THEORY OF THE EARTH

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Introduction

WE NEED A NEW THEORY OF THE EARTH. Most people are accustomed to treating the earth as a relatively stable place that they live on and move on. Today, however, this stable ground is becoming increasingly unstable—for some of us more than others.[1]

Due to the widespread use of global transportation technologies, for example, there are now more people and things on the move than ever before in history. Vast amounts of materials are in constant circulation as billions of humans ship plants, animals, and technologies around the world. More than half the world's plant and animal species have now been forced into migration due to climate change.[2] The earth is becoming so mobile that even its glaciers are speeding up. Karl Marx was not thinking of receding glaciers or greenhouse gases when he said "all that is solid melts into air," but that is what is happening.

Geological time used to refer to slow, gradual processes, but today we are watching the land sink into the sea and forests transform into deserts in our lifetimes. We can even see the creation of entirely new geological strata made of plastic, chicken bones, and other waste that could remain in the fossil record and affect geological formations for thousands, even millions, of years to come.[3]

Some human groups are now changing the entire earth so dramatically and permanently that geologists have begun calling our age the

Anthropocene.[4] It no longer makes sense to think of humans as transient occupants moving on a relatively stable earth. Humans are geological, atmospheric, and hydrological agents entangled in all the earth's processes, which are now increasingly in flux. The arrival of the Anthropocene, more than any human historical event, is finally awakening us to the realization that we have never lived on a stable earth. There is significant literature now on climate change and the role of humans as geological agents.[5] Nevertheless, I argue that the most radical import of the Anthropocene is the unpredictable agency and mobility of the earth itself.

In other words, defining the Anthropocene by human historical markers such as agriculture, the industrial revolution, and nuclear bombs should not cause us to lose sight of the most important lesson of our time. *Nature and humans have never been separate systems*. The Anthropocene is not only about humans and what they have done to the earth. It is about the earth and what it is doing to itself through humans.

However, the participation of the earth in climate change in no way negates the need for ethical action on the part of humans.[6] Climate change is a significant problem that demands radical social change. Some historical actors and social systems are particularly responsible for ecological destruction, while others are disproportionally affected by its consequences.[7] But these problems will not be solved using our old paradigm of humans *as separate from* nature. New epochal problems require new philosophical and historical orientations, which is why this book tries to provide a new theory and ethics of the earth for the present.

We tend to think of the world in terms of stasis rather than process. In our zeal to halt our runaway energy consumption, we act as if the goal were to conserve, accumulate, and stabilize energy use. And yet humans, as part of nature, have evolved alongside other life forms in a way that maximizes our collective energy use, flow, and movement.

But it has gotten to the point now that we won't even let our trash degrade. We make things from plastics that last for tens of thousands of years and then bury them underground. Vast islands of plastic are floating in our oceans like quasi-immortal beasts. The net effect of all this is that the planet's *own* energy consumption is *slowing down*, with disastrous consequences.

We continue to think of the earth in terms of stability and conservation, against our best interests. This book is motivated by the advent of increasing

planetary mobility, which pushes us to think about the earth and its history in a whole new way. We need a different history and ethics that will help us to go *with* the flow of planetary energy processes, not *against* them.

TWO PROBLEMS

The Scottish "father of modern geology," James Hutton (1726–1797), published his groundbreaking work, *Theory of the Earth,* more than two hundred and thirty years ago, in 1788. Hutton wrote at a time when humans knew little about geological processes or the age of the earth. The 18th century was a time when geology was still a wide-open field.

Like all new sciences, geology was mostly theoretical at first. Over time, it was separated from philosophy and made into a physical science. As more time passed, other sciences, such as chemistry, physics, biology, and cosmology, had philosophy turn its attention back to them, but geology has still not become a subject of philosophy again.[8] To my knowledge, there is no definitive book-length work on the philosophy of geology in existence today.[9] However, given our present historical situation, I think it is high time for philosophy to rethink the history of the earth.

I wrote this book because I think there are at least two significant problems with our theories and treatments of the earth in the Western tradition.[10] These problems are at the heart of the current ecological crisis, and whether or not we overcome them will play a significant role in the survival of future planetary forms of life.

Stasis

The first problem is that of stasis. Historically, we have tended to view the earth as the stable object par excellence.[11] Many prehistoric mythologies described the earth as the primordial womb or egg from which all things were born and to which they cyclically return.[12] In the ancient Near East and the classical world, most people thought of the earth as the stable center of the universe, a static sphere upon which the whole cosmos turned.[13] For Copernicus, the earth itself was still a relatively unchanging sphere, even if it rotated around the sun. Even Hutton defined the earth as a profoundly slow, uniform, and relatively stable cycle of balanced change.[14]

The theory of plate tectonics, in the 1960s, was the first major geological revolution to question the stability of the earth itself. However, even then,

the near consensus of "uniformitarianism" still described tectonic movements as slow, uniform, and relatively homogeneous. Even when we have acknowledged that the earth moves, we have rarely and only recently begun to acknowledge that the movements of the earth are profoundly and unpredictably affected by, and integrated with, nonlinear and non-geological cosmic, biological, and chemical processes.[15]

We have treated and, in various ways, continue to treat the earth as a kind of unmoved mover.[16] We either act as if our scientific knowledge about the earth is a separate thing, unconditioned by the earth itself, or we think that the earth that existed before us and will exist after us is somehow radically unrelated to us.[17] Most geologists still believe that there are uniform and mechanical laws of geology.[18] Most of us in the West are unconscious uniformitarians. We still act like the earth is largely stable but punctuated by exceptional environmental disasters.[19]

Meanwhile, we have new technologies, including high-precision geochronology and satellite observation, along with detailed data on the earth's temperature, precipitation, river flow, glacier behavior, groundwater reserves, sea level, and seismic activity. We can now directly see that many of the earth's processes are neither as slow nor as constant as we thought.[20] All of our significant predictions about climatic change failed to anticipate how rapid and nonuniform the changes have been so far and how integrated the earth's systems have proven to be.[21] Climate scientists still have no working models to explain sudden "tipping points" in the earth's history, where temperatures suddenly rise 10 to 15 degrees in less than ten years.[22]

Treating the earth as stable, uniformly predictable, linear, or mechanistic allows us to continue to act as if we can pollute it and extract as much as we want from it without significant or uncontrollable consequences. If the earth is just a bunch of mechanical stuff, we can treat it however we want and then mitigate the problems with geo-engineered solutions.[23] So far, however, no such technical fixes exist that are feasible, nor are any likely to appear.[24] As George Bataille once remarked, "All that we recognize as truth is necessarily linked to the error represented by the 'stationary earth.'"[25]

History

The second, related problem is that we have treated the earth as an ahistorical substance lacking genuine novelty.[26] For most of recorded Western

history, humans have thought of the earth primarily as a passive object or as the product of natural, divine, or mechanical laws. The natural sciences frequently explain the movements of the earth according to causes other than the earth itself (laws, forces, principles of uniformity, etc.). Geological histories are thus typically histories written about the earth, not histories written as practices of the earth itself.

The anthropocentric assumption is that only when nature becomes aware of itself in the human being can we say that it becomes genuinely historical and meaningful.[27] Western historians have long believed that only humans can have a history, because only humans are self-conscious and genuinely novel agents.[28] People too often think that the earth's systems simply form the backdrop or stage upon which real history, i.e. human history, occurs.[29]

This anthropocentric narrative is evident from the almost complete historical erasure of earth processes as active contributors to some of the most significant events in Western history. The Holocene glacial retreat, the medieval warm period, and the "little ice age" all played significant active roles in shaping human history. Yet historians frequently leave these events out of the books.[30] Earth processes like volcanoes, fires, hurricanes, earthquakes, and tsunamis also continue to shape history in crucial and active ways.[31]

Even when we acknowledge the activity of the earth, we tend to do so while thinking of the earth as a living and vital subject like ourselves.[32] Unfortunately, this is still a biocentric image of the earth. This image misunderstands inorganic matter as being like organic matter when the historical situation is precisely the opposite. The earth is mostly *not* alive. The earth is part of much larger non-living cosmic cycles and patterns that are not fully captured with the idea of the planet as an organic individual (Gaia).[33] The earth is neither in stasis nor in homeostasis; it is neither mechanistic nor vitalistic; it is neither an object nor a subject. Instead, I argue, it is a turbulent process operating far from equilibrium.[34]

I do not think, as some do, that we have arrived at the "end of nature," in which nothing exists unmixed with human activity.[35] The origins of this idea were well-intentioned but wrong and are now potentially dangerous. The idea was that if we emphasized how significant and widespread human intervention in nature was, that would help us see that nature is a human ethical issue we should take seriously.[36] However, the flawed assumption of

this position is that reality can be otherwise than it is only through human activity.

Unfortunately, the focus on human structures[37] and human-nature hybrids[38] has tended to obscure the profoundly nonhuman indeterminacy of the earth and the cosmos.[39] Not everything is or has been a human hybrid. Human-nature hybrids are only a very tiny portion of nature.

There is today a marked reluctance (whether implicit or explicit) on the part of humanists and social scientists to interrogate the prehuman material conditions of human beings.[40] Critical and social theories always seem to begin and end with human histories rather than with the deep historical prehuman earth as the turbulent and mobile condition that is immanent to humans themselves.[41]

On the one hand, I think that the geosciences need to recognize the historical and social conditions of their claims about the earth. On the other hand, the social sciences and humanities, in turn, need to recognize the geological conditions of their concepts and social structures.[42] Moreover, both need an immanent critique of the earth as their shared material kinetic condition.[43] For all the recent interest in things and objects in the theoretical humanities, there has been ironically little attention given to the earth.[44]

The danger of starting all our histories with classical Greece or early human evolution is that it gives us an inflated sense of our importance. For example, if humans do not take the earth's deep and turbulent history seriously, we are more likely to think that we can dominate or geo-construct it at will.[45] If we want to overcome the nature-culture duality, we need to start taking the cultural history of the earth seriously.[46] Starting our histories with European modernity or even human history only reasserts an implicit division between nature and humans, whatever we might say to the contrary.

I worry that if we think the earth has no genuine historical agency, we may foolishly think that it can have no real effect on human history. Natural scientists often treat earth systems as passive mechanical processes following universal laws, punctuated by random changes. However, we ignore the truly indeterminate movement of the earth at our peril. The deep history of the earth is not a secondary or derivative history merely told by humans about something that they are not. The earth is the immanent material condition of human historicity itself.[47] Humans are the earth and therefore

bear its history. In my view, our ability to see this ought to be the real point of the Anthropocene.

The aim and novelty of my work here in *Theory of the Earth* is to overcome these two problems, the problems of stasis and of history, by inverting their static and ahistorical assumptions. What new philosophy and geology might await us if only we took seriously the earth's genuinely unpredictable power of movement? What would it mean to reconsider human ethics and politics as terrestrial and geological formations?

A HISTORICAL ONTOLOGY OF THE EARTH

The Anthropocene marks a new period in geological history. It forms the limits of a previous epoch and provides the outline of a new one, defined in part by the increasing mobility and instability of the earth.[48] However, the advent of the present is never limited to the present alone. Now that our present has emerged, it is possible, in a way that it was not before, to inquire into the conditions of its emergence and discover something new about the nature and history of the earth's constitutive mobility.[49]

Most of our existing theories assume that the earth is homeostatic, uniform, stable, or capable of being stabilized by life. However, it seems to me that the recent increase in planetary mobility, sudden climatic change, and emergent feedback patterns in earth systems ought to draw our attention to this instability.[50] More importantly, it should draw our attention to a previously hidden dimension of the earth's fundamental instability, only now coming into view: the earth is suddenly proving to be more mobile and eccentric than we thought possible. It's time to start taking this seriously. It's time for, among other things, a different conceptual framework.

The approach of this book is not to write a philosophy *about* the earth, as a distinct substance separate from philosophical practice or humans. Humans and their philosophies are not outside of or separate from the earth's systems. *Theory of the Earth* is also not a "natural philosophy," "cultural history," or "geophilosophy" that studies human thoughts about nature or the earth's relationship to human thought or culture.[51] The focus of this book is instead on the earth *itself as a theoretical practice*.[52] Recent works have done a good job of showing the importance to humans of geological and material processes. *Theory of the Earth* goes one step farther, theorizing these deep geological and material processes themselves.

This book is also not a philosophy of geological science as a human institution.[53] *Theory of the Earth* makes extensive use of contemporary earth and natural sciences but does not critically engage them all using the full repertoire provided by science and technology studies. There are already plenty of books that do this, including my own.[54] My purpose and usage here are entirely different. I cite scientific studies in this book not because I naively accept them as universal truths about the objective facts of nature nor because of so-called science envy.

Instead, *Theory of the Earth* treats the earth sciences as real historical ontological dimensions of our present. Rather than trying to prove that knowledge and nature are endlessly open to human revision and reconstruction, my goal here is to demonstrate the performative reality that the earth itself has produced *as* our scientific knowledge of it. Knowledge is not something we have *about* the earth, as if the earth were something separate from us. Knowledge is something that a region of the earth performatively *does* to itself and with itself.[55] This book is a study of the deep historical and material conditions of this earthly knowledge performance.

Before there were humans, the earth moved independently of what humans thought about it.[56] However, this deep historical earth and its cosmic flows are not radically unrelated to humans. The present is the key to the past because some of the past coexists immanently within the present, within us. We cannot go back and change the earth's deep history, but insofar as it is literally in our bones, we are immanently related to it.[57]

We are not cut off from access to the earth, nor stuck inside our heads. Our heads are not entirely our own—they too belong to the earth. We have access to the earth and the cosmos because we *are* them, albeit only a small region of them.[58] We can, therefore, know something about this deep history precisely because it is the material condition of our very existence. Our bodies and cultures are material memories or traces of the deep history of the cosmos and the earth. This is the earth I am primarily interested in. By this, however, I do not mean that there is only one true objective earth that humans can know absolutely, or even progressively, through science. The earth is neither a single objective reality nor a mere construction of human scientific knowledge.

The methodology of this book is what I call "historical" or "material" ontology. It is historical and material in the sense that our practical inquiry

always begins from somewhere historically particular: the present-day earth. From the specificity of the present,[59] the world *is* a specific way, a way that includes us as a region of that same world.[60] Sensation, knowledge, and the historical present are not separate from the world just because we are humans.

This method is ontological in the sense that our situated descriptions are real aspects or dimensions of reality. My method is neither about the earth in itself, independent of or unrelated to us (naive realism), nor about the earth as it is strictly for us (constructivism). There is no division; we are a region of the real earth itself. Its deep history persists into the present as our immanent deep history. The earth really and performatively constructs itself.

In other words, my question is not "what is the earth like in itself?" or "what is human language, mind, economics, or power like such that it is possible to think of the earth?" My question is, "what are the material and historical conditions of the earth, up to and including us?" Multiple human structures shape contemporary reality. These structures are, in turn, conditioned by other real, terrestrial processes that have been around since long before humans walked the earth.[61] This is what I am interested in: the deep conditions of the present.[62] What is especially interesting is that these conditions have turned out to be more profoundly eccentric than we ever imagined.

This work aims to locate the historical conditions of this present-day eccentric mobility.[63] It is not a universal history but a single situated account, among others, from the vantage of the present. I do not offer any final word or universal theory of the earth.[64] Reality does not mean totality. Human history is open because the movement of the earth is open, not the other way around.

The history of the earth is like a double image. In the well-known images of the old/young woman and the duck/rabbit, both figures are really there in each case. Both descriptions are true and different at the same time. The earth, however, is not just two images but a vast multiplicity of images, and the perceiver of those images is only a region of the image itself, who changes the image by looking at it.[65]

The natural and earth sciences tend to act as if there were one fixed objective world and a single set of universal natural laws about that one nature.[66] However, there are as many natures as there are paths leading from past

to present. All the paths are real, just as each figure in the double images is real. If humans are part of the earth, then so is this book. What are the cosmic and terrestrial conditions for this book and for the body writing it?

Theory of the Earth is both a theory of the earth before humans and, at the same time, a theory of the immanent material conditions of the human itself as a region of the earth's deep history.[67] They are the same ongoing history. The historical ontology of the earth is thus not situated because we are humans but, rather, we are humans because we are a historically situated region of the earth's present.

Theory of the Earth is, therefore, not a theory in the traditional sense of an abstract and universal mental representation of the world. Instead, it is a "theory" in the etymological sense of the Greek word *theōría*, as a "movement, sending, or process." Theory is, therefore, a performative process that describes the structure of the immanent movements that constitute it.[68]

MOVING TOWARD A KINETIC THEORY OF THE EARTH

Theory of the Earth reconsiders the immanent history of the earth from the perspective of the increasingly unstable mobility that defines the Anthropocene. It thus provides a uniquely movement-oriented or "kinetic" theory of the earth. This methodology has two significant consequences.

First, by focusing on the movement of the earth, we are able to avoid problematic theories of the earth as an "active," "generative," "vital," "living," subject or as a "passive," "law-driven," "mechanical," "dead" object. I find it unhelpful to divide, oppose, and choose one side of these binaries against the other.

Matter in motion is the immanent historical condition for both subjective and objective dimensions of the earth. There are different patterns or regimes of motion, but movement has no historical opposite. There is, strictly speaking, nothing in the universe that is not in motion.[69] Even space and time themselves are products of motion—not the other way around.[70]

Motion is neither determined nor random. Patterns of nature are emergent features of a universe in motion. There are no laws of nature before there is a universe in which those laws are emergent features. In short, motion allows us to overcome the dualisms we have projected onto the earth.

Second, focusing on movement allows us to see the material continuity between beings that have historically been thought of as categorically

and ontologically divided. Movement, for example, flows between cosmos, planet, life, humans, animals, plants, rocks, microbes, and so on, down to the smallest vibrations of matter. The movement of matter plays a constitutive role at every level. Rather than project our own life and subjectivity back onto the earth (Gaia), this book begins its history prior to life and the earth to show how they emerged as a material process.

As mentioned previously, the assumptions of stasis and stability are at the core of the Western project.[71] They are at the top of the great chain of being. Our most straightforward definitions of motion, as a transition from point A to B, assume a static background and internally static, self-identical, points "A" and "B." Even when we consider closed cycles, loops, and orbits, we assume a change that merely oscillates between A and B without any fundamental instability in the line itself.[72]

The material basis for this abstract idea of a static background and identical points is the earth. One of the main reasons we have assumed planetary stability in the first place is because most of human history has taken place during a geological epoch of relative climatic stability, the Holocene. In other words, our idea of motion is historically and geologically particular—but we have taken it to be universal.[73] This is the great epochal error of our time.

However, if the earth is a non-uniform and turbulent mover, as I argue, then the movement from A to B is much more like a continual transformation of the whole line AB itself.[74] The earth is not uniform. Its movement is turbulent, unstable, and entangled with the cosmos in ways that we are only now discovering. This has radical and undertheorized consequences for our understanding of the earth and of motion.

A THEORY, HISTORY, AND ETHICS OF THE EARTH

I have organized this book into three major parts covering the theory, history, and ethics of the earth.

Part I: Geokinetics

I propose a new movement-oriented theoretical framework of the earth as an alternative to the traditional ones defined by stability. Instead of thinking about the earth as an object, subject, substance, or essence in isolation from the cosmos, I introduce a process theory of the earth. I call this a

"geokinetic" theory because it treats the hydrosphere, lithosphere, atmosphere, and biosphere as fully integrated earth processes that flow, cycle, and circulate through one another.

The kinetic theory of the earth begins from the contemporary observation that the earth is much more fluid and unpredictable than we ever thought possible. The earth flows. We are now aware of the deep historical coproduction, or "sympoiesis," of all kinds of material flows that we used to study separately. Flows of rock, flows of water, flows of air, flows of life, and even vast cosmic flows of matter are profoundly interdependent processes. What if we retold the history of the earth from this perspective?

In my previous books, I began my historical ontologies with early human prehistory in order to study the longue durée of the emergence of politics, ontology, art, and science in the Near Eastern and Western traditions. In all of these works, I attempted to show the hidden and constitutive primacy of movement and matter. Although I started with human history, the goal was to show the transversal historical patterns of motion that moved through human and nonhuman processes alike.[75]

But where did these patterns of motion come from in the first place, if they were not the sole invention of human beings? *Theory of the Earth* is an answer to this question. What I call "geokinetics" is the study of the deep historical and material conditions for the emergence of, among other things, human politics, ontology, art, and science. In my movement-centered philosophy, I named my study of these areas, "kinopolitics," "kinology," "kinesthetics," and "kinemetrics" to emphasize the primacy of movement. A central thesis of this book and of "geokinetics" is that humans and their culture are continuous with cosmic and terrestrial processes of kinetic dissipation (see Table I.1).[76]

Human culture is only a regional and specific expression of what nature has already been doing in a general sense for a very long time. I realize that this is a big claim, and I do not expect most readers to agree with it immediately. But if it is accurate, it has enormous consequences.

Part II: History of the earth

Another consequence of my movement-oriented perspective is that it makes possible a new history of the earth. Against mechanical and vitalistic theories, I argue that the history of the earth is about the indeterminate dissipation of energy through four patterns of motion.

TABLE I.1 Theory, form, content, and patterns of motion

THEORY	FORM	CONTENT	HISTORICAL PATTERNS
Kinopolitics	Relation	Border	territorial, political, juridical, economic
Kinology	Modality	Surface	space, eternity, force, time
Kinesthetics	Quality	Image	function, form, relation, difference
Kinemetrics	Quantity	Object	ordinal, cardinal, intensive, quantum
Geokinetics	Nature	Earth	mineral, atmospheric, vegetable, animal

Each of these patterns is associated with the rise and prevalence of a different planetary structure in the earth's history. Minerals emerged through a centripetal motion, the atmosphere through a centrifugal motion, plants through a tensional motion, and animals through an elastic motion. In each historical eon, a new regime rises to predominance, while all the older ones persist and mix with it. Now, in the 21st century, we find our contemporary earth at the intersection of all four major historical regimes. These are the limits not of what the earth can do, but rather of what the earth has done so far (see Table I.2).

The earth is not just a rock. In fact, a rock is not just a rock. The profound uncertainty of the earth's systems today prompts us to completely reconsider our previous categories, substances, teleologies, and hierarchies. We need new definitions and histories for these new hybrid processes of mingled minerals, atmospheres, plants, and animals. We need a process theory of the earth based on patterns, not substances.

The conditions of the present are not locatable in the present alone nor in human history alone. Deep history, in all its uneven flux, is the key to understanding our planetary present. The past does not go away but persists and coexists, to varying degrees, in the present. In other words, there are humans only because there are rocks.[77]

A new kinetic history of the earth will help us to see more fully the present earth that we *are* and how to live better on it. This history is critical if we are to move away from our current tendencies toward mechanism,

TABLE 1.2 Patterns of motion

	CENTRIPETAL	CENTRIFUGAL	TENSIONAL	ELASTIC
Politics	territorial	political	juridical	economic
Ontology	space	eternity	force	time
Art	function	form	relation	difference
Science	ordinal	cardinal	intensive	quantum
Nature	mineral	atmospheric	vegetable	animal

vitalism, uniformitarianism, geo-constructivism, and homeo*stasis*. This book is an immanent critique of our moving earth.

Part III: The Kinocene

The third consequence of the kinetic theory of the earth is that it will provide us with a new perspective on contemporary life—what I am calling the "Kinocene." There are as many Anthropocenes as there are ways to think about the present. That is a good thing.[78] So without wishing to negate the others, I would like to propose the addition of one more. The Kinocene is an age defined by the earth's post-Holocene return to itself as an increasingly mobile, turbulent, and dynamically entangled process.

This transition is historically gendered, raced, economic, and asymmetrical, and in our examination of this transition, we must also think about the real possibility of human extinction, something we want to avoid. But it is also crucial to recognize that the Kinocene would be nothing without the contributions of the earth itself. These include fossil fuels, metallurgic compounds, positive climate feedback processes, hydrologic conditions, and the plants and animals that also transform the climate.[79]

Of all the names for our geological epoch, we should not forget the earth itself as a constitutive part of this transition.[80] The twin narratives of humans as earth-destroyers and as earth-savers are two parts of the same anthropocentric dilemma.[81]

By thinking only about our own movements of energy expenditure and conservation on a "relatively static earth," we have failed to see ourselves as part of the larger cosmic and terrestrial drama of increasing flow rate and mobility. By damaging the earth's dissipative processes (especially the biosphere), humans have slowed down the kinetic movement of energy throughout the planet. Fossil fuel capitalism has increased human energy consumption, but only at the cost of decreasing planetary energy consumption by much more.

I rewrite natural and human history from the broader perspective of movement. This offers a new ethical orientation to our "Kinocene" present and to the cosmos. My thesis is that, if humans want to survive, then the most geohistorically likely way forward is to contribute to the earth's massive process of energy expenditure, including land fertility, biodiversity, and climate stability. This shift requires us to reject our current biocentric emphasis on conservation in favor of expenditure and flux.

Today, unprecedented increases in the earth's unpredictable mobility prompt us to reconsider all our planetary paradigms. These changes challenge us to reconsider the nature of nature as well as the deep history of the earth. Perhaps most importantly, the earth's turbulent mobility forces us to rethink our ethical relationship to one another, the planet, and the cosmos at large. The Kinocene is calling us to become what we are: the earth.[82]

Notes

Introduction

1. See chapter 15 of this book for the contemporary political consequences of the earth's instability.

2. Craig Welch, "Half of All Species Are on the Move—And We're Feeling It," *National Geographic*, 27 April 2017. https://news.nationalgeographic.com/2017/04/climate-change-species-migration-disease/

3. For a review of the various "-cene" designations and their shortcomings and strengths, see Jairus Grove, *Savage Ecology: War and Geopolitics at the End of the World* (Durham: Duke University Press, 2019).

4. Paul Crutzen and E.F. Stoermer, "The 'Anthropocene,'" *Global Change Newsletter* (2000) 41: 17–18. The rhetoric of the Anthropocene often makes it sound like all humans are equally responsible and equally vulnerable when they are not. See Dipesh Chakrabarty, "Postcolonial Studies and the Challenge of Climate Change," *New Literary History* 43, no. 1 (Winter 2012): 1–18.

5. See Kathryn Yusoff, "Anthropogenesis: Origins and Endings in the Anthropocene," *Theory, Culture & Society* 33, no. 2 (2016): 3–28; Timothy LeCain, "Against the Anthropocene: A Neo-Materialism Perspective," *International Journal for History, Culture and Modernity* 3, no. 1 (2015): 1–28; Jason W. Moore, *Anthropocene or Capitalocene? Nature, History, and the Crisis of Capitalism* (Oakland: Pm Press, 2016); Astrida Neimanis, Cecilia Åsberg, and Johan Hedrén, "Four Problems, Four Directions for Environmental Humanities: Toward Critical Posthumanities for the Anthropocene," *Ethics & the Environment* 20, no. 1 (2015): 67–97; Eyal Weizman and Fazal Sheikh, *The Conflict Shoreline: Colonization as Climate Change in the Negev Desert* (Göttingen: Steidl, 2015); McKenzie Wark, *Molecular Red: Theory for the Anthropocene* (New York: Verso, 2016); Jan Zalasiewicz, Mark Williams, Will Steffen,

and Paul Crutzen. "The New World of the Anthropocene," *Environmental Science and Technology* 44, no. 7 (Feb 2010): 2228–31; Arianne Conty, "The Politics of Nature: New Materialist Responses to the Anthropocene," *Theory, Culture & Society* 35, no. 7–8 (Oct 2018): 73–96; Heather Davis and Etienne Turpin, *Art in the Anthropocene: Encounters Among Aesthetics, Politics, Environments and Epistemologies* (London: Open Humanities Press, 2015); Richard Grusin, *Anthropocene Feminism* (Minneapolis: University of Minnesota Press, 2017); Adam Bobbette and Amy Donovan, eds., *Political Geology: Active Stratigraphies and the Making of Life* (London: Palgrave Macmillan, Cham, 2019).

6. See chapter 15 of this book for more on the ethics of the Kinocene.

7. Kathryn Yusoff, *A Billion Black Anthropocenes or None* (Minneapolis: University of Minnesota Press, 2018); Dipesh Chakrabarty, "The Climate of History: Four Theses." *Critical Inquiry* 35, no. 2 (Winter 2009): 197–222; Andrew Baldwin, *Life Adrift: Climate Change, Migration, Critique* (London: Rowman & Littlefield International, 2017).

8. "For most of the last two centuries, with some exceptions, social thought has not given serious attention to the earth sciences. While the social sciences and humanities have conversed productively with biology, linguistics, psychoanalysis, complexity studies and even mathematics, the geosciences seem to have offered less fertile ground for engagement." Nigel Clark and Yasmin Gunaratnam, "Earthing the Anthropos? From 'socializing the Anthropocene' to geologizing the social," *European Journal of Social Theory* 20, no. 1 (Aug 2016): 146–63; 147. See also Nigel Clark, *Inhuman Nature: Sociable Life on a Dynamic Planet* (London: Sage, 2011).

9. For a literature review of the limited work done on the philosophy of geology, see Claude C. Albritton, "Philosophy of Geology," in *General Geology. Encyclopedia of Earth Science* (Springer, Boston, MA: 1988). https://link.springer.com/referenceworkentry/10.1007%2F0-387-30844-X_45

10. Ecofeminists have been writing about this for a long time. See Carolyn Merchant, *The Death of Nature: Women, Ecology, and the Scientific Revolution* (San Francisco: Harper One, 2008).

11. "With some half a century of developments in the geosciences converging on the idea of earth systems with multiple possible operating states, the very nature of 'the ground' needs major overhauling." Clark and Gunaratnam, "Earthing the Anthropos?," 159."Here Arendt rediscovers Heidegger's analyses that we cited in the first part of this present work: The Earth viewed from outer space is no longer the 'earth on which man lives,' it is no longer the homeland (Heimat). In the same way that for Husserl, the Earth is not a heavenly body in motion among many others but first and foremost a 'ground,' it 'does not move and does not rest,' since 'only in relation to it are movement and rest given as having their sense of movement and rest.' It is in this sense that the Earth is the 'arche-dwelling,' the 'ark of the world' that nothing can replace and that we reference and intellectually give as an answer each time we imagine that the Moon or an airplane could constitute another foundational basis or 'ground.' 'Arche-dwelling,' 'homeland,' 'habitat,' for Arendt,

Heidegger, and Husserl, the thesis is clear: humanity is under condition of the Earth, understood as that which can't be reduced to an object, or a subject—in other words, a transcendental nonobjective form." Frédéric Neyrat, *The Unconstructable Earth: An Ecology of Separation*, trans. Drew S. Burk (New York: Fordham University Press, 2018), 170."In a certain way, Arendt's concrete transcendental is neither concrete nor historical enough, just as Husserl's arche-dwelling does not take into account the fact that the Earth has not always been for humanity. And Heidegger failed to make a cosmic event out of the 'homeland.' In order to concretize the transcendental of the Earth, we must not consider it as an object (that we can capture from outer space thanks to a camera) or as a quasi-subject (such as Gaia, a rather local expression of naturing nature) but rather as a *trans-ject* or perhaps more specifically and simply a *traject*, as an interval spanning space-time. In fact, the Earth is not merely a 'ground' upon which we stand, not simply a planet surrounded by a moon and artificial satellites; it's also a long-term event that began 4.54 billion years ago, the historical trajectory of an entity that will disappear in several billion years." Neyrat, *The Unconstructable Earth,* 171.

12. See Thomas Nail, *Being and Motion* (Oxford: Oxford University Press, 2018), chapter 14.

13. See Nail, *Being and Motion,* chapters 17–20.

14. See Stephen J. Gould, *Time's Arrow, Time's Cycle: Myth and Metaphor in the Discovery of Geological Time* (Cambridge: International Society for Science and Religion, 2007).

15. Vladimir Ivanovich Vernadsky, *The Biosphere*, eds. David B. Langmuir and Mark A. McMenamin (New York: Springer Science, [1998] 2013)."As historian John Brooke recounts, the years 1966–73 alone saw the emergence of four major new perspectives on the dynamics of the earth: (1) the confirmation of the theory of plate tectonics; (2) a new appreciation of the role of extra-terrestrial impacts in shaping earth history; (3) the thesis that evolution is punctuated by catastrophic bursts linked to major geophysical events; and (4) the beginnings of the idea that the different components of the earth function as an integrated system—as expressed in the Gaia hypothesis and earth systems theory. Look beyond the immediacy of Anthropocene debates into the encompassing field of contemporary geosciences and we are soon reminded that such processes as cyclical changes in the planet's orbit and axis, the openness of the earth to solar radiation and astronomical events, the magma-driven movements of tectonic plates, the stratal composition of the earth's crust, the deep structures of biological life and functioning of the biosphere continue to set the broad parameters for the functioning of the earth system." Clark and Gunaratnam, "Earthing the Anthropos?," 156."If we take seriously evidence from the earth sciences that the main driver of the Mid-Holocene Climatic Transition was variability in the earth's axis and orbit, then there may indeed be a trace of 'universality' woven into the fabric of human cultural-historical difference." Clark and Gunaratnam, "Earthing the Anthropos?," 157."Neocatastrophism has enlivened modern geo-science by dispatching the belief that the planet took on its current shape only through the

gradual and continuous operation of familiar processes like erosion and sediment buildup. The new geology lets into the picture abrupt die-offs and bursts of species formation, climatic and geomorphological upheavals, and high-speed collisions with extraterrestrial bodies." Jeremy Davies, *Birth of the Anthropocene* (Oakland, CA: University of California Press, 2018), 9."Neocatastrophism has introduced us to a whole list of geophysical forces—asteroids, ocean currents, volcanoes, and the like—that, under the right circumstances, can suddenly come to exert a much greater and more destabilizing influence than usual on the workings of the earth system." Davies, *Birth of the Anthropocene,* 10.

16. Aristotle, *Physics*, trans. Joe Sachs (New Jersey: Rutgers University Press, 2001), Book VIII, page 188.

17. Several contemporary thinkers have conceived of a world "without us" (Alan Weisman, *The World Without Us* [New York: HarperCollins, 2014]; Eugene Thacker, *Cosmic Pessimism* [Minneapolis: Univocal, 2015]), or an "earth after us" (Jan Zalasiewicz, *The Earth After Us: What Legacy Will Humans Leave in the Rocks?* [Oxford: Oxford University Press, 2014]), or an "ancestral" earth revealing a "world where humanity is absent" (Quentin Meillassoux, *After Finitude: An Essay on the Necessity of Contingency* [London: Bloomsbury, 2017])."This fiercely unilateral conception maintains the divide between 'us' and the 'world,' between the human 'subject' and the 'ancient' realities that can only be accessed by pure science." Neyrat, *The Unconstructable Earth*, 172.

Meillassoux is right that the past-being, before humans, is not related to humans (who did not exist yet). Nevertheless, this does not mean that our thoughts about this being are unrelated to that past-being. The past makes human thought and existence possible. This is not a non-relation but rather an asymmetrical relation.Furthermore, by making thought and being non-relational, Meillassoux is anthropocentric and rationalist, because he says that nature cannot think. Nature, however, is already mathematical and thoughtful to some degree. Humans are not a break with nature; they are a regional expression of processes already present in nature.

Meillassoux says that humans are mere matter, but that we are unique matter that is radically different than what nature has. However, how does such a break occur in matter? It cannot.

18. Uniformitarianism still holds sway over many geologists and remains a matter of lively debate. See Marcia Bjornerud, *Timefulness: How Thinking Like a Geologist Can Help Save the World* (New Jersey: Princeton University Press, 2018), 61.

19. Bjornerud, *Timefulness,* 61.

20. Bjornerud, *Timefulness,* 63. See also John L. Brooke, *Climate Change and the Course of Global History: A Rough Journey* (New York: Cambridge University Press, 2014); Mike Davis, "Cosmic Dancers on History's Stage? The Permanent Revolution in the Earth Sciences," *New Left Review* 217 (1996): 48–84. "One of the crucial breakthroughs, hinging on a wealth of empirical evidence and a deepening appreciation of the way feedback operates in complex systems—was the discovery that climate change

in the past has often been abrupt rather than incremental." Clark and Gunaratnam, "Earthing the Anthropos?," 153.

21. "Just think, as I write this in 2008, more than one thousand of the world's best climate scientists have worked for seventeen years to forecast future climates and have failed to predict the climate of today. I have little confidence in the smooth, rising curve of temperature that modelers predict for the next ninety years. The Earth's history and simple climate models based on the notion of a live and responsive Earth suggest that sudden change and surprise are more likely." James Lovelock, *The Vanishing Face of Gaia: A Final Warning* (Vancouver: Langara College, 2013), 7.

22. Peter D. Ditlevsen and Sigfus J. Johnsen, "Tipping Points: Early Warning and Wishful Thinking," *Geophysical Research Letters* 37, no. 19 (October 2010). DOI: 10.1029/2010GL044486

23. Neyrat, *The Unconstructable Earth,* 41.

24. See Bjornerud, *Timefulness,* chapter 6, for a full description and critique of each technological fix.

25. Georges Bataille, "Corps célestes," *Oeuvres Complètes*, *Volume* 1 (Paris: Gallimard, 1970), 516.

26. "Where did we ever get the strange idea that nature—as opposed to culture—is ahistorical and timeless? We are far too impressed by our own cleverness and self-consciousness. . . . We need to stop telling ourselves the same old anthropocentric bedtime stories." Steve Shaviro, *Doom Patrols: A Theoretical Fiction about Postmodernism* (New York: Serpent's Tail, 1997).

27. "One can have interesting thoughts about the long intervals between such revolutions, about the more profound revolutions caused by alterations of the earth's axis, and also those caused by the sea. They are, however, hypotheses in the historical field, and this point of view of a mere succession in time has no philosophical significance whatever." Georg Wilhelm Friedrich Hegel, *Hegel's Philosophy of Nature: Being Part Two of the Encyclopedia of the Philosophical Sciences* (1830), translated from Nicolin and Pöggeler's edition (1950) and from the *Zusätze* in Michelet's text (1847) by A.V. Miller (Oxford: Oxford University Press, 2004), 283.

28. See Immanuel Kant, "Idea for a Universal History from a Cosmopolitan Perspective," in *Toward Perpetual Peace and Other Writings on Politics, Peace, and History* (Yale University Press, 2008).

29. "One reason for this may be that our planet—as presented by the scientific disciplines specializing its study—has appeared to change so gradually that it can largely be taken for granted as the static backdrop of social existence. Perhaps more importantly, in its very obduracy, the earth has generally signified inertia and stability, so that any association with social life has usually been taken to imply a limitation or closure of the possibilities open to collective social action." Clark and Gunaratnam, "Earthing the Anthropos?," 147.

30. See Benjamin Lieberman and Elizabeth Gordon, *Climate Change in Human History: Prehistory to the Present* (London: Bloomsbury Academic, 2018).

31. See Clark, *Inhuman Nature*; Karen Bosworth, "Thinking Permeable Matter through Feminist Geophilosophy: Environmental Knowledge Controversy and the Materiality of Hydrogeologic Processes," *Environment and Planning D: Society and Space* 35, no. 1 (2017): 21–37.

32. See Isabelle Stengers and Andrew Goffey, *In Catastrophic Times: Resisting the Coming Barbarism* (London: Open Humanities Press, 2015), 44. "The intrusion of Gaia. It is a matter here of thinking intrusion, not belonging." Stengers and Goffey think of Gaia as a subject distinct from humans that intrudes on them. This assumes an anthropocentric division.For similar vitalist and subjectivist theories of the earth, see Bruno Latour, *Facing Gaia: Eight Lectures on the New Climatic Regime* (Polity: United Kingdom, 2017); Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham: Duke University Press, 2010); Isabelle Stengers, "Autonomy and the Intrusion of Gaia," *South Atlantic Quarterly* 116, no. 2 (2017): 381–400.

33. I agree with much of Gaian systems theory and think it pushes in the right direction on many fronts. In particular, Gaia theory's emphasis on the earth as a non-static and non-stable planet is key. I support "a perspective in which one inhabits not a static environment," as Dorian Sagan puts it. However, Gaian theory, as Sagan admits, "has occasionally served as a platform for a New Age joy slide into the muck of planetary personification. If biocentrism is currently a prime grove for the culling of noble fictions, then certainly the tree of Gaia, at the very best, bears some of the most tempting fruit" (Dorian Sagan, *Cosmic Apprentice: Dispatches from the Edges of Science* [University of Minnesota Press, 2013], 176). My main concern is with those who personify the earth and think of Gaia from a narrowly biocentric perspective.

34. See Thomas Nail, *Lucretius I: An Ontology of Motion* (Edinburgh: Edinburgh University Press, 2018); Thomas Nail, *Lucretius II: An Ethics of Motion* (Edinburgh: Edinburgh University Press, 2020).

35. "In this actual world there is . . . not much point in counterposing or restating the great abstractions of Man and Nature," wrote the cultural theorist Raymond Williams. "We have mixed our labour with the earth, our forces with its forces too deeply to be able to draw back and separate either out." Or, as the geographer Neil Smith asserted, surveying the cumulative effects of the ever-expanding forces of production: "No God-given stone is left unturned, no original relation with nature unaltered, no living thing unaffected." Quoted in Clark, *Inhuman Nature*, 8. See also Bill McKibben, *The End of Nature* (New York: Random House, 2006).

36. Clark, *Inhuman Nature*, 7. See Andrew Baldwin and Giovanni Bettini, eds., *Life Adrift: Climate Change, Migration, Critique* (London: Rowman & Littlefield International, 2017), for an excellent study of the "climate refugee."

37. See Rosi Braidotti, *The Posthuman* (Oxford: Polity Press, 2012).

38. Excellent work has been done on human-nature hybrids. See Bruno Latour, *We Have Never Been Modern* (Cambridge: Harvard University Press, 1993); Donna Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham: Duke University Press, 2016); Eduardo Kohn, *How Forests Think: Toward an Anthropology Beyond the Human* (Berkeley: University of California Press, 2013). However, not

much has been said about nature-nature hybrids before there were humans. For all their talk of post-humanism, the humanities have been extremely hesitant to examine a time before the human."In a weird resonance with critiques by Donna Haraway, Bruno Latour, Philippe Descola, Jane Bennett, William Connolly, and others who have effectively demonstrated that there is no 'nature' external to humans, ecomodernists have conceded the point, declaring the need to invent precisely the human/non-human or culture/nature binary of modernist social theory via an unprecedented scale of global governance." Jarius Grove, "The Geopolitics of Extinction," in *The Anthropocene to the Eurocene in Technology and World Politics*, ed. Daniel R. McCarthy (New York: Routledge, 2018), 204–33; 213.

39. See Stacy Alaimo and Susan J. Hekman, eds., *Material Feminisms* (Indiana: Indiana University Press, 2008), Introduction. "If we acknowledged this energetic subsidy as lending of not just materials but capacities for the geologic within hominid corporeality, then the location of agentic power shifts. When we understand our being is mineralogical as well as biological, and that we already possess a capacity for the geologic, then the specific constellations of where and how we locate responsibility changes." "There can be no human that is other to these forces, because the human is an expression of the various constellations of this minerality. There is no telos or origins to this experimentation and mutation—it is just that." Yusoff, "Anthropogenesis," 12; 21–22."Geometry, in effect, is the science of what is absolutely objective—i.e., spatiality—in the objects that the Earth, *our* common place, can indefinitely furnish as our common ground with other men. But if an objective science of earthly things is possible, an objective science of the Earth itself, the ground and foundation of these objects, is as radically impossible as that of transcendental subjectivity. The transcendental Earth is not an object and can never become one. And the possibility of a geometry strictly complements the impossibility of what could be called a '*geology,*' the objective science of the Earth itself." Jacques Derrida, *Edmund Husserl's Origin of Geometry: An Introduction* [1962], trans. J. P. Leavey Jr. (Lincoln: University of Nebraska Press, 1989), 38 (emphasis in original).

40. "In summary, we suggest that one of the main provocations of contemporary earth science—within and beyond the Anthropocene thesis—is to push critical social thought's own insistence on locatedness, positionality and contextualization to its logical conclusion. From this perspective there are no societies that do not bear the trace of the geoclimatic conditions in which they emerged, no social formations that are not in some significant way shaped by the geological formations in which they are embedded, no cultures that are impervious to the flows or strata they tap into." Yasmin Gunaratnam and Nigel Clark, "Pre-Race Post-Race: Climate Change and Planetary Humanism," *Darkmatter* 9, no. 1 (2012). Available at: http://www.darkmatter101.org/site/2012/07/02/pre-race-post-race-climate-change-and-planetary-humanism/

41. Michel Foucault, Giorgio Agamben and others remain focused on human history. See Neyrat, *Unconstructable Earth*.

42. Clark and Gunaratnam, "Earthing the Anthropos?," 159.

43. See Nail, *Being and Motion*, chapter 4, for the theory of the kinetic transcendental.

44. Clark, *Inhuman Nature*, 11.

45. "The earth is characterized as living or quasi-living not to emphasize the organic interconnection between everything on earth, but to take into consideration the surplus that results from any project of technological dominance. It's precisely this surplus that makes the earth into a wholly full body—not a body filled with matter or organs, but with potentialities that no system—whether technical or living, artificial or organic—is able to contain." Frédéric Neyrat, "Eccentric Earth," *Diacritics* 45, no. 3 (2017): 4–23.

"No longer a static, rigid taxonomy; it becomes protean, upwelling, a vital force erupting forth, proliferating, unpredictable, and metastasizing. We may actually be facing the most extraordinary frontier—the frontier of nature as an ultimately creative, responsive, and transformative power, which regards human beings simply as a trace that is overcome and left behind." Michael Bess, "Deconstructing Nature," *Letters* 8, no. 1 (Fall 1999): 2.

"The long-held barriers between nature and culture are breaking down. It's no longer us against "Nature". Instead, it's we who decide what nature is and what it will be." Christian Schwägerl, *The Anthropocene: The Human Era and How It Shapes Our Planet* (Santa Fe: Synergetic Press, 2014).

46. The unpredictable earth is what Frederic Neyrat calls the *traject*. "As unconstructable traject, the earth can neither be controlled nor dominated. From its dark origins to its glacial ends, the earth will always love to hide." See Neyrat, "Eccentric Earth," 11.

47. Neyrat calls this the "concrete transcendental" ("Eccentric earth," 9). "This proto-anthropogenic subject whose death is signaled through this epochal shift heralds a new philosophy in which the earth returns not to ground the figure of thought, but as a condition of its labour; thought must continually move through and with the inhuman, before, during and after subjectivity. So there is a shift in register from humanist thought, which characterized the inhuman as a dehumanizing force, to a concept of the inhuman as materially constitutive of the possibilities of life." Yusoff, "Anthropogenesis," 7.

48. The increasing mobility of the earth is not an "epochal concept" of "our era" in a univocal or exclusive sense. It is only one of the most popular and powerful features of the present, among others. See Gabriel Rockhill, *Interventions in Contemporary Thought: History, Politics, and Aesthetics* (Edinburgh: Edinburgh University Press, 2016), 51–52."Such an ontological framing draws upon the new geoscience notion that the earth system has, at any stage, the potential to shift into other, not yet actualized states—though we should be mindful that, as a philosophical or cultural thematic, this is an extrapolation from scientific findings that may exceed the concerns or priorities of these sciences themselves." Clark and Gunaratnam, "Earthing the Anthropos?," 159.

49. We cannot know everything about the earth, but we can learn something new about it.

50. See Lovelock, *The Vanishing Face of Gaia*, 7, on climate change feedback and unpredictability.

51. Geophilosophy is not nearly deeply historical enough. Deleuze's geophilosophy only goes back to the Greeks. See Gilles Deleuze, *What is Philosophy?* (New York: Columbia University Press, 1994), 87–89. There is thus a kind of implicit anthropocentrism in geophilosophy. A true geophilosophy would start with the earth before humans and with the cosmos before the earth. See Gasché Rodolphe, *Geophilosophy: On Gilles Deleuze and Félix Guattari's "What Is Philosophy?"*; Anna Hickey-Moody and Timothy Laurie, "Geophilosophies of Masculinity: Remapping Gender, Aesthetics, and Knowledge," *Angelaki* 20, no. 1 (Mar 2015): 1–10; Gary Shapiro, "Nietzsche on Geophilosophy and Geoaesthetics," in *A Companion to Nietzsche*, ed. Keith A. Pearson (Chichester: Wiley-Blackwell, 2009), 707–31.

For an excellent survey and critique of the geophilosophy literature (Lefebvre, Kant, Husserl, Hegel, Bataille, Derrida, Deleuze), I can do no better than Nigel Clark has already done in chapter 1 of *Inhuman Nature*.

52. "If we are unable to enclose this involvement against an outside that purportedly has no language, and if the subject of interpretation is consequently also its object, then we are within the perverse desires of a geomancy, a geo-logy, whose figurations are strangely 'fitting.' Could the generalized origin of re-presentation, the hiccough of this subject/object shimmering as the 'always already not yet,' be thought as the Earth's own scientific investigations of itself?" Vicki Kirby, *Quantum Anthropologies: Life at Large* (Durham and London: Duke University Press, 2011), 34.

53. The study of human knowledge is important, but that is not the subject of this book. See Bruno Latour, *Politics of Nature: How to Bring the Sciences into Democracy* (Cambridge: Harvard University Press, 2009). Latour has not given nearly enough attention to nonhuman or prehuman networks. Graham Harman acknowledges this as well. Despite the hypothetical embrace of other-than-human autarchies, "only the most flickering hints of networks devoid of human involvement" can be found anywhere in the Latourian corpus. Graham Harman, *Prince of Networks: Bruno Latour and Metaphysics*. (Melbourne: re.press, 2009), 124."This may be more than an accidental oversight. If it is not permitted for human interlocuters to speak of non-human worlds without documenting their own role in the description, translation and inevitable re-composition of these realities, then it is hard to imagine how a domain fully independent of the human can legitimately receive attention as anything more than an abstract possibility. To engage substantively with an inhuman region in and for-itself would by definition repudiate the entanglement that attends all such intervention, according to Latour's logic, thereby constituting an act of purification of the human presence. And yet, as I suggested in the introduction, if we pursue the injunction of actor-network theorists to follow the things themselves, it is inevitable that sooner or later we are going to be drawn into realms which precede, antecede or otherwise exceed human influence—as the

current understanding of issues like global climate change makes all too apparent." Clark, *Inhuman Nature*, 37.

On the possibility and status of doing a nonhuman philosophical geology and the question of asymmetrical relations between past and present See Ian Hodder and Gavin Lucas, "The Symmetries and Asymmetries of Human-Thing Relations. a Dialogue," *Archaeological Dialogues* 24, no. 2 (2017): 119–37.

54. Thomas Nail, *Theory of the Object* (Oxford: Oxford University Press, under review). See also Daniel Lee Kleinman and Kelly Moore, eds., *Routledge Handbook of Science, Technology, and Society* (New York: Routlege, 2019).

55. See Nail, *Lucretius II*.

56. The earth also continues to move today in ways that are not affected by what humans think or do.

57. There is no symmetry between the present and the past. However, that does not mean that things are radically unrelated. Ontology is not flat and symmetrical but curved and topologically heterogeneous. There can be no flat ontology in an irreversibly entropic cosmos. See Ilya Prigogine and Isabelle Stengers, *Order Out of Chaos* (New York: Verso, 2018); Ilya Prigogine, *From Being to Becoming* (San Francisco: Freeman, 1980).Graham Harman is right that matter is related to itself without us. However, it does not follow that a) we are unrelated to the past (which supports and conditions and persists through us) or b) that there is an irreducible, non-relational, vacuum-sealed, withdrawn essence hiding in every object. It just means that there are regional relations that occur within larger pedetic, entropic, or asymmetrical relations between the past and present of all objects. Harman calls this a "non-relation," but it is just a pedetic or asymmetrical relation.The problem with vitalism is that it treats all relations as having an equally flat ontology, as a democracy of things. However, this provides no tools for helping us to think about new things, or for politically clarifying the asymmetrical relations between and among things and humans. Vitalism poses a political problem because it assumes the equality of agency. Vitalism is also an ontological problem because it does not account for changing relationships of dependence.

58. "If this virtual 'geometry' requires no outside to access the human—for the genesis of humanness would be an internal articulation of and within itself—then, by implication, 'the human' would not be bound and restricted by some special lack of access to that same generative unfolding. 'The human' would certainly be a unique determination, yet 'one' whose cacophonous reverberations would speak of earthly concerns." Kirby, *Quantum Anthropologies*, 39.

59. "We are at a moment, I have been arguing, when ongoing developments in the earth sciences, some recent turns in philosophical inquiry, and a range of ethico-political issues arising out of our ecological predicament are gathering over the theme of an autonomous, dynamic, self-generating cosmos." Clark, *Inhuman Nature*, 211.

60. This is what Merleau-Ponty called the "flesh." See Maurice Merleau-Ponty, "Eye and Mind," in *The Primacy of Perception: And Other Essays on Phenomenological Psychology, the Philosophy of Art, History and Politics* (Chicago: Northwestern

University Press, 2015). See also Maurice Merleau-Ponty, *The Visible and the Invisible: Followed by Working Notes* (Evanston: Northwestern University Press, 1997).

61. Kathryn Yusoff challenges fellow critical social thinkers to "use the Anthropocene as a provocation to begin to understand ourselves as geologic subjects, not only capable of geomorphic acts, but as beings who have something in common with the geologic forces that are mobilised and incorporated." Kathryn Yusoff, "Geologic Life: Prehistory, Climate, Futures in the Anthropocene," *Environment and Planning: Society and Space*. 31 (2013): 779–95; 781.

62. There are several major historical conditions of the present. For a closer look at each of them see my following books: Thomas Nail, *The Figure of the Migrant* (Stanford University Press, 2015); Thomas Nail, *Theory of the Border* (Oxford: Oxford University Press, 2016); Thomas Nail, *Theory of the Image* (Oxford: Oxford University Press, 2019); Nail, *Theory of the Object*; and Thomas Nail, *Being and Motion* (Oxford: Oxford University Press, 2018).

63. For more on the methodology of kinetic philosophy see Nail, *Being and Motion*.

64. See Nail, *Being and Motion,* for a full description of the historical method. Or, as the historian Christophe Bonneuil puts it: "Anthropocene science offers 'a single grand narrative from nowhere, from space or from the species.'" Christophe Bonneuil, "The Geological Turn: Narratives of the Anthropocene," in *The Anthropocene and the Global Environmental Crisis: Rethinking Modernity in a New Epoch*, eds. Clive Hamilton, Christophe Bonneuil, and François Gemenne (London: Routledge, 2015), 29. "Anthropocene discourses will need to embrace 'a plurality of narratives from many voices and many places'" to avoid a new master narrative. Bonneuil, "The Geological Turn," 29.

65. See Karen Barad, *Meeting the Universe Halfway* (Durham: Duke University Press, 2007).

66. See Barad, *Meeting the Universe Halfway,* and Kirby, *Quantum Anthropologies*, for a critique of the notion of a single objective nature.

67. See Nail, *Lucretius II*. If the cannot be "false" or "unreal" to itself, then "all perceptions are true," just as Lucretius says.

68. Theory, however, also has its own material kinetic process of inscription. The study of this process of inscription warrants its own independent investigation. See Nail, *Being and Motion*.

69. See Nail, *Being and Motion*; Nail, *Theory of the Object*.

70. For a kinetic theory of quantum gravity see Nail, *Theory of the Object*.

71. See Nail, *Being and Motion*.

72. Speaking of climate, Michel Serres reminds us that "our lives depend on this mobile atmospheric system, which is constant but fairly stable, deterministic and stochastic, moving quasi-periodically with rhythms and response times that vary colossally." Michel Serres, *The Natural Contract* (Ann Arbor: University of Michigan Press, 1995), 27.

"A symphony of rhythms and temporalities thus underpins our development

as humans and as living organisms. It marks us as creatures of this earth, as beings that are constituted by a double temporality: rhythmically structured within and embedded in the rhythmic organisation of the cosmos." Barbara Adam, *Timescapes of Modernity: The Environment and Invisible Hazards* (London: Routledge, 1998), 13."Beyond this short-term frequency, now relatively well-understood, climate scientists speculate about larger-scale periodicities that could range between decades, centuries or even millennia." Mike Davis, *Late Victorian Holocausts: El Nino Famines and the Making of the Third World* (London: Verso, 2001), 234.

73. Western culture has also taken itself to be universal, and critical theorists have shown the geographical, historical, gendered, raced, and classed particularity of that claim. But we have yet to appreciate the deeply geological and atmospheric particularity of all our planetary pretensions to universality and particularity.

74. In the example of the line AB, it is "already motion that has drawn the line" to which A and B have been added afterward as its endpoints. Henri Bergson, *Matter and Memory* (New York: Zone Books, 1991), 189.

75. I have made it clear in the conclusion to each of my books that limiting historical ontology to human history is not the same as an ontological commitment to anthropocentrism. I have always believed that these patterns are not the sole invention of humans, but exceed them. They are emergent patterns of the cosmos itself, as we will see in depth in this book.

76. See Vicki Kirby, ed., *What If Culture Was Nature All Along?* (Edinburgh: Edinburgh University Press, 2018).

77. "What would a human be without elephants, plants, lions, cereals, oceans, ozone or plankton?" Bruno Latour, "To Modernise or Ecologise? That is the Question," in *Remaking Reality: Nature at the Millennium*, eds. Bruce Braun and Noel Castree (London and New York: Routledge, 1998), 220–41; 231.

78. T.J. Demos, "Anthropocene, Capitalocene, Gynocene: The Many Names of Resistance," FotoMuseum.com, 6 December 2015. https://www.fotomuseum.ch/en/explore/still-searching/articles/27015_anthropocene_capitalocene_gynocene_the_many_names_of_resistance"Carbocene: an age of powerful carbon-based fuels that have helped to create ways of thinking and acting that humans now find exceedingly difficult to escape." LeCain, "Against the Anthropocene," 1.

79. LeCain, "Against the Anthropocene."

80. Donna Haraway's concept of the Chthulu scene is perhaps closest to recognizing the constitutive role of the earth in climate change. See Haraway, *Staying with the Trouble*. "Consider that none of the other officially recognized geological periods are named for a specific class or order of creatures, much less one species." LeCain, "Against the Anthropocene," 19.

81. Katherine Yusoff, "Anthropogenesis." "Yet in suggesting that humans were indeed powerful enough to cause such global ecological shifts, the Anthropocene concept also tends to encourage the hubristic modernist faith in the human ability to fix the resulting problems." LeCain, "Against the Anthropocene," 4."But rather than crediting humans alone, neo-materialism suggests that they accomplished these

things only at the price of throwing their lot in with a lot of other things, like coal and oil, whose powers they only vaguely understood and certainly did not really control. Likewise, once the partnerships were made, these powerful things began to shape humans and their cultures in all sorts of unexpected ways, many of them not necessarily for the better. In sum, neo-materialist theory pushes us to consider how the planet has made humans rather than the other way around." LeCain, "Against the Anthropocene," 5.

82. "Geologic corporeality is something that is inherited; it is before us and immanent within the condition of our being. If there is a response to be made to our fossil fuelled-being, it must acknowledge this condition, and seek to question its geosocial reproduction." "Only by learning to know and sense ourselves as geological (and accepting that this knowledge will never be complete), and as a being that is toward the geological, can we hope to move against coal-fired inheritances." Yusoff, "Anthropogenesis," 23.

Chapter 1: The Flow of Matter

1. "Through loss man can regain the free movement of the universe, he can dance and swirl in the full rapture of those great swarms of stars. But he must, in the violent expenditure of self, perceive that he breathes in the power of death." Georges Bataille, "Celestial Bodies," translated by Annette Michelson, *October*, Vol. 36, Georges Bataille: Writings on Laughter, Sacrifice, Nietzsche, Un-Knowing (Spring, 1986), pp. 75–78; 78.

2. "The crowning achievement of this tendency is anthropocentrism. The weakening of the terrestrial globe's material energy has enabled the constitution of the autonomous human existences which are so many misconceptions of the universe's movement." Bataille, "Celestial Bodies," 77.

3. See Nail, *Lucretius II*.

4. Helge S. Kragh and Dominique Lambert, "The Context of Discovery: Lemaître and the Origin of the Primeval-Atom Universe," *Annals of Science* 64, no. 4 (2007): 445–70.

5. Carlo Rovelli, *Reality Is Not What It Seems: The Journey to Quantum Gravity* (New York: Riverhead Books, 2018).

6. Rovelli, *Reality Is Not What It Seems;* Nail, *Theory of the Object*; Lee Smolin, *Trouble with Physics: The Rise of String Theory, the Fall of a Science, and What Comes Next* (New York: Penguin Books, 2008).

7. Martin Heidegger, *Being and Time,* trans. Joan Stambaugh (New York: SUNY Press, 1996).

8. For a full development of this triple parallel, see Nail, *Theory of the Object* on elasticity in modern objects and Nail, *Being and Motion* on elasticity in the modern ontology of time.

9. See Lisa Randall, *Dark Matter and the Dinosaurs: The Astounding Interconnectedness of the Universe* (New York: Vintage, 2017).

10. See Rovelli, *Reality Is Not What It Seems*; ChunJun Cao, Sean M. Carroll, and