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INTRODUCTION

Deep Time: A Counterhistory

Deep Time before Geology

Until recently, deep time was defined against human history. It was nearly synonymous with geological time, which was widely understood to measure processes of planetary formation so ancient, and so slow, that margins of error in the tens of thousands of years were the least that could be expected. Stephen Jay Gould, John McPhee, and other natural historians popularized deep time in the 1980s by showing that the thin glaze of human history was comparatively trivial, incommensurable with the grand narratives preserved in strata that were pushed down deep into the earth's crust, only to resurface tens or hundreds of millions of years later. It was often argued that geology established itself as a science by diverging from the field of history.¹ But then twenty-first-century earth system scientists, among others, began to entertain the possibility that human activity might be causing system-level changes that would endure in the geological record as an Anthropocene epoch. Earth system-level changes were known as revolutions by the naturalists who first began to expand the Geologic Time Scale (GTS) in eighteenth-century Europe, and they are some of the main actors in this counterhistory of deep time before geology. The history of deep time involves a paradox that is sharpened by the proliferation of scholarship on our newest revolutionary epoch. As Jeremy Davies puts it in *The Birth of the Anthropocene*, we are now “living in deep time.”² At this moment, deep time comes into view as a concept with a history.

Deep time is supposed to be the time of the other, the not-human, outside history. But as a way of imagining the cosmos, it has a history much older than geology and broader than the field of European ideas. Geology has established the age of the earth as 4.6 billion years. In Hindu cosmology, this is roughly equivalent to one *kalpa*, a day in the life of Brahma; since Brahma is about fifty

years old, this makes our current world much older, well over 150 trillion years.³ Events on this scale remain inaccessible to history, but a conceptual history of deep time can accomplish two things: it can help to explain how human actors, who were insignificant by definition in the context of the earth's deep past, could suddenly become “players in geologic time,” as the climatologist David Archer noted in 2009; and it can recover deep time as a field of imagination, providing a counterhistory to the twentieth-century narrative of a “time revolution” happening exclusively within modern empirical science.⁴ Unlike this time revolution, which banished human actors from deep time, and unlike the Anthropocene, which restores them to it, the concept of deep time has many possible histories. By choosing the mid-eighteenth century as a starting point, I aim to show how deep time became associated with earth history in the first place, expanding its conceptual domain to include colonial natural history, oral tradition, and scientific romance—all frontiers of the expanded time horizon associated with modernity.⁵

One of the many unsung literary actors in this counterhistory is the science fiction writer J. G. Ballard. The central characters in Ballard's novel *The Drowned World* (1962), most of them scientists, find that their dreams are disturbed by transformations of the geobiosphere caused by a rapid rise in global temperatures: all major cities become flooded and giant reptiles reemerge within two human generations. The characters dream of a giant sun that triggers deep evolutionary memories, causing them to embark on a quest in their waking hours to merge once again with their ancient reptilian ancestors. One character who seems to be immune to this delusion asks the others, knowingly, “How are things in deep time?” Writing twenty years before McPhee supposedly coined the phrase “deep time”—according to Gould's partial account—Ballard uses it numerous times in this novel, which deliberately invokes geological and evolutionary time to establish temporal scale.⁶ *The Drowned World* has rightly attracted attention since a revival of interest in global warming sparked the rise of climate change fiction (cli-fi) in the mid-2000s.

It is more surprising to find an early-nineteenth-century geologist marginalized by some historians for his catastrophism, Georges Cuvier, reemerging as a prophet in another book about the Anthropocene, Elizabeth Kolbert's *The Sixth Extinction*. Endorsing Cuvier's paradigm of occasional “revolutions on the surface of the earth,” Kolbert concludes that some of his “most wild-sounding claims have turned out to be surprisingly accurate.”⁷ *Epochs of Nature* by Georges-Louis Leclerc, Comte de Buffon, is an even earlier work on the theory of the earth that is now experiencing a startling revival. Early in the book,

originally published in 1778, Buffon declares his motive for outlining the Epochs of Nature: “How many revolutions have taken place beyond the reach of human memory!”⁸ Buffon, too, was uncannily accurate in some of his predictions. Less thorough than Cuvier but more daring, he identified the six definitive revolutions that altered the earth on an epochal scale, leading up to the “seventh and last” epoch belonging to human beings (Fig. 1a). One of the co-translators of *Epochs of Nature*, Jan Zalasiewicz—who is also a stratigrapher and the leader of the Anthropocene Working Group—has written that Buffon could be regarded as the founder of the geochronological time scale.⁹ Today’s GTS (Fig. 1b) looks quite different, and the epoch is one of its smaller units of periodization, but it too correlates geological features with a series of discrete events in the planet’s history. The Anthropocene epoch, which has not been ratified by the International Union of Geological Sciences, would appear as a microscopic line at the top of the Holocene in the upper left-hand corner of the current version.

Geologists no longer describe the events that mark period boundaries as revolutions. The word *revolution* now has a predominantly sociopolitical meaning, and that is why Cuvier’s and Buffon’s revolutions suddenly seem to make sense again: planetary change is now human-driven. Resistance to the Anthropocene among scientists grows, in part, out of a sense that this line between the natural and the social should remain intact.¹⁰ My counterhistory of “the time revolution” seeks to recover these revolutions of nature along with other key terms from the eighteenth century—expressions like “primitive rocks” and “the abyss of time”—that illuminate the qualitative dimensions of deep time as an imaginative experience.¹¹ The goal of this book is to juxtapose the emerging geological past with new experiences of ethnographic time: with the disruption of European chronology through contact with other cultures and with the deep past of poetry as it came into view through the study of oral traditions. The book concludes with a look ahead to Charles Darwin’s *The Descent of Man* (1871), taking note of the materials that Darwin used to situate human origins more securely in the context of geological time once the long time scale had gained wider acceptance. These materials range from recent findings in the new disciplines of archaeology and anthropology back to Darwin’s own youthful experience as a voyaging naturalist in the 1830s and even further back to the Enlightenment narratives that he read aboard the *Beagle*—and from which he and his contemporaries still imbibed many of the narrative strategies and aesthetic tropes through which deep time was conceptualized, including spatialized images of “the dim recesses of time” (*DM* 188) and the framework of conjectural history.

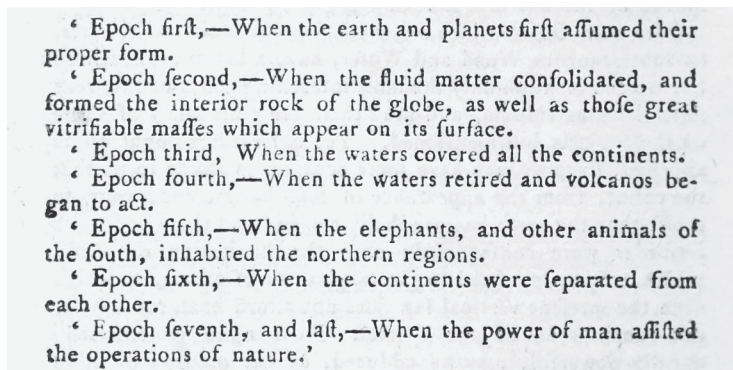


FIGURE 1. (a, above) Buffon's Table of Epochs. From a review of *Natural History, General and Particular*, in *The Critical Review, or, Annals of Literature* 61 (May 1786): 368. Courtesy of HathiTrust. (b, facing page) J. D. Walker et al. (2018), *Geologic Time Scale v. 5.0*: Geological Society of America, <https://doi.org/10.1130/2018.CTS005R3C>.

According to the historian Dipesh Chakrabarty, the Anthropocene marks the “collapse of the age-old distinction between natural history and human history.”¹² To grapple effectively with the collapse of two scales of time, we must try to understand how the separation came about in the first place and how the geological understanding of deep time might be embedded in human experience both before and after this modern division. Ironically, one dominant interpretation of the break between human and prehuman time locates it at the point where geology first met human prehistory: in 1859, Joseph Prestwich published his report on the first human artifacts found together with extinct animal bones—proving that our species was old enough to have entered the fossil record—and in the same year Darwin published *The Origin of Species*, which set the evolution of all species within the scale of geological time.¹³ In fact, explorers in the Pacific had located the intersection between geology and prehistory almost a century earlier, before these sciences were formalized. Even earlier, the Copernican revolution greatly expanded the scope of cosmic time, and scholars reflecting on the history of astronomy began to suspect that this science, and therefore humanity itself, must be much older than the written record.¹⁴ By the eighteenth century, colonial researchers in Asia began to communicate what they were learning about indigenous traditions—such as the cycle of Great Time in the *Mahabharata*, which seemed and still seems improbably long to Western readers.¹⁵ Last but not least, naturalists working in the field established by the 1750s that the primitive

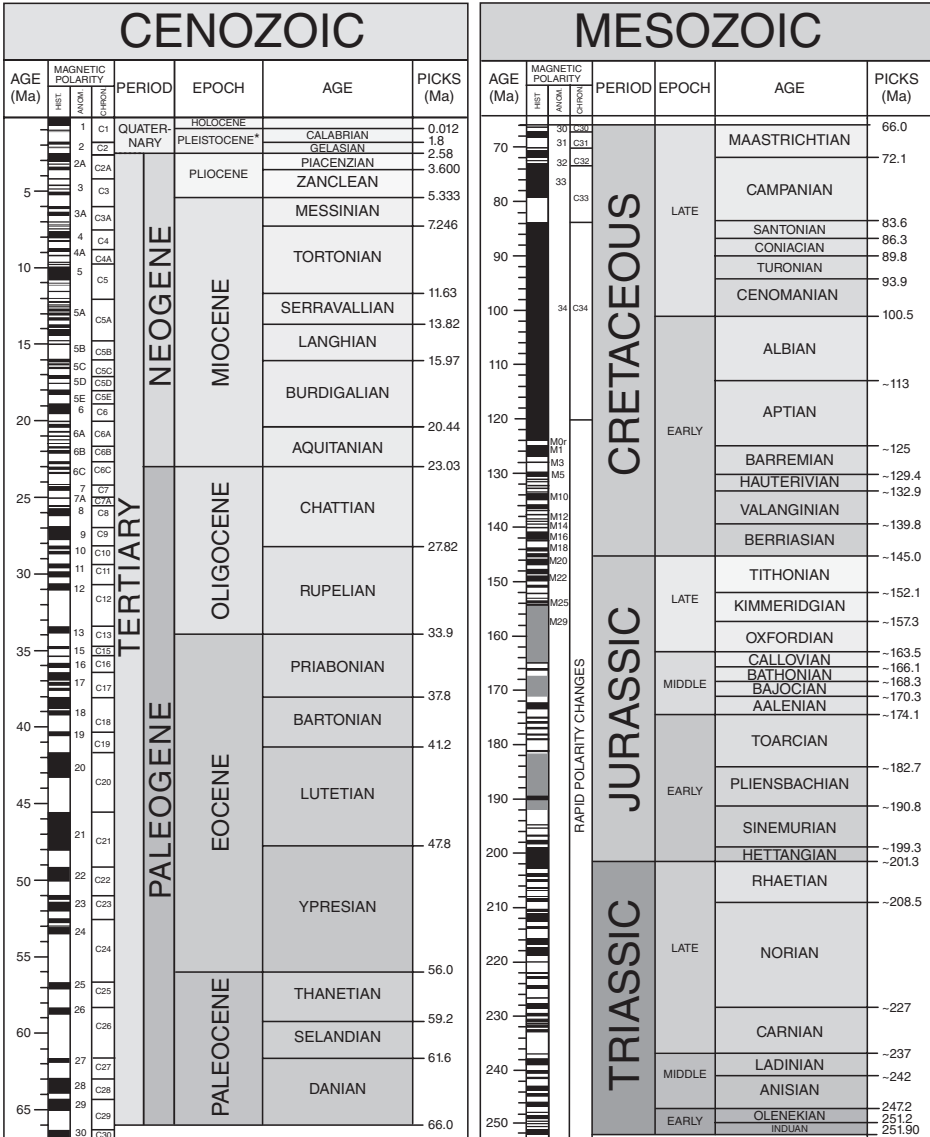


FIGURE 1. (b, continued).

or unstratified rocks underlying the layers of sedimentary rock had to be more ancient than anyone had ever imagined—simply because they began to measure the time needed for all those fine-grained sedimentary strata to be laid down, all of which must have happened after the formation of the primitive masses, as they were then called.

Cuvier attempted to define modern geology by putting all but the last of these factors to one side. The positive evidence concerning the revolutions of nature, he said, would be found in the fossil-bearing sedimentary rocks. In attacking geological speculation concerning the primitive rocks, Cuvier explicitly cited the ethnographic content of the time of the other, recognizing the qualitative, composite nature of deep time in its early European form.¹⁶ Deep time was increasingly reformulated as geological time in the course of the nineteenth century, and this association was strongly reinforced by Gould's misleading priority claim on behalf of McPhee, who merely used the expression in a sense that was consistent with Gould's own view of the history of geology. In the question posed by an enigmatic colonial adventurer named Strangman to Kerans, the atavistic hero of Ballard's *The Drowned World*—"How are things in deep time?"—deep time operates in biological and "archaeopsychic" as well as geological registers. Ballard's treatment is no more original than McPhee's, but the unquestioning restatement of Gould's claim by more recent scholars (myself included) is symptomatic of a larger displacement of scientific romance by science writing (a twentieth-century genre) as the authorized source of explanations concerning the meaning of deep time.¹⁷ More recently, deep time has been applied metaphorically by scholars to media history and to literary history, which operate on a human scale. Although this usage is accurately characterized as an analogy derived from geological time, my claim is that deep time as a figural register predates geology, and therefore the use of "deep time" by Siegfried Zielinski, Wai-Chee Dimock, and others seeking to recalibrate the temporality of media or other histories is no less original than the dominant geological usage.¹⁸

The point of the joke in Ballard's novel is that humans aren't supposed to know "how things are in deep time." By acknowledging in this way that his protagonist suffers from a kind of delusion, Ballard implicitly recognizes an earlier set of priority claims around the discovery of deep time, those of James Hutton and the uniformitarian tradition. This is the tradition recognized by Gould in the vast prehuman time scale so vividly evoked by McPhee's narratives of geological processes. Hutton is central to Gould's history as the thinker who incorporated "time's arrow" into the cyclical model of earth history established by Thomas Burnet in the seventeenth century. Many other histories of geology and geological time, especially those written in English, begin with Hutton's *Theory of the Earth* (1788/1795), and Hutton is widely known as the "father of geology." Geology textbooks continue to feature brief treatments of Hutton as an ancestor figure and allude to his famous declaration that he saw

“no vestige of a beginning, no prospect of an end” in the geological record, placing it beyond human reckoning.¹⁹ My account begins instead with two projects from the 1770s that have remained marginal to the history of geology: first, the comparative data gathered by John Reinhold Forster and his son George on their voyage around the world (1772–75), and second, the revisionist geochronology put forward by Buffon in *Epochs of Nature*. Hutton’s bold paradigm provides a useful touchstone, especially in cases when the history of geological time is used to contextualize another body of thought, whether in science or in cultural history. However, the emphasis on Hutton also has the potential to distort or oversimplify the state of earth science around 1800, as Martin Rudwick has suggested by calling Hutton’s paradigm “eternalist” rather than “geohistorical.” Hutton’s commitment to geological continuity led him to argue against the “supposition of the primitive” that is a central concern of this book.²⁰

Charles Lyell, too, plays a major role in many histories of geology as the thinker who incorporated Hutton’s insights on the slow and continual agency of geological forces into a systematic uniformitarian theory. In Gould’s account, Hutton’s *Theory of the Earth* marks a midpoint between Burnet’s *Sacred Theory of the Earth* (1684–91) and Lyell’s *Principles of Geology* (1830–33), which achieves a synthesis between the cyclical and linear models of its two predecessors. Lyell is of interest here as the first geologist to devote a book-length study to the chronological place of the human species, *Geological Evidences of the Antiquity of Man* (1869). Lyell’s work will enter the picture in the later chapters of this book, but here again I have chosen to emphasize other sources that offer a more holistic approach to matters of uncertain antiquity, geological and otherwise. In a chapter on the early history of the ballad revival, I consider a largely independent body of thought on human antiquity that is brought into dialogue with the natural history of the earth by the philosopher Johann Gottfried Herder. Rather than taking Lyell as a guide on the integration of geology and anthropology, my final chapter addresses two evolutionary thinkers, Darwin and John Lubbock. Both younger contemporaries of Lyell and deeply influenced by him, Darwin and Lubbock situate human behavior (including the primal song that fascinated the ballad revivalists) in evolutionary and geological time.

This book is not a history of geological time, though I am much indebted to Gould’s, Rudwick’s, and other excellent scholarship on that subject.²¹ Deep time, in my view, is not identical with geological time as it is currently understood; the metaphor “deep time” has a wider purchase and a longer history than the modern-day GTS. Without rejecting existing accounts of geological time,

I seek to recover that longer human history and to focus on the imaginative act of distinguishing *any* kind of long-scale time outside recorded history (including sacred history). Geological time is incommensurable with historical time, yet the distinction appears less absolute in light of the Anthropocene proposal, which recalls the uncertainty historically associated with deep time. The topos of uncertain antiquity is common to many earlier inquiries about origins, including human origins. It plays a critical role in the voyage narratives of the Forsters, which look to natural history for the keys to human history, and it informs the much later evolutionary narratives of Darwin and Lubbock, who consider the history of species as integral to the history of the earth. The experimental chronology of Buffon and the conjectural histories associated with the ballad revival, including those of Herder and William Blake, also share the naturalists' interest in linking anthropological and geological data to account for human origins. Hutton's more canonical "abyss of time," by contrast, rules out the question of origins and severs this connection. I am casting a wider net here, drawing in a broad constellation of genres and traditions to recover the generative area of uncertainty between geological and human time that persisted even beyond the moment when Lubbock claimed it for a new discipline, "prehistory." Pratik Chakrabarti has offered another kind of revision by re-centering the history of deep time geographically and historically on nineteenth-century India, where the nexus of geology and prehistory produced a "naturalization of antiquity."²²

The attachment to deep time as a scientific truth only intensifies with the Anthropocene awareness of "living in deep time" as reality rather than science fiction. But Ballard's remarkable account of a "descent into deep time" stands as part of a longer literary tradition informing the current literature on deep time and on more recent concepts relating to the fusion of human and natural history, including the Anthropocene, deep history, and the Long Now. Thomas Carlyle's reference to the "deep time" of cultural history, the earliest use recorded by the *OED*, operates within the scope of recorded and future history, so it makes sense to leave it out of the story of geological time, as Gould does. The "abyss of time," made famous by Hutton's popularizer John Playfair, has a longer history, which incorporates both anthropocentric usage and the macro-scale, prehuman sense of deep time foregrounded in McPhee's *Annals of the Former World*. Like "deep time" in the twentieth century, the "abyss of time" and related figures appeared in both literature and science; in the eighteenth century, these figures crossed over more readily between the disciplines and began to put pressure on conventional ideas of large or small

“spaces of time.”²³ Carlyle’s reference does share with these early approximations of geological time the strongly relative conception of time as comprising units of vastly differing magnitudes, the scalar flexibility also captured in poetry by Blake’s infinitely extendable “moment of time.”²⁴ Ballard articulates these magnitudes in post-Darwinian terms when he positions his narrator as “marooned in a time sea, hemmed in by the shifting planes of dissonant realities millions of years apart.” I will argue later that Ballard’s account of a “descent into deep time” follows *The Descent of Man* closely.²⁵

The first stage of our descent here will be the critical distinction between primitive and secondary rocks established in the mid-eighteenth century. The following chapters trace the ramifications of this sequential view of natural history in narratives of Cook’s second voyage around the world (Ch. 1) and in Buffon’s *Epochs of Nature* (Ch. 2). My third chapter emphasizes the ethnographic side of the primitive past as brought into focus by the study of oral tradition, initiated by the ballad revival and further refined in poetic and philosophical form (respectively) by Blake and Herder. The fourth chapter rereads Darwin’s *Descent of Man* in light of these precursors. The book concludes with an envoi proposing evolutionary nostalgia as a characteristic form of deep-time narrative for the twenty-first century.

In this eclectic body of work, reflection on geological time is commonly prompted by the question of human origins. There was no fixed discipline or genre dedicated to the problem of locating human origins within the natural history of the earth. Fostered by secular tendencies in Enlightenment thought and by a disciplinary ecology that had no fixed rubric for archaeology or prehistory, many writers from the mid-eighteenth century onward arrived at a concept of deep time by asking, in their own terms, what developments in the history of the earth must have been required for the human species to become viable. The imaginative urgency of creating a naturalistic context for human origins gave currency to the idea of a long prehuman history. Beginning with the discussion of primitive rocks that follows, my argument draws upon the frequently overlapping ideas of naturalists, explorers, philosophers, and poets in order to present the full range of locations where geological and anthropological questions are brought into proximity. The concepts and narrative forms associated with deep time, including revolution, reversion, catastrophe, species memory, and the primitive, result from cross-pollination rather than disciplinary specialization. As against the linear chronology of specialization, a literary history of deep time allows for a synchronic emphasis on the persistence of personification, analogy, anagnorisis, and other formal techniques in

deep time narrative across a century (1770–1870), and likewise on the persistence of genres, including voyage narrative, ballads, myth, and scientific (or philosophical) romance. These formal continuities reveal the full scope of the uncertainty associated with “living in deep time,” a long-term result of the convergence between human and nonhuman elements in the imaginative space of deep time.

Primitive

The German *Neuzeit* is generally translated as “modernity,” as English lacks a native term to designate this reflexive awareness of belonging to recent history. But the idea of “new time”—the diachronic sense of which is absent from “modern,” a Latinate adjective meaning “up to the minute” or “of the present”—enters English usage through the neo-Greek terminology used by geologists, who designate our current era as Cenozoic, the era of new life. Whereas German historians, most prominently Reinhart Koselleck, have established *Neuzeit* as the central frame of reference for postmedieval European history, especially since the French Revolution, the newness of modern times is harder to pin down in English.²⁶ The lack of such a vocabulary for human history may help to explain the enormous popularity among English speakers of the Anthropocene, a new geological term that deliberately crosses over into history. Given the popularity of this new geological epoch, the “new time of man,” it is indeed surprising that no renegade earth system humanist has yet claimed for the Anthropocene the dignity of an era, superseding the Cenozoic, or even of a period (these are both higher-order categories than “epoch” on the current GTS, Fig. 1b). Why should Man content himself with a mere Epoch?

From the Anthropocene perspective, the deep future appears depopulated, a scene of very long-term human impacts without human witnesses. For Hutton, Buffon, and other writers who helped to shape the concept of deep time, the future that it opened to view was more compatible with Enlightenment notions of progress. In his philosophical history of time, Hans Blumenberg characterizes the opening of a “world time” much vaster than “life time” as a strategy of buying time for civilizational progress. In this reading, establishing a comparatively young age even for “advanced” societies allows them to project their progress into an expanded future.²⁷ The historian Frederik Albritton Jonsson, however, has identified historical anxieties about resource exhaustion that preceded and helped to spur industrial progress,

suggesting that the “shallow” future is likewise a product of modernity.²⁸ Thomas Malthus’s projection of inevitable food scarcity is only the most obvious example. Darwin acknowledges the influence of Malthus explicitly in *The Origin of Species*, and Malthus seems an important source for the later Darwin’s gloomy certainty concerning the naturalized “extinction” of indigenous peoples in Tasmania and elsewhere, a view of cultural evolution consistent with the thought of Lubbock, Alfred Russel Wallace, and other Victorian contemporaries. On the whole, however, the human future associated with deep time seems to expand rather than contract in the course of the nineteenth century. There is no real precedent for the attenuation of the future evoked by our present preoccupation with anthropogenic impacts, though traditional deep-time narratives provide the allegorical figure of a far-distant future reader (or witness) that is sometimes used to describe these impacts.²⁹ According to the principle of superposition, the abyss of time opens downward, into the past. Conceptions of the deep past will be my main focus, but these carried with them specific implications for the future that are of special interest in the Anthropocene context.

Unlike *Neuzeit*, *Tiefenzeit* is a recent import from English—in fact, *Tiefenzeit* (deep time) entered the German language via the 1990 translation of Gould’s *Time’s Arrow, Time’s Cycle*.³⁰ The contrast between these two German words illuminates the dialectical relationship between deep time and the modern intellectual history that produced this concept of time as a natural precondition of life exceeding the scale of history by several orders of magnitude—a “metahistorical” given, in Koselleck’s vocabulary. This book offers a conceptual history of deep time that is indebted to Koselleck’s method, though it will necessarily trace a different path from the histories of sociopolitical concepts foregrounded in his account of the structural transformation of modern societies. Temporalization (*Verzeitlichung*) is the common factor uniting the concepts that define modernity in Koselleck’s reading. In pointing out the expanded “temporal horizon” associated with vastly increased estimates of the age of the earth proposed by Enlightenment thinkers including Buffon and Immanuel Kant, Koselleck’s approach to modern temporality somewhat resembles Michel Foucault’s influential account of the historicity of nature in *The Order of Things*. Koselleck’s self-conscious use of geological metaphors such as “sediments of time” (*Zeitschichten*), however, suggests that the conceptual history of deep time is not simply a product of the Foucauldian historical turn.³¹ This modern concept should be understood, rather, as the product of a *prehistoric* turn, the discovery of a synchronic space outside or prior to the historicity of

nature and of nations. This negative or paradoxical relation between deep time and its dialectical other, modernity, bears witness to the continuities underlying geological eras and historical epochs.

Davies's vividly paradoxical image of "living in deep time" echoes Chakrabarty's influential thesis on the collapse of human into natural history. Historicizing deep time, however, also means recognizing the time of the other that is inscribed in it. The history of deep time as a concept is routinely neglected in these otherwise trenchant accounts of recent anthropogenic effects that will remain visible in the fossil record on the same scale as some landmarks from the first few billion years of the planet's history. Two moments of this conceptual history are essential for the eventual consolidation of "deep time" as a geological metaphor in the twentieth century: the older classification of "primitive rocks" and the nonlinear temporalities assigned by European savants to non-European or unlettered peoples. The idea of primitive rocks (also current in French, Italian, and German as *terrains primitifs*, *monti primari*, and *uranfängliche Gebirge*) was fundamental to all Western accounts of the earth's deep history between roughly 1750 and 1850. Spatially and conceptually, the idea of primitive cultures emerged in close proximity to this geological idea. This proximity is still apparent in *The Voyage of the Beagle*, where Darwin locates "savages of the lowest grade" among "immense fragments of primitive rocks."³² "Primitive" takes on its characteristically modern pejorative connotations as it disappears from the geological vocabulary and becomes the province of newer social science disciplines. My contention is that what Johannes Fabian called "natural time" did not preexist and then shape the "time of the other" as it was constituted by anthropology; instead, the separation of natural and cultural time postdates and depends on the ambivalent Enlightenment articulation of "primitive rocks" to establish the early history of the earth.³³ In this sense, deep time was a composite of human and natural history to begin with.

Examples from either end of this prehistory of deep time will indicate briefly the broad purchase of "primitive" in this multivalent sense. Johann Gottlob Lehmann's 1756 *Essay toward a History of Secondary Rocks (Flötzgebürge)* was widely cited throughout the nineteenth century as the original source for the subdivision of rocks and mountains into primitive (or primary) and secondary groups. Lehmann's work became widely known via the French translation of Baron d'Holbach. Cuvier and Humphry Davy are among the nineteenth-century followers who relied on this translation, which renders Lehmann's term *uranfänglich* as "primitive." Davy maintains the importance of this fundamental distinction, arguing that geology in the nineteenth century still requires a

boundary to mark the difference between formations with observable causes and “that matter of our globe as yet unchanged by any known natural operations.”³⁴ Although nineteenth-century geologists typically rejected Lehmann’s premise that primitive rocks remained unchanged since the creation, it was still the case that these rocks occurred far below the hundreds of strata formed by processes that were increasingly known and recognized, while the formation of unstratified masses remained largely unknown. As George Forster observed of the “so-called human races,” a primitive rock is simply “a kind without a known origin” (*ein Stamm, dessen Herkunft unbekannt ist*).³⁵ Darwin’s account, informed by his shipboard reading of George and Reinhold Forster and of Alexander von Humboldt—another traveler trained in geognosy—makes it especially clear that the apparently primitive opens a window into deep time. He returns in his late work to his encounter with “savages of the lowest grade” among the “immense fragments of primitive rocks” at Tierra del Fuego because this encounter in situ leads him to regard those peoples as “ancestors” of modern humans. By the time Darwin articulated this view in *The Descent of Man* (1871), “primitive cultures” belonged to the remit of anthropology, but Darwinian natural history still shows clearly the composition of deep time out of earth history and human history, reframed as prehistory.³⁶

Darwin’s evolutionary theory depends explicitly on the depth of geological time. His juxtaposition of human and geological history in the field marks an important step along the way to the mobilization of the fossil record for this theory in *The Origin of Species*. Evolutionary time and geological time are in this sense both aspects of the same injury to anthropocentrism that is often described in Freudian terms as the third *Kränkung* (following the first two “outrages” or decenterings of humanity by Copernicus and Kant). It is hard to date the onset of this “temporal marginalization” of humanity, as Peter Schnyder observes, but a consciousness of something like deep time would seem to be a prerequisite.³⁷ Lehmann’s untimely and surprising role as a creator of deep time accords with Koselleck’s paradigm of a *Sattelzeit*, a transitional period after 1750 when the premodern conceptual “legacy is transformed into our present.”³⁸ Rudwick’s history of geology situates Lehmann’s work in the geognostic tradition of Abraham Gottlob Werner and other mid-eighteenth-century thinkers whom Rudwick regards as anticipating modern stratigraphy. He presents these geognosts as historical actors who practice a qualitative insight that precedes and prefigures the recognition of deep time as such.³⁹ After 1750 it became increasingly apparent that even the empirically verifiable deposition of sedimentary rocks exceeded the six-thousand-year span

of sacred history. At the same time, naturalists who were interested in human origins, such as Buffon, recognized that the common chronology was inadequate even for the history of the species. Rudwick makes the point that these speculations, due in part to their qualitative aspect, were not initially received as threatening. The qualitative sense of an unsuspected time dimension thereby achieved the broad currency presupposed by ideas of a “time revolution” associated with Darwin or any other nineteenth-century thinker. The tradition of scientific voyaging that Darwin inherited contributed strongly to this popularization, as I shall argue in the first and last chapters of this book. Humboldt, one of the more celebrated voyagers, presented the recognition of deep time as a kind of *mise-en-abîme*: “May the eagerly curious human spirit be permitted, from time to time, to swerve from the present into the darkness of prehistory [*Vorzeit*], to intuit [*ahnen*] what may not yet be clearly recognized, and so to delight itself with the ancient myths of geognosy, which return in many forms.”⁴⁰ As often in these encounters, deep time confronts the geologist in the form of human prehistory, a reflection of science in myth.

Lehmann’s “fundamental distinction” (as Cuvier termed it) between primitive and secondary mountains should not be equated with deep time, but his prose and that of some of his contemporaries introduce key narrative structures that enable the formation of this modern concept. Lehmann’s terminology is among the salient survivals from this early period in nineteenth-century geology, when the substantive part of his work had long been superseded. Lehmann devotes considerable energy to establishing the “endless depth” of the primitive masses, a dimension amplified in d’Holbach’s translation.⁴¹ The key feature of these masses (now known as igneous rocks) is that they are not stratified, and hence, in a certain sense, not temporal at all. Koselleck recognizes the pun on *Geschichte* (history) and *geschichtet* (stratified) in his explanation of *Zeitschichten* (literally “layers of time”). This is not merely a pun, he insists, because it denotes a real affinity between geological unconformity and historical discontinuity, the interaction of “strata [*Zeitebenen*] of varying duration and diverse origin, which are nonetheless simultaneously present.” The materialist d’Holbach, in a lengthy editorial preface to Lehmann, points out that the depth of the secondary masses provides evidence of a colossal lapse of time postdating the formation of the primitive masses themselves.⁴² As a translator, d’Holbach used language to exploit the abyssal, unlayered, almost atemporal qualities of Lehmann’s paradigm.

These early experiments with figures of temporality have implications for the shape of time not only in modern geology but also in history, as Koselleck’s

heavily geological vocabulary shows. Koselleck develops this vocabulary in his late work on “sediments of time,” which marks a departure from his earlier account of temporalization, or historicity as it was more widely understood in that poststructuralist moment. His recognition of Enlightenment natural history as laying the groundwork for the expanded “temporal horizon” of modernity inspired his own adoption of a geological vocabulary and attests to the deep synchronic dimension as well as to the dynamism of the natural history tradition, both of which the present study sets out to recover. This dynamism is opposed to Foucault’s conception of a “static” natural history and to the idea of a historical turn that follows from it. Foucault’s archaeology of knowledge illuminates the process of disciplinary change more broadly, but Koselleck’s geological metaphors help to identify a geological dimension of history that precedes and destabilizes the historicity of nature. His concept of a *Sattelzeit*, the period of transition to modernity, derives from a geological model for the formation of mountain passes or *Bergsattel*, literally “mountain saddles.”⁴³

By virtue of its origins in this period after 1750, the geognostic distinction between primitive and secondary masses occupies a clear position in conceptual history, namely that of an antecedent that allows us to recognize deep time as an object of conceptual history. In this “determination of its meaning for us,” deep time occupies a special place in relation to modernity, the onset of which is “witnessed,” according to Koselleck, by conceptual history as a whole. This initial glimpse of deep time, then, promotes the reflection on structural transformation that defines modernity in his account. Deep time, however, continues to structure historical analysis in its role as the dialectical other of modernity, the “new time” that Koselleck explains by means of geological metaphors such as “temporal depth” and “deep diachronic structure.”⁴⁴ He even cites the distinction between primitive and secondary rocks as a critical stage in the historiography of modernity itself, thereby casting doubt on his own conclusion that historicity is merely “transferred back” from nature into history: my contention here is that the figures informing the history of deep time as a concept ultimately exceed and determine its literal meaning. Temporalization in and of itself is neutral, indifferent to the disciplines of geology and history. It is therefore reductive to speak of deep time, or indeed of any temporal dynamism outside history, in strictly Foucauldian terms as a historicization of nature.⁴⁵

Gould’s history of geological time rightly draws attention to geological theories and their narrative techniques, too often marginalized in favor of empirically driven fieldwork. In mapping the wider literary field of deep time,

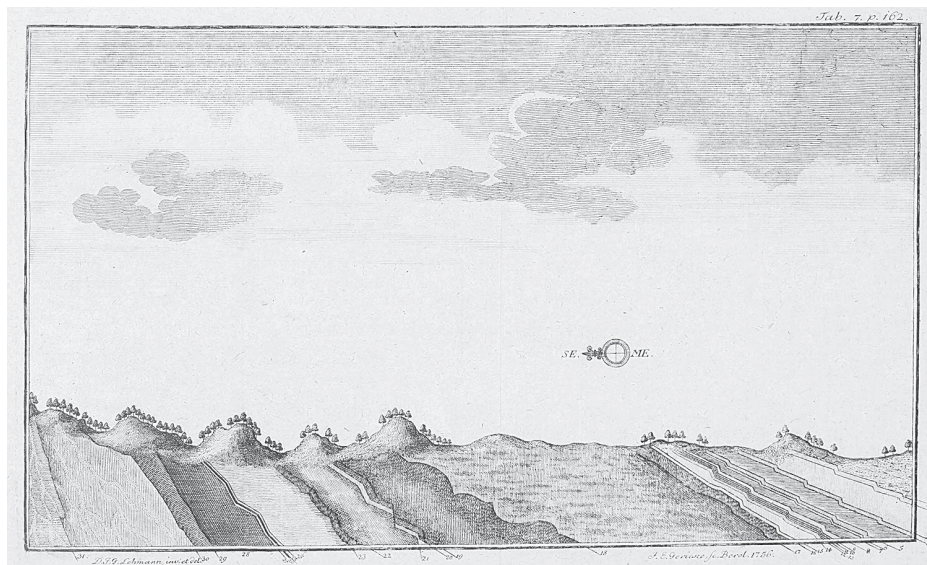


FIGURE 2. Engraving by J. E. Geriare from a drawing by Johann Gottlob Lehmann. Lehmann, *Versuch einer Geschichte von Flötz-Gebürgen* (1756), Plate 7. Universitätsbibliothek Heidelberg / O 2530 RES / 162.

I seek to attend equally to the geognostic fieldwork of Lehmann and his contemporaries and to theories of the earth, more particularly to the voyage narratives that synthesized both these dimensions of early geological thought, and ultimately to the narrative forms transmitted through all these approaches to writing about the earth and its temporality. One of Rudwick's signal interventions in this history is to recognize the conceptual weight of the early geognostic fieldwork, which produces "a widespread qualitative sense of the likely immensity of time" that precedes the quantification of deep time.⁴⁶ Citing precise cross-sections of stratigraphic sequences created by Lehmann, Giovanni Arduino, and Georg Christian Füchsel, Rudwick argues that these images made vivid the sheer diversity and depth of the strata as a wholly secular index of the lapse of time. One engraving in Lehmann's *Essay* (Fig. 2), based on his own carefully labeled drawing made in the field in Thuringia, identifies thirty-one strata in a single section. Siegfried Rein goes so far as to credit Füchsel with the "discovery of deep time."⁴⁷ The proliferation of these priority claims indicates the fundamental place of deep time in histories of geology, on the one hand, and the broadly diffused character of the ideas and materials associated with its discovery, on the other.

The Boundaries of Geology

These mid-eighteenth-century accounts of structural relationships within the earth's material are indispensable for a construction of deep time that becomes associated with geology. My account of Lehmann and the continental tradition in early geology also sets the stage for the first chapter of this book, which concentrates on voyage narratives by the Forsters (1778–82) in which these principles of geological succession are applied and transformed in the field, in conjunction with European ideas of the progress of society. The encounter with landscapes, and even more so with cultures that did not fit these paradigms, further disrupted the framework of chronology. My second chapter positions Buffon's metropolitan theory of the earth, synthesized from the mass of material available to him as the director of a national collection, against the Forsters' empirically driven narratives. In *Epochs of Nature* (1778), Buffon became the first to give empirically based absolute dates for geological periods, but he continued as well to emphasize the qualitative experience of long sequences of strata that emerged from fieldwork. In one evocative passage he observes a thousand-foot hill of shale in Normandy that is topped by a stratum of limestone. The glimpse of limestone, postdating the many strata of shale, prompts a minute analysis of geological processes so slow that human generations are inadequate to measure them: "our all-too-short existence," he declares, provides no adequate scale for "the number of centuries [*siècles*] that were needed to produce all of the animals and shells with which the Earth is replete; and then, the yet greater number of centuries which have passed for the transport and deposition of these shells and their detritus," all of which follow the equally vast periods required for the shale to accumulate at the rate of five inches a year, and then erode again, before the shells were deposited in the first place (Z 36).⁴⁸

Though Cuvier and most later geologists consigned Buffon to the prehistory of geology, his narrative approach to temporality and scale is more timely for the early twenty-first century and brings a capacious genealogy of deep time into view. Reflecting on the formation of this Norman topography in a manner that anticipates Hutton and Darwin, Buffon enters on a philosophical digression, much of it deleted in revision, that problematizes temporal apperception on this scale: "why does the human spirit seem to lose itself in an extent of time, rather than one of space or in a consideration of measures, weights, numbers?" (Z 35–36). Darwin, confronting the inadequacy of numbers to express duration, directs his reader to "watch the sea at work,

grinding down old rocks,” thereby compressing eons of geological process into moments of visual perception.⁴⁹ This rhetoric of compression is a technique shared with poetry, as I argue in my third chapter, which compares these moments of geological retrospect to scenarios created around the deep past of poetry, from the conjectural history of the ballad revival to the eternal present constructed by Blake as the time of his epics. The fourth chapter on Darwin integrates the anthropological approach mooted by early students of ballads and folklore into an account of the larger synthesis of prehistory, geological time, and human evolution that Darwin achieved late in his career. The importance for this late work of his early encounters with the Yaghan and other native people of Tierra del Fuego also bridges the seeming distance between Enlightenment voyage narratives, such as that of the Forsters, and modern evolutionary thinking. Rather than a “time revolution,” this gradual history brings out the importance of inherited tropes, and of cross-cultural encounters, for the sense of deep time.

Buffon’s innovation in 1778 was to augment Lehmann’s qualitative sense of the lapse of time with absolute dates for the epochs of nature, which he verified experimentally. These dates nevertheless proved elusive and arbitrary, as indicated by the heavily revised manuscript of *Epochs of Nature* (Fig. 3), in which values in the millions of years appear periodically only to be crossed out—sometimes more than once—and ultimately replaced with the chronology of 75,000 years that Buffon settled on in print. His experiments with white-hot balls of iron, intended to represent the young earth, relied upon the familiar concept of primitive mountains—in this version a solidified core of granite thrown off in molten form when a comet grazed the sun. In Buffon’s chronology, the secondary formations are deposited in the third epoch of nature, and officially the human species appears only in the seventh and last Epoch. Just here, however, his chronology is disrupted by the anthropological moment of deep time. This account of human origins begins by attributing to “the first men” an inherited or evolutionary memory of the “great convulsions” of the fourth epoch, the global upheaval marked by widespread earthquakes and eruptions that predates this ostensible “time of man” by tens of thousands of years, according to Buffon’s own reckoning. Reinhold Forster offers a similar kind of explanation for an indigenous creation myth that he encountered in the Pacific islands, which was that they were formed when the god Maui dragged a great net through the ocean. Forster explains this legend as a deep inherited memory of prehistoric “revolutions of nature,” comparable to that attributed by Buffon to ancestral humans (O 112).

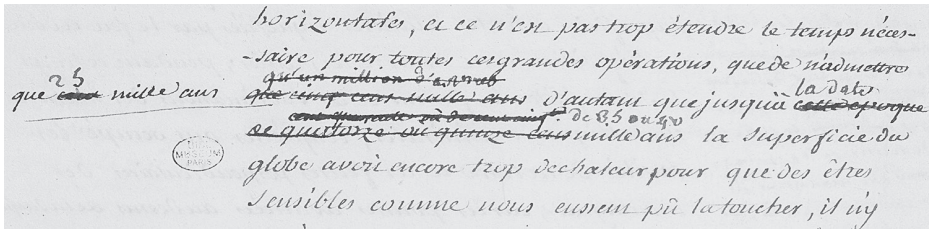


FIGURE 3. Georges-Louis Leclerc, Comte de Buffon, “4eme Epoque,” fol. 24 (detail). MS 883, Cahier 3. © Muséum national d’histoire naturelle, Paris.

From a historical point of view, both these moments together—the geological engagement with primitive mountains and the ethnographic engagement with the time of the other—contribute in an essential way to the formation of deep time as a concept. Eighteenth- and nineteenth-century naturalists themselves reflected on this convergence, as we have seen in Humboldt’s account of the myths of geognosy, and Schnyder has noted the role of wonder tales in popular geology as a way of reckoning with “the alterity of past epochs.”⁵⁰ More often than not, however, naturalists met the mythical qualities of deep time narration with skepticism, as when d’Holbach, in his critical examination of Lehmann’s source texts, rejects all accounts of a Biblical Deluge. Similarly, Jean-André Deluc defended the realm of fact against fable in his harshly critical review of Hutton’s *Theory of the Earth*, and Reinhold Forster, among other readers, criticized Buffon’s *Epochs of Nature* for indulging in romance.⁵¹ The historiography of deep time in fact begins here, with these reflections within the nascent discipline of geology itself, which preserved the old consensus concerning primitive and secondary rocks not for its poetic merit but for its empirical efficacy (as suggested by Davy’s and Cuvier’s qualified praise of Lehmann in the early nineteenth century).

I have positioned Lehmann as a co-creator of the deep time concept because he played a key role in establishing this consensus and the chronology that follows from it. Similar claims might be adduced on behalf of much earlier natural histories of the earth. The paleontologist Rein, as I noted, effectively backdates the “discovery of deep time” by attributing it to Lehmann’s contemporary Füchsel. Many geologists look back even further to the Danish polymath Nicolaus Steno (1638–86), not for discovering deep time per se but for establishing the principle of superposition that assigns a progressively younger age to each overlying stratum.⁵² There is a more pressing reason, however, to look to seventeenth-century geological thought in a conceptual

history of deep time: the wide range of narrative techniques employed by Steno, Burnet, William Whiston, Benoît de Maillet, Gottfried Wilhelm Leibniz, and their colleagues in the natural history and/or theory of the earth. Narrative technique and prose style, as well as empirical method, were at issue in the criticisms of Buffon, Hutton, and Lehmann by other naturalists; Buffon in particular seemed to his critics to be committed to an out-of-date system. Myth, fable, romance, and eventually even Scripture were deemed to fall outside the boundaries of “geology” beginning in the late eighteenth century (when the word was coined). Notably, Forster embraces indigenous myth as a geological source but condemns Buffon for writing a “beautiful romance” in the guise of a treatise on the earth.

One of Buffon’s greatest failings, according to many of his critics, was to adopt a hypothesis very close to those put forward by seventeenth-century thinkers including Whiston and Leibniz: that the passage of a comet through the solar system could be a major agent of geological change (see Fig. 1.1 below). Buffon’s interest in geogony (earth-formation) recalled an unfettered style of bold theorizing and grand narrative that had fallen into disrepute by the late eighteenth century, ridiculed by Playfair as “a species of mental derangement, in which the patient raved continually of comets, deluges, volcanos and earthquakes; or talked of reclaiming the great wastes of the chaos, and converting them into a terraqueous and habitable globe.”⁵³ Writing in 1987, Gould reclaimed one of the “villains” of this progressive history of geology, Burnet, by arguing at length that he conceptualized geological time in the same cyclical manner as Steno, the ancestor generally considered to be a “hero” for his empirical rigor. Gould’s reclamation of Burnet is the first step in his demonstration that “metaphors of time’s arrow and time’s cycle . . . proved as fundamental to the formulation of deep time as any observation about the natural world.”⁵⁴ As Gould himself acknowledges, the conceptual field of deep time was shaped by a large number of actors in many branches of early modern inquiry; he limits his account heuristically to a small number of canonical actors and two specific metaphors. My account takes in a wider cross-section of all three—actors, disciplines, and narrative forms—but favors the period between the mid-eighteenth and mid-nineteenth centuries.

The boundary between the history of geology and its ancestral romances is not a stable one. Rudwick, for example, realigns Hutton with pre-paradigm geology by tracing his “eternalism” to de Maillet’s *Telliamed* (published posthumously in 1748) and ultimately back to Aristotle. De Maillet posited a

geological past of millions of years based on a vision of geological processes extending “to all eternity” and therefore lacking any meaningful historicity, Rudwick observes.⁵⁵ Rudwick’s intervention has not stopped textbook authors from positioning Hutton as the “father of geology,” though geology students today are getting a more nuanced account than I did as a first-year undergraduate in 1987.⁵⁶ Buffon, whose theory seemed romantic and amodern to his contemporaries, now seems more relevant to geochronology and may in time enter the textbooks again. It will be sufficient here to keep in mind the early modern antecedents ruled out of bounds by later geologists, noting that many of these antecedents have a renewed interest in the twenty-first century, as Lydia Barnett has argued.⁵⁷ In the eighteenth- and nineteenth-century context, it is striking that early modern European thought is often relegated to the same doubtful sphere as non-Western antiquity by those seeking to establish the history of the earth as the preserve of a separate discipline.

Cuvier’s contributions to the history of geology reinforce the old distinction between primitive and secondary masses while also casting doubt on early modern and on some more recent approaches. His account is essential for my argument because it cites the ethnographic content of the time of the other explicitly in attacking geological speculation concerning the primitive. Cuvier’s research agenda was to draw the attention of geologists away from the *terrains primitifs* and toward the *terrains secondaires*, represented as a vastly underexploited archive of clearly demarcated geohistorical events. His *Rapport historique* on the progress of the geological sciences (1810) begins by noting this “fundamental distinction in geology,” the recognition (co-credited here to Lehmann and Guillaume-François Rouelle) that the horizontal strata, deposited along with their fossil content on the flanks of the primitive mountains, were necessarily younger in age than the latter.⁵⁸ In his famous preface to *Recherches sur les ossemens fossiles des quadrupèdes*, Cuvier adds that only the fossils contained in the *terrains secondaires* can “testify with certainty” that the crust of the earth has undergone any change at all and that even the basic distinction between primitive and secondary would be impossible without organic fossils. By analogy to these fossil archives, Cuvier infers that the primitive mountains too have undergone “revolutions” in the past, but he argues that Werner and H.-B. de Saussure have already established all that can be conjectured concerning these primitive revolutions.⁵⁹

Compared with their work, he declares, research on the fossiliferous strata has only just begun. By dedicating his science to this new field, Cuvier seeks to redirect the young discipline of geology away from the domain of the primitive,

which is too reliant on speculation and tends too readily to lapse into mythology and antiquarianism. In this context, Cuvier's famous self-description as "a new species of antiquary" refocuses disciplinary attention on the fossil archive of extinct species, which offers a sure path toward reconstructing the more recent "revolutions." He concedes that a study of the more shadowy revolutions of primitive times may promise to reveal the planet's origins but argues that the archival detail of the fossil record makes its interpretation a more suitable task for human beings, "to whom is permitted only a moment on this earth."⁶⁰ At the end of his preface, in spite of himself, Cuvier is very much concerned with old-style antiquarianism, because he feels compelled to refute antiquarian arguments for the high antiquity of some non-European cultures. While not literally true, the Biblical Deluge for Cuvier stood as a folkloric record of the last great revolution of nature; since he claimed that the species postdated this global revolution, non-European chronologies that claimed to predate the Deluge had to be wrong. Thus he rejects Chaldean and Egyptian claims to an antiquity of several thousand years on the basis of insufficient evidence and dismisses other chronologies with contempt. Cuvier denies India's high antiquity, for example, dismissing the *Mahabharata* as "nothing more than a poem" and insisting that all textual references to India's supposedly two-million-year-old astronomy postdate the Middle Ages.⁶¹

By banishing the human species entirely from deep time, Cuvier reduces the latter to purely "natural time," sharply distinguished from history. The vision of "nature's own history," often defended by scientists and historians of science today, may be seen in this way as a disciplinary construct, an intervention in the way deep time was conceived.⁶² The grounds for reconsidering this division are widely apparent in our own geohistorical moment.

By contrast to Cuvier's self-conscious geology, the Forsters' Pacific travel narratives place natural history and geology at the service of a revisionist history of the human species. All but two of the islands they visited with Captain Cook between 1772 and 1775 were of volcanic origin. The elder Forster had published an introduction to mineralogy (1768), and his voyage on the *Resolution* offered the opportunity to deepen his knowledge in the field; his knowledge of volcanism proved especially serviceable. Both his account and George's cite the corresponding European scholarship, including material that appeared during their voyage, such as Johann Jakob Ferber's important letters on the Italian volcanoes (inspired in turn by the stratigraphy of Arduino). Volcanoes and their products differed from both primitive and secondary masses and remained a hotly contested category in the specialized debate around basalt as

well as in broader geological texts such as Cuvier's *Rapport*—which counts volcanic materials as the most modern strata of all—or Davy's *Lectures on Geology*, in which volcanoes feature as “the most sublime of the phenomena belonging to our globe,” whose unknown powers still hold great potential for the theory of the earth.⁶³ The Forsters prefer Ferber as a source because he delivers exact observations without committing to a theory. It was precisely the ambiguity of volcanoes—which acted in real time, on the one hand, but also left behind unstratified masses of indeterminate age, on the other—that allowed the Forsters to acknowledge their uncertainty concerning the history of the indigenous peoples without attempting to fit their development into the progressive scheme of the Scottish and French “armchair philosophers.”⁶⁴

Several points on the *Resolution*'s itinerary, especially in Melanesia, were sites of first contact between the Europeans and indigenous peoples. On Malekula, George Forster brought the large active volcano on the island to bear directly on the history of its indigenous people, who, he argues, must have arrived recently (R 699). In the two exceptional cases of sites that lacked any evidence of volcanism, New Caledonia and Dusky Sound, the absence of volcanoes plays a comparable role. Forster projects the primitive or “original, chaotic condition” of Dusky Sound onto the “patriarchal family” of Maori they encounter there (181; see Fig. 1.2). The geological puzzle of Grand Terre, New Caledonia, leads him to declare that the native Kanak are “a race of men very distinct from all we had hitherto seen” (V II.588). He qualifies this claim by showing the inadequacy of climate, diet, and other conventional explanations for understanding their distinctive characteristics. These could only have developed over “a series of many ages” from a multiplicity of largely unknown causes (II.592). George's own German rendering of “many ages” is *geraume Zeit* (R 827), literally “a spacious time,” a figure very much akin to deep time in its self-conscious spatiality.

George Forster's account of another volcanic island, Tanna (Vanuatu), not only refers to Ferber and the European literature but also calls on indigenous knowledge concerning the volcano, just as Reinhold retells the native legend he claims to have heard concerning Maui's creation of the archipelago. The Forsters' empirical revisions of the “history of mankind” appear again and again as a motive for their geological investigations; conversely, geological uncertainty concerning the origin of volcanoes contributes substantially to the chronological openness that characterizes this revisionist history. The Forsters sometimes manage to steer clear of the fallacy of imagining Pacific Islanders as ancestral Europeans, and their occasional glimpses into the deep

time of the species as a whole, by way of geology, ultimately lead to the unexpected conclusion that “the history of the human species in the South Seas cannot yet be unravelled” (VII.563).⁶⁵

These human and natural histories together articulate the unknown origin of the primitive, reiterated in George’s later definition of a “so-called human race” as simply “a kind without a known origin.”⁶⁶ Thus, a significant moment of deep time is lost when Cuvier decides to shore up the boundaries of geology by marginalizing primitive mountains along with non-European peoples and their traditions. Nevertheless, this moment reappears throughout the nineteenth and twentieth centuries. Darwin, for example, even though he had a much more substantial geological time scale at his disposal than the Forsters, nonetheless entered into an ethnographic experience of deep time at Tierra del Fuego. From this point of view, evolutionary theory itself might be seen as an attempt to bridge the two time scales separated by geology. In his late work on human evolution, Darwin returns to this encounter on Tierra del Fuego because it allows him to produce the image of a prehistoric human ancestor. The Forsters’ travel narratives do not explicitly challenge the common chronology of their milieu, but they attest clearly to the pressure to which this chronology was subjected by ethnographic and geological questions and by the relation of these questions to each other. Hence my argument in this book that the collision of geological and ethnographic temporalities produces a qualitative experience of deep time that predates and in some ways anticipates geological time.

This clash of temporalities reverberates through the critique of colonialism and through the modern struggle to liberate natural time from the constraints of sacred history. These ideological fault lines remain decisive for our present moment. The legacies of slavery and settler colonialism, on the one hand, and denialism (of evolution, of climate change), on the other, have been subject to more intense critical scrutiny in the twenty-first century than ever before. The eighteenth- and nineteenth-century thinkers studied here were certainly aware of these fault lines, and in some cases made their analyses of temporality an occasion for critical reflection on colonialism, as I will show. The binary construct of “science vs. religion” is of more recent date, but the production of deep time affords a historical perspective on the tangled history of evolution, colonialism, race, and religion that may be useful for present-day critical engagements. In Chapter 4, I argue that the acceptance of species time in the form of human evolution initially seemed to support scientific racism, and here one of the through lines in this book dovetails with recent scholarly

accounts of race and temporality. The performance studies scholar Tavia Nyong'o, for instance, argues that performance art built around the memory of enslavement replaces the historical concept of "change over time" with an emphasis on "time over change." By analogy to deep time, Nyong'o posits a "dark polytemporality" that bridges the "incommensurabilities" of racialized experience, "a deep time that is also a dark time of inhuman concerns."⁶⁷ Nyong'o's position highlights some of the ways in which ideology and ideological conflict are integral to the conceptual history of deep time.

Abysses of Time

My last chapter places Darwin's work on human evolution at the end of a conceptual history in which deep time appears as a set of imaginative possibilities not yet tied exclusively to geology. The first chapter engages closely with the Forsters' revisionist history of the species, picking up where this historical introduction leaves off. Using Lehmann and Cuvier as historical bookends—or as neighboring mountain ridges, to extend Koselleck's metaphor of *Sattelzeit*, a "saddle time" spanning the transition from premodern to modern concepts in geology—I have placed the Forsters and Buffon in relation to the history of geology here in order to create a wider context for them in the two chapters that follow. The third chapter, on epic time and oral tradition, departs even further from the history of geology to explore the deep human past increasingly associated with artistic practice, an association that was also of particular interest for Darwin in *The Descent of Man*, the subject of the fourth and final chapter.

Of the authors treated in this study, Buffon is perhaps the most frequently mentioned in specialist histories of geological time, for two reasons. The first is that Buffon experimented with absolute dates for stages in the earth's history, more empirically grounded and therefore less extreme than the conjectural dates in the millions of years posited earlier by more cosmologically inclined Enlightenment thinkers including de Maillet, Denis Diderot, and Immanuel Kant.⁶⁸ The second reason is a common but mistaken attribution to Buffon of a phrase that is central to the literary history of deep time, "the [dark] abyss of time" (*le sombre abîme du temps*), which is incorporated into the titles of books on the history of geology by Paolo Rossi (1979/1984), Claude Albritton (1980), and Paul Lyle (2016) and of a work of archaeological theory by Olivier Laurent (2008). Rossi and Laurent explicitly attribute "le sombre abîme du temps" to Buffon but do not cite a location, and neither this phrase nor its

variants turn up in an electronic search of the corpus. The “dark” is lacking in Albritton and in Lyle, who focuses on John Playfair’s expression “the abyss of time” and its context in Anglophone geological debate.⁶⁹ The vertiginous quality of this poetic figure powerfully suggests the dislocation that occurred when students of earth history began to recognize the scalar incommensurability of geology and sacred history.

As useful as it is in a geological context, the dark abyss of time also has a rich literary history, in both French and English, that should not be overlooked. “The dark abyss” (*le sombre abîme*) is one of several epithets attached to time by a contemporary of Buffon, Antoine-Léonard Thomas, in his “Ode to Time,” which won the French Academy’s poetry prize in 1762. In English, Shakespeare gives us the earliest instance of “the dark backward and abyss of time” (*Tempest*, I.ii), followed by John Dryden, who published an adaptation of *The Tempest* and used the figure of “time’s abyss” in a translation of Juvenal as well as (most influentially) in his own tragedy *All for Love* (1677).⁷⁰ Variations on this theme occur in the works of a range of eighteenth-century poets. Albritton also notes that “the comparison of time with a fearsome abyss is common in writings from the seventeen hundreds, though this conceit goes back much earlier.”⁷¹ In the literary tradition, the dark abyss of time signifies death and the fear of oblivion, and these abyssal associations powerfully inform the metaphor in its new application to the long secular time scale.

The story of this book is an alternative history of deep time—not as a “time revolution,” created suddenly in its modern form when Darwin drew out the implications of Lyell’s geology for the history of life, but rather as an imaginative framework created gradually through the Enlightenment habit of gazing into the abyss of time. Deep time as an area of uncertainty entails multiple scales and forms of evidence, and even today the figure of deep time is associated as much with the literary science writing of McPhee as with any scientific discovery. For this reason, my third chapter concentrates on literary history, on poetry and the conjectural history inspired by the ballad revival. Blake, Robert Burns, and Herder are among the poets who strive in this context to make the deep past present through poetry. The ballad, according to its many theorists, also does this work as a form. Herder’s monumental conjectural history, *Ideas Toward a Philosophy of the History of Humankind* (1784–91), deliberately incorporates human origins into a larger history of the earth, drawing material from both written and oral traditions. For its theorists, and for many of its practitioners since at least the eighteenth century, the ballad instantiates the deep past of the species, as a singing one.

As Blake's fascination with "ancient men" develops in his later work into a sustained engagement with human antiquity—most famously through his allegorical character Albion, the Ancient Man—it becomes easier to see the relationship between poetry and speculations about deep time. But his earlier *Songs of Experience* makes an essential starting point in part because of its direct relationship to the ballad revival. Preliterate human societies were the major concern of conjectural history, the discipline that in turn provided the common ground shared by poets and philosophers. The history of civil society as propounded by Adam Smith and his followers provided a theoretical idiom for theorists and practitioners of the ballad revival in Britain; on the continent, Rousseau and Montesquieu (among others) played a similar role not only for theories of culture but also for natural history, and hence the discourse of species. Even Buffon, as I argue in Chapter 2, depends equally on natural and antiquarian evidence, fossils and conjectural history, to support his dramatic expansion of the time scale in the 1770s.

The first two chapters concern themselves with nonverbal media of the deep past: volcanic soils and practical arts, primitive rocks and primitive customs, hand axes and fossil bones. For this same period, poetry was the verbal medium of deep time: not of geological time, to be sure, but of a deep human past predating the written record, not yet formally understood as prehistory. According to Herder, the self-styled "historian of culture and of humankind," the true history of the species predates the "dead letter." The boundary between geology and human prehistory appears more permeable than ever in our geological moment, and Eric Gidal has made a compelling case for "bibliostratigraphy" as a method for showing how the development of human-induced climate change is inscribed in eighteenth- and nineteenth-century texts.⁷² Moreover, geological science today relies more than ever on metaphors of inscription such as stratigraphic "signatures," thereby diminishing the conceptual distance between deep time and the deep human past. The ballad revival, and in particular Blake's complex response to it over the course of his poetic career, demonstrates that poetry—like other deep time media—can serve a speculative reconstruction of the deep past.

The method of Blake, Walter Scott, and other poetic antiquaries is not naturalistic in the same sense as Buffon's, but like him they turn to ancient art as an evidentiary basis for prehistory: putatively ancient oral traditions are their equivalent for the flint arrowheads and similar artifacts used by Buffon and others to argue for a species history much anterior to the written record. Songs and ballads are analogous in several ways to the natural/cultural artifacts

elsewhere used to negotiate antiquity. My notion of “deep human time” is perhaps even more tendentious than the proposition that “deep time” in any form was recognized prior to the mid-nineteenth century. It is also, in a way, the keystone for the argument of this book, which is that the modern, post-Darwinian understanding of deep time rests as much on ethnographic disruptions of the Biblical timescale as on any recognition of the historicity of nonhuman nature. Blake and the “balladeers” (to adopt Maureen McLane’s capacious term) recognized that poetry, and the arts and sciences more generally, antedated the historical record, and this recognition “crossed over” into the recalibration of geological time in the sense that the expansion of human antiquity provided a powerful impetus to seek for earlier origins within natural history as well. The expansion of the human time scale in this domain of poetic antiquarianism thus offers a paradigm for the expansion of the GTS itself.

If a ballad revivalist such as Joseph Ritson (like Rousseau before him) could argue that writing was a late arrival on the scene of species history, then Cuvier could argue that the human species itself was a late arrival on the scene of earth history. The depth of human antiquity is not merely transferred from “natural” time, once the latter is discovered (this is the premise of Daniel Lord Smail and Andrew Shryock’s “time revolution” and, I think, of Foucault’s biological turn as well), but rather informs geological time in the first place, creates a favorable condition for the discovery of deep time in its broader sense.⁷³ In Chapter 4, I argue that Darwin’s *The Descent of Man* (1871) preserves this composite character in its attention to ethnographic encounter and to the evidence concerning prehistory afforded by the “comparative method” of making “savages” analogous to prehistoric peoples or even prehuman ancestors.⁷⁴ Darwin uses these materials to forge a link between geology and prehistory, thereby placing human evolution, too, in geological time.

Today we have a history of the human species that situates itself deliberately in the deep time of geology, as in the “deep history” of Smail and his colleagues or in the stunning proliferation of theories about the Anthropocene. The conceptual history of deep time reveals it as a story of the earth that reflects the entire history of the human species back to the reader at a glance. Ballard captured the curious composite that enables this “descent into deep time” in *The Drowned World* when he had Strangman, in imitation of Kerans’s typical mode, observe that “leaving the sea two hundred million years ago may have been a deep trauma from which we’ve never recovered.”⁷⁵ Ballard’s novel might be seen as anticipating both the geological idea of deep time popularized by McPhee and Gould in the 1980s and the climate change fiction of the twenty-first

century. *The Drowned World*, with its rich texture of allusions to baroque painting, Shakespeare, Keats, and T. S. Eliot, also incorporates a cultural history that predates the scientific revolution. Ballard alludes to a strand of *The Tempest* that is entirely apposite for the fiction of a planet nearly submerged by its oceans: the song beginning “Full fathom five my father lies,” Ariel’s account of the sea change suffered by a drowned man. Ballard passes over an equally apposite reference from this same scene (I.ii), Prospero’s injunction to Miranda to look “in the dark backward and abysm of time” and remember what she can of her life before their shipwreck, before her third birthday. Although it is merely a matter of twelve years, the bottomless depth of these early memories expresses the indefinite power of escalation inherent in time itself. The image calls for an extension of memory into prehistory, an imaginative labor akin to the contemplation of other temporal depths that nearly elude our grasp, including the origin of the earth as it is now understood.

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