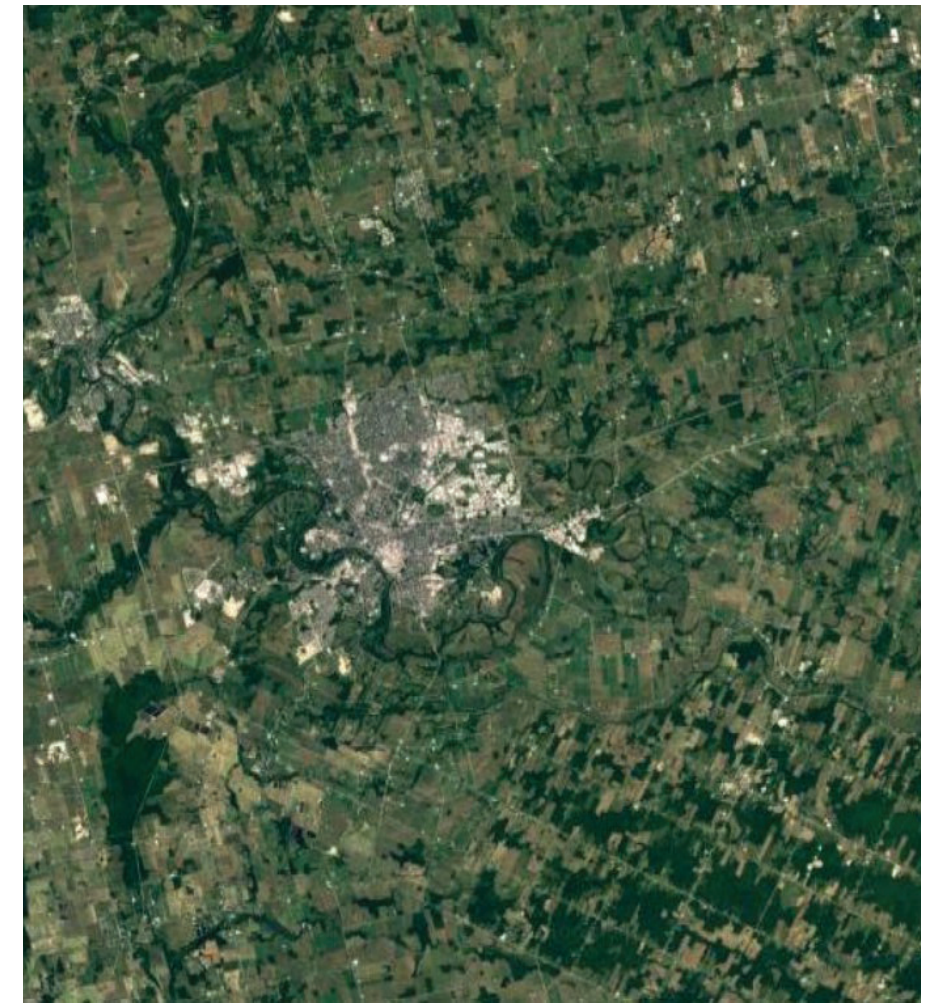




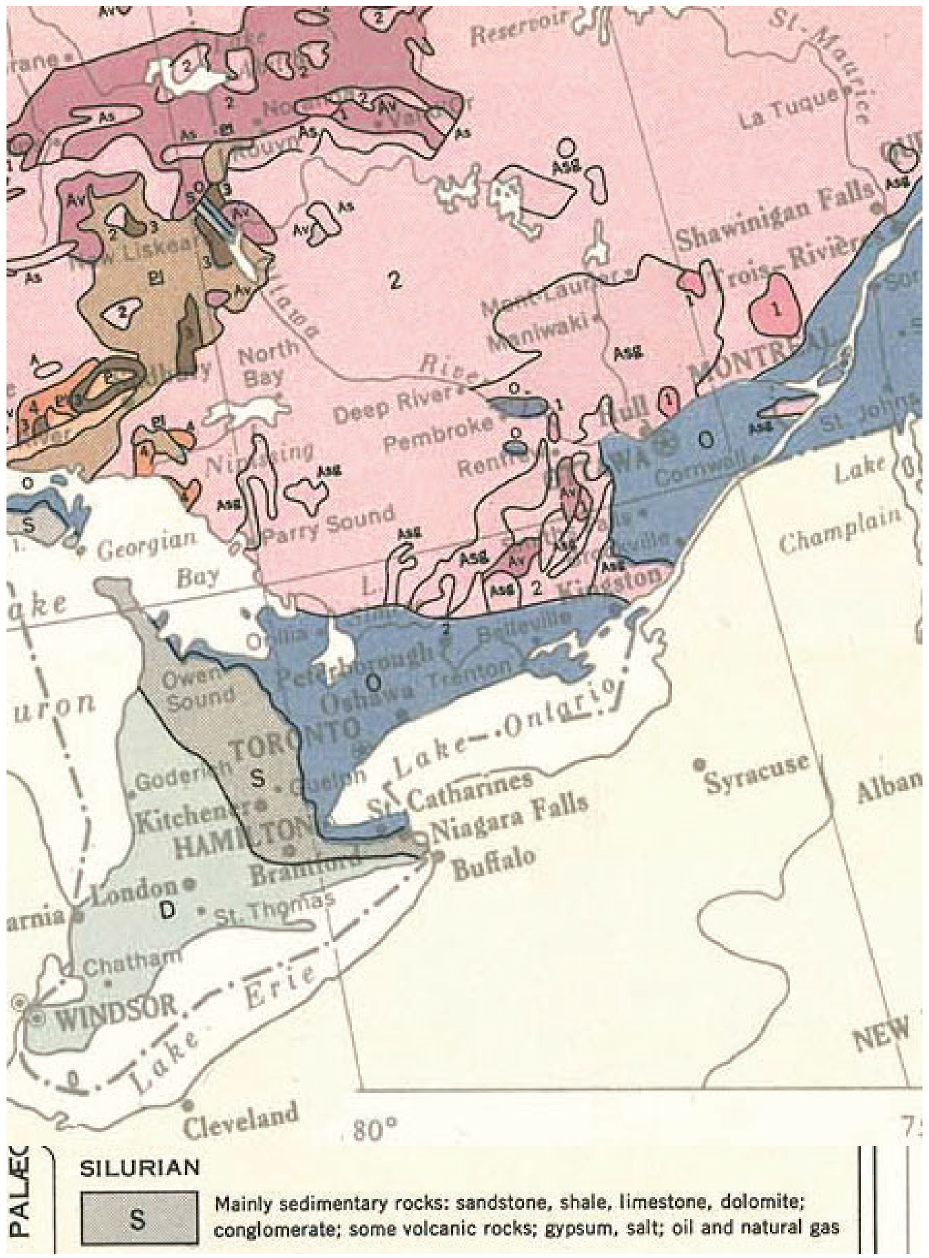
Toronto Donlands clay deposit, now the location of Evergreen Brickworks park. This soil map of Toronto lables this deposit as Iroquois Clay.

Historic images of the old quarry at the Evergreen Brickworks, various images are superimposed on to the bricks of the old buildings surrounding the park.

Compilation of maps used in finding deposits of wild clay.

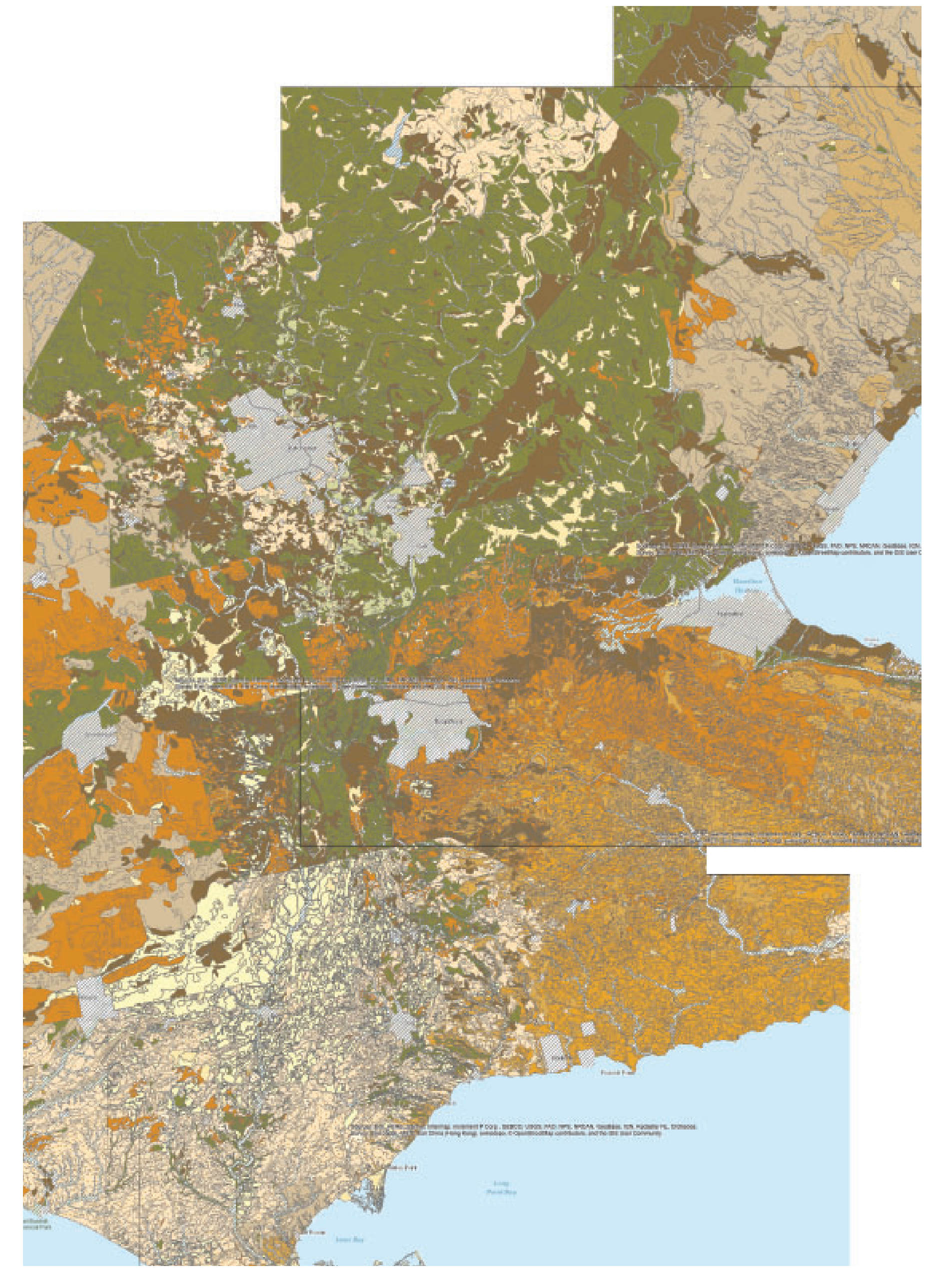


GPS map taken from Google Maps.



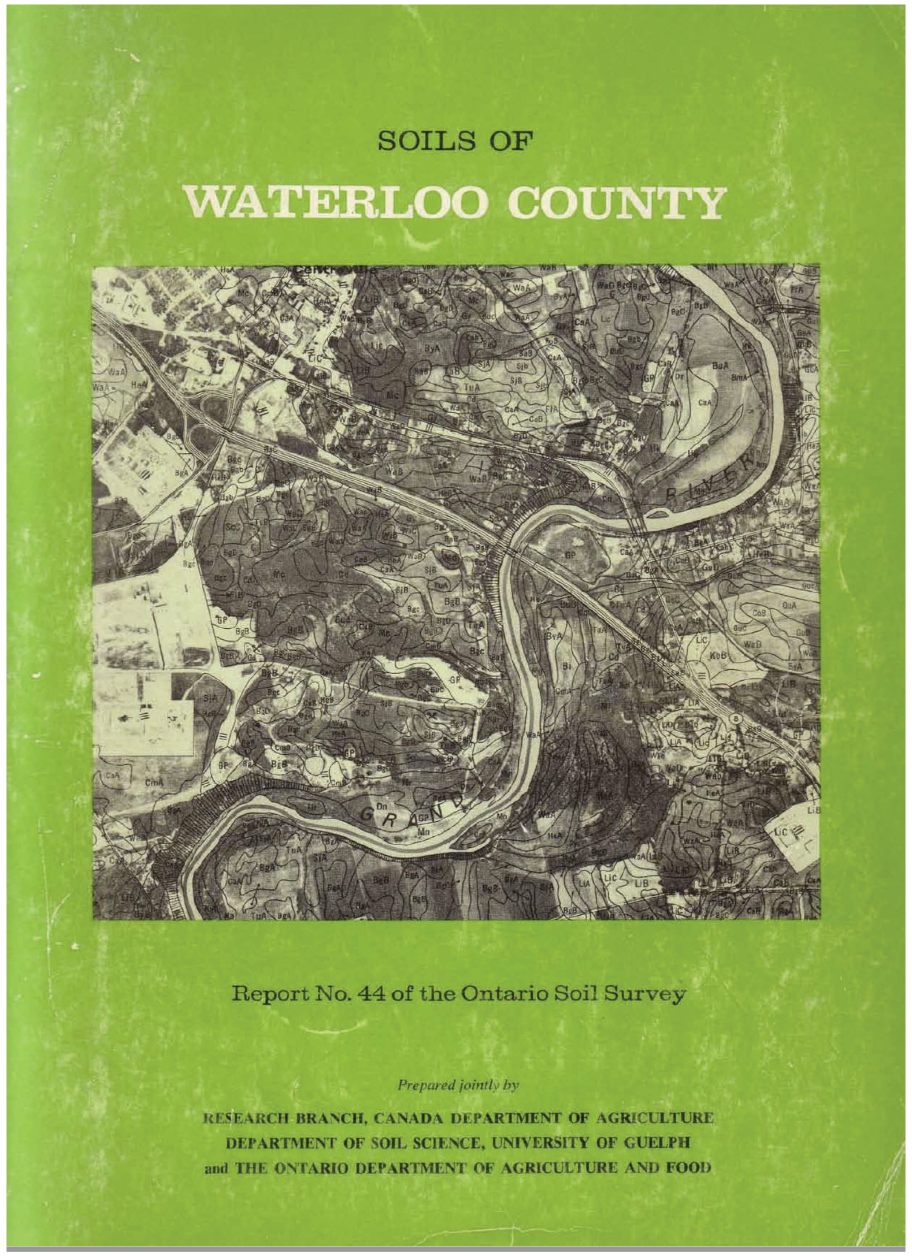
Silurian

443.8 million to 419.2 million years ago



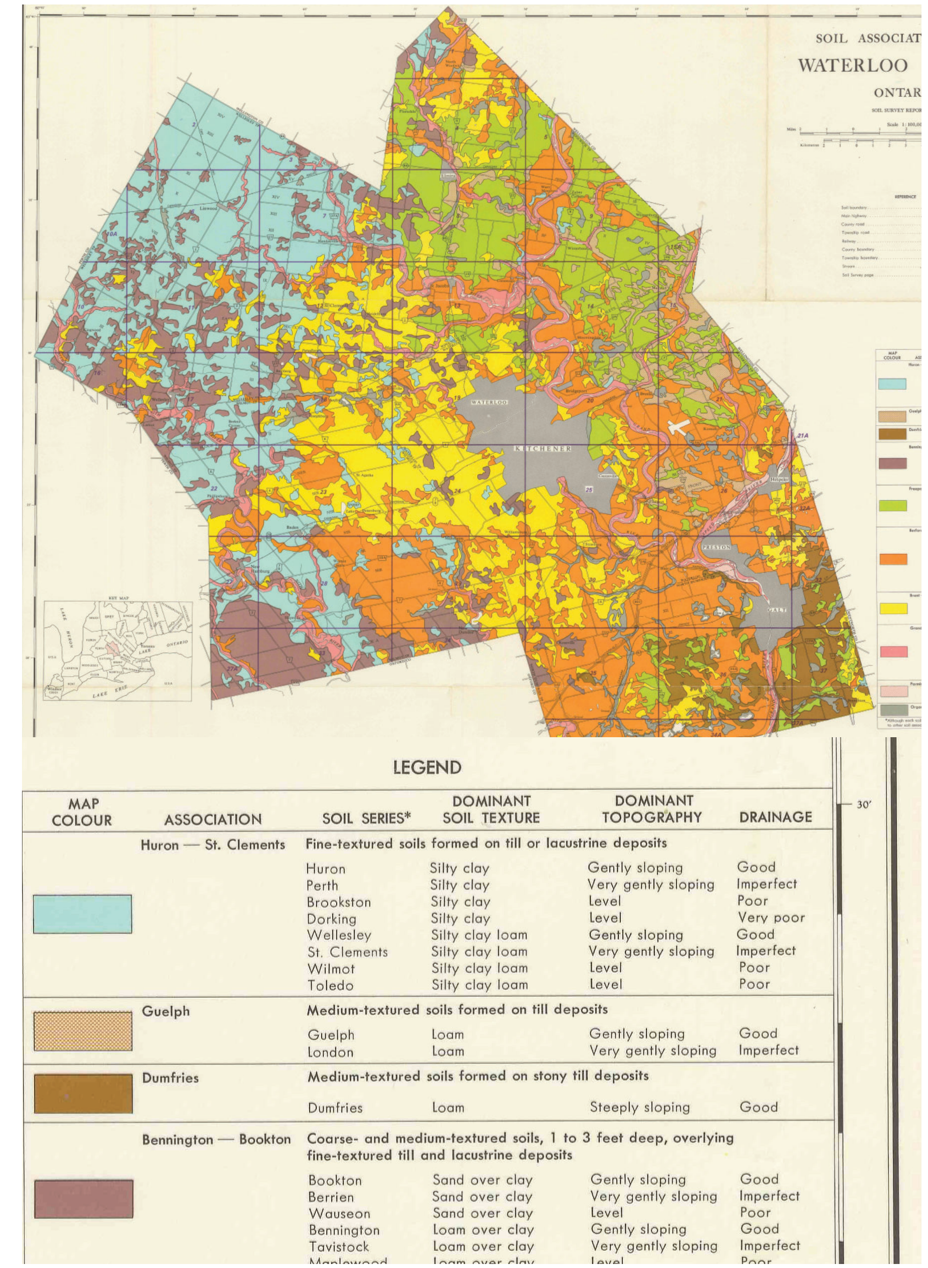
Silurian

443.8 million to 419.2 million years ago



The Soils of Waterloo County

Soil Report 1971



The Soils of Waterloo County

Soil Report 1971

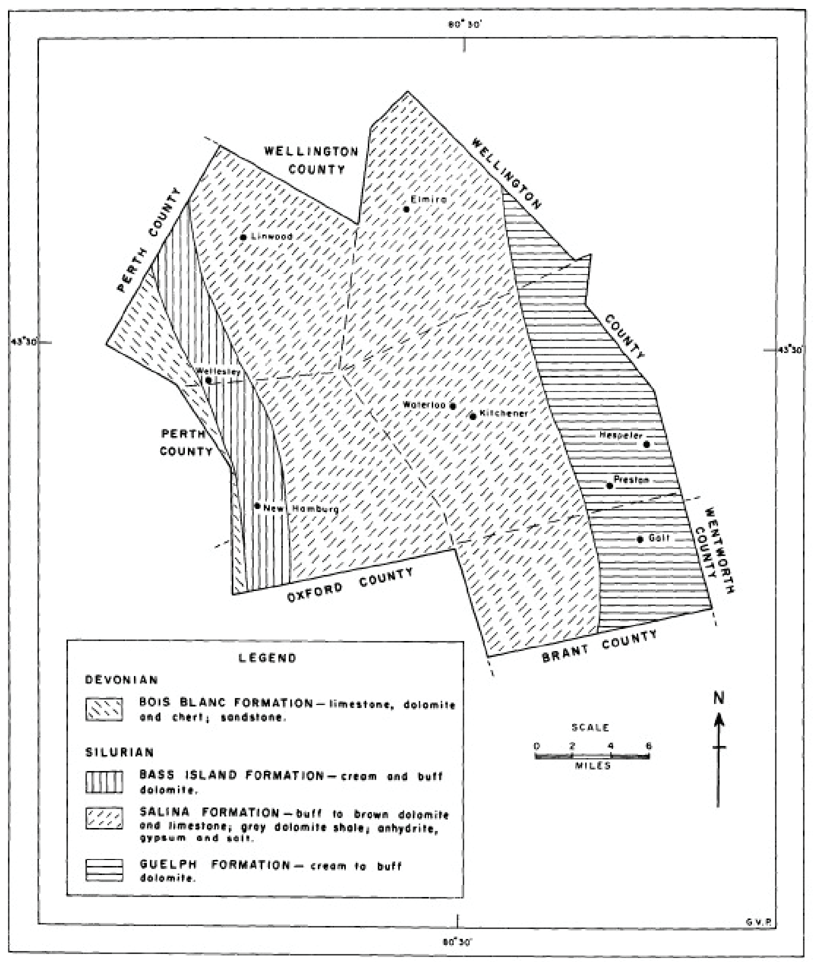
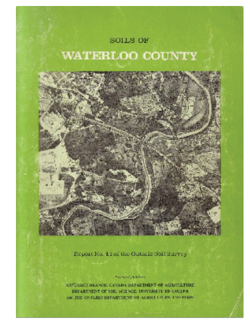
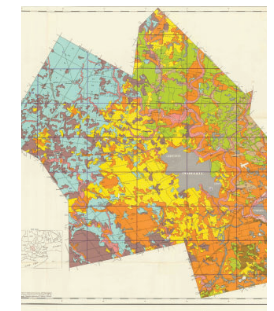


*Figure 3 — Outline Map Showing Bedrock Geology of Waterloo County***

**Adapted from Sandford, 1958 (20)





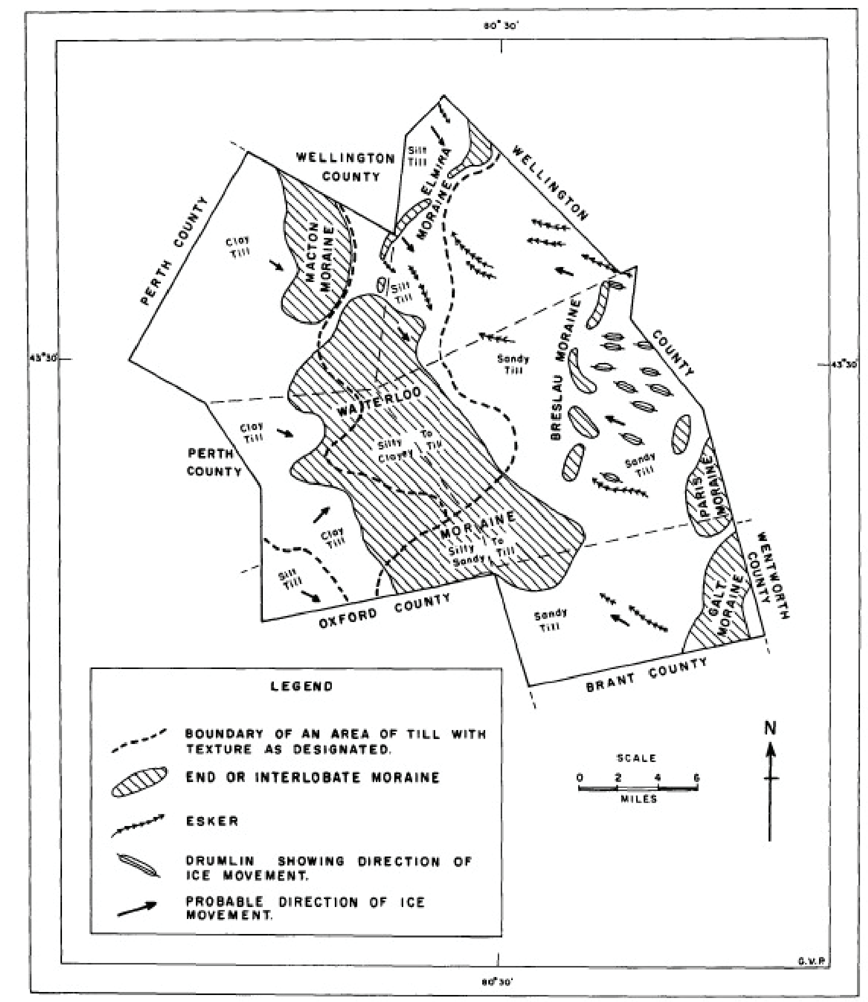


Figure 4 — Outline Map Showing Pleistocene Geology of Waterloo County

Waterloo County soil maps.

Waterloo County soil maps.


RESEARCH SUB-PROGRAM

State of the Resources: Improving the Land Resource Data Base - The Regional Municipality of Waterloo Soil Information Upgrade

March 1996

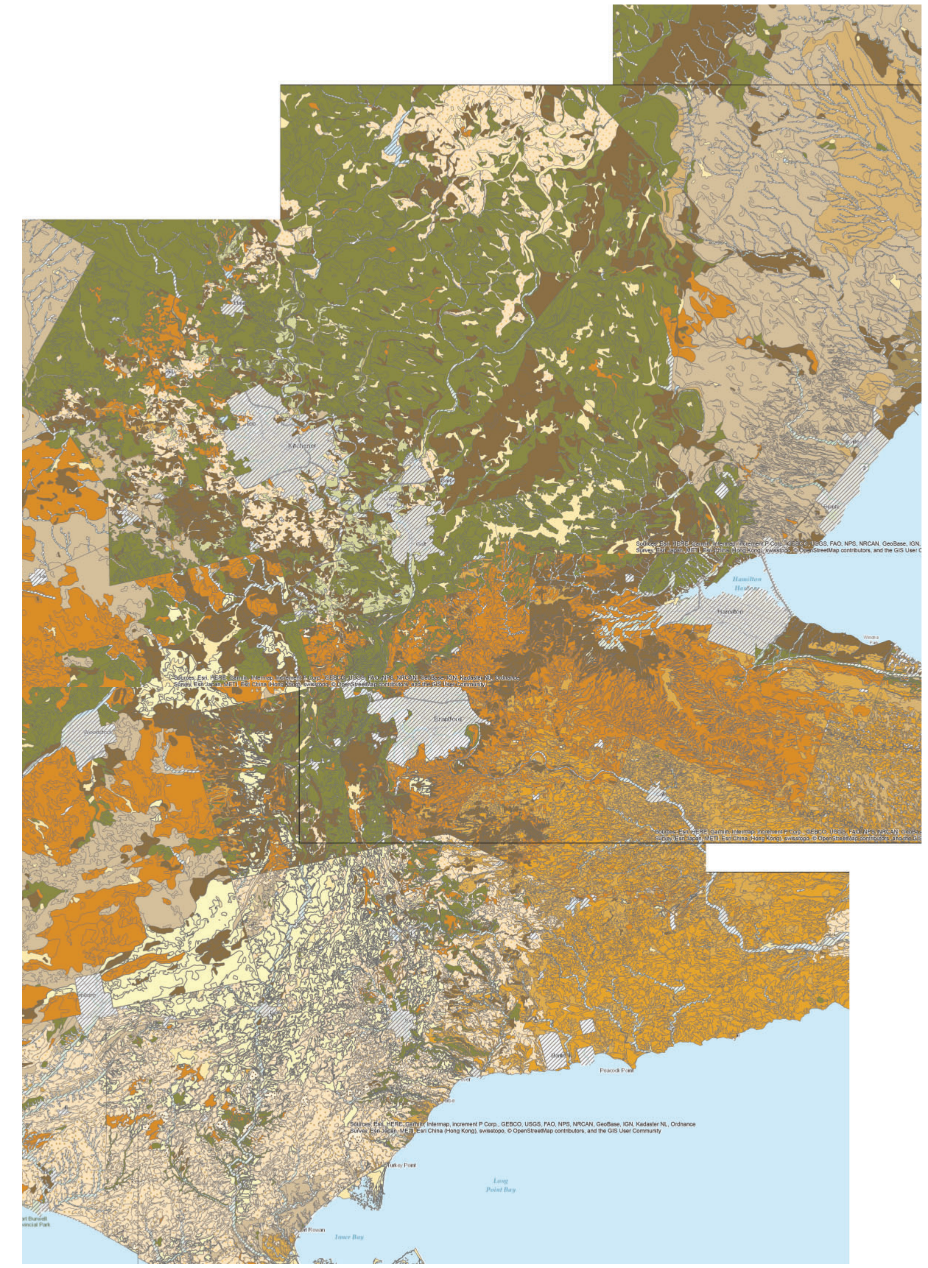
COESA Report No.: RES/MON-011/96

CANADA-ONTARIO AGRICULTURE GREEN PLAN

PLAN VERT CANADA-ONTARIO EN AGRICULTURE

The Soils of Waterloo County

Soil Report 1996



The Soils of Waterloo County

Soil Report 1996

Appendix E

Interview with Toast Magazine about the Land Marks Vessels.

TOAST WOMEN MEN HOUSE&HOME CHRISTMAS EVENTS MAGAZINE OUR APPROACH SEARCH SAVED (0) ACCOUNT BAG (0)

Home / TOAST Magazine / Kelsey Rose Dawson | New Makers

TOAST Magazine

1 September 2021

Kelsey Rose Dawson | New Makers

STYLE & STORIES

Kelsey Rose Dawson is one of the five New Makers that TOAST will be supporting and nurturing throughout the year. Her ceramic pieces are rooted in the language of place and site; the earthy vessels have grid-like patterns linking to the geographical coordinates of her wild clay findings.

On the cusp of finishing her thesis at the Waterloo School of Architecture, ceramicist Kelsey Rose Dawson is looking back fondly on her studies. For her university research she has been working with wild clay as a way to understand place and site. “Part of the origins of that was trying to better understand the land that I live and work upon,” Kelsey says. She grew up on the Haldimand Tract, land that was promised to the Six Nations which includes six miles on each side of the Grand River. It is on the banks of this river where she digs for clay. “I’m trying to understand what it means to be a white settler, living in Canada, working with the land. I started to question how I situate myself as a settler, architect or potter, and began looking down to the ground, finding clay along the banks of the river that I grew up beside.”

Kelsey gathers the wild clay responsibly, so as not to affect any wildlife. She cites the book *Braiding Sweetgrass* by Robin Wall Kimmerer, and her writing about the ‘honourable harvest’, as her guide. “You never take the first of something you see, in case it is the last. You only take what you can carry, you don’t take too much or what you can’t use,” Kelsey explains. She often sources her clay from land that has already been unearthed, such as on construction sites. For the TOAST Smoulder vessel, she used clay that was found when her family were digging a hole for a tree in their garden in Kitchener, Ontario. “As I’ve started to look for clay, it’s revealed itself to me more. When you have these open eyes looking for it in the world you’re able to see it more clearly.”

The elemental patterns running across the surface of the Smoulder vessel are created in a smoky fire pit. "The marks on the pot really become a record of the smoke and the fire and the process," Kelsey explains. "I love patterns that embrace natural phenomena, like smoke curling around the surface of a pot. The shape of the vessel was developed to be put into the fire. These round, smooth surfaces really lend themselves to capturing the patterns of the smoke." She experimented with different techniques to create varying patterns, such as moving the fire and wood to make certain pigments in specific spots, and throwing in sawdust to create speckling. She also considers what parts of the pot to keep buried in the ash and which to raise to the open air. The whole process takes about three to four hours. "It's very active. You're with that fire constantly and it's the only thing that you're thinking about. You're working with these thoughts to create the surface."

The Survey and Litterfall vessels also act as thoughtful articulations of place. The Survey vessel is patterned with a grid, which maps latitude and longitude lines along the curved surface. It was a way of Kelsey exploring "how to create straight lines, that Western rationalisation, on a curved surface, like the earth or the pot". The Litterfall vessel is patterned with abstract marks, inspired by the shapes created by the leaves that fell from trees onto the ground at the area where Kelsey dug for clay in Ontario, "mapping the forest floor".

During her studies, Kelsey was based in the Waterloo School of Architecture building, an old silk mill on the banks of the Grand River in Cambridge, Ontario. She recently moved to Montreal, and has found a new studio that echoes the shared environment she is used to, based along the Lachine Canal in Griffintown. There are around six or seven ceramicists in the building, some of whom Kelsey has already been collaborating with. It's here she's been working on a series of vessels also based on place and land, inspired by Monte Testaccio in Rome, an artificial hill formed almost entirely of broken shards of ancient Roman pottery. Almost all the pieces there are amphorae, many of which contained olive oil, and were disposed of there after use. Kelsey studied in Rome for a semester in 2018, and many of her pieces echo the forms she saw in the museums there, such as the National Etruscan Museum on Via Giulia, with expressive necks and handles.

Bound up in ancient pottery are the notions of the boundless passage of time, and how ceramic objects can outlive societies. Kelsey muses on the slow process of clay creation, how it is still being formed with the degradation of rocks, turning into crumbling sediment that comes down from the mountains to be compressed in riverbeds and move along waterways. "It's humbling to place yourself in a part of something that's so completely larger than yourself."

Interview by Alice Simkins.

Studio photography by Suzie Howell.

*Shop Kelsey Rose Dawson's series of **elemental vessels**, forming part of our 2021 New Makers collection.*