



History of Sciences

The Creation of the world and the birth of chronology



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ABSTRACT

The eternity of the world and, correlatively, the cyclical nature of time were agreed upon by all Greek philosophical schools except the Platonists. As for matter, all of them posited that it was eternal so that the idea that something could be made from nothing was considered as pure absurdity. With the advent of Christianity, however, a matter coeternal with God raised fundamental theological difficulties. Toward the end of the second century, apologists such as Tatian the Assyrian, Theophilus of Antioch, Irenaeus of Lyons or Tertullian thus emphasized God's absolute freedom and power by claiming that Creation had been made from nothing. Along with the Passion of Christ and the Last Judgment, the initial moment defined by the Creation then conferred to time an irreversible, linear orientation and to history both a new sense and an obsessing concern for chronology. Unambiguously, the Creation became the reference point for the world's history. From Scripture analyses, one determined that it took place about 5500 years earlier within a framework where the History of man and that of the earth were not distinct. Having designed a consistent, universal time scale from chronological data recorded for all ancient peoples, Eusebius of Caesarea could thus attribute to the Great Flood the fossils found on the top of Mount Lebanon. The short *Mosaic* chronologies were eventually rejected during the 18th century, but Eusebius' chronological procedure was unknowingly transposed when a relative geological timescale was then set up from the fossil record. The close association of Creation with Christian dogma in turn induced some circles to reject the second law of thermodynamics at the end of the 19th century and, a few decades later, the thesis of an expanding universe. In both cases, the reason was that continuously increasing entropy would imply some low-entropy initial state akin to a Creation.

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1. Introduction

Among major scientific disciplines, geology distinguished itself by the late 1775–1825 period, termed its *heroic age*, at which it was defined and its goals spelled out clearly. The main difficulty had been to recognize that the Earth's surface had a history, so that depicting it, first and foremost through reconstitution of the stratigraphic

column, became the main purpose of the new science. But any historical account necessarily rests on an adequate chronology, which should in particular extend back in time up to its starting point. Without being able to estimate precisely the age of the Earth, thus stressed Lord Kelvin (1899), geology would be left “in much the same position as that in which English history would be if it were impossible to ascertain whether the battle of Hastings took place 800 years ago, or 800 thousand years ago, or 800 million years ago”. For decades, Kelvin had been fighting against the notion of an almost unlimited

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geological timeframe embodied by Hutton (1788)'s famous saying "The result, therefore, of our present enquiry is, that we find no vestige of a beginning, no prospect for an end".

The question of time was, therefore, at the core of the reform that Kelvin was calling for. As particularly justified by the newly formulated second law of thermodynamics, his ambition was to rebuild geology on the basis of the concept of linear time in opposition, on the one hand, to the cycles embodied by the eternal rebeginnings of Hutton's uniformitarian party, and, on the other, to the violent convulsions of the catastrophists evidenced by repeated extinctions of living species. Even though the age of the Earth lower than 100 million years calculated by Kelvin quickly proved to be considerably underestimated, his main point that our planet has an age that can be determined accurately has been fully substantiated. Today even high-school students are taught that the Earth formed 4.55 billion years ago so that the idea that it came into existence at a given moment in time sounds so obvious that it does not need any justification.

Historically, however, such an idea would have actually seemed ludicrous, if not outright absurd to almost all ancient philosophers who posited instead a world eternal along with a time of cyclical nature. Ironically, the late 19th-century debate about geological time was in some way repeating the controversy that took place in Late Antiquity when Christian apologists defended the idea that the world was not eternal, but had been created in time. The purpose of this note is to describe how and why this idea of a world created from nothing was proposed and justified (for extensive accounts, see Nautin, 1973; May, 1978). Actually, a major issue was to know whether or not matter was itself eternal. We will thus go back to the first centuries of our era when the topic became of importance to Church Fathers. The arguments put forward in the debate were of course not scientific, but philosophical and theological. They were not much developed in a previous account of the notion of the age of the world (Richet, 1999) so that they will be presented here into more detail along with a few remarks about the beginnings of chronology. Of particular interest will be that the methods developed by the early 19th-century geologists to set up a relative chronological scale from the fossil record had already been designed by Eusebius of Caesarea (~265–339), of early Church-history fame, for establishing a universal chronology applicable to human history in relation to the age of the world. Jumping finally to the end of the 19th century, we will briefly mention how the issue Creation *ex nihilo*

came back to the foreground as a result of the problems raised by the second law of thermodynamics and then by the expansion of the universe, which were both contradicting the philosophically grounded idea of an eternal or cyclic world.

2. A world assuredly eternal

From Democritus (~470–~380), Plato (~428–347) and Aristotle (384–322) to Epicurus (341–270) and Zeno of Citium (~335–262), the founder of Stoicism, the main Greek philosophers formulated their worldviews within only a century and a half. In the great cosmological account given in his *Timeaus*, only did Plato claim that the world was created and that it was purposely created by a *Demiurge* out of the *khôra*, a *third kind* or *receptacle* that was later identified with formless matter. In spite of really fundamental disagreements (Table 1), both the Atomists and Stoics assumed that the world was endlessly going through cycles of formation and destruction, the latter being caused either by chance atomic collisions or divinely ordained general conflagrations, respectively.

In the long run, however, the most influential ideas were those of Aristotle: picturing a small universe centered on the Earth and bound by the sphere of fixed stars, the *Philosopher* took pain to demonstrate philosophically and physically that it was necessarily eternal. For instance, a beginning of time would imply an absence of time *before*; but one could say *before* unless one had already supposed the existence of time. Likewise, a movement could not arise spontaneously: either it had existed for all eternity, or it was resulting from the action of another movement, which, itself, had existed for all eternity or was the product of a preceding movement, and so forth. And the existence of an obviously unchanging celestial world also testified to the eternity of time, because incorruptibility was by definition absolute. In *On the Heavens*, Aristotle thus concluded that "the heaven as a whole neither came into being nor admits of destruction, as some assert, but is one and eternal, with no end or beginning of its total duration, containing and embracing in itself the infinity of time".

This fundamental connection between time and celestial motions was of particular importance. As summarized by Aristotle in his *Physics*, "so far as time is concerned, we see that all with one exception are in agreement in saying that it is uncreated [...] Plato alone asserts the Creation of time, saying that it is simultaneous with the world, and that the world came into being". Regardless of whether

Table 1

Contrast between the main tenets of the Atomists with those of the Platonist, Peripatetic, Stoic and Neoplatonist schools in natural philosophy^a.

	Atomists	Other Greek schools
Matter	Eternal, discontinuous, with vacuum	Eternal, continuous, without vacuum
Soul	Material	Immaterial (except for Stoics)
Motion	Random	Subjected to Design
Dynamics	Linear	Oriented toward the Earth's center
Earth	Flat	Spherical
Universe	Infinite, non-limited to our cosmos	Finite (= cosmos)
	Eternally evolving	Created, eternal or cyclical
Explanations	In terms of accidents	Teleological

^a From Furley (1986), modified.

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