

# Introduction

This is a book about how to take the measure of a crisis. It is hard to grasp the scale of the modern environmental crisis, and part of the reason is that many things that had once seemed almost immutable are now changing rapidly.

The sea, for instance, is getting deeper. The world's oceans are likely to grow in height by between 40 and 120 centimeters before the end of the present century, letting them spill onto coastal land, where cities have always clustered. The cycle of the seasons is changing. The times are out of joint for plants like the early spider orchid, which has evolved to deceive mining bees into "pseudocopulation" as its only means of pollination: warmer springs mean that the bees emerge too early to be seduced by the flowers that depend upon them. Similar decouplings threaten many other lifecycles, like those of the birds who now hatch their eggs too late to catch the caterpillars that feed their young. Even the map of the world is being redrawn. The rivers that sustained the Aral Sea have been diverted for irrigation, shrinking it to barely a tenth of its former size. Sand and salt from the exposed lake bottom, mixed with pesticides, heavy metals, and defoliants, now blow onto the surrounding farmlands, making crop yields plunge and afflicting local farmers with asthma, tuberculosis, eye problems, typhoid,

and cancer, and with kidney ailments from the saltiness of their drinking water.<sup>1</sup> Taken all together, this revolution that raises the oceans, reschedules the year, and turns water to land is bringing about a new epoch in the history of the world.

That last sentence might sound more declamatory than insightful, but in geology the word *epoch* has a specific technical meaning. A geological epoch is a midsize section of the planet's history. Students of the earth's biology and physical processes are now increasingly persuaded that the planetary system as a whole is undergoing an epoch-level transition. Earth's atmosphere, oceans, rocks, plants, and animals are experiencing changes great enough to mark the ending of one epoch and the beginning of another. The present environmental crisis is epochal in this particular, specialized sense. It is hard to comprehend its magnitude, but if we regard current environmental changes as the birth pangs of a new epoch, and if we give that epoch its place in geological time, in the long history of the earth itself, we might start to make sense of what we are facing. Recognizing what is now ending and what is beginning can help us respond to the predicament of living in the fissures between one epoch and another. The incipient new division of geological time has already been given a name: the Anthropocene. The idea of the Anthropocene epoch lets us understand the ecological crisis of the present day in the context of the distant past.

The central argument of this book is that the idea of the Anthropocene provides both a motive and a means for taking a very, very long view of the environmental crisis. It gives the ecological upheavals of the present day their proper place in the history of the planet. If you want to grasp the force, the scale, and the shape of the catastrophe as it unfolds, look for how it opens a fresh chapter in the long sequences of planetary time. To make sense of climate change, biodiversity loss, rain forest logging, and the rest, pay attention to how the current and imminent states of the world compare to those seen in the various epochs that went before.

If contemporary environmental changes add up to the birth of a new geological epoch, then earth scientists should ready themselves to adjust the geological timescale, the diagrammatic summary of the history of the planet upon which the whole science of geology rests. For now, the Anthropocene is not included on the official chart of the timescale that is maintained by its designated custodians, the International Commission on Stratigraphy. But a simplified and abbreviated version of that chart, with the Anthropocene added to it, would look like the diagram in figure 1.

Geological epochs such as the proposed Anthropocene are subsections of larger time units: periods, like the current Quaternary; eras; and ultimately eons. Epochs can themselves be subdivided into units called ages (not shown in this simplified diagram). All of these divisions and subdivisions come with fixed start dates and end dates, specified with greater or lesser margins of uncertainty according to the present state of geological knowledge. Evidently, when stratigraphers—experts in the physical sequences of rock strata upon which geological time sequences are built—postulate the beginning of a new epoch, they are making a quite specific claim. They envisage introducing one new piece, of a certain size and shape, into the carefully wrought mosaic of the geological timescale. The significance of the new interval, like that of all the older ones, would depend in large part on when it was said to have begun. Its hierarchical status, too, would matter greatly: to declare a new epoch would be a smaller step than creating an Anthropocene period, but an epoch would loom larger in geologic time than a mere Anthropocene age. So when it is used by stratigraphers, the word *Anthropocene* designates an interval that would occupy one particular place within the immense volume of geological time.

As yet the stratigraphers' debates about the Anthropocene, and the ins and outs of their conclusions, have never been examined at all closely from outside the tradition of the earth sciences. One of my aims in this book is to introduce other readers to the perspective on environmental history that has

EON	ERAS	PERIODS	EPOCHS
Phanerozoic since 541 million years ago	Cenozoic since 66 mya	Quaternary since 2.58 mya	Anthropocene
			Holocene
			Pleistocene
		Neogene 23–2.58 mya	Pliocene
			Miocene
		Paleogene 66–23 mya	Oligocene
			Eocene
			Paleocene
	Mesozoic 252–66 mya	Cretaceous	Subdivision into 31 epochs
		Jurassic	
		Triassic	
	Paleozoic 541–252 mya	Permian	
		Carboniferous	
		Devonian	
		Silurian	
		Ordovician	
		Cambrian	

Figure 1. Phanerozoic eon.

emerged from those debates. That perspective—which begins with an assessment of the geological traces that the last few centuries will leave behind in the distant future—has the potential to be enlightening for anyone concerned about the environment, not just geologists. But this book also has a much larger aim. I argue that the stratigraphers’ version of the Anthropocene can yield a new way of understanding and responding to the modern ecological catastrophe. The catastrophe is so far-reaching that it cannot really be under-

stood without setting it in the context of geologic time. That means that the long view provided by geology can change the basics of environmental politics for the better. The Anthropocene of the stratigraphers opens a window onto the geological past, and the politics of the environment can be put on a new footing by the stratigraphic vision of the new epoch.

With contemporary politics in mind, the most immediate and most telling point of comparison for the Anthropocene is the Holocene epoch, the 11,700-year span of time that in the established version of the geological timescale still continues to the present day. I believe that in order to make sense of this comparison between the Holocene and the Anthropocene we will also need to look much further back into the geological past, where monsters abound. But the first crucial point is that introducing an Anthropocene epoch to the geological timescale (and placing its starting point somewhere in the last few centuries) would mean declaring that the Holocene is now arriving at its end. This book, then, will eventually be just as much about the terminal crisis of the Holocene as it is about the birth pangs of the Anthropocene, or rather, I emphasize that those two things are one and the same. The Holocene matters because it is the only geological epoch so far in which there have been symphony orchestras and hypodermic needles, moon landings and gender equality laws, patisseries, microbreweries, and universal suffrage—or, to put it plainly, the agricultural civilizations that eventually made all of those things possible. With its demise, the civilized rights and pleasures previously confined to the Holocene will have to negotiate radically changed ecological conditions if they are to endure, let alone if they are to be extended more generously to more people. That is the political problem of the Anthropocene.

It is always intellectually stimulating to find that you are positioned in the interstices of two different worlds. The idea of the Anthropocene makes this state of being in between epochs the starting point for political thinking. In the last chapter of this book, and in the conclusion, I argue that

environmentalists should think of themselves as being caught up in the transition between two geological intervals, and that the goal of environmentalism should be to negotiate a way through this transition. That means demoting the ideal of “sustainability” from its status as the greens’ highest objective. Instead, environmental movements will need to be concerned above all with environmental injustice and with fostering ecological pluralism and complexity in the face of the simplifying tendencies of the Holocene’s final phase. The birth of the Anthropocene should be attended by vigilant resistance against the searing away of multifaceted socioecological systems and their replacement by vulnerable, saturated monocultures. Or to put it more positively, the jerky crossing between epochs can be cushioned by upholding states of life—both ecosystems and human societies—that are variegated, intricate, and plural, ones in which lively forces of all kinds contend with and interweave with one another.

The word *Anthropocene* is descended from the Greek *ἄνθρωπος* (*anthropos*), meaning either “man” or “human.” It is a recent addition to the vocabulary of environmental politics: it was coined, or at least it came to something like widespread notice, only at the end of the twentieth century. But since then it has prospered in a remarkable way. In some academic circles it has lately become a much-used and fashionable term. In the most advanced circles of all it has already gone on to the next stage and is considered rather worn-out and *déclassé*. Among both the enthusiasts and the skeptics the word has been tossed into debate much more frequently than it has been explained or defined. More often than not, it has been used without the intention of any very specific allusion to the work of the stratigraphers that provides its significance in the context of this book. That’s fine, of course. There is no reason why the word should not be used in a whole range of diverse, contested, and even incompatible ways. For the sake of clarity, however, I would like to set out, before going any further, some of the things that “the Anthropocene” will not mean in the pages that follow.

Firstly, the Anthropocene, in this book, is not the name of a fall from Eden. It does not describe the period in which human acts have brought about the end of nature by pollution and despoliation: it is not a rhetorical device to make clear the extent of human depravity. It follows that the Anthropocene is not the kind of thing that it is possible to “mitigate,” like an oil spill. Secondly, and conversely, the Anthropocene is not a breakthrough from tedious natural stasis. It is not the transcendence of the earth’s old limits, the sundering of its chains. It does not stand against all previous epochs and periods, looking glamorous and disreputable where they were worthy and dull. It is one epoch among many on the same footing, rather than one-half of the earth’s history.

Thirdly, despite its name, the Anthropocene is not an anthropocentric concept. The epoch does not get its name because nature is now completely subordinated to human agency, as if clouds now form and swallows now fly only after getting permission from human beings. The name suits it because human societies exert a novel and distinctive degree of sway in the physical world, but other creatures still continue independently to exert their own powers and to pursue their own interests in this new field of action. Humanity is not at the center of the picture of the Anthropocene, opposing, by its powers of mind, the passive matter that encircles it. Instead, human societies are themselves constructed from a web of relationships between human beings, nonhuman animals, plants, metals, and so on. Nor, fourthly, is the Anthropocene a concept that reduces humankind to an undifferentiated mass. I will return—at some length—to that point. To say that the earth is undergoing an epoch-level physical transition, in which the activities of sundry groups of humans are playing key roles, does not imply in the least that all human beings have thus far acted in unison, or that they are all collectively responsible for the new state of affairs.

Finally, in arguing for the importance of looking at the environmental crisis in the context of geological time, I am not at all advocating a distanced,

Olympian perspective on the human condition. Even though the requisite context is prodigiously broad, paying attention to it does not mean rising above the present emergency in a spirit of enlightened impartiality. It does not mean drawing a contrast between the mere fleeting turbulence of humankind's concerns and the eternal currents of the great stream of life, and then looking with cool equanimity to the remote past and future where civilization is as nothing. In fact, it can mean exactly the opposite. Against the facile amorality of the truism that nature will not miss humankind after humans' inevitable demise, the idea of the Anthropocene may yield above all a sense of locatedness in time, a sense of being caught in one particular historical moment.

In a word: no more clean breaks that put humans on one side and nature on the other and, thereby, merge each antagonist into a uniform blob. I argue in this book that the birth of the Anthropocene does something quite different. It redistributes agencies, reconfigures systems, and reorders the loops of consequence and assimilation out of which the workings of the earth are made. The transition from one epoch to another is a generalized disruption, a drawing up of new accounts.

The opponents of the Anthropocene (of whom there are already many) often worry that the new word implies a bleak and narrow-minded picture of the world. In that picture, the planet has become a merely artificial construct, passively molded by human activity, and the best remaining hope for humanity is to allow a scientific elite to administer global affairs from the top down, so that natural resources may be exploited in the most efficient way and affluent consumer lifestyles may be kept afloat for as long as possible. I share those critics' dislike of such a scenario. But this book puts forward a very different world-picture. Here, the world is seen as characteristically full of devious chains of cause and effect; of intricate braids that link economies to ocean currents and ecosystems to plate tectonics; and of what climatologists call "teleconnections," far-distant perturbations that prove to be coupled by hid-



den bonds—although here the teleconnections can take the form of trade routes and cash flows as well as seesaws in atmospheric pressure. Feedback circuits let subtle evolutionary and chemical modifications have worldwide effects. Human societies exert their influence on the planet and so provoke the latest twist in a chancy, surprise-filled geological history.

The recognition that the world is in the midst of an epoch-level transition is of a piece with the general tenor of earth science research over the last forty years. During that time, a conceptual framework usually called *neocatastrophism* has come to the forefront of the earth sciences. I propose in this book that the idea of the Anthropocene should be seen as another product of that neocatastrophist turn. Neocatastrophism has enlivened modern geoscience 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. Bit by bit, the life of the earth before human civilization has come to look ever more dramatic and incident-packed. There was no stately, teleological progress toward the arrival of humans. Instead, the story has been full of sharp twists and transformations. Built into the earth system are a multitude of concatenated feedback mechanisms. These feedback mechanisms have repeatedly amplified even comparatively small initial changes in unpredictable ways, making nonhuman history as contingent and chaotic as the history of kingdoms and empires.

This new understanding of the earth system has greatly influenced climate scientists, for instance. As they keep struggling to explain, the reason to be concerned about global warming is not that the composition of the atmosphere is now altering rapidly for the first time ever, or that it is disrupting the eternal harmony of the climate system to frighteningly unknowable effect. On the contrary, it is that the atmosphere and the climate have

changed swiftly and mightily from time to time in the past. These changes have tended to bring with them a new configuration of living things, one that—however fine in itself—has been to the old one like a conquering army to a fallen city. That ominous historical record is the reason why contemporary perturbations to the climate system are at the heart of the dangers posed by the birth of the Anthropocene.

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. The idea of the Anthropocene, as I want to construe it, simply adds human agency to that list. The Anthropocene gets its name from humans, the *anthropos*, because its distinguishing characteristic (for now) is the dramatic influence that human societies are having on the physical world. It is not the case that human interventions in the earth's organic makeup, or in the processes governing its soil or water or atmospheric cycles, are still dwarfed by any mightier forces that transcend humankind's paltry strength. Far from it. Human societies are now among the most powerful of the ecological forces that operate on, above, and below the surface of the earth.

In this light, perhaps the most incisive account of the new epoch so far has come not from a scientist or a campaigner but from a poet, the Canadian Don McKay. McKay's rich body of work has been characterized most of all by his interests as a birder. In his two most recent collections, however—*Strike/Slip* and *Paradoxides*—his line of sight has turned lower and slower. Geology has become the keynote of his poetry, which has hunkered down among fossils, rocks, and tales drawn from deep time (that is, by analogy with “deep space,” the abyss of time that stretches back from a few thousand years ago to the beginnings of the earth). McKay has written poems about hexagons of quartz that formed long before the first mathematics, about stumbling across a trilobite on the shore of the North Atlantic, about the

imponderability of hundred-million-year timescales and the wearing away of mountains. In a lecture in 2008 he reflected on the uses of the Anthropocene. “All poets take naming seriously,” he observed, and for him, giving a name to the Anthropocene creates for us “an entry point into deep time.” The preceding geological epochs seem to run backward from this new one “like rungs on a ladder” descending within a few steps into a time before human existence. With a quantity of blunt sarcasm, McKay lays out what seems to me the profoundest significance of the birth of the Anthropocene:

If we think of ourselves as living in the Anthropocene Epoch, we realign our notion of temporal dwelling. Generally, time is viewed in relation to humanity’s place in it, and consists of a present, where we live, and a recent past called history, which is felt to be important for informing the present and helping us understand ourselves better. When we speak of the past with reverence or chagrin, it is this shallow past we mean. Before history there is a vague distant past called prehistory, comprised of a jumble of relics and catastrophes, dinosaur bones mixed with clovis points, missing links, Lucy and The Flintstones cohabiting in the caves of Lascaux, *Australopithecus* confused with *archaeopteryx*, and the whole *mélange* construed as a sort of amniotic stew from which we, the Master Species, miraculously emerged. The name “Anthropocene,” paradoxically enough, puts a crimp in this anthropocentrism, making the present a temporal unit among other epochs, periods and eras. . . . On the one hand, we lose our special status as Master Species; on the other, we become members of deep time, along with trilobites and Ediacaran organisms. We gain the gift of de-familiarization, becoming other to ourselves, one expression of the ever-evolving planet. Inhabiting deep time imaginatively, we give up mastery and gain mutuality.<sup>2</sup>

The Anthropocene sweeps humankind into the turbulent flow of geohistory. It announces a new intimacy with the older rungs on the ladder. “We”—and there will be much need to examine the implications of that collective pronoun—join the trilobites as actors in the long drama of life on earth: as

another planetary force exerting its powers of survival and transformation. More than anything else, the Anthropocene is a way of thinking with deep time.

The best guides to this wild drama of deep time are the most fastidious and bookkeeping of figures in the profession of geology: the stratigraphers, who devote their labors to the precise demarcation and time-tabling of the deposition of rock layers all around the world. They have sought to measure the nascent epoch against the strict and cautious criteria that they have established for the formalization of geological intervals. The willingness of some stratigraphers to take on that task has given rise to the most vivid, the most radical, and the most disconcerting of all conceptions of the Anthropocene as it comes into being. It is their Anthropocene, a brand-new epoch to join the dozens that preceded it, that is my subject here.

In the first chapter that follows, I draw attention to the place of deep time in contemporary environmental news reporting. News stories often describe modern-day environmental changes as being unprecedented for thousands or even millions of years. That sounds not only sinister but also potentially confusing to anyone who is not an expert in earth history—a category that includes the great majority of people who are concerned about environmental issues. I criticize some unhelpful ways of imagining deep time, and describe how an alternative, geological perspective has grown up since the late eighteenth century. I also explore the question of just how much influence human societies currently have over the workings of the living planet. The idea of the Anthropocene itself enters the scene in chapter 2. Since the earth system scientist Paul Crutzen coined the word at the end of the twentieth century, its use has spread ever more widely. I trace the most important of those uses, and the backlash against the term that has developed in the last few years, before arguing that at least some versions of the Anthropocene are not guilty of the charges—of anthropocentrism and antidemocratic arrogance—that have been brought against it.

Chapter 3 looks in detail at just one way of thinking about the Anthropocene. This is the stratigraphic version of the term, the one that takes it literally as a potential new addition to the geological timescale. I explore how the implied relationship between the Anthropocene and the *anthropos* changes when the word is taken in a stratigraphic sense, and I describe the thought experiment that underpins the stratigraphers' approach: if alien geologists were to arrive on the earth in a hundred million years' time, what fossilized traces of present-day events would they find? I spend a long while on the seemingly hairsplitting question of when exactly the new epoch should be said to begin, because that question proves to be a way of addressing the crucial issue of how geological designations can reflect the environmental history of the world over the last several centuries.

Those first three chapters describe how the idea of the Anthropocene can open up a window on geological time. The final two chapters offer a look through that window. The main part of each one is a broad-brush narrative time line. Chapter 4 surveys the Phanerozoic eon, the 541-million-year interval within which the Anthropocene ultimately belongs, and chapter 5 surveys the Holocene epoch, the Anthropocene's immediate predecessor. The aim of those narratives is to give life and significance to the geological timescales that are the necessary points of reference for the new epoch, timescales that might otherwise look blankly intimidating to many environmentally conscious people who do not happen to be professional geologists. Along the way, chapter 4 considers the place of *Homo sapiens* in deep time, and chapter 5 considers the place of civilization in the period since the end of the last ice age. In the conclusion, I tease out the political implications of the idea of the Anthropocene epoch. It can be both a polemical slogan and a conceptual basis for environmental politics. Talk of sustainability, and of respecting the ecological limits to growth, tends to imply a forlorn attempt to escape from temporal constraints. In contrast, a stratigraphic perspective makes the specifics of the present crisis the point of origin for

environmentalism. A politics grounded on the attempt to dwell within and to shape the terminal crisis of the Holocene epoch would be transnational in its spirit and committed to analyzing the inequalities of power that often trigger environmental catastrophe. Its aim would be to foster a raucously democratic pluralism in the ecosystems of the birth of the Anthropocene.