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Pascal Richet

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Pascal Richet

Institut de physique du globe de Paris, 1, rue Jussieu, 75005 Paris, France

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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.

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

Email address: richet@ipgp.fr.

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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 the19th 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.

they were assuming the eternity of the world, its temporal Creation or periodic destructions, however, all schools postulated that matter was eternal, in accordance with the famous statements made by either Parmenides of Elea (515–after 450) that "being *is* and nothing *is not*" or by Democritus that "nothing can come into being from that which *is not* nor pass away into that which *is not*".

Matter thus had the status of a fundamental *principle*. Being by definition immaterial, did the God of Christians create the world in a Demiurge-like fashion by having put order onto a preexisting chaos? The dogma eventually formulated that the world had been created instead from nothing would play a crucial role in the emergence of a true science of nature. It is thus useful to summarize how it was enunciated and defended at a time where it was representing a thesis whose total absurdity was unanimously agreed upon. Accordingly, the Christian philosopher Boethius (∼480–∼525) would state in his *Consolation of Philosophy* that "it is a true sentence that of nothing comes nothing, which none of the ancients denied", so that this postulate represented "the ground of all their reasoning concerning nature".

3. A Christian absurdity: Creation *ex nihilo*

Aristotle's picture of a small universe remained accepted for two millennia without having been really questioned in the Middle Ages, either in Islam or in the Latin West. But his demonstration of the eternity of the world did get early challenged by Christians, because it was plainly contradicting the detailed account of the Creation of the world given in Genesis, the first book of the Pentateuch (supposedly written by Moses), which they had borrowed from the Torah along with other books making up the Old Testament. For early Christians, however, the Creation of the world was neither a matter of dogma nor a cosmological problem. As part of a History centered on Man, it was a divine act whose reality was beyond any doubt. And it did not require any philosophical explanation because it was relegated to the background by the Incarnation and passion of Christ.

It was in the middle of the 2nd century that the Creation issue took on a great importance in the course of polemetics with gnostic sects that were raising a major theological problem: if everything had a divine origin, how could the good God of the Scriptures have caused the existence of evil? And since God could not have created the world out of Himself, in view of His indivisibility and immutability, the only reasonable way to explain the existence of evil was to keep a Demiurge-like Creation made out of preexisting matter. According to complex schemes, it was then possible to imagine how a clearly defective cosmos had been produced, not by the real God, but by a celestial being of lower rank who had ignored Him or rebelled against Him once the heavenly world had been created.

The question of the origin of the visible and invisible things, matter included, was thus raised seriously. Unfortunately, however, no clear answer could be found in sacred texts, as the theologian Origen (∼185–∼254) testified to when he deplored in his treatise *On First Principles* that "up to the present we have nowhere found the term *matter* itself used in the canonical scriptures to denote that substance which is said to underlie bodies". The Gospels, in particular, were silent in this respect, whereas the very first words of Genesis "In the beginning God created the heavens and the Earth. The Earth was formless and void", were ambiguous. They could have meant that formless matter was preexisting at the Creation of the world, as actually understood when, in the Septuagint (the Greek version of the Torah), the Jewish translators described God's creative act with the verb *poïein* previously used by Plato for that of his Demiurge. As for the Jewish tradition, it was of little help, because it was rather stressing the mystery of the creative operation and at the same time closely associating with this *beginning* the presence of *the One who is* [Yahweh] and conferring a special importance to the ensuing Alliance with the elected people.

For Christians, assuming the Creation to have imposed order onto a preexisting chaos was raising a major difficulty in that God's freedom would not have been absolute, but markedly constrained by the nature of this chaos over which He would not have had any ontological preeminence. A preexisting matter thus had to be rejected. But the thesis was so implausible by ancient standards that, as illustrated by Justin Martyr (∼100–∼165),it could not be formulated at once. Justin had first come through unsuccessful philosophical initiations by a Stoic (who was ignoring everything about God), a Peripatetic (who asked him to pay his fees in advance), a Pythagorean (who required him first to be fluent in geometry, music and astronomy), and a Platonist (who, at last, gave him a real glance at God). Eventually it was a chance encounter with a humble Christian that let Justin discover the true God and then open a philosophical school in Rome. Faithful to Platonism in this respect, he stated in his *Apology* to "have been taught that, being good, He [God] crafted all things in the beginning from unformed matter for the sake of human beings".

Tatian the Assyrian (∼120–∼185), a former disciple of Justin in Rome, thus made an important step forward when he imagined a two-stage Creation. Matter was not a principle, did he claim, "for matter is not without beginning like God, nor because of having beginning is it also of equal power with God". Instead "it was originated and brought into being by none other, projected by the sole creator of all that is". In a letter written to Autolycus, which included the brief but most ancient known commentary on Genesis, the pagan-born bishop Theophilus of Antioch (d. ∼190) likewise described a two-step Creation from nothing for which he gave a real philosophical justification: "As God is immutable because he is uncreated, if matter is uncreated it must also be immutable, and equal to God; for what is created is changeable and mutable, while the uncreated is unchangeable and immutable". Hence, Theophilus asked,

> "What would be remarkable if God made the world out of preexistent matter? Even a human artisan, when he obtains material from someone, makes whatever he wishes out of it. But the power of God is revealed by his

making whatever he wishes out of the non-existent, just as the ability to give life and motion belongs to no one but Gold alone."

Upon reading of the sacred authors, Theophilus thus concluded that "in complete harmony they taught us that He made everything out of the non-existent" and explained that "matter from which God made and fashioned the world was in a way created, having been made by God".

A one-step Creation to produce all beings was alternatively proposed at the same time by the Greek-born Irenaeus (~130–202), bishop of Lyons, in his important *Against the Heresies*, which has lead him to be considered as the founder of Christian theology. By postulating a transcendent God who had first created formless matter, and then a Demiurge creator of all things, the Gnostics declined to admit that, contrary to men, who "cannot make anything out of nothing; only out of matter that exists", God "Himself invented the matter of His work, since previously it did not exist". Likewise, Irenaeus added, they "do not believe that this God, who is above all things, made just as He willed the diversified and dissimilar things in His own realm through the Word, since as a wise architect and a very great king He is the Maker of all things".

Tertullian (~160–~225), another Pagan-born apologist of note, made a similar plea when refuting a contemporaneous Platonizing Christian named Hermogenes, whose gnostic penchants led him to invoke a matter "equally unborn, equally unmade, equally eternal, set forth as being without a beginning, without an end". This thesis was refuted in the tract *Against Hermogenes* where, leaving aside the evil problem, Tertullian noted that an uncreated matter could have proclaimed before God:

> "I, too, am the First – I, too, was before all things – I, too, am from which are all things; equal we have been – together we have been – both without beginning and without end – both without a creator and without a god. Who subjects me to God, my equal in time, my equal in age? If this is done because He is called God, then I, too, have my own name; or rather I am God and He is matter, because we both are also that which the other is".

As also evoked by Theophilus, such a *ditheism* was of course pure absurdity to Christians. And since the world would return to nothingness at the end of times, as stated by the Scriptures, Tertullian stressed that such an epilogue would not make any sense if matter were eternal. One thus had to conclude that "all things produced from nothing will in the end come to nothing".

Whether in Rome, Lyons or Antioch, Tatian, Theophilus, Irenaeus and Tertullian independently transformed the initial cosmological question of the formation of the world into the theological problem of the divine power of Creation. In spite of their different backgrounds, their claim for a Creation *ex nihilo* thus shared an emphasis on the unity, absolute power and unlimited freedom of God by evoking the unfathomable mystery of a work whose divine origin only was absolutely known.

4. From cyclical to linear time

It took only a few generations for belief in Creation *ex nihilo* to prevail among Christians. As early as the beginning of the third century, it had become one of the main tenets of their faith even though it resolutely opposed almost all ancient thought on the most important philosophical problem, that of the origin of the world. One of its fundamental consequences was to negate the concept of cyclical time, which did not imply that events were repeating themselves identically, but according to the same archetypes. Whereas Creation from nothing represented a unique and unambiguous chronological starting point, the Passion of Christ and the perspective of the Last Judgment were giving time an irreversible linear orientation as it was unthinkable to assume that such events could happen twice or more. This major break with previous conceptions was most clearly spelled out by Augustine in his *City of God*: "For once Christ died for our sins; and, rising from the dead, He dieth no more", so that only "the wicked walk in a circle not because their life is to recur by means of these circles, which these philosophers imagine, but because the path in which their false doctrine now runs is circuitous".

At the same time, religious controversies had another important effect, namely, to prompt Christians to master the philological and other scholarly methods used by their pagan opponents for attacking their faith in order to deepen their own understanding of Scriptures and defend them on the basis of rational arguments. As summarized by R.M. Berchman (2005), "first reactive, then proactive, the Church Fathers became philologists, text-critics, historians, ethnographers, chronologists in accord with the best standards of their times". In this way, "Christians eventually offered a sophisticated interpretation and defense of their Bible based on the same criteria used by Greeks and Romans on Homer, Virgil, Polybius and Tacitus".

But disagreements remained of course irremediable between Pagans and Christians. A case in point was the eternity of the world defended by the former, which kept being vigorously denied by the latter. Because dating could now be *absolute*, and no longer only *relative*, among Christians the idea rapidly prevailed that human history had to deal with the whole world ever since the very first moment of Creation. Now, this moment could be precisely dated. As claimed by Theophilus, at the death of the Roman emperor Aurelius Verus in 169, "the total number of years from the creation of the world is 5695, with the additional months and days". The method followed by Theophilus has previously been put to use by the Jewish historian Flavius Josephus (37–~100) within the framework of the Alexandrian polemics between Greeks and Jews about the relative antiquities of Plato and Moses. As also developed by Tatian, Clement of Alexandria (~150–~215), Hippolytus of Rome (d. 235) and other Christian apologists, this method consisted in counting years when following generation after generation Adam's lineage as reported in the Pentateuch by Moses, and then the historical events recorded in the other books of the Old Testament.

Independently of any consideration of natural philosophy, the short timeframe of these *Mosaic* chronologies (derived from Moses' account) became firmly entrenched among Christians because of the infallible authority of the Scriptures. As illustrated by the first apologists, a haunting concern for chronology appeared within this context to accompany the new sense of history that was emerging. How incomplete would have been History if it had been lacking precise dates and, thus, firm landmarks? But this history was no longer that of the sole Jewish people. It had become universal. By definition, the *annus mundi*, the year of the Creation, represented the starting point of the *Era of the world*. In accordance with Theophilus' calculations, the world was from 5600 to 5700 year old. Among other dates, a younger age of 5228 years at the beginning of Christ's public life was derived by Eusebius of Caesarea, yielding about 5199 years for the Nativity. With respect to the usual 5500 years, it had the advantage of making the world 300 years more recent and, thus, of postponing its end by the same amount for people who feared that it would take place at the end of the sixth millennium.

But it appeared that more accurate dating was possible on the basis of astronomical considerations. It was known that Christ suffered passion on Nissan 14 at full moon. Besides, it seemed reasonable to assume that the world had been created at a noble stage of the celestial revolutions. In this respect, the vernal equinox was the obvious choice because, from time immemorial, it has been selected as the reference longitude in astronomy. Beginning from the date of the Passion, the problem then consisted in determining in how many years one could go back to the vernal equinox of Creation through appropriate luni-solar cycles (cf. Grumel, 1958). One of the various solutions found in Byzantium gained a very wide acceptance. It was claiming that the Creation had taken place on the 23rd of March, 15 days before the Moon first appeared, 5509 years before the Passion of Christ. It was in this way that the Byzantine *Era of the world* got defined, which would become the official calendric reference up to the end of the Byzantine Empire and even later in Russia.

5. From the first universal chronology to the fossils of the Great Flood

The 5228 years derived by Eusebius did not prevail. This fact was somewhat anecdotal, however, when compared with the major achievement represented by Eusebius' *Chronicle*. As stated by B. Croke, this work "must rank as one of the most influential books of all times" because of the outstanding scholarship it displayed to erect firmly History on *chronography*, the science which Eusebius founded to date any event of human history with reference to a *universal* chronological system. Biblical exegete, apologist, philologist, historian and even geographer, Eusebius had close links with the emperor Constantine (r. 306–337) whose biography he wrote in the form of a panegyric. He is mainly known today through his extensive *Church History* in which he firmly opposed Pagan criticism to demonstrate that Christianity was not an ephemeral and irrational faith, but was expressing instead a historical necessity attested to by the Church's triumph.

Although Christians progressively distinguished themselves from Jews, one of the reasons why they did claim their Jewish background was to fend off the accusation of their opponents that their cult was too novel and recent to be taken seriously. Following Tatian, Theophilus or Clement of Alexandria, Eusebius thus wanted to prove that, thanks to its Jewish roots, Christianity predated Pagan cults since Moses had for instance lived 1500 years earlier than the Greek philosophers. In his chronological work, however, the originality of Eusebius was not to break completely new ground. By excluding any recourse to mythology, Eratosthenes (∼275–∼193) had already established in his *Chronographies* the first critical chronology for Greek history from the fall of Troy (in 1184/83, according to his scheme) until the death of Alexander the Great in 323 BC. Also in Alexandria, the Jewish chronicler Demetrios (end 3rd–c. BC) had attempted to set a detailed biblical chronology; a single long passage of his work (on Jacob's history) has been preserved thanks to Eusebius' *Preparation for the Gospel*, but his system was perpetuated by Flavius Josephus who adopted it in his important *Antiquities of the Jews*. As for the Romans, they recorded dates in political or daily life in terms of the names of the consuls in office during the relevant year, but dated major events as years elapsed since the foundation of Rome [*ad Urbe Condita*].

Pagan chronologies were basically lists of reigns, public offices or Olympiads, complemented here and there by records of significant events having taken place in given years of their reference systems. To make them consistent, the difficulties were that the various calendars involved were themselves inconsistent, that reference periods were rarely beginning on the first day of the year, that for political reasons some periods had been purposely deleted or lengthened, that in Greek or Aramean texts confusion could originate in the use of letters to write numbers down, and especially that these chronologies were mutually unconnected so that there were no means to check them for errors and prevent these from accruing over long time intervals.

In brief, Eusebius' originality was to design a comprehensive and consistent chronology by considering simultaneously all the chronological information he could gather in the books (most of them now lost) consulted in the well-stocked Palestinian libraries of the period. He published his work in two installments. In his *Chronography*, he first reported the chronology of the Chaldeans, Assyrians, Medes, Lydians, Persians, Hebrews, Egyptians, then the chronological information available for the Greek rulers or the lands of Sicyon, Athens, Argives, Lacedaemon and Corinth, and finally the data for the Olympiads and the kings or leaders of the Macedonians, Thessalians, Syrians, Asians and Latins. In the *Chronological canons*, Eusebius then established his system by using the same events recorded in different subsystems as mutual anchors to ensure their sought-after internal consistency.

For this purpose, Eusebius displayed the relevant data in synoptic tables so that synchronic correlations could be readily made. That Rome had been founded the first year of the seventh Olympiad, for instance, allowed him to tighten mutually the Latin and Greek chronologies. Likewise, the

Jewish and Persian histories were connected by the fact that, according to the Book of Ezra [4:24], construction of the second temple in Jerusalem began during the second regnal year of the Achemenid king Darius I (r. 522–486). By harmonizing in this way all ancient chronologies, Eusebius succeeded in establishing his system from Abraham, the most ancient figure whose dates seemed to him well-enough known, until the year 311 AD, when he completed his book. Half a century later, the *Chronological canons* were translated into Latin, complemented and extended until 378 AD by Saint Jerome (∼347–420). Whereas the Greek original was lost, its content was preserved by Jerome's translation, which would meet in Occident with a long success.

Independently of fragments transmitted by other authors, of excerpts quoted in extant Syriac books or of passages that Eusebius incorporated himself in his *Preparation for the Gospel*, the original text of the *Chronicle* is otherwise known by a 5th-century Armenian translation. A passage kept by this version has a considerable interest for the history of the Earth (Ellenberger, 1988). As reported by Eusebius,

> "As we are writing this chronicle we have received confirmation that the flood arose above the highest mountains – a contemporary eyewitness account of the veracity of the account. In our day, [the fossils of] fish were discovered up Mt. Lebanon. It happened that while rocks were being quarried there for construction in the valley, [the fossils of] various types of ocean fish were uncovered, pressed into the mud. These [fossils] had been preserved to the present, thus providing evidence that the old story [of the flood] is credible. Those who hear this may believe it or not."

The presence of shell and fish embedded in rocks had long been known. Xenophanes of Colophon (∼575–∼477), for example, reported that "a mixture of earth with sea occurs and in time earth is dissolved by the moist", which was why "in the quarries of Syracuse impressions of fish and seaweed have been found, and in Paros the impression of coral in the depth of a rock, and in Malta fossils of all sea creatures". With respect to these statements, Eusebius' interpretation was novel in view of its historical framework: through a general submersion of the lands, Eusebius correlated the Great Flood with the presence of fossils at the top of mountains. In this way, he connected a vestige of the Earth's history with a supposedly well-defined ancient episode of human History, which made him the author of the very first absolute geological dating.

6. Epilogue

Until the 18th century, Mosaic chronology remained a very active field of research to which even Isaac Newton (1642–1727) contributed when he applied his gravitational theory in an attempt at resolving scriptural inconsistencies. As summarized with some disappointment by A. Des Vignoles (1649–1744), director of the Academy of Sciences in Berlin, in 1738, "I myself have gathered more than 200 different calculations, of which the shortest counts only 3483 years from the creation of the world to Jesus Christ, and the longest counts 6984". Actually, the problem raised by the ubiquity of fossils and their presence up to the summits of the highest mountains was one of the main factors that caused throughout the 18th century the slow rejection of these much too short and inconsistent chronologies and, correlatively, the birth of the new science of geology. Having understood that various fossil species could be used as time markers because they had lived for only limited, but well-determined periods of the Earth's history, 19th-century geologists set up another universal chronology. The interesting point is that, from correlations made between scattered series of fossils found at great distances from one another on different continents, they unknowingly applied to natural history the very procedure that Eusebius designed 15 centuries earlier for human history. They could even have invoked Eusebius' initial statement in his *Chronicle*: "Permit me, right at the outset, to caution everyone against [believing that] there can be complete accuracy with respect to chronology".

As a matter of fact, creation from nothing long remained a preserve of Christian theologians. It was in particular denied by the Neoplatonists, who constituted the last great philosophical school in Late Antiquity. Following Plotinus (204–270), they pictured the world as originating in an eternal series of emanations from the One, the supreme God. And, although creation *ex nihilo* also became an Islamic tenet, the ambiguities of the Qur'an in this respect led great Islamic thinkers as different in their philosophy as al-Fârâbî (∼870–950), Avicenna (before 975–1037), Averroes (1126–1198), Suhrawardî (1154–1191) or Tûsî (1201–1274) to defend also the eternity of the world on either Neoplatonist or Aristotelian grounds. The reason was of course that, as for example expounded by Aristotle, this thesis appeared the only rational one and, as such, was much more convincing than any interpretation of a divine revelation.

In this respect, it is worth reminding that the philosophical problems raised by Creation *ex nihilo* were still lingering on at the end of the 19th century when the second law of thermodynamics met with strong opposition in materialist and positivist circles because a continuous increase in the entropy of the universe was implying at one end the ultimate heat death of the universe and, at the other end, the existence of an initial state of minimum entropy, which could be too readily identified with the Christian creation. As summarized by Kragh (2007), for leading scientists such as the chemists W. Nernst (1853–1932) and F. Soddy (1877–1956) or the geologist A. Holmes (1890–1965), the great pioneer of radioactive dating and early proponent of mantle convection, "cosmology had priority over the laws of thermodynamics and radioactivity. They considered it as an *a priori* truth that the universe could have neither a beginning nor an end". It happened that the second law of thermodynamics was one of the key sources of inspiration for the Belgian priest G. Lemaître (1894–1966) when he pioneered in 1931 the thesis of the expansion of the universe and the associated beginning of the world (Lemaître, 1931). Contrary to Nernst et al., however, Lemaître could not be misled by a metaphysical a priori because he firmly dismissed any interpretation in

terms of a divine creation by considering instead this initial state as a *commencement naturel* from a kind of enormous radioactive nucleus, the *primeval atom*, from which no information could be derived on what took place earlier (see Kragh and Lambert, 2007).

To conclude on a lighter note, one can reflect that current astrophysical and geochemical work would certainly be understood better by Plato and Church Fathers than by other Greek or Islamic philosophers. Dating the Big Bang and the formation of a planetary system in effect approximate dating the creation from nothing and from formless matter, respectively, if the latter is meant to designate the product of element nucleosynthesis in stars. At the risk of falling into an apologetic trap, one might then venture that the current cosmological picture represents in some way a late synthesis of the Christian and Platonist traditions, colored by the slight Atomist or Stoic touch of stellar evolution cycles.

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