Approaching Vertical:

A Guide Through Land-Use in Ontario's Niagara Escarpment

By

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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

Ontario's Niagara Escarpment is a landscape 450 million years in the making. Over this immense time line, great natural forces of the earth have aggregated, eroded, and carved this landscape, a 725-kilometer scarp face stretching from Niagara Falls to Manitoulin Island, informing much of the land mass in Southern Ontario. Despite the minuscule fraction of geologic time that humans have occupied this region, the scale of our land-use is abundantly evident throughout its depth, from the marks and scars of industrial extractions to the layering of infrastructural erections used to inhabit the land. In a reciprocal fashion, the significance of this landform underlies the urban, social, economic and cultural development of human occupation in the region. The geologic landscape of the Niagara Escarpment forms the backbone of Southern Ontario.

Humans are a geological force, from the elemental matter of our physical being to our extended use of the planet's material resource, our species is rooted in the deep history of the Earth. Likewise, as proposed with the introduction of the Anthropocene epoch, the extended effects of human action are embedded in the immanent future of this world as a stratigraphic layer in its geologic makeup. The landscape is defined by this three-dimensional stratigraphy, at once a homogeneous entity (place) and heterogeneous assemblage (site). Despite these complexities, the understanding of the land is often relegated to its surface, a keen focus on the horizontality of landscape; represented, interpreted and experienced through two-dimensional projections onto a flat plane.

The new realities brought forward by the Anthropocene require altered sensibilities towards our understanding of landscape and our agency within it. The development of our contemporary society is caught in a state of acceleration, an exponential curve ever steepening, and we are rapidly approaching a world which exists at a right angle to history. In this accelerated time scale, geology can no longer be considered an exploration of past conditions of the earth, it is becoming more and more evident that the geologic is a present condition which we are actively shaping.

The landscape of the Niagara Escarpment is the ideal site through which to explore these emerging sensibilities as it naturally exposes its underlying form on a vertical surface, revealing a stratigraphy of geologic processes that encompasses the transformations of both human and non-human agents. Borrowing conventions from the field of geology to study and understand the world from the side, in section and elevation, and a through a broad range of temporal scales, this thesis seeks to present an alternate approach to the earth's landscape to include the expanding depths and heights of the "surface" we occupy.

Part One of the thesis, A Journey Through Land-Use, forms a collection of stories on the use of the land, relating the complex local histories of this specific landscape to a larger context of landscape interpretation. Part Two, A Stratigraphic Guide to the Niagara Escarpment, brings these revelations into immediacy, formalized in a guide that presents an altered interpretation of the Escarpment landscape through its elevation and section, focusing on the physical and ephemeral depths of the landform as it intertwines with networks of cultural and industrial land-uses.

The goal of this localized study is to reveal the broader condition of connections and intersections between the natural world and the humans that build on it and with it, interpreting the geologic not as a thing in itself, but a tracing of these associations through a vast range of temporal and physical scales. Through this interpretation, representation, experience, and use of the land, the landscape is expressed as a complex assemblage of human and non-human factors rather than an ontologically distinct entity. What we create, where we create it, and the material from which it is created is a holistic, geologic being. As we approach new verticals within this world, these sensibilities should guide our agency in the continual transformation of this deep surface.

Acknowledgments

I would like to express my gratitude to my supervisor, Rick Andrighetti, for joining me on this journey. It was at your suggestion that I turned my focus towards the Niagara Escarpment, a turn which fueled not only this thesis, but a rekindling of love towards the Southern Ontario landscape, a place for which I did not hold enough respect. Thank you for your continual guidance and insight as I got lost within this place.

Thank you to the many faculty and staff who were also part of this process, my committee member Jane Hutton for urging me to look up and down rather than across and through, my internal reader Adrian Blackwell who, despite entering late in the process, asked all the right questions, as well as Andrew Levitt and Dereck Revington, whose initial Thesis Research and Design Studios sparked many explorations which are at the foundations of this work.

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Prologue:
Maintenance
and
Care



fig. 001 The Motorcycle in the Appalachians

My work on this thesis began with a fascination with maintenance. The year before returning to the University of Waterloo for my graduate degree I purchased a 1981 Suzuki motorcycle while working on the East coast in Saint John, New Brunswick. This bike, with more than 30 years of life, had already seen a lot before it came into my hands, the signs of its age evident inside and out: fading paint and upholstery, spots of rust on the steel pipes, scratches and filled holes in the engine casing where it had clearly been dropped, and an engine that, at first, would not turn over. After sitting in the previous owner's garage for several years, all it needed was someone new to take care of it, and for a surprisingly low price, that someone was to be me. Over the next few days, with the help of some friends, we dove into the engine to get it running. A clogged carburetor was stopping one cylinder from firing, throwing off the whole timing and power of the engine, a simple cleaning was all it took to get it running and on the road.

Over the course of that summer, I all but lived on the bike. From evening rides to extended road trips with friends, I rode all over the East Coast, along the way learning the ins and outs of the bike. Understanding the little quirks in the engine, the small problems that kept it from running at 100 percent, and dealing with small fixes and routine maintenance needed to keep the both of us going. Owning the bike became a symbiotic relationship between human and object, as much freedom and joy it gave me, it needed back in a little love and care.

This engagement sparked a fascination in me, an interest in why we care for the objects of our everyday life. Most people have inanimate things that they care for, family heirlooms, nostalgic items from their past, places that have housed their histories, objects that the feel connected to. Unpacking this idea of care, I came to realize that this care is intrinsically connected to the passage of time and the age and experience that comes with it. In sharing the facets of human life with a non-human artifact, that thing comes imbued with the memory of experience. This imbued memory is most evident physically in the marks of wear and use, the patina of age and weathering on the thing, but there exists also an ephemeral mark of connection in the owners or users







subconscious, and unquantifiable relationship between person and object that draws out a desire to maintain, a sense of care.

fig. 002 Refinshed Handtools fig. 003 Repasting a CPU/ Heatsink fig 004 Repurposing a Wagon

This care for the non-human things in our world lead to a breakdown of what comprises the thing, not just in it's form and function, but how that form is the result of a continuous process, tracing its use back to its construction, back further to the materials used in its creation, and back further again to the processes which created those materials. This timeline could stretch endlessly backward, extending well beyond the time-line of human life into the vast layers of geologic time that precede us, yet is evident present and immediate moment through those objects.

This timeline of an object becomes a series of transformations, from the growth and change of matter at an atomic level to the evident change of material as it is cut, combined, and redistributed in new form. This transformation carries on in the maintenance of an object, both passively in the wear of use and actively in the repair, adaptation, restoration and recycling that comprises the care of everyday things.

In tracing these links of transformation, I discovered first hand not only the extended connections between our contemporary creations and the history of this world, but how that history can actually inform how we create in the world today. All material comes from the natural matter of this earth, no matter how processed it may be. This material carries a vitality, an ability to inform its use. The extended properties of that matter, imbued through its creation, allow for set ways in which one can work with the material. It is not within the agency of the creator to make from nothing, to impart something

new onto the world. Instead, the maker transforms material, teasing its properties into form, working with the matter and giving it agency within the process. In this sense, the making of something is not an act of creation, but an act of transformation akin to the act of maintenance.

These realizations left me with a yearning for more, to explore how human agency intertwines with the agency of the natural, non-human world. I began a series of explorations at the scale of hand-held objects, designed and made with the intention to evidently express their continual use through their







fig. 005 Soapstone Espresso Cup fig. 006 Mahogany Soap dish fig 007 Copper Inscence Holder

material properties, but these objects resulted in little more than fetishization of patina on objects and lacked the real depth of connection I was looking to explore. In order to broaden the depth of the exploration, a shift in scale was necessary, bringing this study outside of the individual to a more globally relevant condition.

The focus of the thesis then shifted, or rather, took a massive leap, towards the root of the material I was interested in exploring and the scale at which it is influenced; the geologic conditions of the natural landscape. The earth became the object through which to investigate care. Much like the marks of wear found on the everyday objects, the landscape too is riddled with signs of transformation, both though immense, natural forces and the equally immense yet significantly quicker forces imposed by human use and development. The landscape is a globally shared object, both the building site and the source of material for all that we create, to explore the connections between the human and the non-human at this scale would begin to understand our place within this geologic timescale and the agency we have as creators within it.

That summer with the motorcycle culminated in my return trip to begin masters back in Ontario, a week long road trip on the bike through New Brunswick, Maine, New Hampshire, Vermont and New York. The trip took me from the rugged coast of the Atlantic, smashed by immense forces of water, through the ancient Appalachian Mountain ranges, east to the sediment beds of their eroded matter and along the scarp faces tailing through New York and the Niagara Region to my arrival in Ontario. The movement through this extended landscape was not a calculated route, but a natural wandering with a loose destination, the ultimate path was defined by decisions in the immediate moment, following the landforms; a valley that would take me through a winding route, a road up a mountain that may offer a stunning view, a river that may offer peaceful stopping points. The seemingly still and static landscape became alive with my movement, the geologic transformations that occurred over billions of years to create the present landforms became fluid and evident as I traversed them.

Unbeknown to me at the time, I was traveling along a path once marked before. Not a distinct path of human travel, but a broad geologic path of erosion and sedimentation. The dust I carried on my tires followed the same route as sediment did almost 500 million years prior, finding it's resting place amongst the Great Lakes region, one of a series of transformations at a massive scale which led to the formation of the current landscape of Southern Ontario and the Niagara Escarpment.

This thesis became a journey in itself, constantly fluctuating between these scales of transformation, looking at the fine details that could be held within your hand and the larger context to which it belonged, ever expanding inwards and outwards.



fig. 008 The Escarpment Close and Far in the Beaver Valley



Introduction

Ontario's Niagara Escarpment

The Niagara Escarpment is winding cliff face of exposed dolomitic limestone which snakes its way across Ontario's southern peninsula, bisecting the land south-east to north-west along a 725-kilometre line of stone from Queenston on the Niagara River to Tobermory on the Bruce Peninsula where it dips under the waters of Lake Huron, emerging as Manitoulin island and continuing westward into the state of Michigan. This massive natural feature was formed through roughly 450 million years of geologic processes - transformations of deposition, sedimentation, and erosion; slow yet immensely powerful forces of nature, operating at a scale almost incomprehensible to humankind The result of this geologic journey is the predominant landform of Southern Ontario that we see today, maybe known to most as the mound of rock perched at the sides of Highway 401 in Milton, warranting little more than a passing glance as we speed past. However seemingly static this formation of rock may appear; the landform holds within it a subtle yet dynamic history of transformation and use, an active life underlying the development of this region; it is quite literally the backbone of Southern Ontario.

From industrial resource to recreational amenity, the landscape of the Escarpment has a great impact on the everyday life of this place, offering a significant array of land-uses. The vast road networks, major infrastructures, and building projects of the Golden Horseshoe region rely heavily on the stone, aggregate, sand and cement products extracted from the natural formation as a primary building material. Similarly, the force of cascading water over the Escarpment's edge in Niagara is captured and harnessed for energy generation to fuel our cities. On the southern shores of Lake Ontario, the combination of unique soil deposits and the micro-climate formed by the Escarpment's presence in relation to the lake results in the fertile growing area for tender Niagara fruits and wine production. Beyond the industrial and productive uses of the landform, the Escarpment area contains a large number of conservation areas, natural wildlife protection zones, recreational amenities such as ski hills, mountain biking and rock climbing areas, as well as the extensive trail networks focused around the Bruce Trail, a continuous







footpath running the length of the escarpment.

linked to the conditions of the natural world.

The diverse and polarizing uses of the Escarpment land presents an fig. 011 Road Cuts in Hamilton intertwining relationship between this place and the people that inhabit it, one in which both the human and non-human entities are equally active in informing. As we remove material from the earth, reform and redistribute it in the development of our urban growth, we are continuously shaping the landform at the scale of the geologic, contributing to the 450-millionyear-old processes of erosion and deposition. The marks and scars left in the land mirror the ancient scarp faces that carve through the landscape and the paths and routes we lay through the land parallel the movements and natural flows of water and ice. Likewise, our urban infrastructures are riddled with the geologic, as the cracks and erosion of concrete structures and road paving reveals the natural properties of the material's history, the fuel and power that runs our cities are harnessed from natural forces far beyond our creation, and the lifelines of our very existence, our food, water, and air, are intrinsically

Despite the dynamic nature of the landscape that is made evident by broadening the physical and temporal scales at which we read changes in the land, the human interpretation of a landscape is highly tied to its visual aesthetic and representation. Artworks, photographs and maps are the standard mediums that attempt to gather the information present in the landscape and represent it in a singular, digestible format. These representations are linked to one instance of time, captured and projected onto a 2-dimensional surface. These flattened representations of the landscape end up informing our interpretation of the information they intend to portray.

The way we inhabit and occupy this world is so focused on its horizontal surface, dominated by flat perspectives about human societies formalized

fig. 010 Hiking at Rattlesnake Point

fig. 012 Sir Adam Beck Generating Station in the Niagara Gorge

around a conceptualization of the land as flat surface, an expansive horizon to be explored and conquered. Human geography, territory, sovereignty and even experience are flattened by a reliance on two dimensional, top down projections from high above. In the contemporary world, geopolitics – international politics studied through geographical variables – is a "flat discourse [that] largely ignores the vertical dimension and tends to look across rather than to cut through the landscape". Human geography is essentially defined by the jostling of nation states cartographically laid out on maps and globes². These geographic traditions are tightly ingrained in western culture, dating centuries back to the colonial expansion that's main focus was the exploration and control of the earth surface, a desire to dominate the horizon. This is a mindset still witnessed today within the rampant overuse tendencies of capitalism, the urban sprawl of subdivision housing, and the continual territorialisation of "vacant" landscapes.

These conditions of expansive overuse and exponential growth are not limited to our coverage of the horizontal surface of the earth, but is evident across the many material phenomena that are responsible for a the contemporary reassessment of our present geological epoch, the Anthropocene. Whether it's population, ocean temperature, energy consumption, or atmospheric gasses, the speed of the material relations of human life find themselves ultimately approaching an asymptote³.

These material changes over time can be represented as a series of exponential curves, a projection of immense acceleration within which the present exists at a point where the world becomes defined not by a time, but by a speed. It is at this point that "the world can no longer be imagined as merely an extension of our own, as a difference in degree, but ultimately something which takes on a difference in kind: another sea, another wind, another world at right angles with our own"⁴.

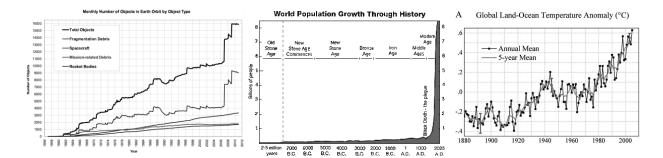
In this age where the material realities of this world in an observable state of constant change, sparked by the actions of humanity, we are urged to reconsider our relationship to this place. We're now living on a qualitatively

^{1.} Stephen Graham, Vertical: The City From Satellites to Bunker (London: Verso, 2016), 1.

^{2.} Ibid, 3

^{3.} https://fopnews.wordpress.com/2012/02/19/beyond-rocks-architects-and-everyone-else-living-the-geologic/

^{4.} Ibid



different planet. This does not necessarily mean that human knowledge fig. 013 The Exponential Curves needs to start over, it does mean we need to rethink, reconfigure, and reinvent "what we know" from an entirely different angle⁵.

of Human Development and Affect

This altered sensibility is driven by the relationship of mankind to the natural world. As such, our interpretations of the landscapes in which we are acting is crucial to making this turn, requiring a shift from the plan-dominated, flattened interpretations of a surficial landscape towards an elevational, sectional, and 3-dimensional understanding of the expanding heights and depths of the landscape. Our occupation of the land is not a surficial endeavour. From subsurface mining operations, vast underground networks of infrastructure and transportation, deeply embedded foundations and mass excavations of earth to the expanding heights of urban architecture, the occupation of the atmosphere by drones and satellites, and the ever higher reaching exploration of distant space, the stratigraphy of the Anthropocene is an inconsistent layer occupying an expanding vertical dimension.

The concept of representation is crucial in making this shift in sensibilities towards these changes in our world. This thesis traces the shifting, global trends in the aesthetic and technical representation of landscape and their correlation with the changing interpretations and understanding towards the natural world alongside a history of land-use within the specific locality of the Niagara Escarpment. This sequence begins with a geologic history of this land-form, a tracing of mass forces of the earth in action. This leads to a redefinition of geology as a concept; not simply as an exploration of past histories of the earth's materiality, but as a tracing of the associations between these material qualities, an active and ongoing process. From here, through the exploration of landscape photography, mapping exercises, and

^{5.} Elizabeth Ellsworth and Jamie Kruse, Making the Geologic Now: Responses to Material Conditions of Contemporary Life, (Brooklyn, NY: Punctum Books, 2013), 6

the works of land-artists, the representation of the landscape is explored in parallel with the shifting interpretations of the landscape, from a fearful sublime to a controlled and used resource, all the while attempting to grasp at our understanding of our place within this landscape. Each mode of representation is preluded with a a specific history of land-use in the Niagara Escarpment, thematically linked with the theoretical concepts to be explored within each chapter.

Part Two of the thesis looks to present an alternate representation of the landscape of the Niagara Escarpment, moving away from a 2-dimensional and predominantly horizontal reading of the landscape. This representation takes a focus on the vertical and temporal dimensions of the Escarpment formalized around the geological stratigraphy of this place, tracing the transformations of both natural and human-centric forces through the many layers of this landscape, and expanding the influence of these changes to external societal, cultural, and infrastructural conditions present in the locality of Southern Ontario. The result is a guidebook to this landscape, to be used as a tool in experiencing these conditions first hand, inviting a shift in one's sensibilities towards the nature of this landscape and our place within it.

The investigations brought forth in this thesis look to reveal broader conditions of intermingling between the human and non-human, to present an understanding of "landscape" in which the two are not ontologically distinct. What we create, where we create, and what we create with are all ingrained in one continuous landscape, equally informed by the natural forces of geologic processes as well the agency of humans. While taking a focus on Ontario's Niagara Escarpment, this thesis presents a journey through the landscape, from deep histories to the immediate present, continental plates to individual sediments, mass geologic forces to subtle movements, from landform to land-use, piecing together the fragments of this landscape as a means to understand the true nature of this place and our role within it.

[&]quot;One place understood helps us understand all places better"

⁻ Eudora Welty

Part One

A
Journey
Through
Land
Use
And
Interpretation



Revealing the Geologic

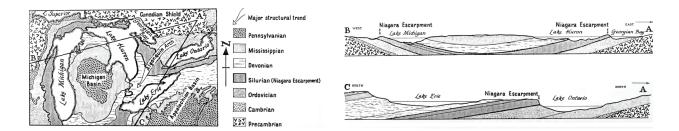
Geologic History of the Niagara Escarpment

The Niagara Escarpment is a unique physiographic feature within the North American land mass. Apart from being the most dominant landform in Southern Ontario, providing some its most scenic natural areas, the escarpment also provides a record of changes spanning the geologic time scale. The formation's sedimentary rock, occurring in stacked, horizontal layers, offers a physical timeline representing movements of geologic forces stemming from the Paleozoic Era.

Over 450 million years ago, during the geologic time period known as the Ordovician, the land area that is now Southern Ontario lay beneath a vast shallow sea that covered much of North America, centred around a dip in the continental plate known as the Michigan Basin. Nearing the end of this geologic period, an episode of mountain building began in the land area that is now the East Coast of North America, a result of the collision of land mass with Baltica, the original land mass of Eastern Europe. The resulting Taconic Mountain range, the modern-day Appalachians, rose from the ground plane through a slow yet intense folding and faulting of the colliding land masses. Over the proceeding 250 million years, this mountain range was subjected to continual transformations as wind an water slowly eroded the exposed formations. During the following Silurian and Devonian periods, the eroded sand, silt, and clay sediments traveled West through the various river systems to a vast area of deltas at the edge of the Michigan Basin. These sediments were filtered through the deltas and ultimately laid to rest at the bottom of the shallow body of water, trapping within it the remains of simple lifeforms that inhabited the sea. As this ancient sea became increasingly shallow, the sediments continued to build and compress over millions of years forming the layers of stone that comprise the bedrock of the escarpment area1.

The sedimentary rocks of the Escarpment can be classified in three major groups resulting from different formative processes. The first is stone

^{1.} Walter M. Tovell, *Guide to the Geology of the Niagara Escarpment: With Field Trips*. Edited by Lorraine Brown (The Niagara Escarpment Commission, 1992), 1



which is formed solely from the eroded sediment of weathering processes, fig. 014 The Michigan Basin compressed over time. These formations result in the softer shale, siltstone and sandstone layers of the Escarpment. The second group results from the chemical reaction between calcium carbonate rich skeletons and secretions of organisms and the sediments in which they were buried. This reaction formed the harder limestone strata of bedrock. In conditions where limestone was formed in waters carrying magnesium compounds, a secondary reaction took place forming a third type of rock, a harder form of dolomitic limestone known as dolostone. This formation exists as the harder and more erosion resistant caprock exposed along much of the Escarpment².

The Escarpment formation that is exposed on the surface today traces the edge of the Michigan basin, a marker of an ancient shoreline. The record of marine life inscribed within the rock ceased some 400 million years ago, but the upper layers of Silurian rock in the landscape indicates that it wasn't the last of seas to occupy this area. Depositions in the form of shales, siltstones, salt, gypsum, and carbonates buried the now exposed bedrock escarpment under a great thickness of sediment. These sediments would have been lain at the bottom of the seas that covered this landscape up until the end of the Paleozoic Era, roughly 245 million years ago³.

As this second collection of seas eventually receded, exposing the land below, a period of denudation occurred, lowering the surface of the land through erosion. The drainage networks that developed on the newly exposed sea floor carried untold amounts of sediment out of the area at a rate of approximately 1cm per 1000 years, suggesting the escarpment may have once been covered in up to 2km of rock and sand, slowly eroded away over 200 million years⁴. While the formation of the escarpment occurred before the earth's period of

^{2.} Walter M. Tovell, 33

^{3.} Ibid, 75

^{4.} Ibid, 77

glaciation, the landform was dramatically altered by the ice cover and melt water of the four stages of glacial advance and retreat during the Pleistocene Epoch (2 Mya). The most recent substage of glaciation, the Wisconsin stage, created the most evident change in the Southern Ontario landform, when the Niagara Escarpment would have been completely covered in ice, roughly 15,000 years ago, followed by the glacial retreat 5000 years later⁵. Evidence of the glacial activity is seen today in in the widening and deepening of major valleys, erratic limestone boulders deposited at a great distance from the escarpment edge, and the vast moraines of till and rock which, in some areas, cover and conceal the escarpment. The retreat of the glaciers as well as the melt water would have also played a hand in the erosion of the bedrock itself, creating smaller re-entrant valleys, smoothed outcrops of rock, and mounds and ridges at the larger scale, as well as smoothed, furrowed, and scraped features on the rock surface at the smaller scale.

The formation of the escarpment face that exists today lends itself to stratigraphic succession of the bedrock, and its gentle slope towards the centre of the Michigan basin along the mass geologic feature known as the Algonquin Arch. As softer layers of shale and sandstone are eroded away by wind and water, the harder dolostone layers are left undercut, eventually succumbing to gravity and breaking off, leaving a vertical scarp formation.



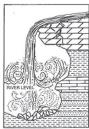






fig. 015 The Sapping Process at Niagara Falls

fig. 016 Exposed Stratigraphy at Tews Falls

Due to the slope of the basin and arch, the escarpment edge would have once existed an unknowable distance away, migrating Southwest over time, a slow moving geologic wave gently rolling and increasing in height over millennia⁶. This general trend of migration would be impacted in by localized conditions, such as the varying depths of the rock formations or the presence of waterways, resulting in the irregular escarpment edge, and larger entrant valleys, and outliers that have become detached from the escarpment proper. This erosion is an ongoing process, the effects of which are most evident

5. Ibid, 87

6. Ibid, 75

today at Niagara Falls where until recent anti-erosion efforts, the river's falls gradually retreated southward at a rate of about 1.16m per year⁷.

The formation of the escarpment is a massive geologic journey that is still ongoing today. From intense transformations incurred by great, natural forces to the microscopic conditions of individual sediments, each movement within this journey has propagated through time, shaping and influencing the contemporary landform, its material properties and qualities.

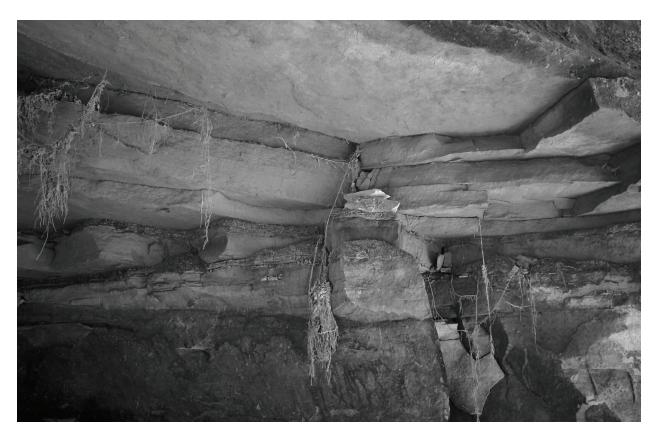


fig. 017 Unconformity at Cannings Falls

^{7.} http://www.niagarafrontier.com/faq.html

Geologic Time & The Anthropocene

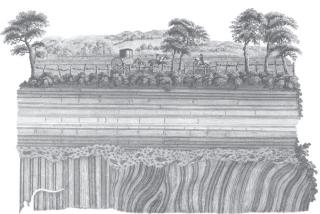
The passage of time is considered as one of the only constant conditions of the physical world, a continuous flow that carries on, unchanged, irreversible and irreducible, forming the very backdrop of all discourse, knowledge, and practice. Varying philosophies exist as to the exact nature of time and its measurability, from its absolute nature, apart from the rest of the world, to its conceptual nature as a referential construct existing between things, itself immeasurable without relativity. The question of it's absolute reality only helps to reinforce the inherent intangibility of time. It functions as a silent counterpart to the physical events of our world, underlying and contextualizing life itself, yet is imperceptible on its own. Humanity is only able to experience time through a sense of relativity, a perceivable transformation or movement within the physical world. We can only witness time through change in matter.

As such, the vast majority of social practices dedicate themselves to this physical realm; the spatial analysis, construction, and regulation of the world. The profession of architecture is one of these many discourses that privilege these spatial and physical qualities of the world, arranging, assembling, and forming materials to create and divide space. Seemingly lost in the spectrum of social practices is a discrete focus on temporal qualities of the physical world, neglecting the change and transformation inherent in all matter, and the connections between these two realms that influence and play off each other.

Contemporary human engagement, instead, tends to focus itself on the immediate and the perceivable, a condition that is wholly evident in the capitalist and consumerist tendencies of human life. We create, consume, extract, process, destroy and discard with a relatively minimal regard for what we leave behind in the wake, both in the immediately measurable waste material from these processes but also in the expanded impact that our actions have on the rest of the physical world. Time is an immediate influence on our agency in the world, we want most things quick and now, but we all too often neglect to consider the inverse, the affect of our agency in time, specifically the time that exists beyond our narrowed perception.

^{8.} Elizabeth Grosz, Becomings: Explorations in Time, Memory, and Futures. (Ithaca: Cornell University Press, 1999), 1





Amongst the fields of practice devoted to the physical study of our universe, fig. geology stands out as interesting case. While the study of geology is a largely physical endeavour, examining and understanding the origin, history and material structures of sediment and stone at the very foundation of the earth, fig. it is also a practice in which time is important agent, not just the immediate passage of time, but a deep, all encompassing time, far beyond the existence of our species on this earth. This concept of "deep time", put forth by geologist James Hutton, observes the earth as composed of an immense past that is made evident in the transformations of materials that is continually observable today, yet span a timescale far outside of the daily life of humans⁹. Hutton's theory formed from observable rifts in the structure of rock forms, a visible trace of history left in the stratigraphy of the earth, a snapshot of transformative events of material composition. Within these frames, Hutton observed unconformities—areas where layers of rock were eroded away and overlain by subsequent deposits. Hutton recognized in these unconformities an ancient Earth, with "no vestige of a beginning, no prospect of an end10."

In considering the distant history of the Earth and specifically recognizing it in the present makeup of the land, we begin to locate our present within the immense geological timeline, considering the larger scale picture of how material changes propagate through our world. This concept of interconnectivity between distant moments and the present condition can be extracted from the practice of geology, and explored within varying fields of

fig. 018 James Hutton's Unconformity observed at Siccar Point in Scotland

^{9.} G.Y. Craig, The 1785 Abstract of James Hutton's Theory of the Earth (Edinburgh: Scottish Academic Press, 1987), 5

^{10.} Ibid, 5

fig. 019 James Hutton's Unconformity drawn at Inchbonny

philosophy and practice. We should recognize that subtle and small changes at a given moment have the ability to influence greater transformations when considered in a larger time scale.

These concepts of the "geologic" extend beyond the study of the earth's material history. Deep time is the context within which the universe operates. Just as microscopic sediments nestled within a stratigraphic layer reveals a condition of massive, transformative forces at a planetary scale, any of the diverse conditions of the present moment contain within it a deep history legible in its subtleties. The goal of considering deep time is to see this infinite timeline compressed and evident in the present and to recognize the potential for seemingly small ripples of change within this timeline to propagate immensely into unforeseeable results.

While this works conceptually as a line of thinking which should influence our actions in the present day, it also brings forth the consideration that humans are a geologic being, intricately nestled in the geology of the Earth. As various recent events and developments affecting life on a global level have revealed, the geologic realities of the earth are sense-able and apparent as contemporary conditions, not simply a history that is out there to be studied.

Major geologic events and disasters that have occurred in recent years have caused humanity to consider its relationship and, sometimes, vulnerability to the natural forces within our world, as urban areas and infrastructures must react or succumb to major transformations outside of our realm of influence. Events such as Japan's Triple Disaster event in 2011, a sequence of a major earthquake, followed by tsunamis, and the resultant meltdown of three nuclear reactors in Fukushima, or the 2010 eruption of the Eyjafjallajökull volcano in Iceland and subsequent mass disruption of air travel across Europe and Parts of North America, drastically exemplify how deeply human life is embedded in the materiality of the external world, as the assemblages of human technologies and the Earth's material dynamics act back upon us in unpredictable ways¹¹. Events such as these are leading people external to the field of geology to consider this larger scale picture of the world and its composition, including humanity and our actions in assemblage with the ever-active, non-human, geologic material forces. Ultimately, the study of the geologic has shifted from an understanding of what has happened in the

^{11.} Elizabeth Ellsworth and Jamie Kruse, Making the Geologic Now: Responses to Material Conditions of Contemporary Life, (Brooklyn, NY: Punctum Books, 2013), 15





fig. 020 Aftermath of the Japanse Tsunami's in 2011 fig. 021 Ash clouds from the Eruption of the Eyjafjallajökull volcano in Iceland

world, to what is currently going on¹².

This shift is reflected the conceptualization of humankind's own epoch in the geologic timescale, the Anthropocene. This concept refers to the physical impact that the development of our species has had on the structure and geology of the earth, enough of an impact to differentiate the influence of man from the past developments in the natural world. These changes are evident across varying fields of study. Humanity has impacted the biodiversity and biogeography of life on this planet, leading to the relocation and even extinction many species. Anthropogenic emissions of carbon dioxide have altered the atmosphere of the earth, resulting in global climate change. Direct changes to the surface of the earth in the development of transportation routes, their grading and drainage, as well as the various material extraction industries have altered the geomorphology, creating drainage and erosional patterns that will persist across a geologic timescale, passively altering the total sediment fluxes across the Earth¹³. It has also been posited that humans actively erode and redistribute more sediment per year in the manufacture of material and the subsequent building and infrastructure development than is displaced by the natural world during any previous geologic epoch¹⁴. These alterations to sedimentations and erosion will become reflected in the stratigraphic composition of the land, even creating conditions where engineered structures and their debris are buried and preserved as "technofossils" marking the age of the human¹⁵. Beyond the surficial evidence of alterations to the geology of the earth, trace elements can be detected in the chemical makeup of certain environments, affected by the various chemical by-products of human industry, including radionuclides from atomic test

^{12.} Seth Denizen, "Three Holes in the Geologic Present" in *Architecture in the Anthropocene: Encounters Among Design, Deep Time, Science and Philosophy*, ed. Etienne Turpin (University of Michigan, Ann Arbor: Open Humanities Press, 2013), 30

^{13.} Ibid, 41

^{14.} Elizabeth Ellsworth and Jamie Kruse, 8

^{15.} https://www.economist.com/blogs/babbage/2014/04/human-artefacts-technofossils

sites, and concentrations of black carbon from the burning of fossil fuels¹⁶. These observations across the globe are clear evidence of human action on the geologic makeup of the Earth, transformations not only apparent within our current lifetime but ones that will be traceable through future millennia. Human agency operates at the scale of the geologic.

Confronted with the reality of the Anthropocene, humanity has to now imagine itself within this extended geologic timeline, shifting in the way in which we consider our agency on this planet. Contemporary artists, popular culture producers, scientists, philosophers, and speculative designers are exposing new layers of meaning and aesthetic to the sensation of the deep time, understanding how the "now" is shaped both physically and culturally by the material dynamic of the geologic. The major difficulty in exploring and representing the connections across this immense timeline comes down to an overall question of scale, or in some cases scalelessness. The geologic timescale presents a spectrum ranging over 4.5 billion years back to the creation of the earth, a timeline which sits amongst an infinite expanse of time as science studies theories surrounding the "nothingness" that precludes the Big Bang and hypotheses towards an unknowable future. At the same time, embedded in the physical stratigraphy of the Earth are the markers of events ranging from hundreds of million year transformations to individual moments of change, evident in scales ranging from continental tectonic plates to individual grains of sediment. Exposing the presence of deep time requires an understanding of both temporally and physically diverse scales. During the nineteenth century, geology practitioners were deeply concerned with the nature of these temporal and spatial scales within the structure of the earth, specifically in experiencing these eventualities of deep time that verged on infinity¹⁷. These geologists focused on how processes occurring over expansive distances are made legible in localized marks and signs. The field of geology is diligently able to grasp and represent these exponential shifts between the micro and macro physical scale, and the immediate and distant temporal scale. This mastery results in almost a conceptual dissolution of scale, recognizing deep histories as contemporary conditions, experiencing the geologic spectrum as a totalizing whole. As such, the geologic landscape

^{16.} Micahel CC Lin, "AnthroPark (2012)" in Architecture in the Anthropocene: Encounters Among Design, Deep Time, Science and Philosophy, ed. Etienne Turpin (University of Michigan, Ann Arbor: Open Humanities Press, 2013), 12

^{17.} Adam Bobbette, "Episodes from a History of Scalelessness: William Jerome Harrison and Geological Photography," in Architecture in the Anthropocene: Encounters Among Design, Deep Time, Science and Philosophy, ed. Etienne Turpin (Ann Arbor: Open Humanities Press, 2013), 51.

of the earth is both a relic and an active agent of transformation.

In a similar line of thinking, there exists a concept that the present contains within it all of the past, that the earliest of events do not cease to have their effects on everything that is subsequent. Even though these forces of the past transform, become restructured, or are given new impact or force, they become part of the continual transformation of the Earth, evident in the physical formation of all subsequent presents. "[D]eep time, the time of the universe's unfolding, the construction of the earth and all that appears on it, the eruption of life forms, all the momentous and unpredictable emergences never cease; they function both as an historical horizon but also as unspent forces, forces whose effects have not been used up by all the time that has separated the present from its primordial past.¹⁸"

Taking such an understanding presents the contemporary landscape of the world as the accumulation of deep time processes. There then exists the possibility to recognize and experience these mass transformations through our understanding and interpretation of the present landscape. As previously suggested, this "landscape" not only comprises the natural landform, but also the human landscapes of urban development, including the resultant altered landforms and environmental change. Understanding our place within the larger geologic spectrum begins with revealing and understanding the intermingling between the human and non-human across the present landscape, sensing within it the accumulation of change spanning all of history and the ability for the current, ongoing processes of change to propagate infinitely forward.

Our agency within the world begins and ends with the landscape. It is through our representation, interpretation, inhabitation, and use of the land that humanity is able to ground and understand our belonging to this land, our sense of place. Responding to the temporal problems associated with the Anthropocene begins first with understanding the physical ground, the landscape to which we belong.

^{18.} Elizabeth Grosz, "Time Matters, Elizabeth Grosz in Conversation with Heather Davis and Etienne Turpin, On Temporality in the Anthropocene in Architecture in the Anthropocene: Encounters Among Design, Deep Time, Science and Philosophy, ed. Etienne Turpin (Ann Arbor: Open Humanities Press, 2013), 129



The Geologic Landscape

Interpretations of the Landscape - Niagara Falls

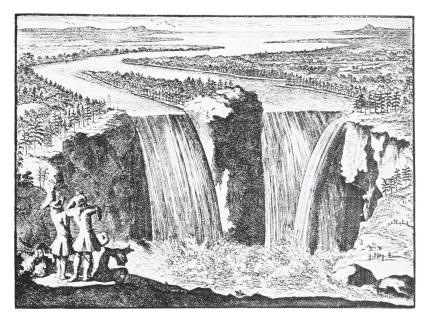
The first recorded impressions of the Niagara Escarpment were naturally focused on Niagara Falls, arguably the most prominent and well-known feature along the escarpment. The great falls, where the waters of Lake Erie cascade over the escarpment edge into Lake Ontario along the Niagara River Gorge, presented a sublime experience with the natural world, their vast size and volume recorded numerously by the first European travelers to the area. These first written accounts were immense exaggerations of the landform, marveling in awe at the "prodigious, frightful Fall", establishing Niagara's reputation as a place of unimaginable power: mysterious, terrifying and unlike any landscape known to the European audience¹.

Throughout the eighteenth century, though more accurate accounts and descriptions of the Falls were made, these attempts at an early scientific study of the landform did not shy away from the idea that this was a landscape to inspire awe and fear. Many subsequent reports followed this pattern, shaping the perception of the land as wild, remote, inhospitable, and dangerous, and yet by the early 1800s, tourists began arriving in significant numbers to view the falls. There was a draw to the early settlers of North America to experience the romanticized Gothicism of the landscape, an experience of awe-full disorientation and danger in the face of indomitable forces, a characteristic which heavily influenced aesthetics of that time².

Niagara, however, was so overpowering that even the most literate of visitors felt an inability to properly describe it itself, instead relying on descriptions of the effects of the landscape on them, how the traveler felt about the place. This indescribability of place became known as the sublime, the awe experienced from these encounters with a landscape. Niagara Falls

^{1.} Walter M. Tovell, *Guide to the Geology of the Niagara Escarpment: With Field Trips*. Edited by Lorraine Brown (The Niagara Escarpment Commission, 1992), 2

^{2.} Sharon R. Yang, Gothic Landscapes: Changing Eras, Changing Cultures, Changing Anxieties (Cham, Switzerland: Palgrave Macmillan, 2016), 93





epitomized the sublime and gothic aesthetics of landscape interpretation of fig. the time, both the gloom and grandeur, the foreboding and awe, respectively. Had Both sensations are based on the same emotion – terror, the ruling principle fall that separates and makes the aesthetic experience distinct from simple and fig. smooth beauty.

fig. 022 Drawing from Hannepin's acount of Niagara Falls, 1699

fig. 023 View Below Table Rock, New York. WH Bartlett, 1839

This iconic conceptualization of dramatic North American landscapes such as Niagara Falls reflected the young national identity of the developing countries in the New World. Unable to culturally compete with the European ruins and relics, the natural landscape of the western world became symbols of national legitimacy (they themselves relics and ruins of longer, more dramatic processes). These places embodied the wild abundance of the western frontier, unlike anything found in Europe. Similarly, these symbolic landscapes did not valorize or reinforce the power of the ruling class, but instead were open to all citizens, reflecting the republican principles that emerged out of the American Revolution³.

As time continued, and the New World countries developed further, a shift in the reading of the landscape became evident. The terror and awe felt at the <u>sites of dramatic</u> landforms developed into a separation from and villainizing

^{3.} Ben Kasten, "Damming God? Making Sense of the Plan to Fix Niagara Falls", March 22, 2016 (http://edgeeffects.net/niagara-falls/)

of the natural world, the landscapes that once symbolized the freedom of the new world became an impedance to it's development. As such, the natural world became something to be conquered, not feared.

By the mid-nineteenth century, Niagara Falls was well on its way to becoming a major tourist destination, hosting 45,000 visitors per year⁴. The symbolic importance of this site seemed to shift with the cultural mindset towards the natural landscape, as commercial development increased in support of the tourism, Niagara Falls became associated with liberal individualism and the technical achievements of modernity. The terror once felt in witness to the grand geologic formation became something entirely new in the hands of celebrity daredevils, as tight-rope artists and barrel-riders looked to conquer the fear of the falls, turning Niagara into a landscape of entertainment and commercial competition⁵.

The turn of the century industrial revolution saw a further re-imagining of Niagara Falls. As corporate capitalism and scientific achievement became the dominant tropes of the modern culture, the falls was seen as an untapped source of electric energy. Looking to now harness the raw natural power that once inspired terror, Nicola Tesla was convinced it was possible to use the falls to generate hydroelectricity to be transmitted via the alternating current



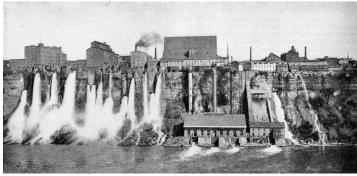


fig. 024 Charles Blondin, the Daredevil of Niagara Falls fig. 025 Industrial Mills near the American Falls

system used in Europe. By 1896, power generated by the cascading water was being transmitted to the city of Buffalo, an event that sparked a widespread use of the AC system to transmit power over great distance, revolutionizing the technological landscape of North America⁶.

^{4.} Ibid

^{5.} Ibid

^{6.} Niagara Falls, History of Power, January 28, 2015 (http://www.niagarafrontier.com/power.html)

Hydroelectric generation at the Falls flourished throughout the 20th century, diverting water from the Niagara River through hydro tunnels to the be cascaded down the height of the escarpment at generating stations located further down the gorge. The construction of such tunnels were infrastructural feats in themselves. The most recently completed tunnel displaced some 1.6 million cubic meters of rock and debris to construct the 10.2-kilometer-long tunnel which stretches around the entire city of Niagara Falls to the Sir Adam Beck generation complex near Queenston Heights⁷. In order to not disrupt the visual appeal of the falls, water is diverted from the river during the night and stored in a massive man-made reservoir to maintain peak production during the day.

In 2016, an action plan was presented to fix pedestrian infrastructures surrounding the falls, a plan that involves "de-watering" the American side at some time in the next few years, temporarily shutting down the flow of water. Niagara Falls had been "turned off" once before in 1969, as the U.S. Army Corps of Engineers looked to study the erosion at the falls in order to implement anti-erosion measures to preserve the landform⁸. Over the course of roughly 12,000 years, Niagara Falls had slowly retreated from the edge of the Niagara Escarpment, 11 kilometers to its current location, with studies placing the average rate of erosion of the Horseshoe Falls at 1.16 meters per year⁹. Through the increased water diversion for hydroelectric generation and anti-erosion remedial steps, including infilling and altering the crestline to even the water flow, the rate of recession of the falls has been reduced to a fraction of what it once was, projected to be roughly 0.3 meters every 10 years¹⁰.

In the contemporary world, human action has not only harnessed and exploited the raw power of this once feared landform, but is actively able to control and alter the ongoing geological processes of this site. The infrastructural development that surrounds the Falls presents a new grandeur, an industrial sublime that is, similar to the Falls, now regarded as banal and commonplace. Niagara Falls epitomizes the shifts in perception and interpretation of the land that has occurred over the course of human habitation and use, a

^{7.} Ibid

^{8.} Ben Kasten, "Damming God? Making Sense of the Plan to Fix Niagara Falls", March 22, 2016 (http://edgeeffects.net/niagara-falls/)

^{9.} Niagara Falls, History of Power, January 28, 2015 (http://www.niagarafrontier.com/power.html) 10. Ibid





fig. 026 De-watered American Falls

fig. 027 De-watered American Falls

shift from the recognition of something awesome and grand to be humbly respected to something to be conquered, controlled, and used.

The upcoming shut-off of the Falls is expected to be a major tourist draw, to witness the dry face behind the thunderous cascading water. Perhaps this event will evoke another shift in the perception of this specific landscape as we readily see the reciprocal influence between the human and the geologic. On one hand, the ability to turn off the flow of water showcases our triumph over this massive power, yet the need to do so in order to repair exposes the limitations of such triumphs. As we recognise this landscape as a continual fluctuation in its iconic meaning, contradictory layers of interpretation, one condition that does emerge is the obvious intermingling between human culture and the geological landscape it inhabits.

Representations of the Landscape

As seen in the case with the early descriptions of Niagara Falls, there is an extreme difficulty in capturing the sensation of a landscape outside of a first-hand experience. Where this may be seen as a fault in the inability to accurately represent a landscape, the altered lens of representation can also be a tool in exposing alternate readings of the landscape. In a situation such as relating human action within the geologic, the scale of not only the temporal and physical aspects of the land, but also the many potential conceptualizations are so vast, the representation must carry an editorial lens. The scalar shifts so readily grasped in the geological study of the earth present a powerful tool of representation for the technical and social practices in the







contemporary investigation of human agency in the context of deep time. fig. 028 G. Bingley, Baldersby Just as the geological evidence of deep time exists in the landform, the power Park, near Thirsk. Large Boulder to present a mediation of geologic concepts is in the representation of the of Carboniferous Grit, 1891 landscape.

At the forefront of representing the geologic seems to be the art of photography. National Park, 1940 A geologic process in itself, the impression of light particles on natural earth fig. 030 Robert Adams, On Signal elements, it is also a process likened to the impressions found within the rocks of the earth, says Adam Bobette in his investigations of the works by geologist and photographer William Jerome Harrison¹¹. For Harrison, photography is a modern mediation of the same processes of fossilization found in the earth, the impression of softer organism onto harder geological forms. As such, his materialist disposition led him to tell the history of photography as a natural history rather than a history of signification or representation¹². For Harrison, the contemporary photograph is a long accumulated history of the entanglements between techniques and material relations. Photography has been a longstanding medium for the representation of the natural world, capturing an instant within time, a "momentary nature in the thinnest veneer of time available". Thus, the photograph as a memory extending beyond the human experience becomes a charged medium for representing a mediation on the deep past¹³.

The subject matter of a photograph is generally understood to be factual

Hill, Overlooking Long Beach,

^{11.} Adam Bobbette, "Episodes from a History of Scalelessness: William Jerome Harrison and Geological Photography," in Architecture in the Anthropocene: Encounters Among Design, Deep Time, Science and Philosophy, ed. Etienne Turpin (Ann Arbor: Open Humanities Press, 2013), 52.

^{12.} Ibid, 53

^{13.} Ibid

fig. 029 Ansel Adams, Jeffrey Pine, Sentinel Dome, Yosemite

and true, creating an image that is approachable and understood by all (in contrast to the more open interpretations presented in other art forms). While the subject presents reality, the framing of a photograph always presents a level of mediation, as the photographer can play with the sense of scale and perspective, creating an alternate lens through which to see the land. The aforementioned William Harrison aimed to retain factual accuracy in his photographs by including common manmade objects as a marker of relative scale. As Bobette explores in his unpacking of Harrison's work, these photographs are the first to remove humans from the frame and replace them with man-made objects, suggesting that along with his likening of photographic and geologic processes, the inclusion of human artifacts are similarly imbricated in these processes, the technical development of man and the geological are entangled within one another¹⁴. Harrisons use of scale ultimately acts as a "medium to create improbable and unexpected entanglements among technical, geological, and human registers"¹⁵.

Further on in the history of landscape photography, while mid-century photographers like Ansel Adams and Edward Weston were carefully framing or manipulating their photographs to remove all evidence of human imposition in the landscape, the works of a group known as the New Topographics photographers, namely Robert Adams, Lewis Baltz, Nicholas Nixon and Bernd and Hiller Becher, actively framed human technology at a larger scale within the natural landscape, documenting large housing tracts, blast furnaces, freeway overpasses and other infrastructures¹⁶. The contrast between these two ranges of work emphasizes the shift recognition of the anthropocentric conditions of the contemporary world.

The stark and idealized images of the American landscape crafted by photographers like Adams presented the landscape as a vast, scaleless nature, outside the realm of man. While the photographs are beautiful, they present the landscape in their sublime nature, something distant and out there, preserved and unaffected. These photographs take a static, framed depiction of nature, unchanging and scaleless. The shift in the 60's and 70's towards representing the acts of man in the landscape added a mediated

^{14.} Ibid, 55

^{15.} Ibid, 51

^{16.} Kelly Dennis, Landscape and the West – Irony and Critique in New Topographic Photography, 2005, (http://www.americansuburbx.com/2012/05/new-topographics-landscape-and-the-west-irony-and-critique-in-new-topographic-photography-2005.html)





scale and context to the images, one which places the cultural and the natural fig. 031 Earthrise, 1968 landscape on the same plain. The subject of these photographer's works was fig. 032 Blue Marble, 1972 often the American West, not depicted as a new, wild frontier, as it was sold in the past, but focused on the myth of the American west, looking at the conditions of suburban expansion, the American dream, and the exploitation and destruction of natural resources¹⁷. What the photographs depicted intended to point towards conditions in flux, observing change, and the essential conditions of the cultural construct of "landscape".

More contemporarily, technological advancements have further altered the way we view and represent the landscape. Specifically, the incorporation of aerial photography has given us an entirely new perspective through which to view our world. While the top down image of the landscape provides an unnatural and distancing view which further removes us from the land itself, it affords us a view through which to see new patterns of landscape at scale far greater than immediately experienced on the ground.

This distanced view of the landscape is epitomized in an image from 1968 taken by Apollo 8 astronaut William Anders. The image, dubbed Earthrise, is a perspectival photograph taken from the orbit of the Moon, showing the earth in half shadow emerging from a lunar horizon. The viewing of the

^{17.} William L. Fox, "From Rock Art to Land Art / From Pleistocene to Anthropocene", in Making the Geologic Now: Responses to Material Conditions of Contemporary Life, ed. Elizabeth Ellsworth & Jamie Kruse (Brooklyn, NY: Punctum Books, 2013), 44

Earth from such a removed distance played a significant role in producing an altered image of earth, one that dissolves the borders and separations conjured by man, catalyzing a notion of planetary unity, whether in political, social, humanist, or precisely non-humanist environmental terms¹⁸. With a similar framing tactic enlisted by the landscape photographers of the early to mid-century, the image presents a referential foreground offering a scale to the image, positioning the viewer outside the earth, viewing it as you would an overlooking landscape vista. A second image from the 1972 Apollo 17 astronauts offers an alternative distant viewing of the Earth, the famous The Blue Marble image. This photograph depicts a shadowless Earth, an almost unsettling, floating globe without any point of reference. While offering a total view of the earth, the pure framing an lack of foreground presents representation without scale. While both iconic images, the slight differences in framing, even from such a massive distance, resulted in a different reading of the subject. The Blue Marble image became an icon not only of totality and unity of the planet, but the freestanding nature of the Earth as a subject provoked a sense of the singularity and vulnerability of out planet¹⁹.

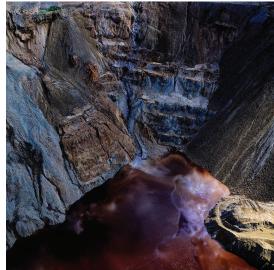
fig. 033 Edward Burtynsky, Oil Fields #27 Bakersfield, California, USA, 2004

fig. 034 David Maisel, The Mining Project (Butte, Montana 7), 1989

At a much closer read scale, the aerial view of the earth is used by contemporary photographers who once again turned their lens toward the human-altered

18. Elizabeth Ellsworth and Jamie Kruse, Making the Geologic Now: Responses to Material Conditions of Contemporary Life, (Brooklyn, NY: Punctum Books, 2013), 16
19. Ibid





landscape. Edward Burtynsky is one such artist who uses the aerial image to document the deterioration and scarring of natural landforms. Similar to previous landscape photographers, Burtysnky uses scale as a tool in the mediation of these landscapes. In his work, an ambiguity of scale presents an almost abstracted image, until a detail is revealed through which the rest of the image can be reconstructed and realized. The reading of the images creates a sensation of awe as the scale of the landscape is slowly realized²⁰. These forms of imagery, however, can verge towards the entirely abstract, showcasing the landscape as nothing more than a composition of colour an pattern. Such is the case with the photography of David Maisel's Black Maps. While similar in subject to the works of Burtynsky, Maisel's careful framing and square cropping of his aerial photographs are even further removed from the sensibilities of the individual in the landscape, almost truly scaleless images. Regardless of the abstraction or approachability of the photographs, the works still presents a factual documentation of the Earth's surficial geology. The affect of the framing leads to a questioning of scale, is the image a micro fissure in the rocks surface, or a massive scar in a vast landscape. Ultimately, within the realm of geological thinking, the scale is almost irrelevant, as the connections between any potential scales can be made apparent and measurable. As such, these subverted views of the landscape offer a highly accurate geological record of the earth in a given moment.

^{20.} Lori Pauli, *Manufactured landscapes: the photographs of Edward Burtynsky* (Ottawa ON: National Gallery of Canada in association with Yale University Press, 2003) 52.



The Landscape In Plan

The Niagara Escarpment Plan

In 1962, Dufferin Aggregates began operating a quarry in the Milton Heights section of the Niagara Escarpment. Resource extraction had been a long-standing use of the escarpment land, as the hard, dolomitic limestone presented an useful and abundant construction material. However, the industrial use of this landscape was mostly out of the public eye, with most extraction sites largely either concealed from view through roadside berming and planting or located far outside populated ares. With the opening of the Milton quarry immediately adjacent to the escarpment edge, the quarry operations needed an access point to move material from the site. The solution was the blasting of a large gap out of the Niagara Escarpment cliff face to allow trucks in and out of the quarry site. Visible from over 3km away on the Highway 401, "The Dufferin Gap" became a prominent display of the industrial use of this landscape, one that sparked public concern towards the environmental damage at the hand of this industry, urging for a protective legislation for this natural landscape¹.

In 1967, a wide-ranging planning study soon began, with a keen focus on the environmental protection and preservation along the entire length of the Escarpment. The Niagara Escarpment Planning and Development Act was passed in 1973, its main purpose "to provide for the maintenance of the Niagara Escarpment and land in its vicinity substantially as a continuous natural environment", and with it the establishment of the Niagara Escarpment Commission (NEC)². The NEC was tasked with the responsibility to develop an extended land-use plan that, unlike the existing Planning Act in Ontario, allowed for direct provincial scale planning with an explicit purpose oriented towards environmental protection, accommodating development only if it was compatible with the conservation objectives³. This method of planning looked at the larger scale landform as a continuous, provincial landscape rather than a collection of individual sites.

The process of developing the plan took several years of studies and proposals and elicited much negative response from local land owners and

^{1.} A Brief History of CONE and Protection of the Niagara Escarpment, (https://www.niagaraescarpment.org/index.php?option=com_content&view=article&id=17&Itemid=23)

George McKibbon, Cecil Louis, and Frank Shaw "Protecting the Niagara Escarpment", Journal of Soil and Water Conservation, March-April 1987: 78

^{3.} Ibid







municipalities. These rural communities felt the overlap of a provincial fig. 035 The Gap from Highway plan on top of the existing municipal plans were overly prohibitive to development as well as the various industries, specifically agriculture, on fig. 036 The Dufferin Quarry which the localities economically relied. Public reaction to the planning Bridge even reached outright venomous reaction in some localities, where citizens fig. 037 Dufferin Quarry protested in rallies, burning effigies of the Ontario premier and slashing the tires of NEC members⁴. The extended public pressure in conjunction with the fact that much of the land being surveyed was already occupied by towns, cities, homes, subdivisions, farms, businesses and recreation areas, resulted in a reduction of the proposed plan area by 60%, with over 90% of that land being privately owned⁵.

Finally, in 1985, the first version of the Niagara Escarpment Plan (NEP) was approved, recognizing a system of over one hundred escarpment parks. The extensive plan designates seven land-use areas; Escarpment Natural, Protection, Rural, Recreation, Urban, Minor Urban, and Mineral Resource Extraction. These designations allow for varying degrees of development, with the "Escarpment Natural" areas being afforded the highest level of protection, covering much of the actual scarp face. The plan, however, is not entirely prohibitive as allowances are made for agricultural operations and small scale commercial and industrial use in "Protection" areas, and various development is encouraged in the "Rural" areas, subject to a permit approval system. "Escarpment Recreation" areas allow for the development of the major ski areas as well as cottage areas along the Georgian Bay shoreline, including the ability to build subdivisions within the designation. "Mineral Resource Extraction" areas recognizes the existing pits and quarries operating in the escarpment lands, yet newly licensed operations are allowed within the "Rural" areas, limited to a set annual max production. There is also the

^{4.} Ibid

^{5.} Ibid

allowance for applications to amend the NEP to permit larger new pits and quarries⁶.

While the NEP was created to explicitly regulate environmental protection in the escarpment and the compatibility of potential development, the success of the plan is ultimately tied to the strength of the appointed commissioners and, as a provincially controlled commission, the elected government's philosophy. Throughout the 30 years of the plan's implementation, the changing governing bodies have held differing views on the importance of the plan, with some attempts to fully dismantle the commission. Likewise, as members of the NEC were government appointed, governments could negate the unbiased approval systems for development in the escarpment lands by appointing very pro-development commissioners. Even today the commission is, ironically, operated under the Ministry of Natural resources, the same ministry that issues licenses for pits and quarries in the province.

Despite it's contested beginnings, the commission has diligently aided in the protection of many important ecosystems in the escarpment since it's implementation. As the resource extraction industry looked to grow it's production rates in conjunction with increased development in the province, various applications for new quarries, even within applicable designations of the plan, have been denied. In key cases where new large quarries could set precedent for further similar applications, the NEC has listened to the public and maintained the focus on environmental protection. The demographic of the escarpment has shifted, the public residents of the escarpment lands who once protested the very regulation now protest the large scale development and exploitation of the land⁹.

However, the Niagara Escarpment has not lost its identity as a productive landscape. As various quarry expansions and new licenses are still regularly approved, the land has also gained a newer productive identity. The Niagara Peninsula has long been known for its tender fruit production, but the development of estate wineries in the area is recent phenomenon. The NEC, who once fought applications for subdivision development in the vineyard

^{6.} Sandra Patano and L. Anders Sandberg "Winning back more than words? Power, discourse and quarrying on the Niagara Escarpment", The Canadian Geographer 49, no 1 (2005): 25–41

^{7.} Ibid

^{8.} Ibid

^{9.} Ibid





lands, now has to deal with he competitive growth of the winery market, as fig. 038 Protesting the NEC businesses apply to build restaurants, culinary centres, large hosting centres, fig. 039 Protesting the Melancthon lecture theatres, and high capacity overnight accommodations, as well as the increased need for clean drinking water and sewage disposal that comes with it¹⁰. The growth of the Niagara wine region presents a difficult balance that needs to be struck between the preservation of the agricultural capacity of the land and the development of tourist programs in the area.

"Mega Quarry"

There have also, of course, been case where environmental protection has not won out against regional development. Hamilton is known as the escarpment's industrial city, it is a place where the iconic landform is ingrained in the urban density of the city, its early Victorian buildings still standing today, unlike other early cities, as they were made from the local stone of the escarpment¹¹. Colloquially known as the mountain, it divides the city of Hamilton in half. The lower land beneath its rim housing great steel industries, active portlands, and the city centre towers that rival its height, while the upper plateau houses sprawling communities. With the Escarpment running directly through the city, the urban centre is veined with wooded trails and numerous waterfalls. One such green corridor through the city, the Red Hill Valley, became the site of a plan for a four lane expressway, first proposed in the 1950s to bypass the city along its southside. The proposal received various cancellations, and subjected to environmental assessments and compromise plans, which were ultimately rejected, and the plan finally was approved in 1979, though still required approval from various boards, including the NEC. Despite the 10. Ibid

^{11.} Gerard V. Middleton, Nick Eyles, Nina Chapple, and Robert Watson, Niagara Rocks, Building Stone, History and Wine, Niagara Field Guide (American Geophysical Union and Geological Association of Canada, May 23, 2009)

opposition from the NEC, the Ontario Environmental Assessment Board, and the Hamilton Region Conservation Authority, a consolidated joint board consisting of members from the Ontario Municipal Board ultimately approved the project¹². After various failed appeals to stop the project, the provincial cabinet ordered the NEC to issue a development permit.

Construction began in 2004, as various environmentalist and First Nations groups camped out in the valley in protest in order to halt construction. Construction ultimately went underway, and the squatters were removed. The Red Hill Valley Parkway is really a 1950s answer to a contemporary problem, requiring the grazing of thousands of trees and blasting of the actual escarpment face to construct¹³. Several years after the completion of the Parkway in 2007, the city of Hamilton is still paying off the debt of the highway, and still involved in a \$75 million lawsuit against the Government of Canada, alleging misconduct in the delaying of the project¹⁴.

Projects such as the Red Hill Valley Parkway emphasize the shortcomings of the NEP as it is ultimately subjected to the decisions of the provincial government. The larger interests in the landscape as a continuous network across the province can often overshadow the smaller impacts made a local sites, especially when considering development. Despite the city of Hamilton's desire to be both an industrial and a natural city, the meeting of the two are not always compatible. The various roads and corridors that connect the lower city to the upper communities, through the escarpment, are in constant battle with the formation. As natural erosion occurs on the rock face, no doubt accelerated by the cuts blasted at intersection with the roads, the city must constantly maintain and repair the infrastructure.

The Niagara Escarpment is as much a human landscape as it is a natural one. The land-use planning of the escarpment lands emphasizes this, looking to reach a compatibility between human development and natural protection. In 1990, the Niagara Escarpment was designated a World Biosphere Reserve by the United Nations Educational, Scientific and Cultural Organization (UNESCO). The Niagara Escarpment was recognized as an internationally significant landform that, with the extensive land-use planning that

^{12.} Sandra Patano and L. Anders Sandberg "Winning back more than words? Power, discourse and quarrying on the Niagara Escarpment", The Canadian Geographer 49, no 1 (2005): 25–41

^{13.} Ibid

^{14.} Ibid

surrounds it, includes representative and scientifically valuable examples of sustainable relationships between human culture and activities, and natural ecosystems¹⁵. The "Escarpment Natural" designations of the NEP fulfill the mandated protected natural areas required within a Biosphere Reserve. These zones, however, are not sterile and recognize a variety of other land-uses. The preserved areas present a standard by which to measure the effects of human activity within these environments.

The Escarpment Plan and the UNESCO designation are examples of a larger scale, totalizing understanding of the landscape, one which recognizes the connections between physically distant places. While sparked by an individual event at a specific site, the land-use planning of the escarpment operates through a distancing view which recognizes the patterns of human culture and ecology that weave through the continuous landform. The is a landscape under pressure however, as regional growth seeks to permit development in "their" section of the land. The growth of tourism and population centres in the Niagara Region, the pressures from the aggregate industry in the Halton and Peel regions (for their proximity to large markets of the Greater Toronto Area), the suburban growth the pastoral Dufferin County into commuter communities, and the ski areas of Simcoe and Grey counties looking to develop high density condominiums to support a destination living lifestyle each represent a case where local pressures look to trump the extended network of land-use planning in the province. As these areas develop, they must not lose sight of the larger landscape to which they belong.

Mapping: Disorientation through Location

The first version of the Blue Marble photograph was just that, a single photograph taken by a camera. In recent years, NASA has released updated versions of the image which, unlike the original, came in a set of two, representing the Western and Eastern Hemispheres of the Earth. The images were also not the result of single photographic image, but a composite of satellite imagery assembled into a seamless mosaic of every square kilometre of the planet¹⁶. The 2012 version of the image was produced using the Visible/Infrared Imager Radiometer Suite (VIIRS) instrument on board the Suomi NPP satellite, generating a composite of remotely sensed data not limited to

^{15.} Ibid

^{16.} Laura Kurgan, Close Up at a Distance: Mapping, Technology, and Politics. (Brooklyn, NY: Zone Books, 2013), 11

visual spectrum but including atmospheric conditions and patterns as well¹⁷.

These new composites create an image of the world that compresses massive quantities of significant data into a flattened, map-like reading of the Earth. The shifts between these versions of the Blue Marble exemplify a modern shift in our representation and interpretation of the land. The landscape is no longer a fixed point of view, framed by landscape painters and photographers, but an intricate web of data, both natural and anthropogenic, woven together across the landform. These representations strive for new level of accuracy, ones of resolution and measurability¹⁸. As past paintings and photographs presented a sense of scalelessness in the geologic conditions of the landscape, these composite cartographies assign a standard scale at which specific data can be read, presenting a different approach in the translation between the representation and the reality of the landscape.

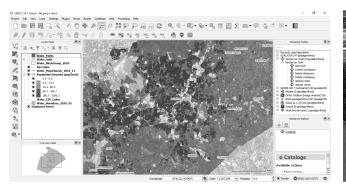
The scaled map presents an uncentred translation of the surface of the earth into a two-dimensional representation, a frame that is referenced to an external data set, generally a cartesian or geographic coordinate system. While maps are created through an altered representation of the landscape, they are also exist as utilities through which to construct space – physical, propositional, discursive, political, archival and memorial spaces¹⁹. They have become infrastructures and systems within which both the human and the natural world are located. These utilities are made accessible to the average person through applications like Google Earth, or Global Information System (GIS) programs which present a full 360-degree composite of the Earth's surface, across which the user can navigate, locating any point in space as the centre through which any number of external data sets can be accessed and read. Likewise, the twentieth-century implementation of Global Positioning System (GPS) satellites provides an open network of precision positioning across the Earth's surface, allowing the user to know, more or less, an accurate geo-location.

While highly accurate in their measurements, these unprecedented tools of geo-location also present an unhinging in our sense of stable and fixed location, as these systems reveal quite clearly that perceivably static forms

^{17.} Ibid, 11

^{18.} Ibid, 12

^{19.} Ibid, 14





of the Earth's landmass are actually in motion²⁰. These planetary scale tools fig. 040 GIS Data Mapping of remote sensing reveal and actively monitor the motion of the earths crust fig. 041 Google Earth Landforms on the shifting structure of tectonic plates, a fundamental dynamic of our Earth's geology that was disputed as recently at the 1960's²¹. This revelation of a dynamic Earth is built into the actual function of the measuring devices, as the system relies on a relative timekeeping between the orbital satellites and the moving surface of the earth²². Given the distance of the orbit, and the weaker gravitational forces, the satellite's clock run at a relatively different pace than the Earth's. In this situation, time is not a static, but only a concept of relative calculation between two points in motion, upending the concepts of time discussed at the beginning of this thesis. Time is only perceived in the physical motion of things, yet our measurement of things in motion requires an alteration of absolute time. This paradox leads to a profound decentering or disorientation, a loss of absolute reference points. This world and everything within it is in motion, undergoing change, and can only be measured and understood in relation to one another. There is no fixed point of reference.

While mapping is a tool to represent a physical space, the main utility of a map is to locate. Depending on a system of scales, codes, graphic representation and coordinates, maps place things in relation to one another, both physical as well as virtual entities. In this quest for orientation, maps tend to obscure or distort the reality of what they represent, either through a overabundance of information that blinds us to what we cannot see or through omission of what we ought to be seeing. They attempt to produce a fixed centre of reference to create a comfortable sense of orientation which ultimately

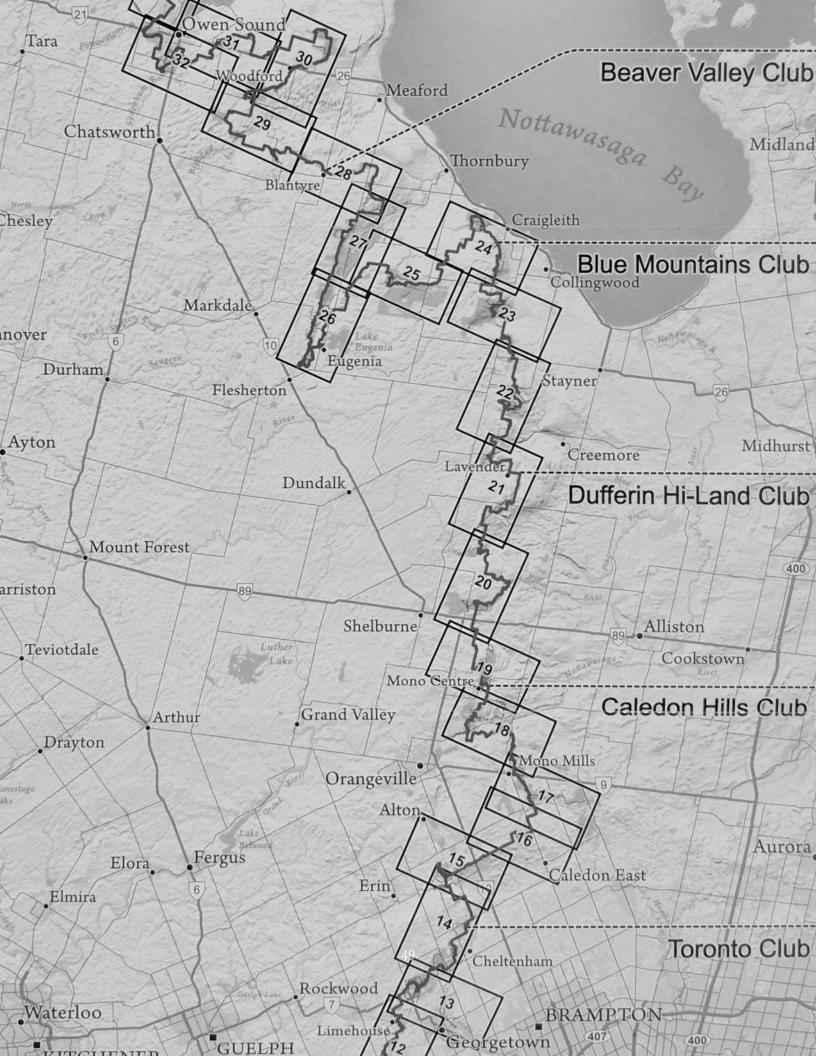
^{20.} Ibid, 15

^{21.} Ibid

^{22.} Ibid

removes the possibility of disoriented discovery.

Mapping does still offer a benefit to the representation of the landscape. As previously mentioned, the large-scale exploration of a place allows us to witness patterns of human and non-human change at the geologic scale at which it operates, imperceptible to an individual perspective in the land. Maps in their function also provide an opportunity to engage in the land. The map as a guide invites travel and exploration into a place.



Here and Now

Recreation in the Niagara Escarpment

The Niagara Escarpment landform is a unique feature in the otherwise relatively flat Southern Ontario Landscape. The winding cliff face and it's various streams, waterfalls, valleys, and naturally forested areas provides an ecological corridor through sprawling development of the area. As such, the Niagara Escarpment is the focus of a majority of outdoor recreation in the area, playing host to a vast network of hiking trails, mountain biking routes, ski runs, rock climbing and over 160 public recreation parks within the Niagara Escarpment Parks and Open Space System (NEPOSS)¹.

At the heart of the escarpments recreation network is the Bruce Trail, an 894 kilometre long continuous trail that runs the length of the Southern Ontario escarpment, following the cliff edge from Queenston on the Niagara River to Tobermory on the tip of the Bruce Peninsula. Along with an additional 400 kilometres of side trails, the Bruce Trail is recognized as one of Canada's premier natural recreation opportunities, and one of the world's greatest hiking trails. It is the oldest and longest continuous marked trail in Canada².

In 1960, prior to the establishment of the Niagara Escarpment Plan or any formal ecological protection plan, the idea was born from a group called the Federation of Ontario Naturals to establish a footpath spanning the Niagara Escarpment. The intent behind the trail was to bring awareness to and educate the public about the escarpment in hopes to aid in its preservation³.

Over the next seven years, the Bruce Trail Committee traveled all over the escarpment, making handshake deals with landowners in each county to allow the trail to cross through their land. Regional clubs were established along it length, responsible for obtaining landowner approval, organizing the trail construction, and maintenance efforts within their region. In 1967,

^{1.} George McKibbon, Cecil Louis, and Frank Shaw "Protecting the Niagara Escarpment", Journal of Soil and Water Conservation, March-April 1987: 78

^{2.} http://brucetrail.org/pages/about-us

^{3.} Ibid







coinciding with Canada's Centennial Year, the cairn at the northern terminus fig. 042 Bruce Trail White Blazes was unveiled, marking the official opening of the Bruce Trail. fig. 043 Bruce Trail Conservancy

fig. 042 Bruce Trail White Blazes fig. 043 Bruce Trail Conservancy fig. 044 Bruce Trail Reference Guide

Being a publicly organized trail network, the Bruce Trail has faced some difficulty throughout its history. With the introduction of the Niagara Escarpment Commission and the ensuing protests from landowners, the handshake deals that were originally made were reneged, with warning signs to hikers posted to stay off their land⁴. Today, only about 50% of the trail runs through publicly owned land, and is thus protected. The other half of the trail relies in the generous donation of landowners or similar "handshake" agreements. The Bruce Trail Conservancy (BTC), the charitable organization that seeks to protect the trail, diligently works to purchase land along the escarpment as it comes to market. With no funding currently from any government agencies, the conservancy relies entirely on donations⁵.

In 1989, the BTC initiated a major project to reclaim the escarpment land adjacent to the Dufferin Aggregates quarry in Milton, the infamous site of "The Gap" blasted into the face of escarpment. Securing \$150,000 in donations from private donors as well as the Ontario Ministry of Tourism and Recreation and Dufferin Aggregates itself, a 40 metre footbridge was constructed over the escarpment gap, and 3km of trail was relocated from its circumvention of the quarry site to actual the escarpment edge⁶. The gap that first sparked the need for conservation efforts in this landscape was now

^{4.} Sandra Patano and L. Anders Sandberg "Winning back more than words? Power, discourse and quarrying on the Niagara Escarpment", The Canadian Geographer 49, no 1 (2005): 30

^{5.} Ibid, 33

^{6.} Ibid







fig. 045 Blue Mountain Ski Hill fig. 046 Caves at Blue Mountain fig. 047 Blue Mountain Biking Trails

connected on either side through this recreational amenity.

The Bruce Trail forms the central spine of recreation in the escarpment, but other user groups have found a home amongst the geologic feature. The great sloping land that surrounds the cliff face makes the escarpment the focus of a majority of ski clubs in Southern Ontario. North on the escarpment, near the town of Collingwood, is a stretch of the escarpment known as the Blue Mountains, spanning from the Osler Bluffs to Georgian Peaks near the Beaver Valley. The Blue Mountains is the highest segment of the Niagara Escarpment with heights over 300m above the surrounding land, providing the best alpine skiing in Southern Ontario. The area has boomed as a winter ski destination, and with over 700,000 skier visits a year, it is the third-busiest ski area in Canada⁷. Beyond skiing, the Blue Mountains is also host to snowshoe trails, and downhill mountain biking runs. Various smaller ski hills can be also found all along the length of the escarpment.

With almost 700 kilometres of exposed shear rock face, the Niagara Escarpment is also the central home to the sport of rock climbing in Ontario. Dating back to 1957, the Toronto section of the Alpine Club of Canada has recorded use of the escarpment for alpine training and practicing mountaineering techniques to be used on travels to mountains out west. Interestingly enough, the first recorded area for training was not a natural cliff face, but a place referred to as the "Milton Quarry" - presumed to be the now rehabilitated Kelso Quarry in Milton⁸. The climbing culture in

^{7.} https://en.wikipedia.org/wiki/Blue_Mountain_(ski_resort)

^{8.} Gus Alexandropoulos and Justin Dwyer, Ontario Climbing: Vol. 1, the Southern Escarpment. (Ontario: If It Bleeds We Can Kill It Productions, 2016), 16







Ontario slowly progressed from mountaineering training to sport all in its fig. 048 Rock Climbing at Lion's own, with guidebooks outlining "routes" developed on outcroppings in the Head Southern Ontario landscape. In 1983, the first guidebook to focus solely on fig. 049 Escarpment Climbing the escarpment was produced, documenting the explosion of routes being developed on crags between from Hamilton to Milton9. While the early fig. 050 Bouldering at Niagara climbing activity relied on placing protection into natural rock features to hold ropes and catch falls, the sport eventually progressed onto the slablike shear walls of the cliff, where subtle geologic features like crystal edges and sapping pockets aided the climber's ascent. These route needed to be protected by bolts drilled into the cliff face.

As the sport grew in the region, so did the organizations and user-groups to support it. Today, at the head of the sport's representation in the region is the Ontario Access Coalition (OAC). The role of the OAC is to secure access to climbing areas from land-owners and managers, educating them about the benefits of allowing climbing on their land, as well as educating climbers on the proper ethics to follow in use of the land¹⁰. The first major impact of the OAC in the escarpment was the negotiation to maintain climbing access in the Niagara Glen Nature Reserve, where the boulder fields deposited as a result of the receding Niagara Falls over thousands of years provided an ideal area for a shorter, sportier form of climb known as bouldering. Through negotiations, access to the Glen remained open to climbers, who have since aided in the documentation and cataloging floral species atop the various boulders¹¹. What began as tension and misunderstanding in the area became

Guide

^{9.} Ibid, 17

^{10.} Ibid, 18

^{11.} Chris Mills, Bouldering Totally Rocks in Niagara Escarpment Views (Spring 2015), 43

a textbook outdoor recreation sustainability initiative. The OAC has also raised funds to purchase various cliff front lands from private owners and donate it to local conservation authorities, aiding in the ongoing preservation of the landform¹².

The northern tip of Ontario's mainland escarpment, where the rock formation dips below the waters of Lake Huron, is home to the Bruce Peninsula National Park, one of Ontario's six National Parks. Established in 1987, the park attracts an average of 74,000 overnight campers and roughly 35,000 day users each year¹³.

Also nationally recognized in the upper Bruce Peninsula is the Fathom Five National Marine Park, Canada's first national marine park¹⁴. Fathom Five encompasses the waters between Lake Huron and Georgian bay, including several islands where the Niagara Escarpment formation rises from the water. The treacherous waters and narrow channels created by the underwater formation has resulted in a series of shipwrecks in the area over the years, making the area a popular diving spot to explore the 19th and early 20th century trading vessels that were wrecked¹⁵.

The northern Bruce Peninsula and Fathom Five islands provide some of the most interesting geologic features of the escarpment. Where the shear cliff meets the Georgian Bay shoreline, the continual erosion of the formation can be seen in the severely overhanging rock features and famous grotto caves that attract many visitors to the parks. Similarly, islands off the tip of the peninsula feature "flower pot" formations - large pillars eroded away from the edge of the escarpment, with vegetation and trees still thriving on top.

Across the breadth of the escarpment formation, it is clear that the recreation and tourism industry fuels the conservation and preservation of this landscape. The various user group and coalitions band together with conservation authorities and parks associations to aid in the continual maintenance of this natural landform as a stable ecological landscape.

^{12.} https://www.ontarioaccesscoalition.com/our-story/

^{13.} Richard Czok and Brad Cuniff, Northern Bruce Peninsula Ecosystem Community Atlas. (Toronto: CPAWS Wildlands League, 2005), 12

^{14.} Ibid, 13

^{15.} Ibid

Recreational engagement within the landscape fosters a way of interpreting the landscape that cannot be gathered from simply aesthetic picturing of the landscape. Through its use, the land becomes part of the important experiences one seeks to have through recreation. This connection between the human the land ultimately leads to a sense of stewardship and care towards the land, emphasizing the need to aid in the preservation of these important landscapes.

Routes Roads and Landscapes

For centuries, the walk has been regarded as perpetual participation in the landscape. The early garden paths were conceived as an experience of the place through movement, through the reorientation of the subject's perspective, the seemingly static landscape was transformed into an everchanging dynamic landscape ¹⁶. The fixed and framed views of the landscape often found in painting and photography present a static view of land, removed from itself, failing to capture its true nature. Taking a dynamic approach to experience the land allows for the frame to shift, revealing conditions imperceptible from a static, single point of view.

The methods of travel to and through the landscape present an ideal prism for the studying and consideration of the modern landscape, it's formation, uses and interpretation. For centuries, the relationship between the route and the landscape has been elaborated from the original trade routes following natural waterways, through road and railway building, designed garden landscape, city planning, and architecture. There is an ever-present symbiosis between the land we traverse, and how we accommodate that movement.

Roads and pathways in the early settlement of North America served an entirely utilitarian function, connecting the gaps between various developments not accessible via the natural waterways for personal travel as well as the shipment of goods. These pathways would follow the topography, conforming to rises and shifts, avoiding obstacles as needed, generating a meandering path that was inefficient and slow yet operated close relation to the landform. The pathways, however, could not handle travel en-masse, and as railroad building ramped up across the continent it became a preferred form of travel. The ease and speed of train travel brought about a desire fore movement beyond utilitarian needs, travel for recreation and pleasure¹⁷. The rail paths that carved through the landscape presented shifting panoramic views of the natural en-

^{16.} Mari Hvattum, Janike Kampevold Larsen, Brita Brenna, and Beate Elvebakk. *Routes, Roads and Landscapes*. (Farnham: Ashgate, 2016), 1

^{17.} David E. Nye, Redefining the American Sublime, from Open Road to Interstate in *Routes, Roads and Landscapes*. (Farnham: Ashgate, 2016), 101







fig. 051 Routes, Roads and Landscapes

fig. 052 Diagrams from The View from the Road, 1964

fig. 053 Norwegian Tourist Routes Project vironment, but in a way which removed the traveller as an active participant, they became a still passenger watching the landscape unfold through a framed window¹⁸.

This new speed of travel only accelerated further with the demands of an increasingly industrialized world. The focus of movement shifted to speed and efficiency. New industrial advancements allowed this shift to happen readily, the form of the land no longer stood in the way as blasting and grading machines were developed to alter the land and create the most efficient route possible¹⁹. Soon, a new landscape was carved throughout regions of travel, and infrastructural landscape of road cuts, bridges, and tunnels that ignored the irregularities of the local topography, laying its own orientations on and through it.

These technological advancements brought out another new form a travel, one which did not confine itself to the single paths and a timelines of railway travel; the automobile. The development of the motorcar brought out a newfound freedom in movement, a freedom that allowed the traveller to move off the beaten path, to once again experience the landscape under their own action, visiting natural sites of their choosing²⁰.

The development of car travel brought about a new appreciation in the land-scape, but soon also created new landscapes as paved roads began to spread out of the urbanized centres, connecting to one another. Initially these highways and byways took inspiration from the carriageways developed by Frederick Law Olmsted in Boston, New York Central Park, and Yosemite, acting as not merely transportation, but for recreation and enjoyment of nature²¹. These meandering "parkways" with their sinuous curves and steep grading where, however, unsuitable for trucks, and the industrialized demand for speed and

18. Ibid

19. Ibid, 102

20. Ibid, 103

21. Ibid, 106







efficiency took prominence once again in the form of straighter and wider fig. 054 Spiral Jetty highways and expressways²². fig. 055 Levitated A

Outside of the development of travel networks, the North American relationship to landscapes was also shifting from the slow and contemplative observation of nature to a fast-paced and interactive engagement in it, evident in the increased popularity of sports such as downhill skiing, white-water rafting, car-racing and much more; the awareness shifted to an immediate and fully engaged relationship through activity in the landscape, rather than a perception of the landscape itself.

This level of individual engagement and experience was the driving force behind an alternative practice for experiencing the concepts of deep time in the landscape, one that didn't take the landscape as a subject, but instead as the medium through which to represent these ideas. This realm of thought is first seen in the works of the earthworks of the 60's and 70's who, again taking the American West as their focus, created works or art within the landscape, using material from the land. Artists such as Michael Heizer and Robert Smithson were entirely aware of geology and the changes wrought to it by humans, and made such a condition the focus of their artworks²³. Smithson's most famous work, Spiral Jetty, a curved line of boulders deposited at the edge of the Great Salt Lake, was defined by Smithson as "fluvial entropy" – an acknowledgment that the geomorphology of the Earth is undergoing constant change²⁴. Heizer, likewise, would displace large amounts of earth in

fig. 054 Spiral Jetty
fig. 055 Levitated Mass Boulder
Origin

fig. 056 Levitated Mass/Slot

^{22.} Ibid, 106

^{23.} William L. Fox, "From Rock Art to Land Art / From Pleistocene to Anthropocene", in Making the Geologic Now: Responses to Material Conditions of Contemporary Life, ed. Elizabeth Ellsworth & Jamie Kruse (Brooklyn, NY: Punctum Books, 2013), 44

^{24.} Ibid

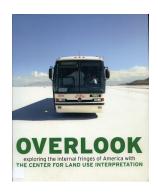




fig. 057 CLUI's Overlook

Publication

fig. 058 Smudge Studio's Geologic City his works, responding to the human history of displacing geological objects²⁵. In Heizer's work Levitated / Slot Mass, a 350-ton granite boulder was relocated to a public site (the most massive single geological object ever moved by humans) to be suspended over a trench²⁶. In another project, Double Negative, 244,000 tons of rock was displaced to form a 1500-foot-long trench, intersecting with a natural canyon in Nevada. The work calls attention to the absence of material, that which was extracted from the site.

Contemporary land art has since moved away from the large sculptural work epitomized by Heizer and Smithson towards a more participatory or experience based approach within the landscape. While the earthworks of these past artists were a refusal of the distance-taking gaze of traditional art, inviting the artist and viewer into the landscape, the works seemingly stood as pseudo-monuments to geologic events, they themselves intended to change and erode in the openness of time²⁷. In exploring the works of collaborative practices like smudge studio and the Center for Land Use Interpretation (CLUI), amongst a diverse cast of thinkers, writers, designers, and artists who have turned their gaze to the Anthropocene, it became apparent that the new sensation of the geologic conditions is to be experienced through events, exhibitions, catalogues, and guides that invited people into the landscape with an alternate lens or understanding, to see the conditions of a place as they exist, yet in a new light. The contemporary shift in reading the geologic landscape has instead placed its focus on a fleeting moment in the present landscape, an instant experience where deep histories may be exposed, and distant futures may be realized.

^{25.} Ibid

^{26.} Ibid

^{27.} John K. Grande, Art Nature Dialogues: Interviews With Environmental Artists. (Albany: State Univ. of New York Press, 2004), xii

These expositions take the form of curations and juxtapositions of conditions in the land akin to the New Topographics photographers, but not set within a framed view on the wall, but to be witnessed firsthand. Smudge studio's Geologic City pamphlet offers a guide to the presence of geologic matter in unsuspecting places in New York City, an attempt to expose the transformations of deep time embedded in everyday life²⁸. Similarly, the CLUI's projects and collections feature the sublimity of the quotidian, ordinary, and sometimes ridiculous intersections of humans and the lands they inhabit. The goals of the Center is "the increase and diffusion of information about how the world's lands are appropriated, utilized, and perceived", a goal they seek to accomplish without ego, embellishment or evaluation, nor political, industrial, or even environmental ties²⁹. This method of exposition asks us to simply look at the existing conditions of the landscape to see how we fit within this larger context of geologic time.

^{28.} Jamie Kruse and Elizabeth Ann. Ellswort, Geologic City: A Field Guide to the Geoarchitecture of New York. (New York: Smudge Studio, 2011)

^{29.} Matthew Coolidge and Sarah Simons. Overlook: exploring the internal fringes of America with the Center for Land Use Interpretation. (New York: Metrolpolis Books, 2006), 16



Material Vitality

Resource Extraction in the Niagara Escarpment

The Niagara Escarpment has had an extended history of industrial use throughout the settlement and development of Southern Ontario. Many towns in the region, both major centres and rural communities, were initially settled along the escarpment where water cascaded over the escarpment edge, taking advantage of the water power to drive mills for material processing and, later, power generation¹. As the communities grew, the hard stone of the escarpment proved an ideal building material for the larger buildings and infrastructural developments. Many of the historically significant landmark architectural projects built in Ontario utilized stone sourced from the escarpment, including buildings at Queen's Park and the Royal Ontario Museum in Toronto².

In the contemporary landscape of Southern Ontario, the stone resources of the Niagara Escarpment have a vast array of industrial uses. In the chemical production industry, limestone is burned to produce lime, an important alkali used in a variety of commercial chemicals. Lime produced from the stone is also used in the manufacture of portland cement³. St. Marys Cement is one of North Americas oldest and largest producers of cement, utilizing escarpment limestone found close to surface, but further south from actual scarp face. Limestone and dolostone from the escarpment is also used on a smaller scale as for refractory manufacture and as a flux stone in steel production, a major industry in the city of Hamilton which is Canada's largest producer of steel.

The most significant industrial use for the escarpment is within the aggregate production industry, as the hard dolomitic limestone cap-rock found throughout provides an ideal base construction material⁴. Niagara

^{1.} William Gillard and Thomas Tooke. *The Niagara escarpment: from Tobermory to Niagara Falls.* (Toronto: University of Toronto Press, 1975)

^{2.} Gerard V. Middleton, Nick Eyles, Nina Chapple, and Robert Watson, Niagara Rocks, Building Stone, History and Wine, *Niagara Field Guide* (American Geophysical Union and Geological Association of Canada, May 23, 2009)

^{3.} Ibid

^{4.} Ibid







Escarpment limestone is quarried and crushed to produce varying sizes of fig. 059 Quarried Blocks aggregates used in both building production and infrastructural projects. The Queenstone Quarry primary use of aggregates in the province is in road building projects from fig. 060 Construction of the provincial highways to private roads, where crushed stone is used for fill Ontario Parliament buildings in and base layers, aggregate within asphalt mixtures for road paving, as well as aggregate in concrete for the construction of bridges, tunnels, ramps and fig. 061 Construction of the medians⁵. Larger size aggregates are quarried for gabion basket fill which, along with large armour stones also quarried from the escarpment, are used in berming and retaining walls for landform alterations. Armour stone and aggregate fill is also used extensively in the erosion control of shorelines along lake Ontario⁶. In some localities, the softer shale formations of the escarpment are also quarried for use in brick casting⁷.

The raw material resource of the Niagara Escarpment is crucial asset to the development of Ontario. While aggregate is a rather low-priced commodity and the industry itself is not a major economic generator for the province, the material resources use is so wide spread and in such high volumes that it becomes an essential ingredient for the end-use industries which do play a major role in the provincial economy⁸. While it is not the dominant resource or product in most sectors, the material is a piece of a larger network of industrial development for which there is no obvious substitute. Much like the material function of the resource itself, the industry is a vital piece to a larger whole.

Welland Canal

^{5.} Ibid

^{6.} Ibid

^{7.} Ibid

^{8.} Derry Michener Booth and Wahl, Limestone Industries of Ontario, Volume l Geology, Properties and Economics (Aggregate Resources Section, Land Management Branch, Ontario Ministry of Natural Resources, 1989)

While the extraction and refinement processes of the material are relatively simple and safe, sand, stone, and aggregate as a resource is logistically difficult to make available, as transport costs for such a heavy material can be prohibitive in the economic viability of its use⁹. The key to this industry's importance in Ontario lies in the regional availability of the resource in close proximity to areas of major developments. The location of the escarpment in Ontario allows for locally sourced material to easily feed the major development projects in Ontario. Many quarries were specifically located to provide material for major highway expansion and large scale infrastructure, such as in the Halton Hills and Niagara region. Conversely, the routing and siting of such projects were equally informed by the location of the escarpment, not just a physical presence or obstacle of the site, but also in terms of material resource proximity¹⁰.

On average, the province of Ontario consumes 164 million tonnes of aggregate resource each year, with projections for higher levels of consumption rates in the next 20 years¹¹. As the growth of the Greater Toronto Area and the Golden Horseshoe accelerates, the demand for aggregate will increase. These two levels of growth eventually become incompatible as the close to market strategy necessary in the use of the resource requires significant land to be productive¹². The productivist landscape is in direct contention with not only the commercial development of land, but as well as the preservation efforts of the various user groups. The aggregate industry is surrounded by a complex political landscape in which various private, government and public activist groups all lobby for a certain use of the landscape.

One notable case in the changing landscape of the escarpment was again focused on the Dufferin Aggregate Quarry in Milton, where an application to expand the quarrying operations in 2001 reached a high level of contention. The proposed expansion was for an 18% increase of the main extraction site north of the infamous "gap". The expansion would entail a re-designation of an Escarpment Rural area to a Mineral Extraction area under the NEP. Additionally, excavation in the site would have to occur below the water table, requiring a continuous dewatering system to remove ground water

^{9.} Ibid

^{10.} Ibid

^{11.} MHBC Planning, The Future of Ontario's Close to Market Aggregate Supply, 2015 Provincial Plan Review, (April 30, 2015)

^{12.} Ibid

form the quarry floor. To reduce the risk of detrimental effects on the water table, the dewatering system would require ongoing active monitoring and maintenance in perpetuity, raising long-term environmental and financial concerns. The application led a discursive battle between the varying user groups of the escarpment land.

Dufferin's promotion of the expansion cited the 'need' and 'demand' for continual close to market access to the material resource, supported by mineral forecasts on the projected growth of GTA¹³. This 'need' narrative also emphasizes the employment generated by the aggregate industry in Ontario. In response to the environmental damage risks presented by the quarrying industry, Dufferin issued technical reports that articulate expertise to convince opponents and decision makers that proposed operations have been carefully planned. Dufferin's studies claimed that impact levels concerning noise controls, blasting design, dust suppression and maintenance of water supply are 'within required provincial guidelines'. Technical reports and detailed site plans of recharge wells, environmental buffers, edge management and enhancement measures and rehabilitation are used to illustrate that all necessary precautions are taken to protect groundwater and habitat for vulnerable, threatened and endangered species¹⁴.

The counter discourse to the expansion proposal was mainly voiced by conservation societies and naturalist clubs dedicated to preservation of the natural environment, as well as local citizens. These groups focused on the environmental degradation that would occur at the hand of the expansion, countering the supposed precautions suggested by Dufferin in their technical reports. The major focus of the counter discourse was the unproven system of surface and ground water management which would essentially place the escarpment on 'life support' Local citizens expressed collective concern over the quality of life in proximity to the quarry expansion, citing a reduction in property value, the noise and dust generated from blasting and truck traffic in the region. A final powerful critique was the dangerous precedent that may be set by approving such an application, as other operating quarries deplete their licensed resources and apply for similar expansion approvals. Likewise, the removal of the land from the protection of the Niagara Escarpment Plan

^{13.} Ibid

^{14.} Sandra Patano and L. Anders Sandberg "Winning back more than words? Power, discourse and quarrying on the Niagara Escarpment", The Canadian Geographer 49, no 1 (2005): 25-41

^{15.} Ibid

would risk the integrity of the plan.

The Dufferin case presents a binary of productivists against conversationalists, as one side contends that the demand for aggregate gives no choice but to expand where the opposition merely focuses on the problems in situ. There are other, deeper, considerations to the case such as why there is such a great demand for the resource in the first place, holding the aggregate producers responsible for supply such large amounts of aggregate and promoting the market for it¹⁶. The management of aggregate extraction in Ontario resides formally within the Ontario Ministry of Natural Resources (OMNR), however, the control has been delegated to the Aggregate Producers Association of Ontario (APAO), a registered lobby group whose objective is 'to be the single voice of the aggregate industry with government to positively influence legislation, regulation and policy to the benefit of the citizens of Ontario, as well as the industry'17. Within the APAO is a branch called the Ontario Aggregate Resources Corporation (TOARC) who controls and manages the Aggregate Resources Trust that consists solely of government (OMNR) funds sourced from the haulage of the material. Some of these funds are used for administration and compiling Ontario statistics on the aggregate industry, but a vast majority (\$8.2 million out of \$8.8 million) is fed back to the OMNR and municipal governments. Another branch, the Management of Abandoned Aggregate Properties Program (MAPP), is dedicated to the rehabilitation of abandoned aggregate pits and quarries¹⁸.

Such labyrinthine interconnections between the APAO, OMNR, TOARC and MAPP, involving potential influence and government funds, are rife with potential conflicts of interest. The power geometry of aggregate production is additionally influenced by the Ontario Municipal Board (OMB), an allegedly independent, quasi-jurisdictional administrative tribunal whose function is to resolve appeals from planning decisions made by municipal councils and local committees¹⁹. Though the board is mandated to balance all competing factors, it addresses environmental policies infrequently.

Ultimately, this convoluted network of organizations has a great influence on the extraction and use of this material resource in Ontario. As seen previously

^{16.} Ibid

^{17.} Ibid

^{18.} Ibid

^{19.} Ibid

in the attempted abolition of preservation efforts in the Niagara Escarpment where the Conservative Government undermined the effectiveness of the NEC and the Escarpment Plan through budget cuts and the appointment of pro-development commissioners, the vast influence of these larger organizations have the ability to completely undermine the intensive approval processes set in place the preserve the ecology of this landscape.

In this landscape, the term sustainability has shifted from referring to natural yields to development, how can we sustain the development of our region? As development, extraction, and preservation efforts of the Southern Ontario clash at eachother, the limited supply of a finite resource becomes ever clearer. Yet, if we look at the landscape holistically, the urban build-up and infrastructural projects are merely an anthropogenic redistribution of this geologic material. Currently, only 7% of the aggregate supply in Ontario comes from recycled sources²⁰. Perhaps soon we will see the need to 'quarry' our disused infrastructures to further redistribute the material as recycled aggregates.

Ultimately, in the case with Dufferin Aggregates, the Joint Board (consisting of a majority of OMB members) ruled in favor of the proposal and expansion to the Dufferin Aggregates Quarry in Milton is going forward. Only the future will tell what the long term impacts of this industry with mean for this landscape. As we look at development projects across the region today, such as the new Highway 407, constructed using nearly ten million tonnes of aggregate extracted from the Niagara Escarpment, we can see that our human landscape is paved with the battles of these organizations. Under the surface, this landform has helped to define the present day urban, social, political, and economic life of Ontario.

20. MHBC Planning, The Future of Ontario's Close to Market Aggregate Supply, 2015 Provincial Plan Review, (April 30, 2015)





fig. 062 Aggregate Shipping
Truck on Escarpment Roads
fig. 063 Walker Aggregates Spring
Creek Quarry, Lincoln Ontario

The extraction and subsequent redistribution of the various aggregates throughout the province not only presents a significant relationship between these small fragments of industry and the larger industries of provincial development, but also a clear signifier of the impact of humanity in the formation of our landscape. In this context, humanity is acting as geologic force, eroding earth and carrying the sediments across great distances to be settled and reformed into the mountainous urban skyline, the ridges and tailings of highway systems and the stark scarp faces of hydroelectric generating stations. Humanity is geologic force, capable of accelerating the processes of hundreds of millions of years of natural force into a timeline of change perceivable in the span of months.

The resultant landform left in the scars and marks of human extraction presents features far more dramatic than those left from even the carving and scraping of glacial movement across the land. The pits, quarries and road cuts that mark the landscape of southern Ontario present a landscape that can no longer be seen as being wholly natural, this also a human landscape. As humankind has occupied and used this land, we have ultimately reformed and shaped it.

Vital Matter: Architecture's Material Life

The Anthropocene is an all-encompassing condition of the earth. Understanding it not merely a taxonomic category, but as a sensorial temporality that we are inextricably bound to requires an attunement to the geologic scale transformations that are unmaking the Earth as we know it. To attune ourselves to the particulate differences that compose change requires a shift in our perceptions of the world, both to encompass the scale at which these changes occur, but also our acknowledgment of them in the everyday landscape. The Anthropocene is so built into our senses that it determines our perceptions, as such the experience of the Anthropocene is an aesthetic one, yet the change in the contemporary world occurs at such a rapid pace, our sensorial and perceptive systems are being refashioned at rates we can barely keep up with. What was once considered sublime and extraordinary are now ordinary and banal, the anthropogenic mountains and canyons of construction and extraction are so ingrained in our landscape that we hardly notice them. Humanity has become anaesthetized to the anthropogenic realities of our world, a condition likely not helped by the aestheticized





presentation of industry in various artworks throughout the past century.

In order to reorient ourselves to better respond to this condition, there is a fig. 065 Black Walnut and need to expand our perception outside of the anthropocentric mindset, to better understand the context within which we operate. Even more important is to acknowledge the agency of that which is distinctly non-human, to sense the change enacted by forces outside of us, both in the external, natural environment and our constructed environment. In her text Vibrant Matter, the Political Ecology of Things, Jane Bennett urges humanity to break with modern habits of assuming and behaving as if the matter that composes the earth is passive stuff, raw, brute, or inert and simply relegated to the status of passive recipients of our designs and desires²¹. As the intermingling of human and natural forces becomes intensified through human development, this condition becomes harder to ignore as the Earth has been seen to react back in both violent and subtle ways. Humanity should be recognizing that we are not the only active agents on the planet. As Bennett makes clear in examples ranging from stem cells to trash to fish oils, humans are able to act intentionally and effectively in the world only "if accompanied by a vast entourage of nonhumans"22.

The concept of the active material is not a wholly new revelation, though it is not a sensitivity that has manifested in the larger, more impactful industries across the planet. Various small scale craftsmen, industrial designers, and woodworkers have always carried these sensibilities towards the materials

fig. 064 George Nakashima in his worksjop

Hickory Bench by Nakashima, 1963

^{21.} Jane Bennett, Vibrant Matter: A Political Ecology of Things (Durham: Duke University Press, 2010),

^{22.} Ibid, 108

they work with. Architect turned woodworker George Nakashima expresses a more philosophical understanding of the concept when he refers to the "soul of a tree" – the conditions of the tree's growth from location, surrounding environment, exposure, even the ephemeral story that surrounds it that in turn effect the material properties of the wood that is produced²³. While somewhat abstract at times, this notion is quite tangible when you consider properties of wood – its grain direction, the thickness of sapwood versus the heartwood, the knots, burls, and bark – which greatly effect how the material can be transformed by the carving tools of the woodworker. For craftsmen like this, a timeline of hundreds to thousands of years dating back to the material's initial fertilization – the material's life - becomes apparent in how that matter can be transformed.

This vitalist theory hinges around the conceptualization of a non-human "life" – a term used as a chronological measure of existence. Matter is alive, not in a mechanistic way, but in the complex interrelationships between matter within the world, and the resultant propensities for open-ended change. In defining the nature of this life, Jane Bennet draws off Gilles Deleuze's distinction between life, and immanent life, to which he states: "A life is everywhere, in all the moments that a given living subject goes through and that are measured by given lived objects: an immanent life carrying with it the events or singularities that are merely actualized in subjects and objects"24. As Bennett interprets, a life is thus a "restless activeness, a destructive-creative force-presence that does not coincide fully with any specific body"25. The "life" that is present, both in humans and in non-human things, is evident only through the transformations caused as a result of such a force. To draw again from Deleuze, this life points to what is described in A Thousand Plateaus as "matter in variation that enters assemblages and leaves them" 26. As Bennet concludes, this vitality within matter is not proper to any individual thing, but to the 'pure immanence' that Deleuze defines.

Ultimately, "life" points to the immanent potentialities of events that define our world, an open-ended realm of virtualities on the verge of becoming, endless possibilities yet to be realised, catalyzed through the forces and energies that move through matter. To see material as alive is to see the world

^{23.} George Nakashima, The soul of a tree: a woodworkers reflections. (New York: Kodansha USA, 2011)

^{24.} Gilles Deleuze, Pure Immanence: Essays on A Life. 2nd ed. (Zone Books, 2005), 25

^{25.} Jane Bennett, 54

^{26.} Ibid, 53





fig. 066 Le Corbusier's Villa Savoye in disrepair

fig. 067 Peter Zumthor's Bruder Klaus Field Chapel interior, created by packing rmmed earth on wood formwork which was then burned out from the middle, revealing a finsh that imbues the process.

as a dynamic flow of matter-energy that settles into bodies, joins forces, and makes connections to formalize the place that we live, the ecology of the world. As Fredreich Nietzsch states in Will to Power, our world is a "monster of energy, without beginning, without end; a firm, iron magnitude of force that does not grow bigger or smaller, that does not expend itself but only transforms itself... not something endlessly extended, but set in a definite space as a definite force, and not a space that might be "empty" here or there, but rather as force throughout, as a play of forces and waves of forces, at the same time one and many, increasing here and at the same time decreasing there; a sea of forces flowing and rushing together, eternally changing"²⁷.

This alludes to a finite world in which the matter that formalizes is eternally constant. There is no ability to create something wholly new within the world, only to transform matter through immanent forces. As such, what humanity creates its absolutely bound the geologic history of the earth, it's material compositions, and the kinetic and potential energy that imbues all matter. The redistribution of earthen matter that is subsequently transformed into building material does not go away, it remains as part of the geologic assemblage of our planet. Humankind is a geologic being, not only in the fact that we are composed of the same elements of the planet; "walking, talking, minerals... redistributions of oxygen, hydrogen, nitrogen, carbon, sulfur, phosphorous, and other elements of the Earth's crust," but we are also a geologic force, able to alter the Earth in countless, massive ways²⁸. The ecological landscape of contemporary life is a geologic assemblage of the human and a non-human nature to which we are materially, cosmically,

^{27.} Friedrich Wilhelm Nietzsche, Walter Kaufmann, and R. J. Hollingdale, *The Will to Power*. New York: Vintage Books 1968), 1067

^{28.} Elizabeth Ellsworth and Jamie Kruse, Making the Geologic Now: Responses to Material Conditions of Contemporary Life, (Brooklyn, NY: Punctum Books, 2013), 244

biotechnically, medially, virally, pharmacologically entangled²⁹.

With such provocations, the concept of the Anthropocene posits a turn in how we consider our agency on the planet, especially within the creative, productive and place making professions. Architecture is very much at the heart of this discourse as a profession that is primarily engaged with the conditions of "site" and its material constitution; we build on and with the Earth; architectural constructions are so dynamically linked with movement and extraction of land for human production. As Eyal Weismann states:

"[G]eological formations exist both inside and outside buildings. They are obviously the ground on which buildings stand, but also appear in construction materials, as stones or the gravel within concrete. A denser concentration of minerals within a rock will often become the line of least resistance, along which a crack will tear it, and likewise the building, apart. So seismic cracks are interesting because they connect the geological, the urban, and the architectural. Cracks are a fantastic demonstration of a shared materiality of the planet, moving from geology to architecture, and studying cracks... demonstrates the necessity to rid our thinking of the figure-ground relation—a building is not ontologically or epistemologically different from the rock or gravel in which it is anchored"³⁰.

As such, architecture has a unique capacity to transform the present and future conditions of the ecological landscape by making a turn towards the geologic, sensing and imagining the material vitality of the earth an how it assembles with the human.

However, this question of reorientation in the Anthropocene does not necessarily dictate a physical or spatial turn, but on that ought to shift our considerations of the temporal aspects of the world (that, of course, manifest in the physical and material). The exploration of contemporary ties to the geologic presents an interesting convergence between two styles of temporality that we formerly considered distinct, the first being geologic time that bi-modally operates at either an explosively transformative speed in the instances of earthquakes, eruptions, or lighting, or the implacably slow

^{29.} Jane Bennett, 115

^{30.} Eyal Weizman in Conversation with Heather Davis and Etienne Turpin, Matters of Calculation The Evidence of the Anthropocene in Architecture in the Anthropocene: Encounters Among Design, Deep Time, Science and Philosophy, ed. Etienne Turpin (Ann Arbor: Open Humanities Press, 2013), 67

deep time of erosion and sedimentation, and a second temporality at the scale of the human, a moderate speed of endeavour, the time of the everyday³¹. As expressed in this study of the Anthropocene, humanity has been seen to act at the superfast speed, evident in complete obliteration through atomic devices and the massive upheaval and redistribution of earth through quarrying, yet also in the slower time as our anthropogenic deposits of infrastructure and buildings become ingrained in the geology of earth, effecting natural patterns of sedimentation, and including foreign deposits of human-centric chemicals such as radioactive wastes.

This dissolution of an ontological dichotomy between human and nonhuman forces in regards their temporalities results in a world that can't explicitly be defined by time, but now instead by speed³². The speed of change across the earth is gradually outpacing the human capacity to understand it, we are only just recognizing the extended effects of events already in motion. In examining the many exponentially curved graphs that might map out the accelerated change of any human condition, we can take notice that we are currently living in a world that exists at a right angle to which we previously understood³³. This speed is, however, also part of the potential answer to how we make these reorientations. The one, solid, condition where human agency differs from non-human agency is in ability to control this speed, to accelerate processes or even slow them down through active maintenance. This ability to shift and extend scales of change may be the answer, as we slow down our development, take the time to look backwards, as far back as the foundation of our earth, operate at this pace and experience it in the present, to maintain what is existing as opposed to looking for the next, immediate gratification.

An altered understanding of the scale and speed of human action may ultimately lead to the extension of the Anthropocene far into the future, to allow it thrive, as, contradictory as it may sound, that is what we want. We can't exist without the geologic, but it most certainly can exist without us. The Anthropocene is a good thing, it is our life, the age of the human on this earth, our time of belonging in this great geological journey. Humanity is constantly looking to expand its horizons, to explore the extended universe, both outwardly and inwardly, not to exploit it, but to understand our place

 $^{31.\} https://fopnews.wordpress.com/2012/02/19/beyond-rocks-architects-and-everyone-else-living-the-geologic/$

^{32.} Ibid

^{33.} Ibid

within it. We look back at our Blue Marble, an assemblage of material floating in space amongst an array of celestial objects, all to recognize that we are earthlings, and even though this earth does not belong to humans, we belong to it³⁴. To continue this belonging into the distant future is the ultimate goal, a goal which first begins with the understanding of our inhabitation and use of this place.

^{34.} Elizabeth Ellsworth and Jamie Kruse, 246



fig. 068 Thesis Review Exhibition

Interlude:
Photographs,
Mappings
and
This
Models

This thesis was not always focused on the Niagara Escarpment. As previously expressed, the process of creating this thesis was a meandering journey, jumping between the small scale fascination with the immediate change of matter as you hold something in your hand and the willingness to get lost in the vast expanse of temporal and physical contexts that surrounded these transformations.

My interest in the Niagara Escarpment began with my recreational use of it, hiking trails within the Halton Region conservation area, climbing at the cliffs of Mount Nemo, and gravitating towards the winding roads through river valleys on my motorcycle rides. What started as a pass time, became a driving force in the work I wanted to create. My experience of this landscape slowly became enriched as I started to look differently at the landscape surrounding me. I began to look at it the way I looked at any designed or crafted object, a transformation of material at varying scales, indexed in the subtle and massively evident formations, marks and scars within the geologic material.

As I ventured through stories of land-use in the Niagara Escarpment and began to trace them to a global context of landscape representation, I endeavored to develop my own readings of the landscape through the mediums I was exploring, photographing, mapping, and working with the material of this landscape myself. The hopes behind this endeavor was to represent the landscape in a new way, reveal the inner workings and underlying form that I had come to appreciate within it, and tease out a critical moment which could become the focus of my work. I was not entirely sure what I was looking for, but the journey brought me to a vast array of sites along the Escarpment, from Niagara Falls up to Mono Hills I saw a diverse cross section through the use of this landscape. I began to draw lines of connection between these disparate sites, from recurring stratigraphic layers and rock types, to the realization that the roads I was traveling were constructed these very same materials.

The following pages present the results of these explorations, a documentation and curated representation of land-use within the Niagara Escarpment through photography, mappings, and models.

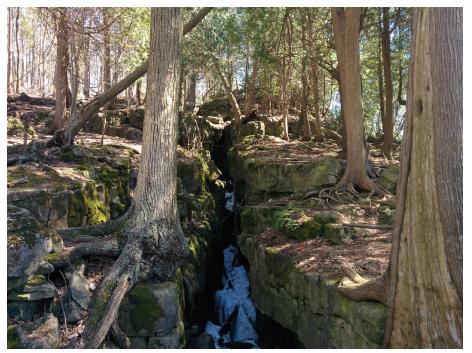


fig. 069 Crevice, Rattlesnake Point, Milton



fig. 070 Rock Face Detail, Rattlesnake Point, Milton

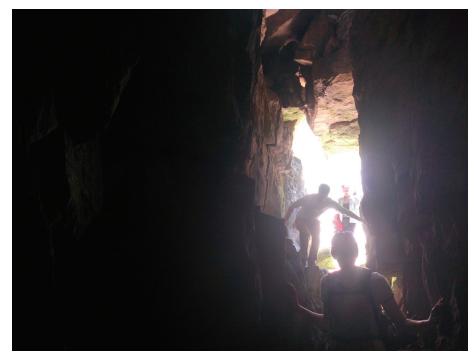


fig. 071 Exploring Cavers, Rattlesnake Point, Milton

fig. 072 Rock Face Detail, Rattlesnake Point, Milton





fig. 073 Climbing at Rattlensake Point, Milton



fig. 074 Cannings Falls, Mono



fig. 075 Tews Falls, Dundas

fig. 076 Unconformity at Cannings Falls, Mono





fig. 077 Escarpment Base, Rattlesnake Point, Milton



fig. 078 Climbing the "cow" formation at Rattlesnake Point

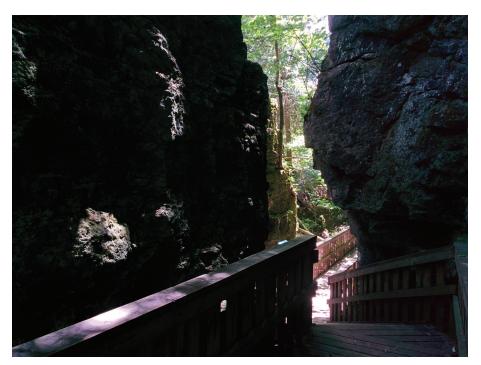


fig. 079 Boardwalk trails through caverns and outliers, Mono Hills Provincial Park

fig. 080 Webster Falls, Dundas

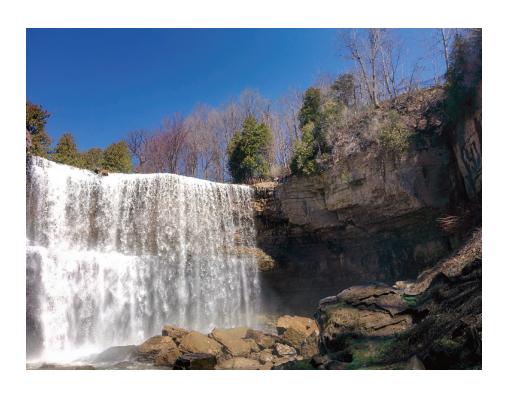




fig. 081 Cataract Falls, adjacent to ruins of an old mill, Caledon



fig. 082 Overlooking Hamilton from the top of the mountain road cuts



fig. 083 Shadow cast from the Escarpment edge, Mount Nemo, Milton

fig. 084 Cascading vegetation, detail of Cannings Falls, Mono

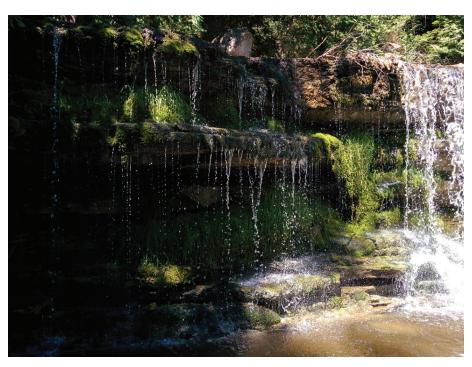




fig. 085 The Escarpment in hand and on the Horizon, climbing at Rattlesnake Point, Milton



fig. 086 Quarried limestone block spotted in transport on Highway 401

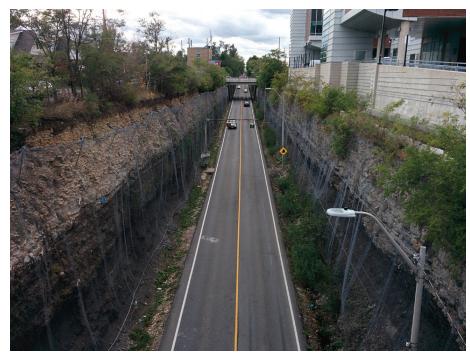


fig. 087 Sherman Access road cut, Hamilton

fig. 088 The Hamilton Mountain from the city below





fig. 089 Driving the Sherman Access road cut, Hamilton



fig. 090 Climbing between Escarpment Outliers at Old Baldy in the Beaver Valley, Kimberley



fig. 091 The Escarpment near and far, looking across the Beaver Valley, Kimberley

fig. 092 Pedestrian and vehicular infrastructure scaling the mountain access roads in Hamilton

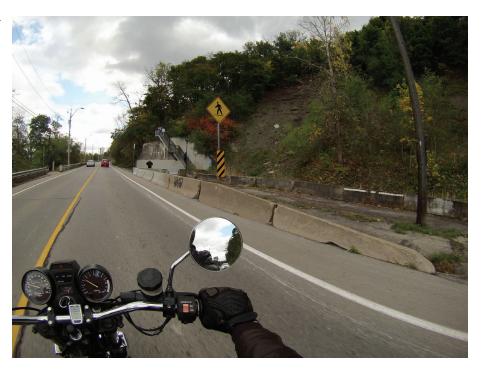




fig. 093 Night climbing, following cracks and bolt-lines by headlamp at Mount Nemo, Milton

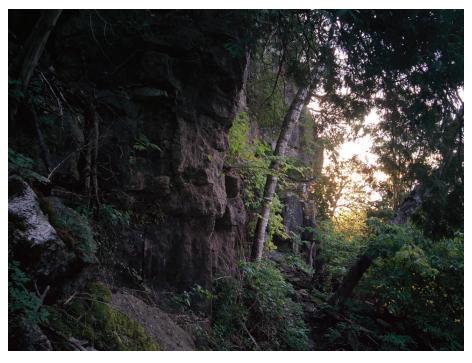


fig. 094 The lush escarpment base, Mount Nemo, Milton



fig. 095 Sequence of movement up a climbing route at Old Baldy in the Beaver Valley, Kimberley

fig. 096 Climbing at Mount Nemo, Milton





fig. 097 Natural hand hold on the Escarpment Face, Rattlesnake Point, Milton



fig. 098 The Cities of Hamilton and Burlington, nestled between escarpment faces.



fig. 099 Dufferin Quarry landscape, Milton

fig. 100 Climbing on displaced boulders in the Niagara Glen, Niagara





fig. 101 Examining a route on the underside of a boulder in the Niagara Glen, Niagara



fig. 102 Lime Kiln Ruins near the Forks of the Credit Provincial Park, Caledon



fig. 103 Dufferin Quarry Bridge where the Bruce Trail spans the gap blasted at Dufferin Quarry, Milton

fig. 104 Dufferin Quarry landscape, Milton



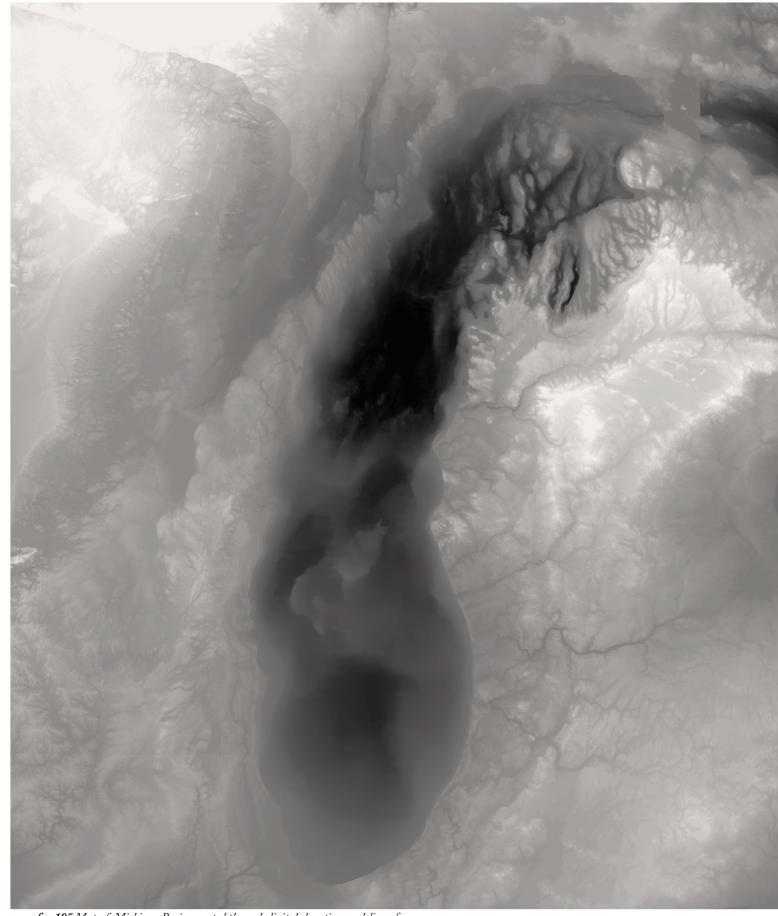
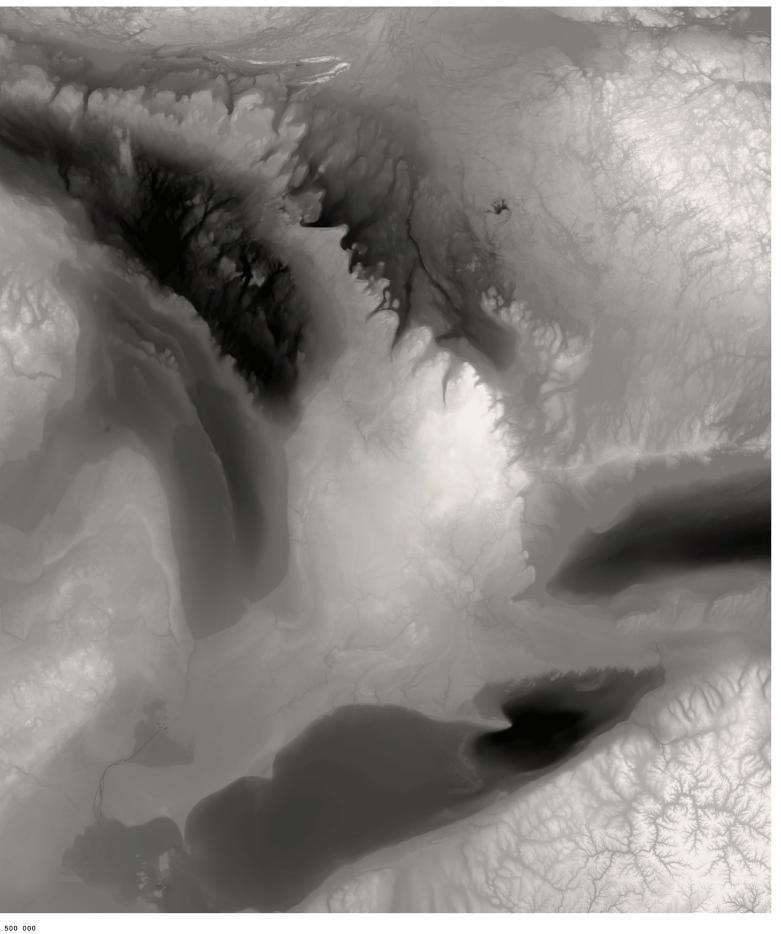


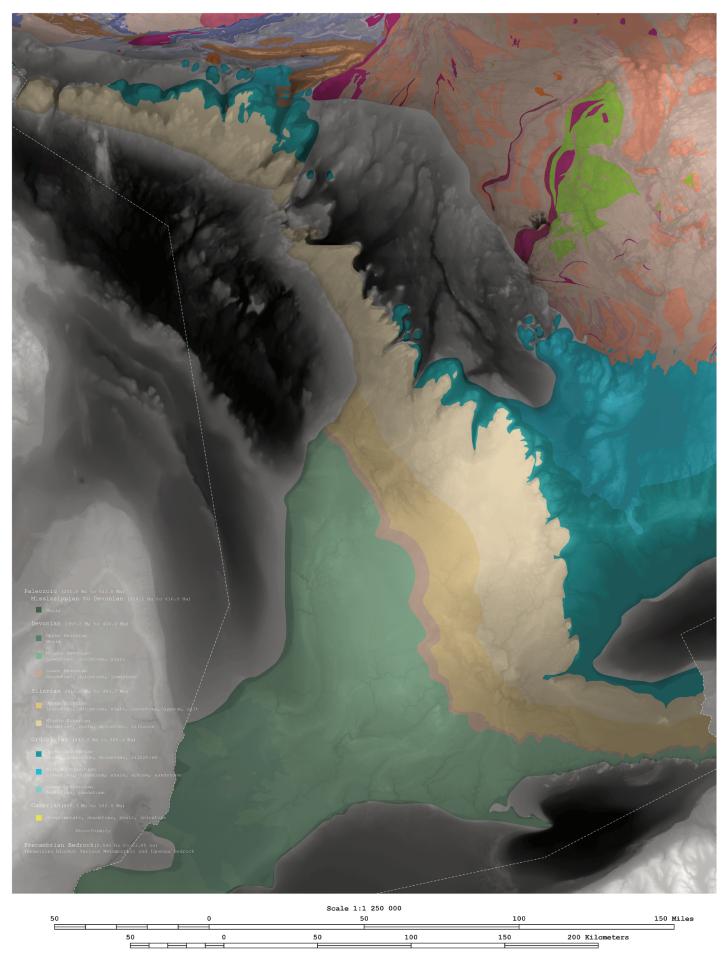
fig. 105 Map of Michigan Basin, created through digital elevation modeling of the earth's surface and lake bathymetry

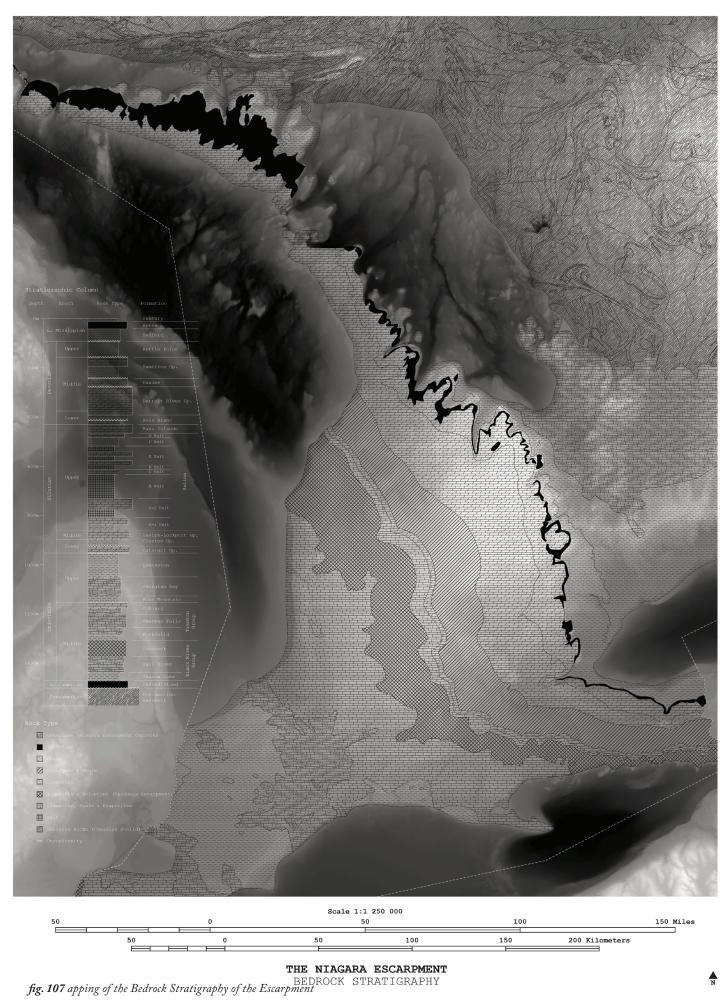




300 000

100		150	200 Miles
150	200	250	300 Kilometers





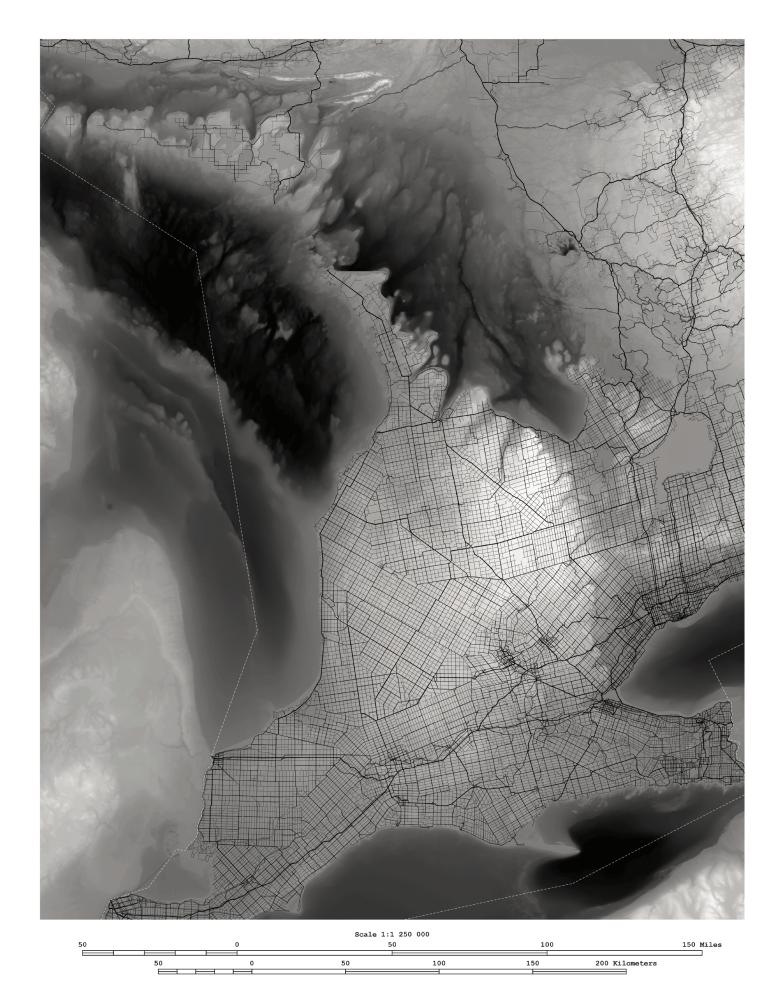


fig. 108 Mapping of Road Networks surrounding the Escarpment

THE NIAGARA ESCARPMENT
MAJOR ROAD NETWORK

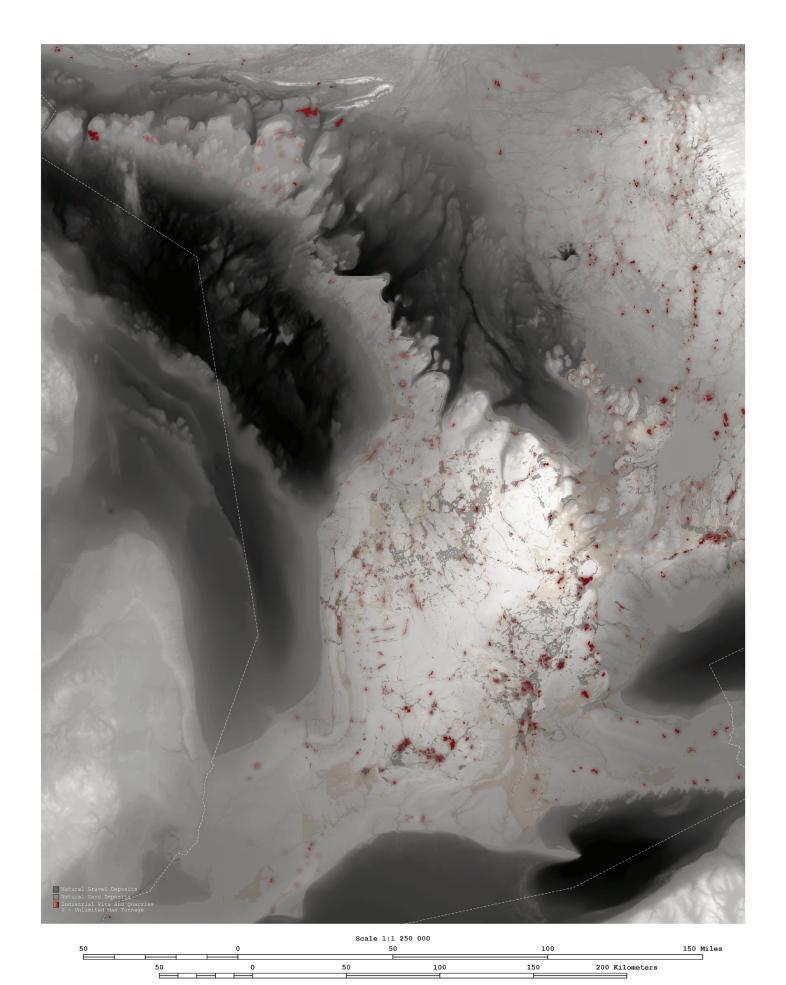


fig. 109 Mapping of pits and quarries surrounding the Escarpment

THE NIAGARA ESCARPMENT RESOURCE EXTRACTION

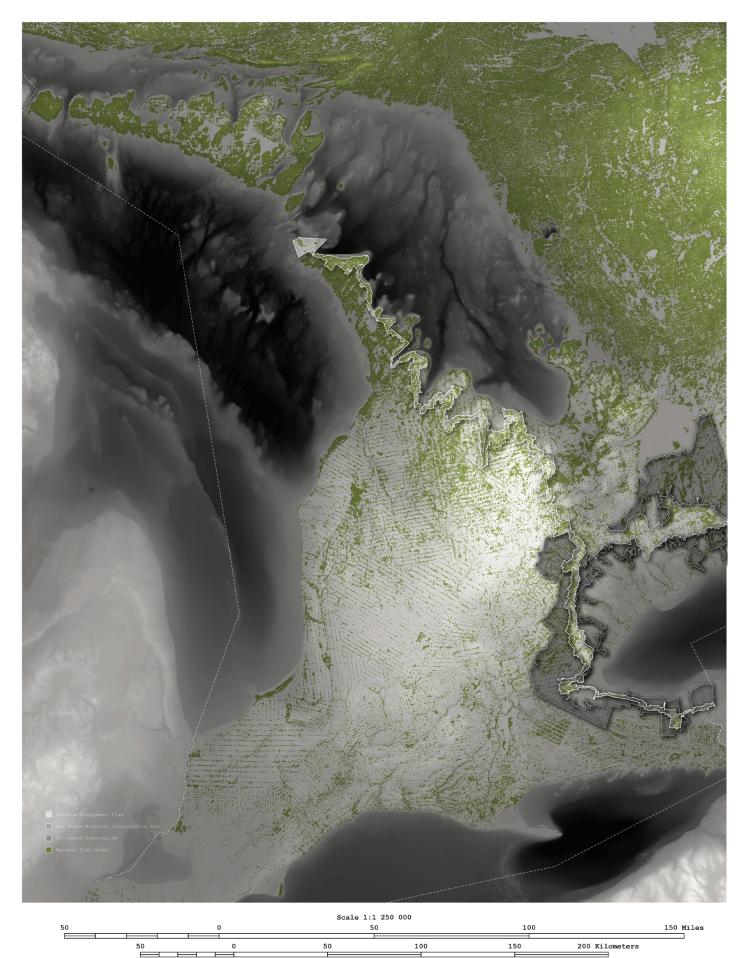


fig. 110 Mapping of protection areas and
THE NIAGARA ESCARPMENT

THE VIAGARA ESCARPMENT

CONSERVATION AND PROTECTION AREAS

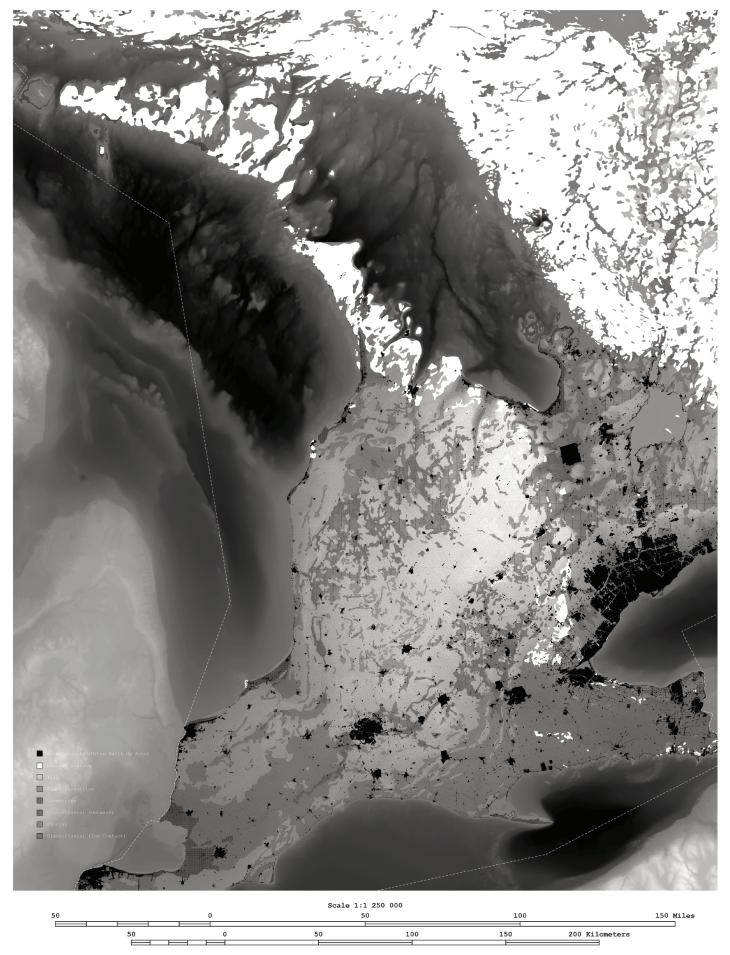


fig. 111 Mapping of Surficial Geology and Urban Areas surrounding the Escarpment

THE NIAGARA ESCARPMENT
SURFICIAL GEOLOGY



Cast Landscapes

Exploring sites of interest along the Escarpment, the natural and the human are cast together in one homogeneous material. The solid concrete, once fluid and flowing, has cemented together the aggregate of the human and non-human as one continuous landscape.

fig. 112 Cast concrete model of the Dufferin Quarry and surrounding area



fig. 113 Cast concrete model detail

Taking a scaled, aerial view, the formation of the landscape is represented in a comprehensible way, the relative scale of the human and the non-human acting together.

The sites of major quarrying industries have been represented in their full extraction depth, at the limits of their current licensed areas and depths.



fig. 114 Cast concrete model detail

fig. 115 Cast concrete model detail





Site Fragments

Attempting to design infrastructural interventions to facilitate movement up the vertical face of the scarp, these models were an exploration between the movement of the natural stone, the human made cast concrete, and the visitor to the site.

These models represent concrete material in varying froms of finish, from pristine to eroding, highlight a material in time, an

fig. 116 Fragment Model 01, Detail



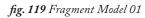
fig. 117 Fragment Model 01

ongoing process. These things are at once in an ideal state, a state of ruin, and a state of change, striking a contrast and camparison between the escarpment stone and the human created material.

The vertical paths of travel were intended to orchestrate a vertical engagemnt with the natural formation, supplementing and opposing the traditional paths that span the Escarpment horizontally.



fig. 118 Fragment Model 02, Detail





Part Two

A
Stratigraphic
Guide
to
the
Niagara
Escarpment



The Guidebook

As I attempted to understand, interpret, and represent the many facets and flows of the geologic within the Niagara Escarpment through classic forms of representation, I came to realize that any end product could not fully encapsulate the conditions i wished to expose. These representations simply flattened the experience I had gained in the first hand interaction with sites along the Niagara Escarpment.

My goal was to create a project which would expose a new layer to this landscape, but I eventually came that something new did not need to be created within this place to accomplish that. What was needed was a shift in the reading of this place. This turned my focus to the ways in which I found my way through the place, the various guidebooks and route maps which directed my approach to this landscape.

The product of this thesis is a guidebook to the geology of the Niagara Escarpment, the purpose of which is two-fold. Firstly, the guide is an invitation to the casual user of this landscape to go out and experience this landscape first hand. Not just through the recreation networks and picturesque sites, but in the seemingly banal roadways, rock cuts and infrastructures that are equally part of this landscape. The second purpose is to represent these sites in a re-imagined way, outside of the standard planning viewpoint. The Escarpment is a landscape that exposes itself on the vertical, the view of this place is at once a section, elevation, and plan of the transformative processes at work within this place. As such the guidebook is structured around the stratigraphic section/elevation of the geologic formation, highlighting the conditions where networks of natural and human land-uses weave through these layers.

This guidebook is not a prescriptive guide in how to approach the landscape of the escarpment, and it does not propose ways of acting within it, but offers a provocation to witness an experience the geologic realities of the Anthropocene within the local landscape, and the agency of seemingly static materials to structure human society.

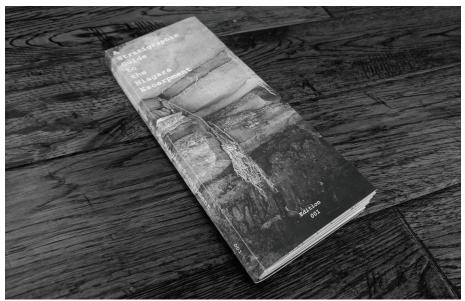


fig. 120 Guidebook cover



fig. 121 Accordian style unfolding of the guidebook pages



fig. 122 The guidebook in hand, as it would be read.

fig. 123 Further unfolding of site details and maps from the main guidebook elevation.



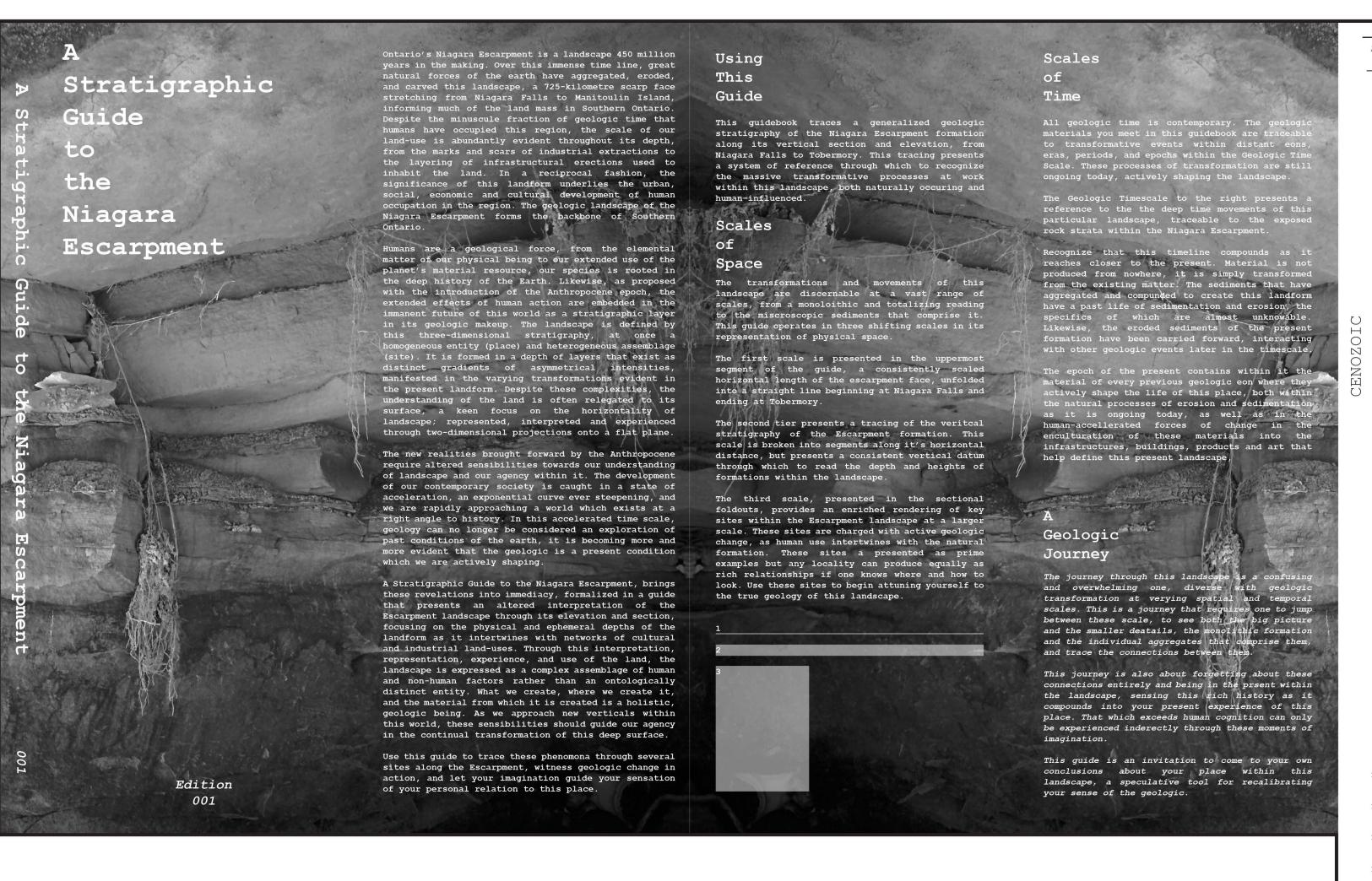
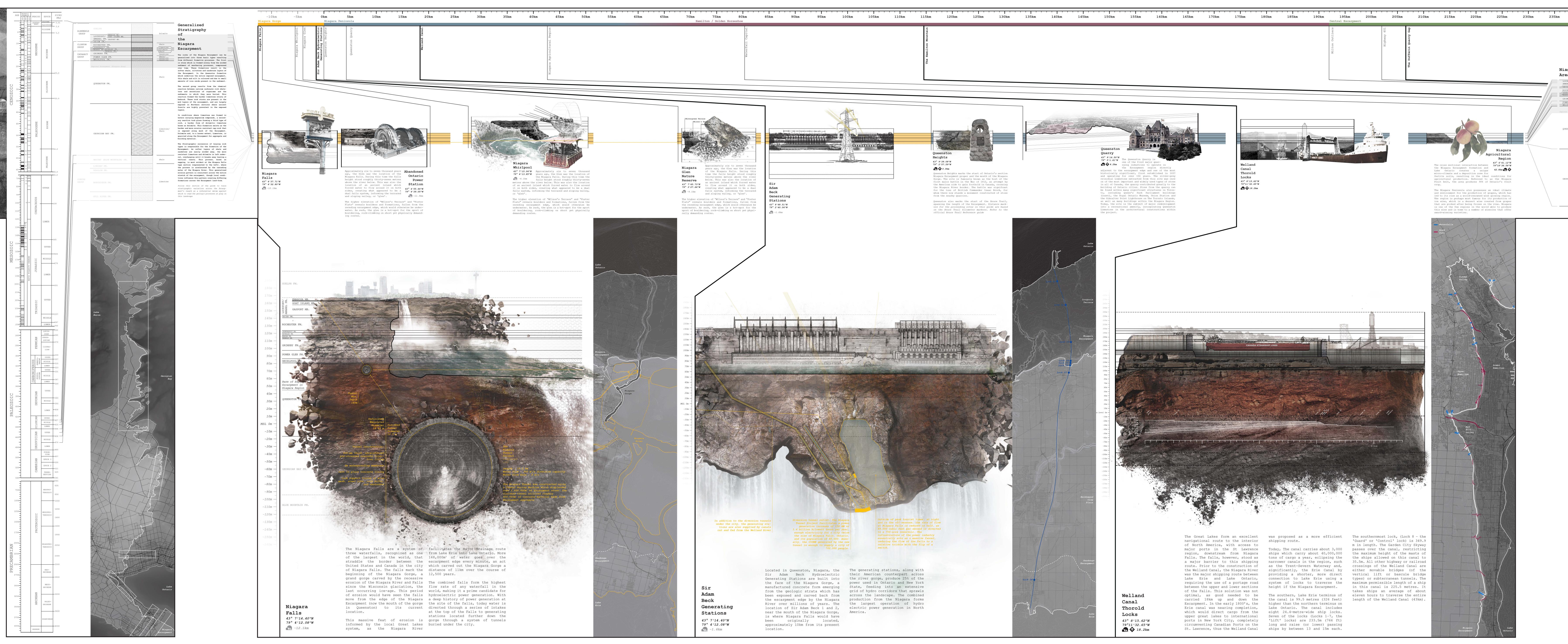


fig. 124 Complete Unfolded Guidebook Spread



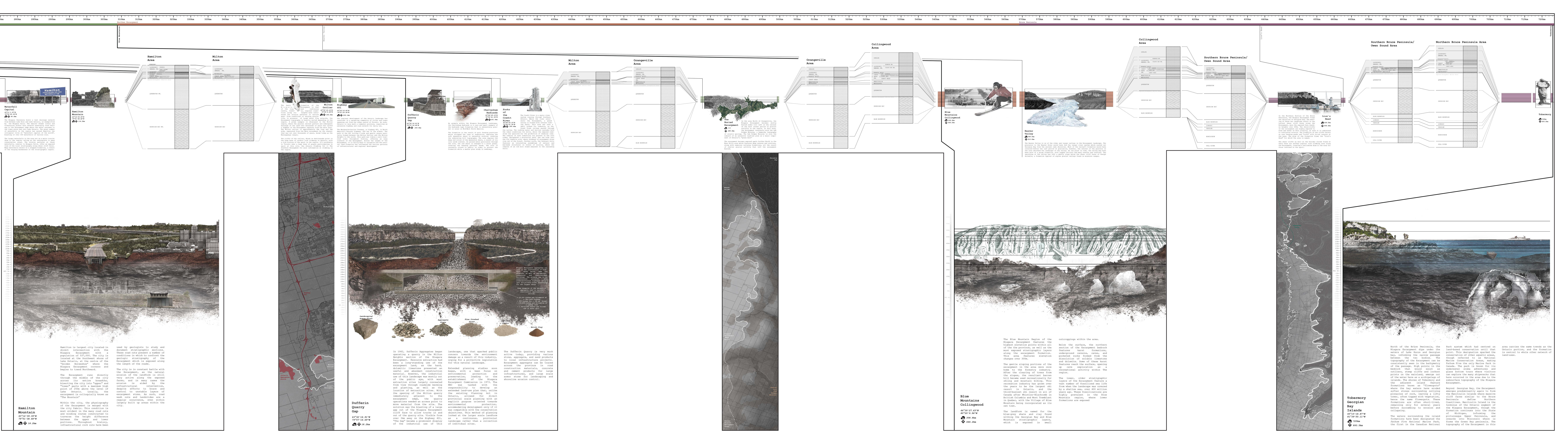




fig. 125 My Home Workshop

Epilogue: Unfinished

At the end of this journey, it is difficult to look around at where I am and see the end result as a single thing. To arrive at a conclusion here is to assume I have found the answers to the questions I had been asking along the way. In actuality, this thesis has opened up to more seemingly unanswerable questions. To me, the work presented here is all about the process, the transformation of matter and ideas. My first explorations in this work were solely focused on the transformations of material objects. From there I dove into the transformation of the geologic landscape, and the transformation of the human interpretations of and relationship to the place to which we belong. The guidebook seeks to present a way in which to approach a process, to look at things from a new angle, look below and above the surface, and discover its underlying form.

Through the work presented here in this thesis, I have come to develop my own approach working within this world, one that does not see an end result but embraces what can be learned by slowing down and watching the processes at work. This is a methodology that I can see filtering into my future work as a designer and maker, and is in direct contrast with the standards of production within our contemporary society. This world is now defined by the speed of transformations brought about by human development, an increasing acceleration of change in matter evident through almost every facet of landscape, but there is another side to this coin. If we have the ability to control the speed of geologic processes that define our landscape, this also implies that we have the means of decelerating this change, slowing down the process.

This thought returns me to the act of maintenance and care I was first exploring. The changes incurred in the act of stewardship are usually seen as a reversal of material transformation, an attempt to return to an original state, but this is an impossible act. Time does not reverse. The real act of maintenance is the ability to slow and control this change. Part of this stewardship also requires once to embrace that there is material change occurring outside of human action in the vitality of material, and acceptance of the weathering and wear of the matter of our landscape. Bringing this sensibility into the

realm of architecture, I now see buildings as geologic forms. They are not new constructions imparted into the landscape, but a spiked intensity of material transformation. As such, the wear and erosion of the built environment is inevitable, another in a line of geologic transformations. There is a beauty to the marks and scars of use within a building. Architecture is a microcosm of the very same material transformations explored through the Niagara Escarpment within this thesis. One can trace the worn floors of a hallway most traveled, or the polished nature of a brass doorknob, to a rich history of use, and revel in the connections between human and non-human transformations at work.

Another facet of the process of this work was the jump in scales between an immediate small scale interaction with matter, and a larger context, and it's evident throughout the work. My first hand experience of the landscape jumped back and forth between the fast paced cut through of the landscape on my motorbike, to holding on to an individual ridge of stone as I climbed the rock face. This is landscape of aggregation, where individual sediments have compounded together in geologic formation, where disparate sites become connected through networks of human use. Scale has always been a major tool in the representations of the landscape, as explored in the first few chapters, but it also a tool in creating within the landscape, a recognition of the relationship between the part and the whole. What we create is always an amalgamation of individual components, aggregated together and transformed into a larger whole. Designing and making within this world requires a fluctuation between recognizing the romantic beauty of a totalizing thing and a fascination with the inner workings, whether they are evident or not. Despite how monolithic or singular something might seem, there is always a rich underlying form to be explored.

This fluctuation between scales can be infinitely expansive, there is always a larger context or smaller component, it is hard to know how deep to look. My investigations into the Niagara Escarpment only represents a certain range of material and change, tending to focus on the larger and more intense changes evident in the landscape. As such, there are many subtleties to this place that do not find their way into my representations. This landscape is diverse with other life, flora and fauna that have their own relationships with both the human life and the material life of this landscape. The neglect to include these elements is not to suggest they don't have a influence within this place,

or are not equally affected by the influence of other actors, there was simply a desire to emphasize the extremes of the landscape. The conservation of flora and fauna is a common association when we consider the impact of human land-use, and these elements are obviously alive. The focus of this guide to the Escarpment was to experience the seemingly inert material of this place as equally alive and active. I also recognize that our society is not the first people to inhabit and use this landscape. Before the settlement of this land by Europeans, this place was host a whole culture of people who have an entirely different relationship to the land. While this can open a whole new topic of exploration, what can be surmised from this recognition is that the traces of this culture are much more subtle and difficult to observe, a relationship to this place more focus on stewardship an care than use and abundance.

The working title for this thesis project had long been "Unfinished", an embrasure of the fact that everything in this world is left in an unfinished state, open to the further transformations of use, time, re-use, and any of the countless ways in which the materiality or idea of the thing may carry forward. I still embrace this mentality, that there is always a deeper layer to uncover. I consider this guidebook to be a first edition, a suggestion that this representation is incomplete and will continue to develop as I continue to find my way through this landscape, exploring the back-roads and watching the landscape unfold in front of me, or climbing the cliff faces and holding the minuscule details within my hands. I embrace that the process is incomplete.

I cannot foresee the path ahead of me, I can only look around to where I am and trace the roads the lead me here, moving forward with a heightened awareness of the active transformations surrounding me and the understanding of how these transformations may propagate. For now, I think I will return to my workshop, continue to work on my bike, and engage in the process of making and maintaining, listening to the material I am working with, and appreciating the acts of transformations as they unfold in front of me.

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