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The Historical Development of the Old-Earth Geological Timescale

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This chapter will summarize the historical development of geology and in particular the development of the modern uniformitarian view of the geological record and the millions-of-years time-scale. The important proponents of old-earth thinking (including Werner, Smith, Hutton, Cuvier, and Lyell) along with some of the opponents of this view as it was developing (the scriptural geologists) will be discussed, as well as the key ideas in the development of the "geological column". This historical context is useful in assessing both the current evolution-creation controversy and the debate among creationists about the validity and role of the "geological column" in their models.[1]

Introduction

The fundamental features of geological study, namely, field work, collection and theory construction, were not developed until the seventeenth to nineteenth centuries. Previously, back to ancient Greek times, many scholars believed that fossils were the remains of former living things and many Christians (including Tertullian, Chrysostom, and Augustine) attributed them to the Noachian Flood. But other scholars rejected these ideas and regarded fossils as either jokes of nature, the products of rocks endowed with life in some sense, the creative works of God, or perhaps even the deceptions of Satan. In the seventeenth and early eighteenth centuries the debate among naturalists intensified. One of the prominent opponents of the organic origin of fossils was Martin Lister (1638–1712), an English physician and naturalist. John Ray (1627–1705), the greatest naturalist of his time, favoured organic origin although he respected Lister's objections. The debate ended when Robert Hooke (1635–1703), a British naturalist, confirmed from his microscopic analysis of fossil wood that fossils were the mineralized remains of former living creatures. However, he did not believe they were the result of Noah's Flood.

Early Geologists and Principles

Prior to 1750 one of the most important geological thinkers was the Danish anatomist and geologist Nicholaus Steno (1638–1686). Born to Protestant parents, he became a Roman Catholic in 1667. Steno was the first person to give a historical reconstruction of the formation of the geological layers of an area of the earth, in this case the area of Tuscany, Italy, where he lived for some time. He did so within a biblical framework and argues that the geological evidence confirms the truth of the literal history in Genesis 1–11.

In his *Prodromus*[2] (1669), Steno expressed his belief that the earth was almost 6,000 years old[3] and that organic fossils and the sedimentary strata were laid down by Noah's Flood. Based on his field observations in Tuscany and his reading about the geology of other locations, he set forth several principles for interpreting the rock record. Those principles laid the foundation for modern geology and are still taught and used by geologists today, although most of them probably have no idea that Steno was a Bible-believing young-earth creationist.

Steno's key geological principles were these. One, most of the rock layers were once water-laid sediments. Two, marine deposits can be distinguished from fresh-water deposits by the fossils they contain. Three, the order of superposition of the layers indicates the relative age of the strata (the older deposited below the younger). Four, the sediments were originally deposited in an essentially horizontal fashion. Five, strata that are no longer horizontal were disturbed after deposition.

Shortly after Steno, Thomas Burnet (1635–1715), a theologian, published his influential *Sacred Theory of the Earth* (1681) in which he argued from Scripture, rather than geology, for a global Flood. He made no mention of fossils and though he believed in a young earth he took each day in Genesis 1 to be a year or longer. Following

him, the physician and geologist John Woodward (1665–1722) invoked the Flood to explain stratification and fossilization, in *An Essay Toward a Natural History of the Earth* (1695). Woodward suggested that the specific gravity of the sediments and fossils determined the order in which they were buried in the rock record. In *A New Theory of the Earth* (1696) William Whiston (1667–1752), Newton's successor at Cambridge in mathematics, shared similar views though not based on personal geological investigations. But he suggested that a comet triggered the onset of the Flood and he added six years to Ussher's date of creation by arguing that each day of Genesis 1 lasted one year. Some of his reasoning was used later by those who favoured the day-age theory for Genesis 1.

In *Treatise on the Deluge* (1768) the geologist Alexander Catcott (1725–1779) used geological arguments to defend the Genesis account of a recent Creation and global Flood which produced the geological record. On the continent Johann Lehmann (1719–1767), a mining and mineralogy professor in Berlin, carefully studied German mountain strata and recognized three classes of rocks: the non-fossil-bearing and greatly inclined rocks in the high mountains (formed during Creation Week), fossiliferous rocks resting roughly horizontally on the flanks of the mountains (attributed to the Flood) and loosely consolidated rocks on top of these (produced after the Flood by accidents of nature from time to time).

Development of the Old-Earth Theory

The idea that the earth was much older than the Bible teaches slowly replaced the traditional view during the late eighteenth and early nineteenth centuries. Geologists such as the Frenchmen Jean Elienne Guettard (1715–1786) and Nicholas Desmarest (1725–1815) and the Italian Giovanne Arduino (1714–1795) denied the Flood and advocated a much older Earth. In his study of mountains Arduino agreed with Lehmann in many ways and gave the three classifications of rocks the names *Primitive, Secondary* and *Tertiary*. The English geologist John Whitehurst (1713–1788) contended in his *Inquiry into the Original State and Formation of the Earth* (1778) that the earth was much older than man and that although the Noachian Flood was a global catastrophe it was not responsible for most of the geological record.[4]

In France, three prominent scientists advanced the old-earth idea. In his *Epochs of Nature* (1778), which built on his thinking expressed in his *Theory of the Earth* (1749), Comte de Buffon (1708–1788) advocated the hypothesis that earth had originated from a collision of a comet and the sun. Extrapolating from experiments involving the cooling of various hot metals, he postulated that earth had passed through seven epochs over about 75,000 years to reach its present state. He had an evolutionary view of the origin and diversification of life (but offered no mechanism for such change) and his geological ideas were similar to Lyell's later uniformitarian theory. The astronomer Pierre Laplace (1749–1827) was strongly motivated to eliminate the idea of design or purpose from scientific investigations. As a precursor to modern cosmic evolution, he proposed the nebular hypothesis in his *Exposition of the System of the Universe* (1796). According to Laplace, the solar system was produced slowly over long ages as a hot, spinning gas cloud cooled and condensed by the laws of physics and chemistry. Jean Lamarck (1744–1829) was a naturalist specializing in the study of fossil and living shell creatures. In *Zoological Philosophy* (1809) he attempted to explain the similarities and differences between living and fossil creatures by a process of gradual evolutionary transformation involving the inheritance of acquired characteristics. He believed in spontaneous generation, rejected the notion of extinctions and became a fierce opponent of the catastrophist Georges Cuvier.[5]

The years 1780–1820 have been called the "heroic age" of geology. During this time geology truly became established as a separate field of scientific study. More extensive geological observations began to be made, new methods were developed for systematically arranging the rock formations, and the Geological Society of London (the first society fully devoted to geology) was born. But it was also during this period that geology became embroiled in the so-called Neptunist-Vulcanist[6] debate (Gillispie, 1951; Hallam, 1992). Neptunists believed that all the rock formations were deposited by water, whereas the Vulcanists contended that granites and basalts were produced by molten lava being pushed to the surface from deep in the earth. The leading advocates of the two positions were, respectively, Abraham Werner (1749–1817) of Germany and James Hutton (1726–1797) of Scotland.

Uniformitarianism

Werner was one of the most influential geologists of his time. He wrote very little. But as an excellent mineralogist and an inspirational and dogmatic teacher for 40 years at the University of Freiberg, Werner attracted the great loyalty of his students, many of whom became some of the prominent geologists of the nineteenth century (Laudan, 1987). His theory of earth history was briefly explained in his otherwise descriptive, 28-page *Short Classification and Description of the Various Rocks* (1786). As a result of his study

of the strata in Saxony, which were clearly water-deposited, he proposed that most of the earth's crust had been precipitated chemically or mechanically by a slowly-receding primeval global ocean over about one million years. Building on the ideas of Lehmann, Werner divided the rock layers into five periods. The lowest three, deposited by the global ocean and constituting most of the geological record, were the *primitive* rocks (devoid of fossils), *transition* rocks (strata with some fossils and roughly equivalent to the lower Paleozoic), and the *floetz* formations (the fossiliferous strata from the upper Paleozoic through the Cenozoic). The upper two nearly-contemporaneous formations were the *alluvial* (relatively unconsolidated deposits) and *volcanic* and were the result of local depositional events. Although Werner's theory of earth history was attractively simple, many objections were soon raised against it. But the idea of millions of years stuck with his students.

Hutton's geological views were published first in a 1788 article and then in a two-volume book in 1795, both entitled *Theory of the Earth*. His theory was significantly different from Werner's. He argued that the primary geological agent was fire, not water. The sedimentary rocks were the result of detrital matter from a previous state of the world being slowly eroded off the continents and carried by rivers to the ocean floor. There the sediments were gradually transformed into rock by the earth's internal heat and later raised by convulsions to form the land masses that we have today, which in time would be eroded into the oceans and later raised to become new continents.

Hutton's view was an early version of uniformitarianism: everything in the rock record must and can be explained by present-day processes of erosion, sedimentation, volcanoes, and earthquakes occurring at a regular rate throughout earth history.[7] His cyclical view of earth history expanded the age of the earth almost limitlessly. In fact, he asserted that he saw "no vestige of a beginning or prospect of an end" in the geological record.

In his *Illustrations of the Huttonian Theory of the Earth* (1802) John Playfair (1748–1819), mathematician and Scottish clergyman, republished Hutton's ideas in a more comprehensible form. He defended Hutton against the charge of atheism levelled by a number of contemporaries by arguing that Hutton's ceaseless cycles of geological processes were like Newton's laws of regular planetary motion. Although Playfair made no attempt to harmonize Hutton's theory with Scripture, he did defend Hutton's notion of the Earth's great antiquity by asserting that the Bible only addresses the time-scale of human history, which Hutton did not deny was relatively short, as the biblical chronology indicates. Like Hutton, Playfair also argued that the Flood was tranquil, not a violent catastrophe.

Catastrophism

Neither Hutton nor Werner paid much attention to the fossils. In contrast, William Smith (1769–1839), a drainage engineer and surveyor, became fascinated with the fossils and rock layers in the course of his work. After many years of field observations, he published three works from 1815 to 1817, which contained the first geological map of England and Wales and an explanation of the order and relative chronology of the stratigraphic formations as defined by certain characteristic (or index) fossils rather than the mineralogical character of the rocks.[8] He became known as the "Father of English Stratigraphy" because he gave geology a descriptive methodology for assigning relative ages to the various formations. This became critical for the establishment of the theory of an old earth. Though Smith believed that a global flood was responsible for producing the gravel, clays and sands scattered over the Earth's surface, he never explicitly linked this with the Noah's Flood and he believed that all of the sedimentary strata were deposited many long ages before this flood by a long series of supernaturally-induced, large-scale catastrophic floods separated by long ages. After each flood, God created new forms of life to replace what was destroyed.[9]

In the early 1800s Georges Cuvier (1768–1832), the famous French comparative anatomist and vertebrate palaeontologist, began to develop his theory of catastrophism[10] presented in his *Theory of the Earth* (1813). It went through several English editions over the next twenty years, with an appendix (revised in each later edition) written by Robert Jameson, the leading Scottish geologist. The son of a Lutheran soldier, Cuvier sought to show a general concordance between science and religion (Coleman, 1973). In his *Theory* he seems to have treated post-flood biblical history fairly literally, but did not interact with the text of the scriptural accounts of Creation and the Flood at all. He reacted sharply against Lamarck's evolutionary theory and his denial of extinctions. From his study of large quadruped fossils from the Paris basin, Cuvier concluded that many species had indeed gone extinct, but not all at once. Rather, like Smith, he theorized that in the past there had been many catastrophic floods. And with Smith he believed that each stratum was characterized by wholly unique fauna. The fauna had appeared for a time, were catastrophically destroyed, and then new life forms arose. Although Cuvier rejected Lamarckian evolution, it was not clear whether the new creatures were supernaturally created after each flood or if the stricken area was repopulated through migration of similar animals from outside

the flood zone. He believed that earth history was much longer than the traditional 6,000 years, but that the last flood had occurred only about 5,000 years ago. This obviously coincided with the date of Noah's Flood, but Cuvier never explicitly equated his last flood with it.[11] These violent catastrophes were vast inundations of the land by the sea. But they were not necessarily global, therefore whole species were not always eliminated. Man had first appeared sometime between the last two catastrophes.

Another important development at this time was the establishment of the Geological Society of London in 1807. It was the world's first scientific society devoted solely to geology. The 13 founding members were wealthy, cultured gentlemen, who began with little geological knowledge but quickly learned. From its inception it was dominated by old-earth thinking (the relation of Genesis to geology was never discussed in its public communications), although it did not overtly favour either uniformitarianism or catastrophism as those views were developing.

William Buckland (1784–1856), professor of geology at Oxford, was the leading geologist in England in the 1820s, initially following the catastrophism of Cuvier and Smith. Like many scientists of his day, he was an Anglican clergyman. Two of his students, Charles Lyell and Roderick Murchison, went on to become very influential uniformitarian geologists in the 1830s and beyond. In his efforts to get science, and especially geology, incorporated into the Oxford curriculum, Buckland published *Vindiciae Geologicae* (1820). Here he argued that geology was consistent with Genesis, confirmed natural religion by providing evidence of creation and God's continued providence, and proved virtually beyond refutation the global, catastrophic Noachian Flood. However, the geological evidence for the Flood was, in Buckland's view, only in the upper formations and topographical features of the continents; the Secondary formations of sedimentary rocks were antediluvian by untold thousands of years or longer. To harmonize his theory with Genesis he considered the possibility of the day-age theory, but favoured the gap theory. He never worked with the text of Genesis to show how old-earth theory could be harmonized with the Bible. Like Cuvier, he believed in multiple supernatural creations and that the creation of man was only a few thousand years ago.

After further research, he published his widely-read *Reliquiae Diluvianae* (1823), providing what he thought was a further defence of the Flood (albeit limited in its geological effects). However, the uniformitarian criticisms of Charles Lyell and others led Buckland to abandon this interpretation of the geological evidence in the early 1830s. He publicized this change of mind in his famous two-volume *Bridgewater Treatise* on geology in 1836, where in only two brief comments he described the Flood as tranquil and geologically insignificant (pp.I:16, 94–95). It is clear from Buckland's personal correspondence in the 1820s that geological evidence had a superior quality and reliability over textual evidence in reconstructing the earth's history (Rupke, 1983), because written records were susceptible to deception or error, whereas the rocks were truthful and could not be altered by man. He did not assert biblical fallibility, but certainly implied it in his statement.

Adam Sedgwick (1785–1873) was Buckland's counterpart at Cambridge, receiving the chair of geology in 1818. He too was an ordained Anglican clergyman and insisted all his life that old-earth theories did not contradict the Bible, but he never once attempted to show how they could be harmonized. Like Buckland, he was a catastrophist in the 1820s, but publicly recanted this view in 1831, embracing Lyell's uniformitarianism. Through the influence of these two clerical/academic geologists and others (for example, George Greenough, Rev. William Conybeare, Roderick Murchison, and Henry De la Beche in England and many geologists in Europe), old-earth catastrophist (or diluvial) geology was widely accepted in the 1820s by most geologists, and many clergy and theologians in Britain and North America.

There were several reasons most geologists at this time believed the earth was much older than 6,000 years and the Noachian Flood was not the cause of the Secondary and Tertiary formations (Buckland, 1820; Cuvier, 1813; Phillips, 1829–1836). First, it was believed that the Primitive rocks were covered by an average of at least two miles of Secondary and Tertiary strata, which showed slow deposition during successive periods of calm and catastrophe. Second, some strata had clearly formed from the violent destruction of older strata. Third, different strata contained different fossils; it was especially noted that strata containing terrestrial and fresh-water shells alternated with those containing marine shells, and that strata nearest the surface contained land animals mixed with marine creatures. Fourth, the lower strata generally showed a greater difference between fossil and living species, which suggested multiple extinctions, attributed to a series of revolutions over a long time. Fifth, evidence that faults and dislocations occurred after the induration of many strata implied a lapse of time between their formation and that of overlying strata. Finally, man was apparently only found fossilized in the most recent strata. Geologists concluded that the Earth was tens of thousands, if not millions, of years old and the relatively recent Noachian Flood affected only the rounded valleys and hills carved into consolidated strata and deposited only the superficial gravels and boulders (c.f., Buckland, 1820; Phillips, 1829).

By the end of the 1820s the major divisions of the geological record were well defined (Fig. 1). The Primary

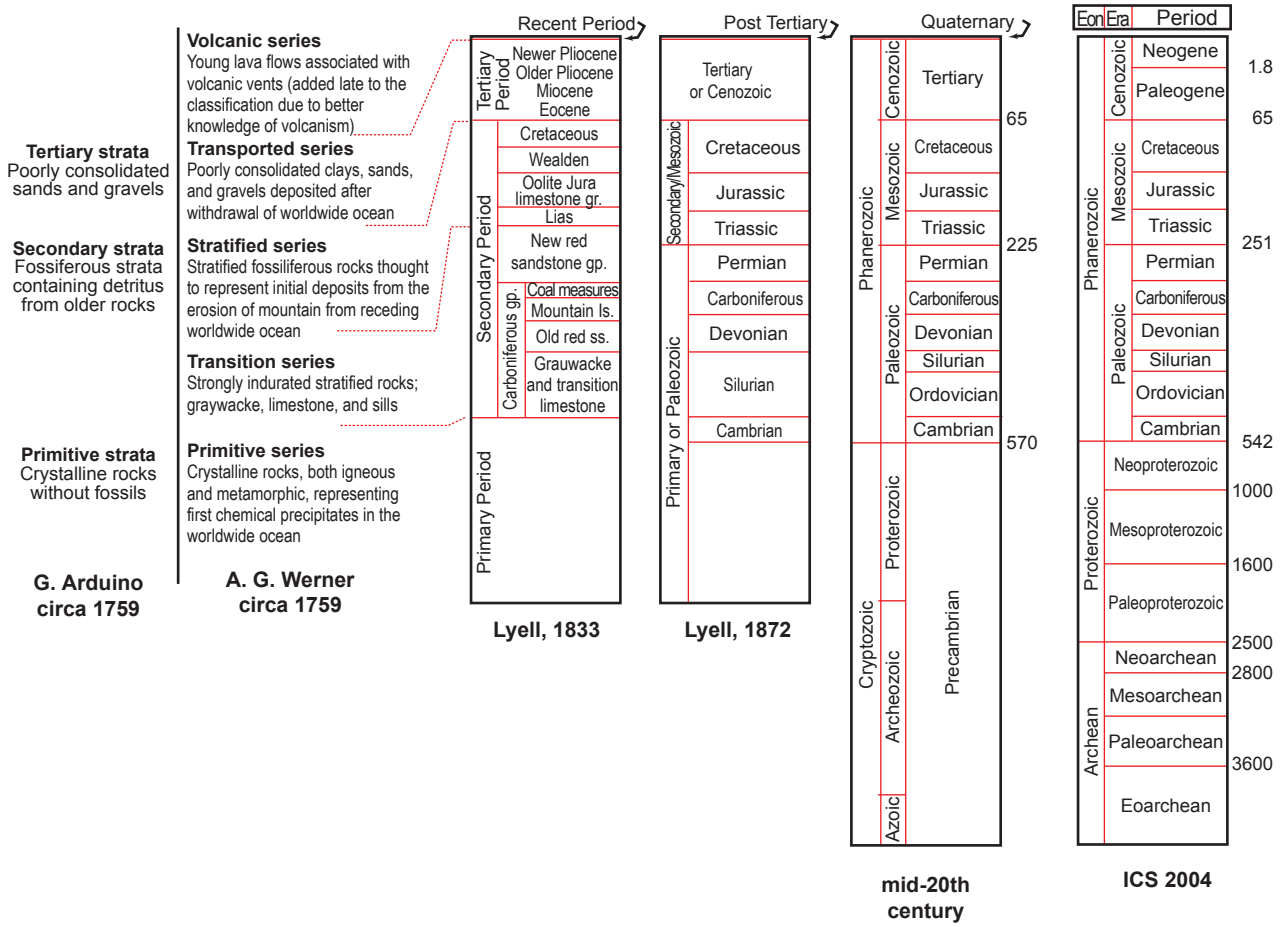

Fig. 1. Chart showing development of geological timescale in England. Modified from Rudwick (1985) and Gradstein et al. (2004).

rocks were the lowest and supposedly oldest, and were primarily igneous or metamorphic rocks devoid of fossils. The Secondary rocks were predominantly fossiliferous sedimentary strata. The Tertiary formations also contained many fossils, but they more closely resembled existing species. Atop all were Alluvial deposits of gravel, loose sands, boulders and soil. More detailed local classifications were not always easily correlated.

A massive blow to catastrophism came between 1830 and 1833, when Charles Lyell (1797–1875), a lawyer by training as well as a former student of Buckland, published his masterful three-volume work, *Principles of Geology*. Reviving the ideas of Hutton, Lyell's *Principles* set forth geological methods based on a radical uniformitarianism: only present-day erosional, sedimentary, volcanic, and tectonic processes at present-day rates of intensity, frequency and magnitude should be used to interpret past geological activity.

Although the catastrophist theory had greatly reduced the geological significance of the Noachian Deluge and expanded earth history well beyond the traditional biblical view, Lyell's work was a fatal blow to the Flood, explaining the whole rock record by slow gradual processes, thereby reducing the Flood to a geological non-event. His theory also expanded the length of earth history even more than catastrophists had. Lyell saw himself as "the spiritual saviour of geology, freeing the science from the old dispensation of Moses" (Porter, 1976, p. 91). Catastrophism did not die out immediately, although by the late 1830s few old-earth catastrophists in Britain, America, or Europe believed in a geologically significant Noachian Deluge.

Uniformitarian and catastrophist old-earth theories of the early nineteenth century did not go uncontested (Fig. 2). During the 1820s to 1840s a group of Christian writers, who collectively became known as "scriptural geologists," published their biblical, geological and philosophical objections in pamphlets, journal articles, and short or quite long books. Some of these men were clergymen; some were not. Some were scientists and others not. And as was not uncommon at this time, some of the scriptural geologists were both clergymen and scientists. Some were geologically competent by the standards of their day (both by reading and geological field work) to critique the old-earth theories. Many of their biblical and geological objections are similar to arguments used by young-earth geologists today. The primary sources of this period show that the writings of the most geologically competent scriptural geologists were ignored and their arguments never refuted

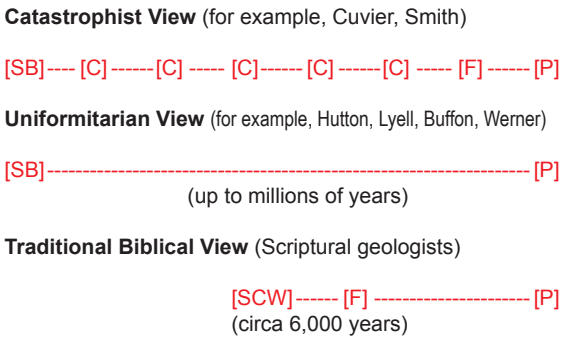

Fig. 2. Timelines of earth history according to the three views of the early nineteenth century.
SB = supernatural beginning;
SCW = supernatural creation week of six literal days;
C = catastrophic flood of regional, continental or global proportions;
F = Noah's Flood;
P = present.

(Mortenson, 2004). While their biblical arguments were not identical and they disagreed on minor details, the scriptural geologists all believed (in harmony with most of the church for 1,800 years) that God had created the world in six literal days about 6,000 years ago and that most of the geological record was the result of the global, year-long, catastrophic Noachian Flood.

Fine-tuning the Geological Column and its timescale

From the mid-1820s geology rapidly matured. Smith's stratigraphic methodology (using fossils to correlate the strata) was applied more widely by a growing body of geologists to produce more detailed descriptions and maps of the geological record. There was still debate over the nature and origin of granite, and Cuvier's widely-accepted interpretation of the Paris basin was being challenged. By the early 1830s, all the main elements of stratigraphic geology were established, and maps and journal articles became more technical as geology made the transition from amateur avocation to professional vocation. The 1830s and 1840s saw much debate about the classification of the lowest fossiliferous formations (the Cambrian to Devonian), and the glacial theory emerged to explain geological features which the earlier catastrophists had attributed to the Flood. By the mid-1850s all the main strata were identified and the nomenclature was standardized (Fig. 3). However, none of these developments added any fundamentally new reasons for believing in a very old earth, and all of this fine-tuning was based on principles established by Cuvier, Smith, Lyell and others.

In the last half of the nineteenth century, estimates of deep time increased and became more precisely

Eon	Era	Epoch	Date	Basis for stratigraphic nomenclature
Phanerozoic	Cenozoic	Holocene	1885	Third International Geological Congress renames Lyell's "recent"
		Pleistocene	1839	C. Lyell, eastern Sicily, based on % modern molluscks
		Pliocene	1833	C. Lyell from mollusk studies in England, France, Italy
		Miocene	1833	C. Lyell from mollusk studies in England, France, Italy
		Oligocene	1854	H.E. von Beyrich, northern Germany and Belgium
		Eocene	1833	C. Lyell from mollusk studies in England, France, Italy
		Paleocene	1874	W.P. Schimper, based on rocks in the Paris Basin
	Mesozoic	Cretaceous	1822	Conybeare/Phillips (England) grouped chalk and lower strata, following Smith's earlier 4-fold division
		Jurassic	1893	L. von Buch formalized von Humbolt's Jura Limestone from Jura Mountains in Switzerland
		Triassic	1834	F.A. von Alberti grouped three distinct units into "Trias" in southern Germany
	Paleozoic	Permian	1841	Murchison from type section in Urals, near Permian, Russia
		Carboniferous	1822	Conybeare and Phillips formalized name for coal-bearing strata in northern England
		Devonian	1839	Sedgwick and Murchison, type section near Devon, England
		Silurian	1938	R.I. Murchison from type section in Wales
		Ordovician	1879	Lapworth identified new epoch to resolve Cambrian-Silurian controversy (Murchison vs. Sedgwick)
		Cambrian	1835	A. Sedgwick from section near Cambrian (northern Wales)
Precambrian				Informal name for everything beneath Cambrian, formal divisions (that is, Archean) are based on absolute dating

Fig. 3. Nomenclature for the column developed during the mid 1800s.

quantified. In 1863 the great English physicist Lord Kelvin (1824–1907) used thermodynamics related to the internal heat of the earth to argue for a "young" age of the earth of only about 98 million years, much too short for Darwin's theory (which he rejected). But his view did not hold sway for long. Radioactive isotopes were discovered in 1896 by the French physicist Henri Becquerel (1852–1908). Heat from their decay negated Kelvin's conclusion, supporting the geologists' calls for hundreds of millions of years. Between 1903 and 1906, the famous New Zealand physicist Ernest Rutherford (1871–1937) determined that isotopes could be used to date rocks. By the 1930s, through the efforts of Arthur Holmes, the age of the earth had expanded to about 2 billion years, and has since risen to ~4.6 billion years (Robb et al., 2004). Modern additions to geology (for example, plate tectonics) are merely refinements of the uniformitarian-naturalistic worldview.

In the last part of the twentieth century, two unexpected ideas emerged. In 1961, the young-earth creationist movement was launched by the publication of *The Genesis Flood* by John Whitcomb and Henry Morris, who had been influenced by a few critics of old-earth geology in the first half of the twentieth century. Since then, creationists have been hammering out an increasingly sophisticated model of origins (Morris, 1993). In the 1970s, some secular geologists also began to question uniformitarian assumptions. Returning to ideas of the early nineteenth century catastrophists, these "neo-catastrophists" reinterpreted many formations to be the result of rapid, violent catastrophic floods (Ager, 1973; 1993). It remains to be seen if the geological establishment will continue to ignore the work of modern YEC geologists, as they did the writings of geologically competent scriptural geologists.

Key Issues in Old-Earth Theory

To understand the historical development of the old-earth theory and the extent of the validity of the conventional geological column, it is important to carefully consider several key issues.

Naturalism

Philosophical assumptions drove the development of the old-earth theories in the early 1800s. Two key assumptions were: (1) everything in the physical universe can and indeed must be explained by time, chance and the laws of nature working on matter; and (2) natural physical processes have always acted in the same manner, rate and intensity as we see operating today. These assumptions form the basis of uniformitarian methodological naturalism, which took control of modern science in the early nineteenth century, decades before Darwin published *Origin of Species* in 1859. Although many scientists today allow large-scale catastrophes, uniformitarian thinking is still endemic and naturalism is king. So, the heart of the debates about the age of the earth and about how to correctly interpret the geological record is a massive worldview conflict.

Many old-earth pioneers expressed their worldview clearly. For example, Buffon wrote:

> In order to judge what has happened, or even what will happen, one need only examine what is happening.... Events which occur every day, movements which succeed each other and repeat themselves without interruption, constant and constantly reiterated operations, these are our causes and our reasons (cited in Gillispie, 1970–1980, vol. 2, p. 578).

Hutton similarly wrote:

> The past history of our globe must be explained by what can be seen to be happening now … . No powers are to be employed that are not natural to the globe, no action to be admitted except those of which we know the principle (cited in Holmes, 1965, pp. 43–44).[12]

Obviously, such statements ruled out a priori God's supernatural creation of the world in six days and the supernatural, global, year-long, catastrophic Noachian Flood. Werner, Laplace, Smith, Lyell and other leading developers of old-earth thinking followed this reasoning, and sadly many Christian geologists (Britain's Buckland and Sedgwick, America's Benjamin Silliman and Edward Hitchcock) were infected with this kind of thinking without realizing it.

Conscious rejection of Scripture

This naturalistic (deistic or atheistic) way of thinking developed in the social context of an overtly Christian culture in Europe and it was the result of a conscious rejection of Scripture. This anti-biblical worldview was often deliberately hidden from view in early published works which played lip-service to God's existence. But unpublished writings from the same men are more straightforward.

Buffon correctly perceived that his old-earth theory would be unacceptable to the Catholic Church. So, although his unpublished manuscript estimates 3,000,000 years for the age of the earth, his published book gives an age of 75,000 years (which still was not acceptable to Catholic theologians). Jacques Roger, a leading twentieth century French historian of science, says that "Buffon was among the first to create an autonomous

science, free of any theological influence" (O'Connor and Robertson, 2004, no pagination). Of course, he did no such thing. Rather, he wanted to enslave science to his own unbiblical theology and to "free" science from the Christian framework that was the womb for modern science.

In his *Theory of the Earth*, Cuvier briefly mentioned Genesis, the Creation, the Deluge and God, but dismissed all earlier efforts (including Burnett, Woodward and Whiston—no mention of Steno) to make sense of the geological record in light of those two events. He himself made no attempt to correlate his theory with biblical history except to allude to the post-Flood biblical chronology as giving a reasonable date for the Flood. But he did not specifically refer to any passage and ignored Genesis 1–9 and Exodus 20:8–11.

Lyell explained in a lecture on King's College London in 1832 that:

> I have always been strongly impressed with the weight of an observation of an excellent writer and skillful geologist who said that 'for the sake of revelation as well as of science—of truth in every form—the physical part of Geological inquiry ought to be conducted as if the Scriptures were not in existence' (Rudwick, 1976, p. 150).

Such reasoning might be permissible, if the Bible did not describe any events relevant to the formation of the rocks of the earth (such as the Creation Week and the Flood). But since the Bible does speak of such events, Lyell's approach is like trying to write a history of ancient Rome by studying the surviving monuments, buildings, artwork, and coins, but intentionally ignoring the writings of reliable Roman historians!

Lyell revealed his animosity toward the Bible and his devious plan to undermine its teachings in private correspondence. He confided in an 11 August 1829 letter to his friend and fellow old-earth geologist, Roderick Murchison, just months before the publication of Lyell's first volume of *Principles of Geology* (1830):

> I trust I shall make my sketch of the progress of geology popular. Old [Rev. John] Fleming is frightened and thinks the age will not stand my anti-Mosaical conclusions and at least that the subject will for a time become unpopular and awkward for the clergy, but I am not afraid. I shall out with the whole but in as conciliatory a manner as possible (Quoted in Brooke, 1979, p. 45, bracketed words added).

And to George P. Scrope (fellow uniformitarian geologist and Member of Parliament), Lyell wrote on 14 June 1830:

> I am sure you may get into Q.R. [*Quarterly Review*] what will free the science [of geology] from Moses, for if treated seriously, the [church] party are quite prepared for it. A bishop, Buckland ascertained (we suppose [Bishop] Sumner), gave Ure a dressing in the *British Critic and Theological Review*. They see at last the mischief and scandal brought on them by Mosaic systems … . Probably there was a beginning—it is a metaphysical question, worthy of a theologian—probably there will be an end. Species, as you say, have begun and ended—but the analogy is faint and distant. Perhaps it is an analogy, but all I say is, there are, as Hutton said, 'no signs of a beginning, no prospect of an end' … . All I ask is, that at any given period of the past, don't stop inquiry when puzzled by refuge to a 'beginning', which is all one with 'another state of nature', as it appears to me. But there is no harm in your attacking me, provided you point out that it is the proof I deny, not the probability of a beginning … . I was afraid to point the moral, as much as you can do in the Q.R. about Moses. Perhaps I should have been tenderer about the Koran. Don't meddle much with that, if at all.
>
> If we don't irritate, which I fear that we may (though mere history), we shall carry all with us. If you don't triumph over them, but compliment the liberality and candour of the present age, the bishops and enlightened saints will join us in despising both the ancient and modern physico-theologians. It is just the time to strike, so rejoice that, sinner as you are, the Q.R. is open to you.
>
> P.S. … I conceived the idea five or six years ago [1824–25], that if ever the Mosaic geology could be set down without giving offence, it would be in an historical sketch, and you must abstract mine, in order to have as little to say as possible yourself. Let them feel it, and point the moral (Lyell, 1881, I:268–271, bracketed words added).

So we could add one more assumption to early nineteenth century science: the Bible has nothing relevant to say to the question of the age and history of the earth.

But none of this is surprising when we consider the theological orientation of the men who were most influential in the development of the old-earth theory. Buffon was a deist or atheist, disguising the fact with occasional references to God (Gillispie, 1970–1980, vol. 2, pp. 577–578). Laplace was an open atheist (Brooke, 1991, pp. 238–240). Lamarck straddled the fence between deism and atheism (Brooke, 1991, p. 243). Werner was a deist (Page, 1969, p. 257) or possibly an atheist (Hallam, 1992, p. 23) and hence "felt no need to harmonize his theory with the Bible" (Gillispie, 1970–1980, vol. 14, pp. 259–260). Historians have concluded the same about Hutton (Dean, 1975, pp. 187–193). William Smith was a vague sort of theist, but according to his nephew (a fellow geologist) he was most definitely not a Christian.[13] Cuvier was a nominal Lutheran, but recent research has shown that in practice he was an irreverent deist (Brooke, 1991, pp. 247–248). Lyell was probably a deist (or

a Unitarian, which is essentially the same) [Russell, 1985, p. 136]. Many of the other leading geologists of the 1820s and 1830s were likewise anti-Christian. These men were hardly unbiased, objective pursuers of truth, as they would have wanted their contemporaries to believe and as modern evolutionists and historians of science want us to view them.

Shells and the dating of strata

Since shells made up the vast majority of fossils, they had a great, if not singular, importance for old-earth geologists. For example, William Smith, the "Father of English Stratigraphy", based his depiction of the geological column primarily on shells, which constituted the great majority of the fossils he listed in works on the geological record.[14] But he admitted that he did not know much about shell creatures in terms of species classification:

> … on this principle [of arranging the strata by their fossils] I have ventured, without much knowledge of Conchology, and with weak aids in that science (Smith, 1817, p. vi, bracketed words added).

In 1828 Lyell worked out his interpretation of the Tertiary (on which the first and later editions of his *Principles of Geology* depended) solely on the basis of shells (Lyell, 1863) even though he did not start studying "conchology" until 1830 (Lyell, 1881). Buckland stated that fossil shells were "of vast importance in investigating the records of the changes that have occurred upon the surface of our globe" and that "in fact without these [organic remains], the proofs of the lapse of such long periods as Geology shows to have been occupied in the formation of the strata of the Earth, would have been comparatively few and indecisive (Buckland, 1836, pp. I:110–112, bracketed words added). Geologist James Smith (1838) stated that judging the age of a deposit purely on conchological considerations was a sound rule of geological reasoning. So these "index fossils" were of critical importance as evidence for the old-earth theories.[15]

Several scriptural geologists raised objections to this use of fossil shells in dating the strata, referring both to uncertainties in taxonomic classification of shells and to ambiguities about their geological distribution. But they were not the only objectors. In both the 1812 and the 1831 editions of his *Theory of the Earth*, Cuvier rejected the use of shells as a means of reconstructing earth history, because differences in fossil species in the strata may have been the result of slight changes in salinity or temperature of the water or some other accidental cause, and because testaceous animals were still too poorly known to confidently claim that some were extinct (Cuvier, 1813; 1834). From 1808 to 1813 Beudant (to whose work the scriptural geologist George Young referred) had experimentally shown that marine shell creatures could adjust to life in fresh water and similarly fresh-water shellfish could become accustomed to life in the sea if the change in salinity was gradual as in the brackish waters of river deltas (Beudant, 1816). The old-earth geologist Macculloch (1824) referred to this and other observations about fish and shell creatures when he cautioned geologists about the use of these fossils to distinguish fresh-water geological formations from those of marine origin. Six years later, he said that the use of fossils to identify, correlate and date strata from different locations was "groundless" and "nearly, if not entirely, useless" (Macculloch, 1831, pp. I:422–428, 453). In 1819 Greenough (pp. 302–304), then president of the Geological Society and an old-earth advocate, concluded that Cuvier's theory of the Paris Basin was open to "insurmountable objections," one of which was the difficulty of confidently distinguishing fresh-water and marine shells.[16]

Charpentier (1825), one of the leading geologists in Europe, argued that only the relative position of strata could indicate the relative ages of the rocks, because knowledge of fossils and their distribution in the strata was not sufficiently precise to use them as an index for dating. Also, the conchologist William Wood decried the "extreme multiplication of the genera [of shell creatures], rather to increase than remove the difficulty of determining the species" (1825, p. iv, brackets added). In an article on mollusca in the *Edinburgh Encyclopaedia* (1830) the old-earth zoologist John Fleming remarked on persistent difficulties in classifying shell creatures into species, genera and even the correct orders. The next year, De la Beche (1831) expressed strong caution in using shells to date strata, because of the considerable errors and confusion in the catalogues of fossil shells.

In the five editions of his *Introduction to Geology* published and revised between 1815 and 1838, the respected old-earth geologist, Robert Bakewell, repeatedly expressed his conviction that many of his fellow geologists relied too much on shells in their interpretations of the rocks: both in identifying distant, non-contiguous formations and in distinguishing fresh-water from marine deposits. He deemed this unwise because of the limited knowledge of shell creatures and the continuing evidence of much erroneous classification, especially the multiplication of species and genera.[17] One reviewer of Bakewell's 1828 third edition apparently agreed with him about the dangers in applying conchological knowledge to stratigraphy (T. anonymous reviewer, 1829).

One of the most important challenges to the old-earth geologists' use of *mollusca* to identify and correlate rock layers was the work of John Gray (1800–1875), a leading conchologist at the British Museum. In 1833 he

recorded the many difficulties and errors that had been made in classifying shell creatures based on the shells' features, which often resulted in the creation of many different species and genus names for what in reality was a single species. He cited examples where the shell nucleus (its embryonic form in the egg) of some large species had been mistaken for the full-grown shells of another species. He also noted that the nuclei of many shells of different genera do not have the same characters as their parent shells. He gave examples of shells that had swirls in opposite directions and so were classified as different species, when in fact they were the same. He showed that many species possess shells that are very regular when they are young, but whose adult forms are often irregular due to the substrate to which the animal attaches. Then there were the curious anomalies of shells that changed the direction of their last whorls as they approached maturity and sometimes even reverse the position of the mouth. And he noted that fractured shells had sometimes been named as different species. Gray remarked: "The shape of attached shells depends greatly on the form of the bodies to which they are applied; and this is a circumstance that has been generally overlooked by conchologists" (1833, p. 781). He noted that authors had multiplied species on this basis. Gray demonstrated that the water's turbulence, the shell's exposure to light, temperature, and food would profoundly affect the thickness, roughness, color or size of the shells, leading many conchologists to multiply species. The article pointed out many other errors of conchologists (even leading experts) in the identification and classification of shell creatures at the species, genus, and family levels.

Two years later, in 1835, when the old-earth theory was more firmly established in geology (and Lyell's uniformitarianism was rapidly bringing catastrophists to the point of recantation), Gray published further results of his own observations and experiments which he explicitly applied to geology. He showed that some shells which appear to belong to the same genus are inhabited by very different animals and that some species of mollusks live in very different situations from the majority of species in the same genus, or they have the ability to maintain their existence in several different situations. This made it difficult to accurately discriminate different species and genera of living shell creatures and the problem was "much increased" in the case of fossil shells, especially when we have no strictly analogous living shells. For these reasons he stated that geologists had built their theories on much fallacious information about the species and genera of testaceous mollusks and he seriously called into question the propriety of using shells to distinguish and date strata.[18]

So, the scriptural geologists were raising a serious objection against old-earth theories when they contested the use of shells to date the rocks and work out geological history.

Shells as index fossils today

But shell creatures are still very important to the dating of rock layers and the defence of the evolutionary view of the geological record. The respected and detailed reference work *Index Fossils of North America* (Shimer and Shrock, 1944) lists all the index fossils used by geologists to identify and classify rocks in the 1940s. All the fossils found in that text are invertebrates, such as protozoa (single-celled creatures), porifera (sponges), coelenterates (corals, jellyfish, etc.), echinoderms, annelids (for example, worms), bryozoans, arthropods (trilobites, insects, etc.) and some plants (mostly of microscopic size). The largest two groups of index fossils are the brachiopods (bivalve shells) and mollusks (various kinds of other shell creatures such as snails, nautiloids, etc). Fish, amphibians, reptiles, mammals and birds are not listed.

Photograph of *Chesapecten jeffersonius*. From Wikipedia. Contrast the front and back views of this shell with Levinton's second drawing from the top in fig. 6.

In a short layman's book on the age of the earth published by the Institute of Geological Sciences in London (Thackray, 1980), we find a chart (p. 10) of the key index fossils and they are largely shell creatures (Fig. 4). In commenting on the chart (p. 8), Thackray informs readers that graptolites and ammonites are the most useful index fossils and he illustrates with a chart on page 13 (Fig. 5). Here the strata are classified and correlated by ammonites which supposedly represent about 15 million years of depositional history. Note that all the pictured ammonites which have been given different species names and in most cases even different genus names. One can only wonder if these classifications would remain valid under the critical eye of Gray back in 1835.

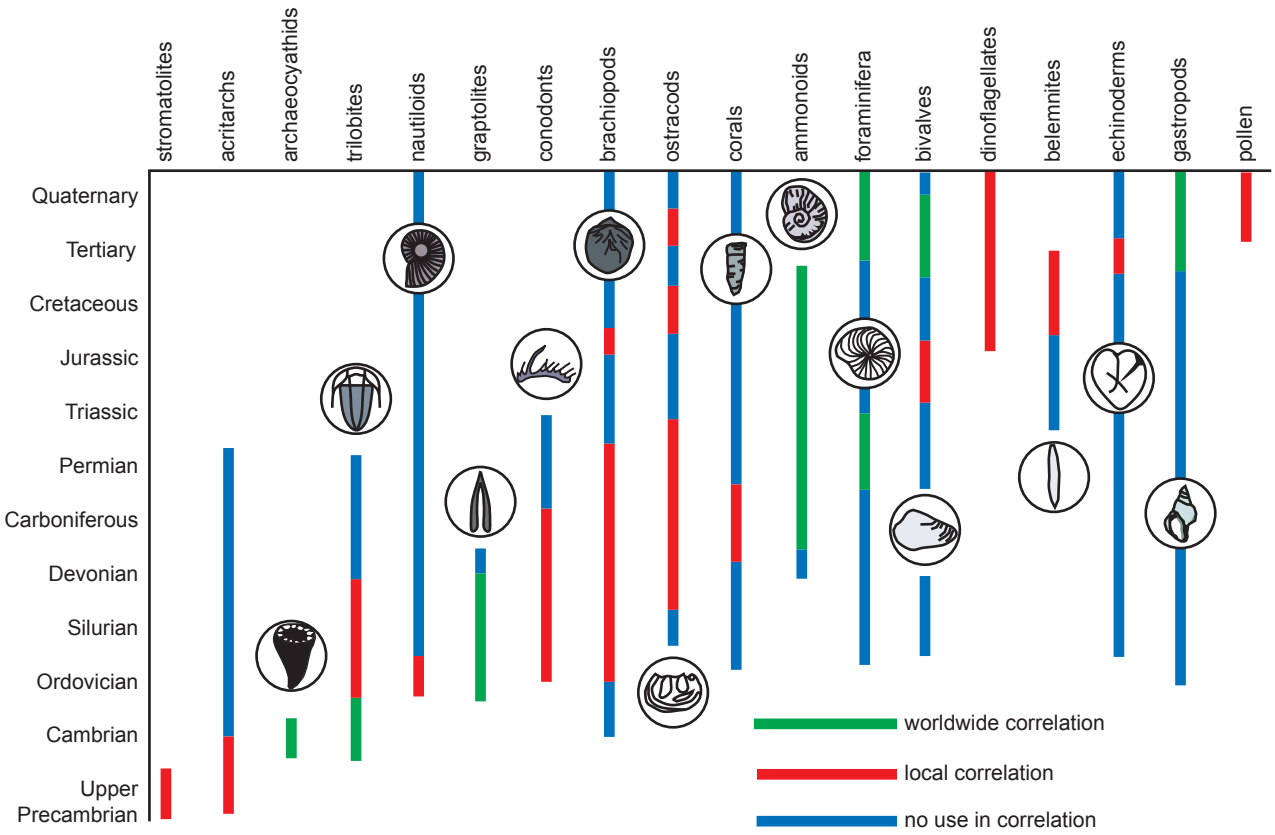

Fig. 4. Ranges of index fossils, modified from Thackray (1980). Note that most are shell creatures.

But there continues to be problems with classification of shell creatures. Ammonites are important index fossils, found in a wide range of sizes and in abundance from the Devonian to the Upper Cretaceous. Milton (1992) discussed their stratigraphic use in an Early Jurassic formation exposed in a pit in the village of Blockley, near Gloucester, England. Two ammonites dominate this formation: *Liparoceras* (fat, with two rows of knobs on the side) and *Aegoceras* (thin, with no knobs). A rare third form is said by evolutionists to be an intermediate between the first two, and has been labelled *Androgynoceras*, which resembles *Aegoceras* when it is young but looks like *Liparoceras* when it is old.

Milton noted that in 1870 an evolutionist named Hyatt arranged these ammonites in the evolutionary order (in ascending order—most ancient to most recent): *Aegoceras—Androgynoceras—Liparoceras*. But after careful examination in 1938 the famous palaeontologist Spath reversed the order: *Liparoceras—Androgynoceras—Aegoceras*. Then in 1963 the evolutionist Callomon re-examined them and rejected both explanations, insisting that *Androgynoceras* and *Liparoceras* are male and female of the same species. Following that example, Milton referred to volume L in the comprehensive 24-volume *Treatise on Invertebrate Paleontology* produced in the 1950s by the Geological Society of America. That volume illustrates and describes hundreds of ammonite species in minute detail. Under the heading "Iterative Evolution" the text states (as quoted by Milton, 1992, p. 108):

> The complexity of the modern classification, seen in the systematic parts of this Treatise, results mainly from acceptance in large measure of the theory of iterative evolution, although there are relatively few proved examples of its occurrence. We often feel sure that it has occurred and that we should be deceived if we accepted similarities at their face value (Haas, 1942 has brought together a few outstanding examples) but we can seldom demonstrate just what the 'iterative' relationships are.

Milton (1992, p. 108) adds that further on in volume L, the editor warns his readers, under the heading "Examples of ammonoid evolution," that:

> Waagen (1869) in a pioneer work attempted to demonstrate lineages, or lines of descent… . The chief obstacle to such studies is that a lineage is an oversimplified concept; it is *impossible* to pick out a stratified succession of individuals which can with certainty be said to be genetically connected in the strict ancestor-descendant relationship (italics added).

Recent research by a Japanese team studying the 20 species of *Euhadra* snails has shown that changes in a single gene can change the direction of the shell spiral, thereby inhibiting, if not prohibiting, two snails

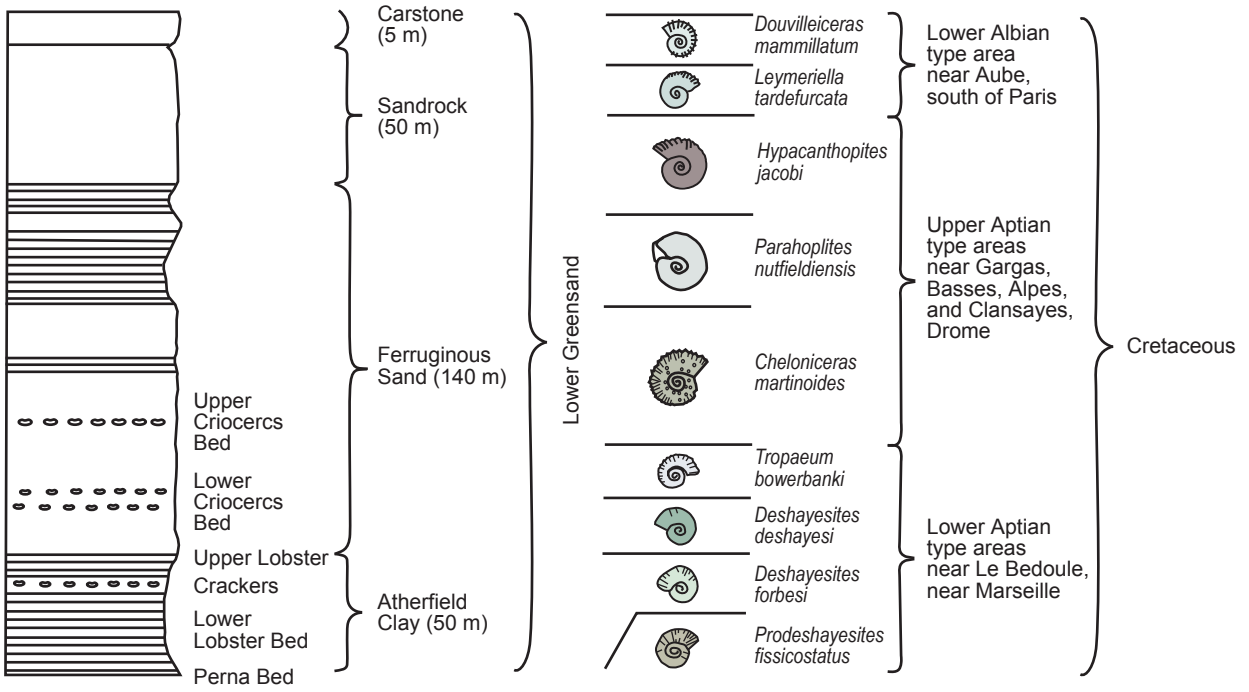

Fig. 5. Thackray's (1980) representation of 15 million years of ammonite evolution.

with different shell directions to mate (Milius, 2003). The great evolutionary neo-catastrophist of the late twentieth century, Derek Ager (1993, p. 142), discussed at one point ten quite different species of shell creatures and showed the significant changes in shell appearance of each species resulting from abrupt climate-induced changes in lake levels in sub-Saharan Africa. However, all his charts in the book showing the time-correlation of strata use only shell creatures (Ager, 1993, pp. 132, 133, 135, 141, 142, 148).

In discussing extinct Chesapecten fossils, Levinton (1992) used a diagram (Fig. 6) to "show steady trends in evolutionary changes that persisted for more than 10 million years" (p. 90). But the differences are miniscule and mirror the development from juveniles to adults in modern scallops (p. 89). Also, in an article on Chesapectens we are told:

> Paleontologists must name species based upon morphology, or shape. It is assumed that similar shape is a reflection of genetic relatedness as well. However, when one is designating a species, she must realize that there is inherent variation within species. Just as no two humans are exactly alike, no two clams are the same. This variation can be produced by simple genetic variation or environmental conditions. For example, some snails that live on rocky coasts may have thicker less ornamented shells than members of their own species that live in quieter water (Huntley, no date).

Levinton's article does not even have accurate drawings of the shells (Fig. 7). Just as Gray argued in 1835, geologists and paleontologists seem to still make too much of the variations seen in shell creatures.

In fact, modern experts on living shell creatures tell us that "Switching species from one genus to another goes on all of the time because our knowledge of mollusks, indeed of all animals, is changing constantly" (Abbott and Dance, 1998, p. 5). The problems seem to be getting worse with regard to the fossil record. Sohn (2003) reports on the development of the Paleobiology Database, which was founded in 1998 with the goal of being an online repository of information about every fossil ever dug up. By August 2003 it had entered 340,000 specimens (from plants to whales to insects to dinosaurs to sea urchins) from 30,000 fossil collections and 10–15 scientists worldwide are adding to the database everyday. Sohn (2003, p. 33) remarked:

> Alroy has also used the database to reassess the accuracy of species names. His findings suggest that irregularities in classification inflate the overall number of species in the fossil record by between 32 and 44 percent. Single species often end up with several names, he says, due to misidentification and poor communication between taxonomists in different countries.

All of this gives us further reason to be suspicious of the validity of the geological column as a representation of the worldwide geological record that has been erected primarily on the basis of shell creatures.

The absence of fossils and the non-existence of creatures

One more very important principle needs to be considered in the development of the geological column. That

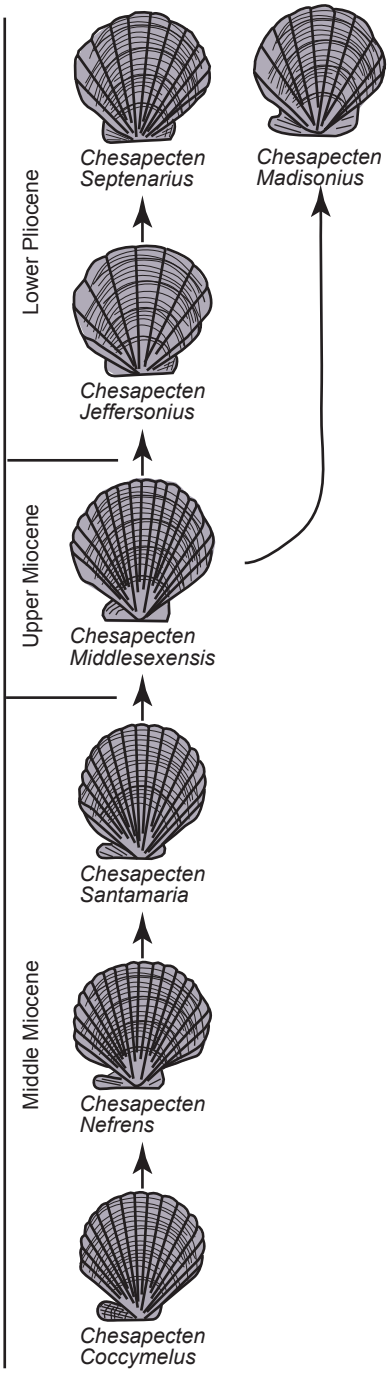

Fig. 6. Supposed evolution of chesapecten shells over 10 million years. Modified from Levinton (1992).

is the principle of judging the non-existence of a creature in history based on the absence of its fossil remains. Consider this discussion of index fossils in a standard geology textbook.

> No matter where on earth they are found individual species always occur in the same sequence relative to one another. By comparing fossils found in a layer of rock in one area with similar fossils in another area, we can correlate the two rock unites. More accurately, we can say that both rock units formed during the span of time that the species existed on the earth. Ideally, a geologist hopes to find an *index fossil*, a fossil from a very short-lived species known to exist during a specific period of geologic time. A single index fossil allows the geologist to correlate the rock in which it is found with all other rock layers in the world containing that fossil (Plummer and McGeary, 1993, p. 167, emphasis in the original).

This reasoning about index fossils is clearly based on the assumption that the absence of fossils in a certain layer of rock means that the creature did not exist at the time in which that layer was deposited.

As Berry (1968, p. 59) summarizes in his book on the development of the geological timescale:

> William Smith provided geologists with a key by which the doors of past time might be unlocked: the principle of faunal succession led others to use specific fossils aggregates to delineate units in a time scale.

Smith's nephew and fellow geologist, John Phillips, put it this way in 1841:

> If instead of classifying the strata by mineral or chemical analogies, we resolve to employ the characters furnished by successive combinations of organic life which have appeared and vanished on the land and sea, we shall obtain an arrangement of remarkable simplicity, more precise in application, and yet less disagreeably harsh in definition, than that which has been so long followed. We shall have three great systems of organic life, characterizable and recognizable by the prevalence of particular species, genera, families, and even orders and classes of animals and plants, but yet exhibiting, clearly and unequivocally, those *transitions* from one system of life to another, which ought to occur in every natural sequence of affinities, dependent on and coincident with a continuous succession of physical changes, which affected the atmosphere, the land and the sea (quoted in Berry, 1968, p. 118, italics in original).

Based on the presence or absence of fossils Phillips was *assuming* that different kinds of creatures lived in different systems of life at different times. Of course, if the Flood occurred, as the Bible teaches, and it produced most of the geological record of sedimentary, fossiliferous rocks, then this old-earth thinking is very erroneous. The absence of fossils is no indication at all of the non-existence of a particular kind of creature.

Evolutionists use the idea that absence of fossils means nonexistence when it supports their theory and then ignore the principle when it does not support the theory. The late evolutionary giant Ernst Mayr (2001, pp. 63–64) reasons,

> The fossil record of the earliest plants is very poor. Fossils of mosses generally considered the most primitive of the living land plants, have been found from the Devonian period, but surely they existed earlier but did not fossilize … The first vascular plants were found in the Silurian. The dominant plants in the Paleozoic era (particularly the Carboniferous) were lycopods, ferns, and seed ferns. The Mesozoic was dominated by gymnosperms, … while the now dominant plants, the angiosperms, did not flourish until the Cretaceous … even though they originated in the Triassic. The entire enormous radiation of the flowering plants occurred since the middle of the Cretaceous, coevolving with a similar radiation of insects.

Mayr assumes the mosses existed earlier than we find them fossilized, because the evolution theory demands it. But he undoubtedly would have cried "foul" if creationists assumed that all plants and insects he mentions actually existed before their first appearance in the fossil record.

So-called "living fossils" are strong evidence of the fallacy of this assumption that absence of the fossils in a particular layer of rock means that the creature did not live at the same time as the fossilized creatures in that layer. Many examples can be given of creatures that evolutionists claimed for decades had long been extinct until living specimens were discovered which looked virtually identical to the fossil specimens. The Wollemi Pine was claimed by evolutionists to have gone extinct about 150 million years ago, because it was not found fossilized in rock layers assumed to be younger than that. Then it was discovered alive in 1994 and when it was compared to the fossil specimens it was seen to be virtually identical (Catchpoole, 2000a). The same could be said of the coelacanth fish and "Gladiator" insects (Catchpoole, 2000b).

Similarly, and related to our previous discussion on shells, slit shells (Family Pleurotomariidae, so called because of the slit part of the way around the shell between the last and penultimate spirals of the top-like shell) are called by evolutionists "the most primitive gastropods" (Hill, 2004, p. 8) because they are found in Upper Cambrian rocks (dated at 500Ma). These deep-water shells were thought to be long extinct until they were discovered alive in 1855 (by Western scientists who didn't know that the Japanese had discovered them in 1772) and observed to be essentially identical to the oldest fossils (Hill, 1996).

Surely no one believes that these "living fossil" creatures actually went extinct for millions of years and then evolved back into existence to look just like their ancestors. Rather, they have been continuously alive since the first specimens were fossilized even though there was no fossil evidence of their existence in later deposited rock layers.

Thus, this fundamental assumption of old-earth geology is wrong. The absence of fossils in a particular rock layer does not mean that those creatures did not exist at the time of deposition of that layer. It only means that the creature was not buried in that layer or that it was but we haven't found it yet. Absence of fossil remains does not demand its nonexistence.

This erroneous thinking was especially applied to the antiquity of man relative to the earth. A significant reason that the vast majority of geologists in the early nineteenth century believed that most of the geological record was deposited long before the creation of man was their conviction that no fossil human bones had been found except in recently formed deposits, and never with extinct animals.[19] Buckland (1836, p. I:103) said that "no conclusion is more fully established, than the important fact of the total absence of any vestiges of the human species throughout the entire series of geological formations." Clearly, even if that were true, it would not mean that man did not exist when the fossilized creatures did. The absence of evidence is not evidence of absence.

But many scriptural geologists argued that several fossilized human bones had been found in older rocks, and that this refuted the generally accepted opinion thereby militating against the old-earth theory.[20] They reasoned that if fossilized man was found in the same rock layer with any extinct creature, this fact would falsify the assumption that any other extinct creatures not found buried with man were necessarily in existence and became extinct before the creation of man.[21] At the time, these arguments by the scriptural geologists were ignored or dismissed by old-earth proponents on the contention that the cited fossil evidence had been misinterpreted either by the men who discovered the fossils or by the scriptural geologists who read their published reports.

However, not many years later Lyell (1863) and Phillips (1855) argued that several findings (cited by scriptural geologists) had indeed demonstrated that man had lived, died and was buried at the same time as some extinct animals. However, rather than argue that the rocks were deposited only a few thousands of years ago, Lyell and Phillips used the evidence to prove the great antiquity of man (beyond the biblical chronology)—even though the scriptural geologists had earlier used the same evidence to argue against the antiquity of the earth. Lyell was not able to examine all of the physical evidence (which had been reported three decades earlier) because some of the sites had been destroyed by quarrying. But what he did see convinced him that the original investigators had provided "ample evidence" for their conclusions. He explained that the reason geologists back then (including himself) had not been willing to believe those conclusions was that the discoveries "contradict[ed] the general tenor of previous investigations" (p. 68, brackets added). The scriptural geologists, however, had contended that the reason for unbelief was that the findings contradicted the old-earth *theories*.

In addition, several scriptural geologists contended that the argument for the non-existence of man (or indeed any other creatures) in earlier times, based on the absence of fossil evidence, was philosophically unsound. They argued that since all contemporary creatures do not live in the same ecological habitat, it is unreasonable to expect them to be buried together. Also, geologists had only examined a very small portion of the earth's strata. Furthermore, if during the Flood much of the antediluvian continents had been submerged to become post-diluvian ocean bottoms, most humans would have been buried out of the reach of geological investigation.

But some old-earth geologists also found the argument for non-existence of creatures based on the absence of fossil evidence to be problematic. Phillips (1837, p. I:96) said it led to erroneous conclusions about the history of birds. Smith (1838, p. 84) remarked that it would result in false inferences about the history of man in the British Isles. Lyell argued that erroneous conclusions about the history of fishes were produced by such reasoning, and in 1855 he provided a table documenting the previous 100-year history of the gradual discovery of different classes of fossil vertebrates in lower (that is, older) formations than had been previously expected. He ended the discussion by saying:

> In conclusion, I shall simply express my own conviction that we are still on the mere threshold of our inquiries; and that, as in the last fifty years, so in the next half-century, we shall be called upon repeatedly to modify our first opinions respecting the range in time of the various classes of fossil Vertebrata. It would therefore be premature to generalize at the present on the non-existence, or even on the scarcity of Vertebrata, whether terrestrial or aquatic, at periods of high antiquity, such as the Silurian or Cambrian (Lyell, 1855, p. 463).[22]

This is a significant revelation, given Buckland's confident assertion in 1836 (p. I:113):

> The deeper we descend into the strata of the earth, the higher do we ascend into the archaeological history of past ages of creation. We find successive stages marked by varying forms of animal and vegetable life, and these generally differ more and more widely from existing species, as we go further downwards into the receptacles of the wreck of more ancient creations. When we discover a constant and regular assemblage of organic Remains, commencing with one series of strata, and ending with another, which contains a different assemblage, we have herein the surest grounds whereon to establish those divisions which are called geological formations, and we find many such Divisions succeeding one another, when we investigate the mineral deposits on the surface of the earth.

Lyell's observation seems to be confirmed on a regular basis in our own time. For example, recently paleontologists digging in China and Mongolia have unearthed thousands of well preserved salamanders in rocks supposedly 165 million years old, although previously the earliest they had been found was in rocks estimated to be 65 million years. These new fossils resemble salamanders found today in North America and Asia (Gao and Shubin, 2003). Many other "living fossils" virtually indistinguishable from their supposedly ancient ancestors could be cited.

Conclusion

Many of the pioneers in the development of the science of geology worked within a biblical framework. They saw in the geological record a testimony to the truth of Genesis regarding Creation and the Flood. But in the late eighteenth and early nineteenth centuries, several false assumptions began to control geological thought.

Uniformitarian methodological naturalism divorced geology from the Bible and excluded God's mighty acts of creation and judgment from history. This rejection of Scripture's testimony to geologically significant events in history was conscious and intentional, and driven by anti-biblical worldviews (for example, deism and atheism). In spite of their great ignorance of living and fossil creatures and the fossil record as a whole, leading geologists based stratal successions on questionable variations in shell creatures. They also assumed that the absence of fossil remains in particular strata was unambiguous evidence for their historical absence worldwide. Errors in logic and empirical errors were both built into their history of the earth. Unfortunately, the old-earth proponents at that time never really engaged the arguments of their well-informed critics (scriptural geologists). That continues today—old-earth proponents commonly ignore young-earth creationists and their arguments.

The correct interpretation of the geologic record can only be obtained by using biblical assumptions gleaned especially from the history of Genesis 1–11. Young-earth creationists must help each other to see when they are unconsciously reasoning with the anti-biblical assumptions developed by the scientific establishment over the past 200 years. Otherwise, the rocks will continue to be a confusing mystery.

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Footnotes

1. Much of the information in this chapter has been taken from various portions of
   Mortenson, T., 2004. *The great turning point*. Green Forest, AR: Master Books, and is used here with the kind permission of the publisher.
2. This was intended to serve as an introduction to a longer work on geology, which never was written. See the English translation and introduction by J.G. Winter in White (1968).
3. He accepted Archbishop James Ussher's 4004 BC date of Creation.
4. For further discussion of these seventeenth and eighteenth century writers on geology, see
   Rudwick, 1985, pp.1–93.
   Young, 1988, pp.27–42.
5. For further discussion of these three writers, see
   Brooke, 1991, pp.234–242.
   Hahn, 1986, pp.256–276.
6. Neptunism was named after the Roman god of the sea whereas Vulcanism takes its name from the Roman god of fire.
7. This was not a completely new idea; Aristotle expressed similar views in his *On Meteorology*. See
   Rudwick, 1985, pp.37–38.

8. Smith, S., 1815; 1816; 1817.
9. See
   Phillips, 1844, pp. 25–26.
   Smith, 1835.
   The latter work (a large one-page explanatory diagram) was Smith's last and clearest statement on his view of earth history and was obviously intended to be a response to Lyell's uniformitarianism. Though, when he referred to the "Deluge" he possibly meant the Noachian Flood, he made no reference to Scripture. However, he was quite emphatic about the supernatural nature of the many revolutions and creations after these catastrophes.
10. The terms "catastrophism" and "uniformitarianism" were coined by the historian and philosopher of science William Whewell. Whewell, 1832, p. 126 in an anonymous review of Lyell's *Principles of geology*.
11. It was the editor and publisher of Cuvier's English editions, Robert Jameson, who made the clear connection between Cuvier's last catastrophe and Noah's Flood, no doubt to make it more compatible with British thinking at the time. The Oxford geologist William Buckland made this idea even more popular. See
    Rudwick, 1985, pp. 133–135.
12. Holmes does not cite his source. The second half of his quote is found in
    Hutton, J., 1795. *Theory of the earth*. Edinburgh: William Creech, vol. 2, p. 547.
    I could not find the first half of the quote in vol. 1 or 2 or in Hutton's 1788 journal article with the same title.
13. Smith's own writings reveal this vague theism, as do comments by geologist John Phillips, Smith's nephew and geology student. See
    Phillips, 1844. p. 25.
    It is safe to say that Smith was definitely not a committed Christian.
14. Smith, 1816; 1817, p. vi and "Geological table" after p. xi. This table is reproduced in Sheppard (1914–1922, opposite page 137.
15. Other old-earth geologists said the same:
    Mantell, 1839, p. I:202.
    Phillips, 1837, pp. I:77–78.
    Taylor, 1829, pp. 26–41.
    This criticism of Cuvier was inaccurate, because, as noted above, Cuvier himself cited reasons why shells were not reliable indices and so why he built his theory of the earth totally on the basis of quadruped fossils.
16. Bakewell, 1828, 3rd ed., pp. 44–45. In this edition quotes from his 1815 second edition without giving the page numbers therein. See also 1833 (4th ed., pp. iv–v, 42–43, 565) and 1838 (5th ed., pp. 46–47, 397–404, 635.
17. It is noteworthy that both
    Mantell, 1839, 2nd ed., p. I:202.
    Phillips, 1837, p. I:78, cited Gray's 1833 article, but not his 1835 article.
    William Buckland, 1836, referred to neither article in the various discussions of shells in his *Bridgewater treatise*.
    c.f., Conybeare and Phillips, 1822, p. lix;
    Lyell, 1830–1833, pp. I:153–154.
18. These included Fairholme, Murray, Young, Penn and Bugg. See Mortenson, 2004.
19. In other words, just because the dodo bird is now extinct (becoming so in the eighteenth century) does not mean that dodo birds became extinct before man was created.
20. Lyell, of course, had his own agenda in saying this. At the time he was still very much opposed to the idea of progression (or evolution) in terms of plant and animal history, favoring instead a cyclical uniformity to life. See
    Gould, 1987, pp. 132–142.
    Ager, 1993, p. xvii.

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