"Geotheory": Past and Present

John K. Reed, Peter Klevberg*

Abstract

The closing decades of the eighteenth century saw the beginnings of modern geohistory. Recent work by historians of science have broken through the persistent mythology of Hutton-Playfair-Lyell, and many lessons have been drawn from a better understanding of the early fusion of secularized science and secularized history. But one lesson that has received little attention is the inhibitive role played by "geotheory," a genre of scientific writing popular in the last half of the eighteenth century. Geotheories were broad systematic attempts to scientifically explain Earth in its totality. They proved a barrier to the development of geology because of (1) their unrealistic scope, (2) unrealistic expectations, and (3) an unrealistic adherence to the hypothetico-deductive method of Newtonian physics, which in turn was related to serious misunderstandings of the limits of science and the nature of history. Numerous geotheories were published, each attempting to build a comprehensive explanation of Earth. By 1800, geotheory had fallen out of favor, replaced by inductive, limited, self-consciously historical investigations. Yet since geotheory reflects an innate drive in the human psyche for comprehensive understanding, it never really died. Our view of science and its disciplines is much different now, but facets of geotheory still exist—evolution being a secular example and grand "Flood models" a creationist manifestation.

Introduction

Mankind has a penchant for explaining his world—from the ancient creation myths to modern social theory. Greece was famed for its philosophy, the Chinese for their technology, and the Mayans for their mathematics. At root, though, most explanations are religious, reflecting the indelible image of God and Augustine's heart-shaped vacuum. Man was made to exercise dominion over the created order, and that required understanding. Despite the distortion from the Fall, man the image-bearer still seeks to know his world.

Beginning in medieval Europe, knowledge came to reside in the burgeoning universities, so named for their quest of finding unity of truth in the diversity of phenomena. Christianity drove this process, leading to the development of modern Western science after the Reformation. It was an evolutionary, not a revolutionary devel-

* John K. Reed, Evans, Georgia, reed4004@gmail.com
Peter Klevberg, B.S., P.E., Great Falls, Montana, grebvelk@yahoo.com
Accepted for publication January 15, 2011

opment (Hooykaas, 1999). Newton was born during the English Revolution, a contemporary of John Bunyan, and saw the end of the Puritan Age and the beginnings of the post-Puritan deism. Unfortunately, because science required a methodological distinction from theology, many grew to believe that it could be completely severed from theology without consequence. Combined with a growing antipathy towards orthodox Christianity in the early eighteenth century, it laid the groundwork for the use of science as an enemy of theology rather than an ally.

Despite the American and British revivalism of Edwards, Whitefield, and the Wesleys, the church languished during the eighteenth century (less so in America than in Europe), and orthodoxy was becoming increasingly irrelevant to the growing class of intellectuals. Deism and unitarianism were symptomatic of this growing trend; the Reformation was over. This era was marked by the emergence of an international group of savants that Rudwick (2005) called the "Republic of Letters." These intellectuals corresponded, traveled, and found common cause with like-minded men who were eager to unlock the mysteries of nature. Their heterodoxy may have appeared benignly eccentric at the time, but as the century progressed it became increasingly rigid and rabid, leading to a crescendo of atheistic fervor culminating in the French Revolution. In all the varieties of unbelief, there were several constants; the rejection of the Bible and a growing confidence that knowledge anchored in science was sure and certain, while that anchored in faith was weak and confused. Science became the new "revelation," replacing Scripture as the basis for truth—a position that only belatedly has been shown to threaten both truth and science.

Geology was born during those turbulent times to provide an explanation for physical phenomena associated with Earth's crustal features—strata, fossils, minerals, volcanoes, and river valleys—that were a growing area of interest among the savants. It was only natural that this new discipline would assume the role of the guardian of the prehuman prehistory that leading intellectuals were promoting as an antidote to Moses, since the story of those vast eons resided in the rock record. Of course, our understanding of geology's origins has advanced significantly in recent decades, largely thanks to serious historians of science who have finally rid us of the self-serving myth of the British invention of geology through Hutton, Playfair, and Lyell. Reading the primary sources has led these historians to recognize the wide variety of people and ideas that contributed to geology (e.g., Gould, 1987; Hooykaas, 1963, 1970; Laudan, 1987; Rudwick, 2005, 2008).

Although a better and more sophisticated understanding of the times has been gained, almost all of these historians fail to understand Christianity and therefore lose sight of its role—first as the mother of science (Glover, 1984; Hooykaas, 1999; Reed, 2001; Stark, 2003) and later as its foil. They record, but seem not to grasp, the depth of antagonism inherent in the secular worldview that was the product of the Enlightenment. Similarly, they do not grasp the importance of church history. Thus, a complete history of geology's origin awaits the historian of science who can add those missing ingredients.

But the current accounts are infinitely superior to what Gould (1987) called the empiricist cardboard myth perpetuated by Lyell and far too many generations of his followers. These recent histories reach into the social fabric of the times and rely on primary sources. These have resulted in a fresh understanding of methods and ideas. One of the lesser examined but significant of these is what Rudwick (2005) called "geotheory"—an enthusiastic search for a terrestrial synthesis to equal Newton's achievement, which explained so much via the law of universal gravitation. Geotheories were typically based on a few initial assumptions and the deductive application of nature's "laws," leading inevitably to the grand truth. The genre attracted many of the best minds of the eighteenth century, and a "theory of the earth" was considered the crowning achievement of a career in the "Republic of Letters."

Though Rudwick (2005) claims that geotheory died in the early nineteenth century, it is all too clear that the demise was really a short slumber. When we examine the basics of geotheory, we see current examples in both secular and Christian circles. Identification requires only that we grasp the essentials of the original genre. It was distinct from the more mundane descriptive and explanatory disciplines of the day, having more in common with the philosophical system building of the continental rationalists and Immanuel Kant.

Rudwick (2005) places the origin of geotheory in Thomas Burnet's (1635–1715) *Sacred Theory of the Earth* but notes that Burnet was heavily influenced by Descartes (1596–1650)—a cautionary example of how ideas in the sciences are often driven by trends in first-order philosophy. Geotheory became more prevalent (and more anti-Christian) in the latter half of the eighteenth century, following the works of Georges-Louis Leclerc, Comte de Buffon (1749, 1778). But what started so well ended in frustration because the ideas could not ultimately be proven or falsified. Once that became clear, the genre faded, replaced in the early 1800s by more inductive methods (Laudan, 1987) that emphasized limited empirical studies of the rock record. The work of Smith, Cuvier, and the savants of the London Geological Society was a clear break from and reaction to geotheory.

But the drive for grand explanations never really died. We need look no further than evolution to see a prime example. As a fundamental principle of the earth, life, and the cosmos, evolution is a template for comprehensive explanation of the past, present, and future. Though Darwin discussed species, modern evolutionists attempt to explain everything in their grand materialistic synthesis. Additionally, elements of geotheory can be found in other modern secular ideas like the big bang and plate tectonics. Nor are secular thinkers the only modern "geotheorists." This concept has even begun to crop up in modern creation science, with marked similarities between geotheory and various grand "Flood models." Thus, it is of concern to creationists, and we need to understand the Enlightenment origin of the genre to evaluate its coherence with the Christian worldview. This includes its historical context, its distinguishing criteria, and the distinctions between it and the subsequent geohistorical work in the earth sciences.

(1) Natural History	*"description and classification of the diversity of terrestrial things" (Rudwick, 2005, p. 59).*
(a) mineralogy	The collection, identification, and classification of specimens of minerals, rocks, and fossils; knowledge distributed by exact pictures.
(b) physical geography	The study of major features of Earth's surface, primarily through fieldwork, such as mountains, rivers, and volcanoes, with an emphasis on pictures and maps.
(c) geognosy	The study of the structure of Earth's crust; emphasizing cross sections to depict the third dimension and closely associated with mining. It was developed most strongly in German mining schools
(2) Natural Philosophy *"earth physics"*	The causal explanation via natural laws of terrestrial phenomena described by the sub-disciplines of natural history, and consciously distinct from the description and classification of those endeavors.
(3) Geotheory *"Theory of the Earth"*	A high-level theory or system of Earth as a whole, derived from unifying the causal explanations of earth physics into a coherent whole. The goal was to discover the one overarching cause of Earth's phenomena, just as Newton had done for the cosmos with gravity.

Figure 1. Sciences of the earth during the eighteenth century as described by Rudwick (2005). Note the absence of familiar boundaries between geology, biology, physics, and chemistry, which were not recognized at the time.

Historical Context

No comparison between Enlightenment and modern-day geotheories can be made without understanding the differences between scientific disciplines relevant to the study of the earth in the eighteenth century. Although both eighteenth-century and modern secularists believe the scientific method the only doorway to truth, the appearance of that doorway has changed in many ways. Rudwick (2005) devotes an entire chapter to explaining them, and what we present here is largely a synopsis of his work. To begin with, he notes:

> There was a major distinction between two complementary ways of studying the natural world. "*Natural history*" dealt with the description and classification of natural phenomena and natural objects of all kinds. "*Natural philosophy*"—or what Diderot called the "science of nature"—included the causal and mathematical relations between natural phenomena, as well as mathematics itself.... The phrase "natural history" therefore denoted the description of the natural world, and the orderly classification of its diversity, without any temporal connotations whatever (Rudwick, 2005, pp. 52, 53, emphasis his).

Thus, the scientific disciplines of the earth in the 1700s resided under three major headings: natural history, natural philosophy, and geotheory (Figure 1). Natural history was primarily a descriptive endeavor, including the acquisitive branch of mineralogy and the field studies of physical geography and geognosy. The former concentrated on landforms and surface phenomena, while the latter was concerned with the three-dimensional knowledge of the crust and especially its sedimentary layers. Natural philosophy attempted causal explanation of various observed phenomena, typically relying heavily on the new physics. Geotheory was the synthesizing of the observations of natural history and explanations of natural philosophy to create an overarching synthesis of Earth, including its past development and future prospects.

Geotheory must also be understood in its intellectual context. As is true in most cases, the best perspective is gained from examining contemporary trends in theology and philosophy. In theology, the Reformation and the Puritan era were over. Skepticism had replaced the earlier zeal for Biblical theology and the worldview that had marked those historical movements. Yet their influences were still felt, albeit in a distorted fashion. For example, the Christian belief in the unity of truth within the diversity of knowledge was clearly inherent in geotheory, although the corollary, that truth could be guaranteed only by God, had been lost in the glitter of the scientific age.

The church was in poor shape to correct these errors, and too weak, despite the revivals of the 1730s and 40s. A symptom of this weakness was the truncated cultural penetration of revivalism. In England, Wesleyanism had little impact on the continent, and with a few notable exceptions, such as Jonathan Edwards, revivals failed to win back the scholars—a hallmark of the Reformation and Puritanism. This led to an increasingly secularized intellectual class—the "Republic of Letters"—that was increasingly hostile to orthodox Christianity. Thus, a strong theological defense of the Christian worldview was lacking just at a time when it was most needed. The "salt" of the church, though still widespread in popular culture, had failed to prevent the rot in those savants that would drive the secularization of Western culture.

The pall of "Enlightenment" darkness is ironic in many respects. The incurable optimism that drove the rise of humanism with its fervent faith in science would not have been possible without the development of natural science spurred on by the Reformation (Reed, 2001; Schaeffer, 1982). Natural science opened doors for applied science, accelerating the pace of technological innovation that came to be known as the Industrial Revolution. Growing prosperity predictably spurred a turn from God. "Give me neither poverty nor riches; feed me with the food that is my portion; that I not be full and deny You and say, 'Who is the Lord?' Or that I not be in want and steal, and profane the name of my God" (Proverbs 30:8b-9 NASB). Europe's elite benefited from a science rooted in Christianity while hypocritically turning it into a weapon against the church.

First-order philosophy played its part in the religious disinterest of savants. The continental philosophers, with their love of system, degenerated rapidly away from the Christian rationalism of Descartes toward the deism and pantheism of Leibniz and Spinoza. Europe's elite deserted the faith, and the 1700s was an age of transition. In Britain, heresy took a different path. Locke's fundamental error in confusing first and second intentions of the mind (Adler, 1985) led eventually to the radical skepticism of Hume, which in turn "awakened" Kant, who built a tremendously influential anti-Christian system.

Yet even the most rabid Enlightenment atheist unconsciously absorbed parts of Europe's pervasive Christianity, and Christian theology informed many of the unexamined presuppositions of these thinkers (Glover, 1984; Reed, 2001). This was reflected in their optimistic humanism and trust in truth in both science and history, despite the lack of a coherent epistemology for either. Thus, geotheory was an interesting mix of ideas marking the transition from the vibrant Christianity of the seventeenth century to the looming atheism of later years. In retrospect, there was a dangerous combination of a blissful ignorance, naïveté of the complexity of creation, and an unwarranted optimism in the human potential to comprehend it.

Geotheory

What Was Geotheory?

This naïveté and unwarranted optimism were manifested in the short-lived enthusiasm for geotheory. A "theory of the earth" was the pinnacle of an eighteenth-century intellectual career. Men spent years doing the more mundane work of gathering and publishing natural history and natural philosophy, while building a foundation for a grand synthesis that would attempt to explain Earth in terms of a few comprehensive natural laws. These laws, it was thought, would break the code to the workings of man's terrestrial home in the way that Newton had deciphered man's cosmic surroundings.

> The ultimate goal of many savants concerned with the sciences of the earth was to construct what they called a "*system*" or high-level theory about the earth. This would be not merely a theory to explain specific features such as the elevation of mountains, the consolidation of rocks, or the emplacement of fossils, important though such problems were. On the contrary, a system would try in principle to include all such limited explanations within a single, overarching causal theory.… The aim was to emulate on a terrestrial scale the achievement of Newton in the realm of celestial mechanics. It was to discover the one and only true explanation of how the earth works, just as Newton was believed … to have discovered the one and only true theory to explain the movements of the sun and its planets, and all other stars and their putative planets throughout the universe, under the laws of universal gravitation. In other words, "Theory of the Earth" … was not just a human conjecture or "hypothesis", which might or might not be valid. It was Nature's (or God's) hidden construction, which another Newton might one day have the honor of discovering (Rudwick, 2005, pp. 133–134).

At first glance, this seems foreign to modern thought, but is perhaps less so than we think. Though theology and first-order philosophy have been jettisoned, materialistic science still possesses a schizophrenic drive for unifying explanation. The rationalism of the geotheorists has evolved into modern positivism, and scientists from both periods still tend to overestimate their ability to reach truth. For example, "evolution" as a general principle is applied with equal zest to the origin of galaxies or various human behaviors—Enlightenment savants would certainly recognize its breadth of application in terms of geotheory. But a closer examination of the Enlightenment genre is needed before we can make a careful comparison.

By the late 1700s, intellectuals had identified the normative features or rules for the genre. Rudwick (2005) identifies six key principles common to all (Figure 2). The ideal geotheory would:

- Explain Earth's major features, such as oceans, continents,

Systematic	Explain planet's major features in a unifying manner, since Earth was a unitary mechanism or entity. Necessarily complex.
Naturalistic	Direct divine action removed from consideration; science demands natural causes only.
Actualistic	Only observed causes are properly applied to workings and history of planet's features. Derived from Newton's "true causes."
Timeless (scientific)	Must be able to explain past, present, and future of planetary phenomena.
Hypothetico-deductive	Principles to deductive implications to supporting evidence.
Comprehensive	Principles must be able to explain everything from theology to human actions to physical phenomena. No demarcation between "scientific" and "nonscientific."

Figure 2. Characteristics of eighteenth-century geotheories, based on Rudwick (2005).

mountains, strata, volcanoes, fossils, and rivers. Earth was viewed as a complex machine or entity, and explanation was required to be equally complex.

- Be restricted to natural explanation. God might be retained as the ultimate cause, but phenomena were expected to have a "secondary" or natural cause. This mechanistic method would lay the groundwork for a mechanistic metaphysic (Glover, 1984) by gradually stepping away from the traditional Reformation view of divine providence (Hooykaas, 1999).
- Be actualistic. The contingent actualism that worked so well for physical science was a different matter for history, because the latter was grounded in special revelation in a way in which the former was not. Unfortunately, Enlightenment atheists and deists realized this sooner than Christians, and subtly altered the concept of actualism to eliminate God from the discussion.
- Describe past, present, and future developments on Earth. This illustrates the extent to which the scientific mind-set of Newtonian physics had been cemented into the minds of savants, in conflict with the linear, progressive time of Biblical history. In this context, it is easy to understand how the steady-state views of Hutton, for example, developed, and the tension between scientific and historical explanation continues to this day.
- Explain in a hypothetico-deductive fashion. Contrary to a later inductive emphasis, geotheorists would present foundational principles, deduce implications, and then present selective supporting evidence to "prove" their implications. Rudwick (2005, p. 137) notes that some savants even presented their theory before they gathered evidence in order to demonstrate their confidence in their fundamental principles!
- Explain everything from theology to fossils. Since Earth was home to man, human nature and actions had to be addressed. Rudwick (2005, p. 138) notes the disjunction between this approach and modern thought, since for Enlightenment thinkers, "any modern distinction between "scientific" and "non-scientific" questions would have been regarded as inappropriate and indeed meaningless."

Examples of Enlightenment Geotheory

Of the numerous geotheories of the eighteenth century, several stand out as examples of the genre, signposts to the future, and strong influences on the development of modern geology in the early 1800s. Rudwick (2005) discusses the ideas of Buffon, presented in two distinct geotheories, those of de Luc, and finally, Hutton's strange system as influential examples of geotheory.

Georges-Louis Leclerc, Comte de Buffon (1707–1788) (Figure 3),

Figure 3. Georges-Louis Leclerc, Comte de Buffon, author of two influential and atheistic geotheories of the eighteenth century.

decades ahead of Lyell, published two grand systems—the first, an implicitly eternalistic steady-state universe in his 1749 *Histoire naturelle*, and the second, a chronological history in his 1778 *Époques de la nature* (for more detail, see Reed, 2010). Although little, if any, of his "scientific" content survived, his aggressively anti-Christian materialism and ability to thumb his nose at the church (thanks to royal protection) set the mood for the rest of the century. Completely ignoring any semblance of Biblical authority, he presented the development of a world without God, a sad parody of Burnet's Christian theory. His strength was not his science, but his trailblazing arrogant materialist heresy.

> Buffon's models for the earth's temporal development were highly conjectural and could easily be dismissed as no better than a form of science fiction. Yet although most of their details were later abandoned, both of Buffon's geotheories were to remain powerful and fruitful exemplars for the future (Rudwick, 2005, p. 150).

Jean André de Luc (1727–1817) (Figure 4) was a Swiss naturalist and a tutor to Queen Charlotte of Britain. In contrast to Buffon, de Luc defended the reality of Biblical history, although his understanding of it was vague and subject to change by natural knowledge. The theme of his geotheory was that the continents and sea floor had exchanged places in a recent "revolution" just a few millennia ago, which he identified as the Biblical Flood. De Luc's determined but shaky defense of Genesis provides a barometer of the times.

Figure 4. Jean André de Luc, court tutor to Queen Charlotte and defender of the Genesis Flood.

> De Luc was well aware that to mention Genesis at all in a "philosophical" or scientific work was to invite a kneejerk reaction from many other savants. Far from expressing a view that was triumphantly dominant in his culture (as often portrayed by modern historical myth making), de Luc as a self-consciously Christian philosophe regarded himself as one of an embattled minority, indeed as part of a minority within a minority (Rudwick, 2005, p. 153).

Ironically, we owe the origin of the word "geology" to his work; he coined the term in his 1778 *Letters on Mountains* as a substitute for "cosmology." Thus, the first meaning of "geology" was geotheory.

Finally, Hutton's profoundly misunderstood and misrepresented geotheory was proposed relatively late compared to continental savants, and not completed until 1795. His deistic, teleological, steady state earth machine is far removed from the Hutton (Figure 5) of geologic lore (Reed, 2008a).

> Above all, however, Hutton's work has been misunderstood because it has not been treated, as it was by his contemporaries, as yet another "system" within the well-established genre of geotheory (Rudwick, 2005, p. 158).

Though dismissed by many of his contemporaries, who were tiring of the profusion of geotheories and who saw Earth's history in chronological rather than ahistorical terms, Hutton ironically became the "father of modern geology" thanks to Lyell's rewrite of the discipline that deliberately downplayed or ignored the prior work of French savants. Ironically, Rudwick (2005, p. 172) provides perhaps the best epitaph for Hutton, noting, "A sense of the history of the earth, whatever its source may have been, certainly did not come from Hutton."

Figure 5. James Hutton, Scottish mineralogist and "father" of uniformitarian geology.

Finally, Rudwick (2005) describes what he calls the "standard model" geotheory because it was common to many published theories of the earth. Its central idea was that of a receding ocean; today we call it "Neptunism" and mistakenly attribute it to Werner. Though Werner taught the concept, it preceded him and was based on the regression of a primordial ocean which precipitated Arduino's "primary" and "secondary" rocks as it gradually fell. Werner never published a geotheory.

> In fact, geotheories based on a falling global sea level were so general that they will be grouped together here and termed the standard model of the earth's temporal development (Rudwick, 2005, p. 173).

Thus, the controversy over the origin of basalt between Hutton the "Plutonist" and Werner the "Neptunist" would be distorted into an argument over the world ocean and the Flood. Some Lyellian propagandists would even present Werner as a defender of the Biblical Flood to bolster Lyell's carefully crafted but false image of Hutton as the empiricist who discovered deep time in the rocks, as against the deductive theologians who clung to the Flood.

The Fate of Enlightenment Geotheory

Like a comet, geotheory blazed through the late Enlightenment before disintegrating under the weight of its own unrealistic expectations, *and this trend may be of great relevance to creationists*. Geotheory was displaced by a competing paradigm of natural studies that emphasized limited field studies with inferences drawn inductively while in search of evidence in nature, rather than from deductive principles. This new approach was seen in the work of men like Nicolas Desmarest (1725–1815) and Jean-Louis Girard Soulavie (1752–1813), which culminated in that of Cuvier, with his emphasis on empirical paleontology, and William Smith and his stratigraphic mapping of England. It became the chosen approach of the rising class of gentlemen geologists in England, whose fieldwork would set the standard for geology for many years.

> However, in Saussure's time [late 1700s] a few savants were beginning to treat the earth as the product of nature's own history.… They were trying to construct narratives of events or states that could not be predicted … from any assumptions about initial conditions, but only pieced together from detailed analysis of specific relics from the deep past. There were two related sources for this new sense of "geohistory." … Ironically, the first was the radically historical perspective of the Judeo-Christian tradition. Rather than being the enemy of progress in the sciences of the earth, as later mythmaking has portrayed it, this orientation fostered the extension of historicity to the previously uncharted vastness of prehuman time. The second conceptual source was the secular analogue of biblical religion, namely the work of "erudite" historians and "antiquarians" in the practice of human history, which was expanding at just this time from its traditional focus on written texts to embrace a much wider range of evidence (Rudwick, 2005, p. 642, brackets added).

In the face of that "hard" scientific study, the rambling speculations of geotheories began to appear weak and ineffective. Furthermore, geotheorists became their own worst enemies. The popularity of the genre produced a number of competing works, none of which could be proven superior to the others because few of their assertions could be tested. This was largely due to their deductive approach.

> Hutton's was openly hypothetico-deductive; he propounded it *before* undertaking fieldwork to find evidence to confirm it (Rudwick, 2005, p. 642, emphasis his).

Perhaps another contributing factor was the weakening of the ties between the "Republic of Letters" during the French Revolution and Napoleonic wars. Ill feelings toward France were inevitable, despite attempts by savants to continue transcending national boundaries even when their respective nations were at war, and the English, who had come out on top in that bitter struggle, were not inclined to generosity. Perhaps this partly explains Lyell's saga that placed the origin of geology with James Hutton, rather than Desmarest, Soulavie, or Dolomieu.

While the technical elite of "natural history" and "geognosy" were concentrated in Germany, the key players jousting over geotheory were French and English. As time wore on, geotheory-riddled English influence continued to grow, not only in the contemporary and previous parts of the British Empire but elsewhere in Europe as well (Børresen and Wale, 2008). In any case, it is inarguable that British geologists and their theories increasingly ruled geology for most of the rest of the nineteenth century.

The Resurrection of Geotheory

Aspects of geotheory survive into the present. In fact, one might make the argument that it never died; it simply retreated into the background for a time. Each generation is quick to overestimate the ignorance of their predecessors and underestimate their own. Grand explanatory theories are typically the result of that twin prejudice. Modern geotheory has revealed itself in two distinct trends—secular and religious. We will examine each in turn.

Secular Resurrections of Geotheory

Perhaps geotheory is an inevitable manifestation of a fundamental aspect of human nature, and for that reason it will never really disappear. Mankind has an insatiable desire for comprehensive explanation, and mankind apart from God must find it in himself, in nature, or in some hidden principle of history (Schlossberg, 1983), such as Marx's class struggle. However, the age of science pushes people toward natural explanations of physical phenomena, and perhaps that is why secular examples of "geotheory" have rebounded and gained popularity.

However, one difference in modern thought has been the conscious identification of disciplines not recognized as such in the eighteenth and early nineteenth centuries. Today, we differentiate between biology, geology, and astronomy, even when they are addressing the mutual concept of natural history. Early naturalists would not have recognized these distinctions. Thus modern "geotheories" tend to remain anchored to particular disciplines, although their implications are broader.

Evolution is the primary example of modern geotheory. Starting as a bio-

Systematic	Evolution unifies explanation of all material phenomena. Everything from galaxies to human behavior can be explained in its evolutionary context.
Naturalistic	Causation is by definition naturalistic because evolution is the first principle of our modern materialistic cosmos. There is nothing beyond evolution that explains reality.
Actualistic	Problematic because evolution in the full sense cannot be observed. However, examples of "microevolution" are set forth in place of actual observation.
Timeless (scientific)	Evolution explains the past, present, and future of the cosmos, the planet, and life. As a principle, it transcends time, although it forces a particular view of history.
Hypothetico-deductive	Typically presented as inductive, but reality is otherwise. Evolution is a first principle; phenomena deduced as needed to support it.
Comprehensive	Evolutionists claim that everything can be explained by evolution, and that many phenomena already have been so explained. It does not always distinguish "explanation" and "interpretation."

Figure 6. Evolution qualifies as a resurrected form of eighteenth-century geotheory. The only difference is the inability of human observers to see evolution in action, requiring the substitution of inference for observation as is done with "microevolution" and biostratigraphy.

logical theory of speciation, it quickly assumed the role as the underlying principle of the entire universe to the point that its twentieth-century enthusiasts would say that "the whole of reality is evolution" (Huxley, 1955, p. 272). There is no question that it meets all of the criteria of eighteenth-century geotheory (Figure 6). It is systematic, naturalistic, actualistic, timeless (at least in the sense that it is an eternal fundamental principle of matter), hypothetico-deductive (the reality is contrary to the claims of its proponents), and comprehensive.

Other examples are not as complete or as fundamental as evolution, but the big bang theory and plate tectonics meet many of these criteria. Although not as systematic as evolution, plate tectonics claims to explain most geological and geophysical phenomena. It might be seen as the evolution of geotheory within later changes in the definitions of the disciplines. It is certainty naturalistic, but it suffers the same problem as evolution in regard to actualism—it exists on a scale of both space and time to make definitive observation and testing impossible. Thus, both evolution and plate tectonics cannot be observed but are inferred from observation. However, the reality of nineteenth-century geotheory was perhaps less actualistic than advertised; Hutton certainly went far beyond observation in his speculations. Plate tectonics is timeless; it is a fundamental process of Earth, inherent to its physical makeup, and spans the entire history of the crust. Like evolution, it pretends to be an inductive conclusion, but in reality, it is a deduction pressed on the data. This is demonstrated by the rigidity of plate tectonic theory; contrary data have not caused modification or rejection of the theory and in many cases they are simply ignored or addressed with ad hoc explanations (e.g., responses to Beloussov, the Meyerhoffs, and other critics). Plate tectonics is not comprehensive in the eighteenth-century sense, but it is comprehensive within the modern domain of earth science. Very little interpretation is done today without some reference to or implication of plate tectonics. With the death of Lyellian uniformitarianism, plate tectonics has joined deep time as one of the main integrating principles of geology.

Diluvial Resurrections of Geotheory

Secular scientists are not alone in resurrecting geotheory. Within a few decades of the rebirth of Biblical creation, creation scientists were engaged in attempting to construct speculative models of the Biblical Flood. Some are broader, attempting to unify the Bible's teaching of Creation, the antediluvian world, the Deluge, and its aftermath into one comprehensive model (e.g., *Creation in Symphony*, 1996). Perhaps the first, and by far the most comprehensive, was the hydroplate theory of Brown (1980), which has grown in scope and complexity with succeeding editions of his book. At the same time, one of the better (and largely unrecognized as such) debates over a Flood model was winding down. After extended published disputation in the 1970s and 80s, the early "vapor canopy" model was laid aside, although work continues on lesser versions (Rush and Vardiman, 1992; Vardiman, 2003). Another limited model was that introduced in 1990 by Oard for a post-diluvial Ice Age. Its propositions were defensible, and it has been largely accepted. But the drive for grand explanatory theories took a step forward with the highly publicized and promoted catastrophic plate tectonics theory (CPT) (Austin et al., 1994). CPT and Brown's hydroplate have found company in ideas of similar scope (e.g., *Creation in Symphony*, 1996; Budd, 1998; Fischer, 1992; 1994; 2006; Gentet, 2000; Tyler, 2006).

Why creationists seem determined to follow the trend toward modern geotheory remains uncertain. Perhaps it is simply human nature. There is a desire for creationists to "catch up" to their secular colleagues, proving that "creation science" is the equal of secular science.

There is also a desire to leverage the work of secularists and apply it in Flood models. This is seen by the embrace of many creationists of the geological timescale and its chronostratigraphy. It is a crucial component of the recolonization model and CPT. Both explicitly use the relative stratigraphic scheme of the timescale to drive key tenets of their model, despite it being an encapsulation of secular natural history and as such embodying both uniformitarian and evolutionary thought.

At present, the two most popular models among creationists are CPT, which since 1994 has been primarily the work of Baumgardner, and the hydroplate theory. Their popularity stems largely from their promotion—CPT by creationist organizations and hydroplate by Brown's own organization and iterative editions of his book. We will examine their similarities and dissimilarities with geotheory, although a similar analysis could be done for any of the Flood models (Figure 7).

	Hydroplate	Catastrophic Plate Tectonics
Systematic	Integrates explanation, over a wide range of phenomena from core to frozen mammoths, with an explicit claim to much greater power.	Makes explicit claim to explain the entirety of the Genesis Flood and all associated phenomena. Most published work is geophysical.
Naturalistic	Explanation does not require divine intervention except at Creation. Flood flows from pre-set planetary characteristics.	Explanation does not require divine intervention except at Creation. Flood flows from pre-set planetary characteristics.
Actualistic	Many earth processes are not actualistic, but can be derived from actualistic natural law.	Runaway subduction is not observed but is deduced and modeled from existing actualistic natural law.
Timeless (scientific)	Past and present explained by model, future predictions could be made based on extrapolation.	Past and present explained by model, future predictions could be made based on extrapolation.
Hypothetico-deductive	Explicitly stated that initial conditions and natural law require historical processes.	Principles asserted, but iterative use of modeling is inductive. But reality of events affirmed without doubt.
Comprehensive	Breadth of explanation is vast, but is self-limited to nature. Does not attempt to explain man or God.	Claimed to be comprehensive model of Flood, but in reality is less broad than Hydroplate model in published assertions.

Figure 7. A comparison of the two major Flood models to the criteria for eighteenth-century geotheory shows many similarities. Neither is as comprehensive as evolution; both are self-limiting to natural phenomena apart from man and God. Catastrophic plate tectonics is more limited and inductive than hydroplate, but both share the hypothetico-deductive bent of the hard sciences and claim unequivocally to represent historical reality.

Using the criteria shown in Figure 2, it is clear that both models share many tendencies of eighteenth-century geotheory. Both speculate about historical events for which there is little possibility of scientific testing. CPT claims a systematic and comprehensive status:

> In my view, as creationists we should be labouring with every resource we have at our disposal to bring to fruition a comprehensive Flood geology model/framework that accounts not only for large-scale tectonic phenomena but also from details of sediment deposition and erosion patterns and tectonics at a regional and local scale (Baumgardner, 2002, p. 81).

Brown's hydroplate model is actually more comprehensive than CPT. It purports to explain a great number of phenomena and presents a number of predictions by which it could potentially be tested. Both are theistic in the sense of affirming God's existence, creative works, and at least secondary causation of the Deluge. However, both are naturalistic in assuming that the events and processes of the Noahic Flood can be completely explained scientifically. In other words, God initiated the process, and physical laws took over. Like modern secular geology, the actualistic method of both models is limited. Past catastrophic events cannot be examined by modern analogues, and many of the conditions and processes of both models are outside the scope of geological observation. For example, no modern observation can confirm or disprove the historical existence of a layer of subterranean supercritical water, just as none can confirm or disprove the special mantle conditions necessary to initiate runaway subduction. Though neither addresses Earth's future, both models claim to present an accurate picture of the past and to explain present-day observations.

Methods of scientific reasoning in natural history are crucial yet seldom examined. Brown addresses his method briefly; Baumgardner does not. Laudan (1987) discussed five methods that have historically been used in geology (Figure 8). Her analysis is interesting, yet it is also illustrative of the futility of attempting to justify truth through science. A tangled web of epistemology underlies each of the different methods and typically presents a Gordian knot of confusion that could easily be cut by the orthodox

Methods of Scientific Reasoning Used in Geology

	Hypothesis	*Vera Causa*	Analogy	Enumerative Induction	Eliminative Induction
Who		defined by Sir Isaac Newton		early official method of London Geological Society	linked to Francis Bacon's "crucial experiments"
What	any hypothesis compatible with observed data is, at a minimum, probable	hypothesis requires causes that are both real and sufficient to explain data	hypothesis infers unknown causes from observed relations of similar nexuses, like ratios in math	hypothesis emerges as simple generalization of data	observed data must refute all possible rival theories
Strength	inferences can be derived from small set of observed data	fruitful results emerged from Newtonian science	allows investigation of unobserved cause/effect relations	inferences closely tied to observations	inferences have the potential for certainty
Weakness	method cannot exclude incorrect inferences that fit the *limited* data set		must establish correct "similarities" between causes and effects that are sufficient to extrapolate to unobserved causes	unsuitable for geology due to spatial and temporal impossibility of observing a relevant cause/effect nexus in Nature	inferences can provide false confidence because it is difficult to know all of the alternative theories
	Least Reliable	**Most Reliable**	**More Reliable**	**Limited Reliability**	**Less Reliable**

Figure 8. Laudan's (1987) analysis of scientific methods applicable to geology and natural history.

Christian position that truth comes by revelation, and as a consequence empirical human observations rest on assumptions that can be justified only by Scripture. This was the epistemology that allowed the unique creation of science in the first place (Glover, 1984). The subsequent rejection of Scripture as a source of truth underlying philosophy, history, or science has led modern philosophers to postmodern relativism and despair. Only the widespread ignorance of scientists regarding these trends has allowed a naïve positivism to persist. Furthermore, the erroneous idea that science is the proper home of natural history has also distorted the methods of both secular and creationist scientists who search for the certainty of experimental science in the inherent uncertainty of the unrecorded past (Reed, 2000).

However, Laudan's (1987) analysis is worth examining, if for no other reason than its rarity in treatises about natural history. She presents five methods that have been applied to geology: (1) hypothesis, (2) *Vera Causa*, (3) analogy, (4) enumerative induction, and (5) eliminative induction. She favors Newton's *Vera Causa* and the method of analogy as the most reliable for geological studies of the past. She favors analogy because it ties observations of modern processes to ancient products. She recognizes that the Lyellian univocal or near-univocal comparison of past and present can no longer be defended, but her belief in a more limited actualism assumes that indirect linkages are possible and helpful. *Vera Causa* has worked quite well in the hard sciences, but her assumption that science is the method of natural history boosts her confidence in its application to the past.

An argument could be made that eliminative induction is a more realistic method. This assumes natural history is a mixed question that inherently possesses the uncertainties of history but can benefit from forensic applications of science. *Vera causa* requires a burst of insight to derive a hypothesis to which true causes can be applied. Analogy is useful only for processes similar to ongoing ones. That may well eliminate aspects of the Flood and certainly eliminates Creation. We must reject the secular univocal uniformity of events and recognize instead that the greatest discontinuities in earth history—Creation and the Biblical Deluge—are the cause of the rock record. As Laudan notes, enumerative induction does not work well for past events. Thus, *by elimination*, we are left with eliminative induction.

In this method, science is used to eliminate historical hypotheses based on their failure to live up to their necessary predictions. Not all may be disproved, and the correct hypothesis may never be discovered. But that uncertainty is only to be expected of natural history. This was recognized by Lyell's contemporary Granville Penn (Mortenson, 2004, p.

60) and, refreshingly, by some in the creationist and intelligent design movements today (Tyvand, 2009). It is thus all the more regrettable that so many prominent creationist researchers habitually follow the evolutionists' natural history recipe and then cover it with a consciously creationist "frosting," failing to see the deeper and essential disparity of worldviews in these mixed questions.

Both CPT and hydroplate have severe weaknesses in describing and justifying their methods. Nor are any other grand Flood models of which we are aware much better in this regard. This raises at least two topics that must be addressed in more detail by creationists: (1) what is the place of grand explanatory models in natural history, and (2) how far can tentative local interpretations be integrated toward that end. Of course, that assumes an inductive rather than deductive approach in the first place, which apparently is also a topic needing discussion.

Hydroplate appears to rely on the method of hypothesis, which Laudan identifies (correctly) as an unreliable method for natural history.

> To explain scientifically an unobserved event that cannot be repeated, we must first assume the conditions existing before that event. From these assumed starting conditions, we then try to determine what should happen according to the laws of Physics (Brown, 2008, p. 116).

Thus, the hydroplate model appears to be an exercise in demonstrating as much coherence as possible between its unique starting conditions and its conclusions.

At first glance, CPT is more inductive, at least in the sense that iterative computer modeling has been applied to the problem. But it seems much the same in essence as hydroplate in the sense that special initial conditions are posited and then demonstration is attempted based on these assumptions. It may even be worse, since the computer modeling is another step removed from nature's reality. On the other hand, it has at least shown an inductive reflex to criticism by changing the timing and number of runaway subduction events (cf. Austin et al., 1994, versus anything by Baumgardner after 2002).

There are certainly differences between these Flood models and eighteenth-century geotheory. Both restrict themselves to scientific explanation, avoiding philosophical or theological discussions about the origin and nature of man. Both are constrained by our modern disciplinary boundaries, being primarily geophysical and geological, with support from chemistry and physics. However, these differences could be attributed to the different definition of the disciplines today. At any rate, they cannot mask the remarkable similarities that also exist.

Geotheory was overthrown by the limited, inductive emphasis of the early English geologists. There is no doubt that geology became organized as an effective field science by that change in strategy, even though elements of geotheory lingered. What relevance does that historical lesson hold for today, especially for creationists whose assets are limited? At the very least, it illustrates the need for a better historical understanding of the roots of the earth sciences and the ideas that drove them over the past two centuries. It also highlights the danger of a naïve positivism—the idea that with just a few "reasonable" assumptions, the "laws" of physics and chemistry can decipher a past that is not simply closed to direct observation but also lacks the uniformity of process necessary to successfully extrapolate knowledge of the present. That in turn should caution us against confusing natural history with empirical science and highlight the complex interaction between them. That is the reason that we have both followed Adler's (1965) classification of natural history as a mixed question and continue to advocate that approach. Finally, we see the most obvious lesson of the age of geotheory as being a warning against overconfidence, recalling that if scientists were objective that there would be no need for science.

Conclusions

The proper appreciation for both the opportunities and the limits of science was severely distorted by the Enlightenment. Science was divorced from its Christian roots and accorded an unrealistic status as the key to truth. Merging that error with the Cartesian mania for system building, eighteenth-century scientists struggled to find scientific systems that would fill the vacuum left by the rejection of Christianity. The result was geotheories, the most influential being those that dismissed biblical history—those of Buffon and Hutton.

But geotheory could not long survive its own weight. Even as philosophical skepticism began to grow, eighteenth-century scientists, being more philosophically attuned than their modern brethren, quickly realized that the geotheories were also unrealistic. Furthermore, they failed to deliver as promised—the end of the century saw a morass of competing systems, none of which could be demonstrated to be true or even as superior to its competitors. The growing trend of deriving geohistory from limited, field-based, inductive studies quickly replaced geotheory as the foundation of terrestrial science, and Hutton gave way to Cuvier, Smith, and the gentlemen geologists of the London Geological Society. Then the aftermath of the Napoleonic wars brought about the elevation of English geology at the expense of their French predecessors. This is illustrated by Lyell's "victory" over Cuvier, as well as by our modern ignorance of the work of Desmarest, Soulavie, Dolomieu, and others, which preceded that of Buckland, Murchison, Sedgwick, and Lyell.

However, man's innate need of grand explanatory theories guaranteed that geotheory would not remain buried. It reemerged in the late nineteenth and early twentieth centuries in the form of evolution, and to a lesser extent in the later big bang and plate tectonics. Creation science is not immune to the virus of geotheorizing. Although less comprehensive than the eighteenth-century theories of the earth, models attempting to comprehensively explain the Flood have begun to proliferate, each seeking to be the "silver bullet" that ties all observation and theory together into one neat explanation. The two most noticeable today—catastrophic plate tectonics and hydroplate—share many similarities with the old genre of geotheory.

But this trend toward grand explanatory models ignores several realities. The first is that science is not an autonomous source of truth and that its only link to truth is through the justification of its assumptions and methods via Scripture. Related to that is the reality that natural history is a mixed question, more closely associated with history than with science. Thus, natural history does not and cannot hold out the same certainty found in the hard sciences, like chemistry or physics, that are constrained by what Adler (1965) called "special experience"—controlled observation and experimentation. A third reality is the enormous complexity of the planet, which is further exacerbated among creationists by the paucity of full-time researchers. Perhaps eighteenth-century savants knew so little that they could be excused in overestimating their understanding of Earth and its processes, but we know enough today to better estimate the extent of our ignorance. In short, the correspondence between any present Flood model and truth is likely limited and perhaps even fortuitous. Finally, the secular rebirth of geotheory and the masking of modern geotheory as "science" (e.g., evolution) should make any creationist cautious of the structure, methods, and assumptions built into what is often presented as innocent summaries of data. A good example is the tendency to accept as much of the geological timescale as is possible (Snelling, 2009), despite its inherently anti-Christian nature on levels much deeper than the amount of time on its geochronologic scale (Reed, 2008b).

In rejecting geotheory as a serious exercise in natural history, early nineteenth-century scientists understood that their efforts were better spent on developing limited answers to limited questions based mostly on field evidence. Lyell was able to use Hutton's geotheory to support his ideas only because he distorted Hutton's actual work (beginning the legend of Hutton's unreadable prose) and convinced his audience that Hutton had not been engaged in geotheory. We cannot help but think that there is a lesson for creationists in this historical sequence: that the modern geotheories of our secular peers should not be emulated in terms of their method, any more than they should in terms of their anti-Christian conclusions.

References

CRSQ: *Creation Research Society Quarterly*

Adler, M.J. 1965. *The Conditions of Philosophy*. Atheneum Press, New York, NY.

Adler, M.J. 1985. *Ten Philosophical Mistakes*. Touchstone, New York, NY.

Austin, S.A., J.R. Baumgardner, D.R. Humphreys, A.A. Snelling, L. Vardiman, and K.W. Wise. 1994. Catastrophic plate tectonics: a global Flood model of Earth history. In Walsh, R.E. (editor), *Proceedings of the Third International Conference on Creationism*, pp. 609–621. Creation Science Fellowship, Pittsburgh, PA.

Baumgardner, J.B. 2002. A constructive quest for truth. *Technical Journal* 16(1):78–81.

Brown, W.T. 1980. *In the Beginning: Compelling Evidence for Creation and the Flood*. Center for Scientific Creation, Phoenix, AZ.

Brown, W.T. 2008. *In the Beginning: Compelling Evidence for Creation and the Flood*, 8th Edition. Center for Scientific Creation, Phoenix, AZ.

Budd, P. 1998. *Forbidden Geology*. Self-published book by author.

Buffon, G.-L. Leclerc, (Comte) de. 1749. *Histoire naturelle, générale et particuliére, avec la description du cabinet du Roi*. 36 volumes. Paris, France.

Buffon, G.-L. Leclerc, (Comte) de. 1778. Des époques de la nature [and] Notes justificatives des faits rapportés dans les époques de la nature. In Buffon, *Histoire naturelle*, supplement 5:1–254, 495–599, Paris, France.

Børresen, A.K., and A. Wale. 2008. *Kartleggerne* [in Norwegian]. Tapir Akademisk Forlag and Norges Geologiske Undersøkelse, Trondheim, Norway.

Creation in Symphony. 1996. DVD. The Creation Evidence Museum, Glen Rose, TX.

Fischer, J.M. 1992. Dividing the earth. *CRSQ* 28:166–169.

Fischer, J.M. 1994. A giant meteorite impact and rapid continental drift. In Walsh, R.E. (editor), *Proceedings of the Third International Conference on Creationism*, pp. 185–197. Creation Science Fellowship, Pittsburgh, PA.

Fischer, J.M. 2006. Shock dynamics. http://www.newgeology.us/index.html (as of April, 2011).

Gentet, R.E. 2000. The CCC model and its geologic implications. *CRSQ* 37:10–21.

Glover, W. 1984. *Biblical Origins of Modern Secular Culture*. Mercer University Press, Macon, GA.

Gould, S.J. 1987. *Time's Arrow Time's Cycle: Myth and Metaphor is the Discovery of Geological Time*. Harvard University Press, Cambridge, MA, 1997.

Hooykaas, R. 1963. *The Principle of Uniformity in Geology, Biology, and Theology*, second impression. E.J. Brill, London.

Hooykaas, R. 1970. Catastrophism in geology, its scientific character in relation to actualism and uniformitarianism. *Mededelingen der Koninklijke Nederlandse Akademic van Wetenschappen* 33:271–316.

Hooykaas, R. 1999. *Fact, Faith and Fiction in* *the Development of Science: The Gifford Lectures Given in the University of St Andrews 1976*. Kluwer Academic Pub., Norwell, MA.

Hutton, J. 1788. Theory of the earth; or an investigation of the laws observable in the composition, dissolution and restoration of the land upon the globe. *Transactions of the Royal Society of Edinburgh* 1:209–304, p. 288. www.mala.bc.ca/~Johnstoi/essays/Hutton.htm, (as of May 2008).

Huxley, J. 1955. Evolution and genetics. In Newrnan, J.R. (editor), *What is Science? chapter 8*, Simon and Schuster, New York, NY.

Laudan, Rachel. 1987. *From Mineralogy to Geology: The Foundations of a Science, 1650–1830*. University of Chicago Press, Chicago, IL.

Mortenson, T. 2004. *The Great Turning Point*. Master Books, Green Forest, AR.

Oard, M.J. 1990. *An Ice Age Caused by the Genesis Flood*. Institute for Creation Research, El Cajon, CA.

Reed, J.K. 2000. Historiography and natural history. *CRSQ* 37:160–175.

Reed, J.K. 2001. *Natural History in the Christian Worldview*. CRS Books, Chino Valley, AZ.

Reed, J.K. 2008a. St. Hutton's hagiography. *Journal of Creation* 22(2)121–127.

Reed, J.K. 2008b. Toppling the timescale, part I: evaluating the terrain. *CRSQ* 44:174–178.

Reed, J.K. 2010. Modern geohistory: an assault on Christianity, not an innovative compromise. *CRSQ* 46(3):201–216.

Rudwick, M.J.S. 2005. *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution*. University of Chicago Press, Chicago, IL.

Rudwick, M.J.S. 2008. *Worlds Before Adam: The Reconstruction of Geohistory in the Age of Reform*. University of Chicago Press, Chicago, IL.

Rush, D.E., and L. Vardiman. 1992. Radiative equilibrium in an atmosphere with large water vapor concentrations. *CRSQ* 29:140–145.

Schaeffer, F.A. 1982. *The Complete Works of Francis A. Schaeffer* (five volumes). Crossway Books, Westchester, IL.

Schlossberg, H. 1983. *Idols for Destruction*. Thomas Nelson, Nashville, TN.

Snelling, A.A. 2009. Order in the fossil record. *Answers* 5(1):64–68.

Stark, R. 2003. *For the Glory of God*. Princeton University Press, Princeton, NJ.

Tyler, D.J. 2006. Recolonisation and the Mabbul. In Reed, J.K., and M.J. Oard (editors), *The Geologic Column Perspectives within Diluvial Geology*, pp. 73–86. Creation Research Society Books, Chino Valley, AZ.

Tyvand, P. 2009. *Darwin 200 År: en Festbrems* [in Norwegian]. Origo, Copenhagen, Denmark.

Vardiman, L. 2003. Temperature profiles for an optimized water vapor canopy. In Ivey, B. (editor), *Proceedings of the Fifth International Conference on Creationism*, pp. 29–39. Creation Science Fellowship, Pittsburgh, PA.