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# Bible and geology

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**KEY WORDS:** Creation, Earth Age, Flood, Diluvium, Evolution, Gap creationism, Young Earth creationism, Uniformitarianism, Scriptural Geology, principle of superposition, principle of actual causes.

**ABSTRACT:** In the 18th and 19th centuries, the main focus of emerging geology was to understand the history of the Earth, a subject that had previously been addressed in the first chapter of the Bible (= Genesis). Geologists and paleontologists had three areas of friction with those who held to a literal reading of the sacred text: (1) age of the Earth, (2) reality or myth of the Flood, (3) evolution of living beings. This history is synthesized with its current extensions.

**MOTS-CLÉS :** Création, Âge de la Terre, Déluge, Diluvium, Évolution, Créationnisme, Uniformitarisme, Géologie des Écritures, principe de superposition, principe des causes actuelles, day-age-theory, Gap creationism, Young Earth creationism

**RÉSUMÉ :** Aux XVIIIe et XIXe siècles, la géologie naissante avait pour objet principal la compréhension de l'histoire de la Terre, sujet antérieurement abordé dans le premier chapitre de la Bible (= la Genèse). Les géologues et paléontologues eurent trois sujets de friction avec ceux qui s'en tenaient à une lecture à la lettre du texte sacré : (1) âge de la Terre, (2) réalité ou mythe du Déluge, (3) évolution des êtres vivants. Cette histoire est synthétisée avec ses prolongements actuels.

## INTRODUCTION

In "*La légende des Siècles*", Victor Hugo describes the flight of Cain pursued by his conscience after the murder of his brother Abel. The culprit finds refuge in a cave that is closed on him. This is not enough because, says the poet: "*The eye was in the tomb and looked at Cain*".

In a text commentary for a small school examination, we would probably see a copy written as follows:

*"There are thus living beings reduced to only one eye and endowed with a night vision".*

It is such a type of reading of the Bible, literally, that many scientists and clergymen made. One may consider that this does not deserve analysis. But one can believe the contrary for two reasons:

- On the one hand, the matter, which is not finished, has lasted for at least four centuries. It thus corresponds to a vast current of thought counting historically.

- On the other hand, the discussions, which will be related, punctuate the progress of natural sciences. From their origin, these are suspected of being hostile to religion. Indeed, to

try to explain the physical and biological world by natural causes is sacrilegious for those who consider it as the materialization of the direct and exclusive action of God. Among all the naturalist disciplines, geology will prove to be sulphureous because its progress will question the Genesis as related in the Bible.

Here, as an example, is the editor's note at the head of a work published in 1835 by Étienne-Marie Victor de Bonald (1780-1871)<sup>1</sup>: *The study of geology is hardly sketched, and already it is introduced in the schools even the most Christian schools. Is it a good thing? It would be difficult to think so. Our modern systems, to be a little more learned than those of the Pagans, are not more reasonable. They can only distort the mind, and weaken the respect due to the Holy Book.*

This conference is therefore set in the context of the history of science. It does not relate a supposed struggle of atheistic Science against Religion because the scientists who were advancing geology are for the most part believers. In the first geologists of reputation, one finds Protestant pastors and Jesuits.

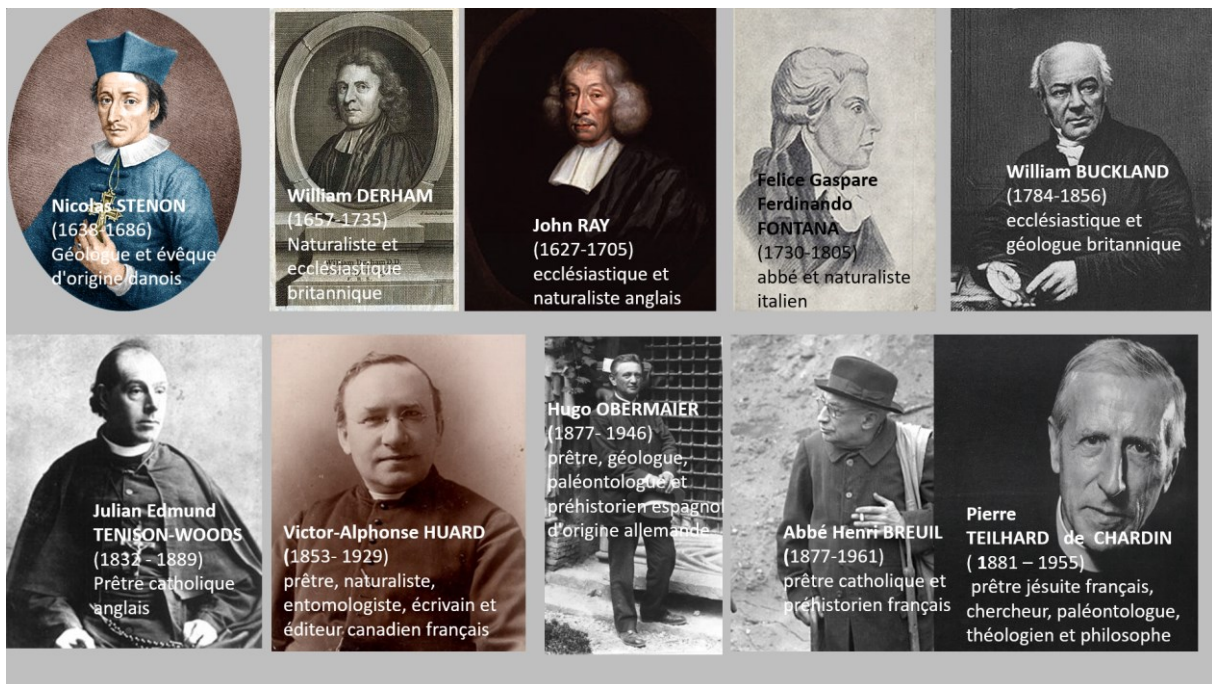


Fig. 1: Several of the first geologists AND clergymen

We will not deal with the organization of the world, a subject that goes far beyond geology alone (order in the Creation, position of the Earth in the universe, form and internal structure of the terrestrial globe). On the other hand, we will deal with the age of the Earth, the Flood and the evolution of living beings. In the last part, we will see the resonances that these questions still have today.

<sup>1</sup> In 1810, he will be named by Napoleon Inspector of the Academy of Montpellier while his son, also called Victor, will be member of our Academy of Sciences and Letters of Montpellier. Enough to get lost in it!

Each time, after having described the victories of modern geology, we will add exceptions, because reality does not accept simplified schemes.

Finally, this history is of particular interest to Protestantism, which is more closely linked to the Bible than Catholicism. The USA, the United Kingdom and its Anglican Church are very much concerned. We will therefore give the English terms because they are used internationally.

## **1. AGE OF THE EARTH**

The Bible does not mention the age of the Earth. It was readily believed that the Earth was designed at a round date number: 4 000 years before Jesus-Christ. But some religious people had applied themselves to specify the things. It was complicated [ROTHEN, 2004]. First of all, it was necessary to take into account, the generations of men described in the Holy Book. Adam would have his third son Seth at the age of 130; Seth himself became a father at 105, etc. It was thus necessary to add up the corresponding durations but also to refer to the Assyrian texts for the periods of which the Bible says nothing. The various known calendars and their drifts complicated the operations. It was imagined that God had begun on a Sunday to rest the next one, thus instituting the day of the Lord, and that he had preferred to operate at the autumnal equinox. On these rather shaky bases, in 1650, and after many other attempts of the same vein, the Bishop James Ussher (1581-1656) determined the date of creation of the Earth: October 23, 4004 at noon.

But it would be an exaggeration to charge the Church of all the weight of the gigantic errors. Geology has progressively discovered that duration counting is in millions of years and up to billions of years. In the past centuries, neither the scientists, nor the clerics, nor of course the man in the street could imagine this.

Let's see what has allowed us to enter the immensity of geological time.

### **1.1. Principle of superposition**

A law of early geology posed a problem. It is the *principle of superposition* that we owe to Nicolas Sténon (1638-1668). In many places, we are in front of stacked geological layers that it was easy to distinguish by a whole series of properties: hardness, composition, color, nature of the inclusions... It took a long time to the geologists to understand that these layers, that we call now geological stages, were generally deposited at the bottom of the seas and gradually. This being admitted, it follows that the most recent is on top when two layers are superimposed. If, at such place, we observe the superposition X then U above, and that elsewhere in nature one finds U then Z, it is proved that the sedimentation was made in the order X, U, Z. From close to close, it is thus possible to reconstitute all the history of the deposits of a same region. The German Johann Gottlob Lehmann (1719-1767) appears as the first specialist of stratigraphy, i.e., the study of strata. In 1756, he had already identified 30 geological layers. Buffon (1707-1788) proceeded in the same way for the stages of the Paris

Basin. On this basis, we can reconstruct the sequence of deposits that affected the globe in its entirety<sup>2</sup>. This is called a *stratigraphic column*. It represents a thickness of more than 40 km. Of course, all the layers are not superimposed at the same place. But the chronological succession remains as well as the afferent duration which is necessarily considerable. As the speed of sedimentation varies according to the places and times, it was impossible to calculate exactly this duration. But we could make estimates that led to high figures. Buffon (1707-1788) thought that it had taken 100 000 years, even millions of years, to accumulate all the deposits.

Going to Auvergne, the Englishman Charles Lyell, about whom we will speak again, saw strata of sedimentation of one millimeter each. He understood that they were annual deposits. As the whole strata was 240 meters thick, this meant a setting in 240 000 years for it. The travel route of Lyell was reconstructed and an unattributed drawing was found representing his car on a background of stratified rocks!



*Fig. 2. The geological travels of Charles Lyell, Charlotte Murchison and Roderick Impey Murchison in France and northern Italy (1828)*

In: M. Kölbl-Ebert  
Geological Society, London, Special  
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The supporters of a literal reading of the Bible have been looking for a way out. For some of them, for example John Woodward (1665-1728), the layers were certainly deposited one on top of each other, but this would have taken very little time. In the seas, one would have obtained a kind of fractionated sedimentation. The heavier limestones would have precipitated first and below; the chalk, lighter, would have been formed above. Proponents of this mechanism have found what they believe to be a beautiful demonstration, still today. Indeed, we observe in nature fossil trunks that cross several geological deposits (*polystrate-fossils*). In this case, all the materials arrived at the same time or more exactly in a period of time during which the trees remained standing. This is possible for example during a volcanic eruption that covers the landscape with thick layers of ash. But it is very localized. The simplistic view of a rapid and fractionated sedimentation of all the deposits of the World does not fit with a lot of observations and measurements<sup>3</sup>.

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<sup>2</sup> Of course, some pitfalls had to be avoided. For example, in the mountainous regions, there are inverted folds in which an older layer can cover a younger one.

<sup>3</sup> However, if the Planet Earth is well the result of the initial accretion of rocky fragments constituted by chondrites with enstatites, it was then differentiated, the heaviest elements plunging to constitute the Nucleus and the lightest elements supernatant to form the Mantle. In other words, a mechanism of sorting by density did exist, but on a scale that the first geologists did not imagine!

## 1.2 Uniformitarianism

In 1785 came the principle of *uniformitarianism*<sup>4</sup>. It is one of the fundamental laws of the discipline. It postulates that the phenomena that we see occurring today, for example the erosion of a coastline, were equally active in the past. The present is the key to the past, it is said. This is also called *actualism* or the *principle of present causes*. When stated in this way, it does not seem to interfere with biblical writings. However, the opposite is true. Let us give just one example, the most famous one. It is the calculation made in 1899 by John Joly (1857-1933): If, originally, the oceans were not salty, if we know their volume, if we measure the annual salt contributions of all the rivers of the world, if these contributions have been constant over time, then we can estimate the time it took to reach the current maritime salinity. Of course, this is a lot of "ifs". But the result is interesting. Joly found 80 to 100 million years; a figure not very compatible with the 6,000 years proposed above for the age of the Earth. To affirm the principle of the present causes is directly to affirm that the Earth is very old!

## 1.3 Measurements

Physics has, on its side, brought its contribution to the knowledge of the age of the Globe. Buffon assumes that our globe was initially a ball of fire that cooled. From 1779, he experimented by heating small iron balls in the red and calculating the time of cooling. He extrapolates to the case of the Earth, which gives him 25 000 then 75 000 years. Later, the calculations were taken up and refined by Joseph Fourier (1768- 1830) [ENGLAND et al, 2007], Lord Kelvin (1824-1907), then John Perry (1850-1920). They showed that the age of the Earth must correspond to tens, even hundreds of millions of years.

From 1902, dating by radioactive elements appeared. It is known that these decompose by giving one or more stable elements, this with a specific and constant speed. Fortunately, these radioactive elements are numerous and their disappearance speeds are very variable, so many of them can be used as a chronometer for small or large durations. In addition, and nowadays, the observation of stars and the use of the Doppler effect allow to believe the universe in expansion. We calculate the corresponding speed and we deduce the date of the origin.

In total, it was established that the Universe is 13.8 billion years old and that the Earth is 4.54 billion years old. The newest geological stages, well known since 450 million years, have start and end dates estimated with an error less than 100,000 years.

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<sup>4</sup> Uniformitarianism is a term coined by William Wheevell (1794-1866), an English historian of science. It was stated by the Scotsman James Hutton (1726-1797), rewritten in 1802 by John Playfair (1748-1819) and popularized by the British Charles Lyell (1767-1849) in *Principles of geology* [after James R. Moore, Ph. D, Trinity Evangelical Divinity School]. Uniformitarianism was later adopted by Louis-Constant Prévost (1787-1856), protégé of Cuvier and founder of the Geological Society of France with Ami Boué (1794-1881).



#### **1.4. Reactions**

Faced with these demonstrations of the age of the Earth, there have been several types of reactions.

Some, making a reading close to the text of the Bible, indicated: God is not held to respect the laws of modern geology. If He wanted to, He salted the oceans in a single moment. The principle of actualism therefore does not apply to Creation, which is by definition a supernatural phenomenon. For them, the Earth is young. They are followers of the *Young-Earth-Geological-Theory*.

The others, sensitive to modern ideas, are behind the *Old-Earth-Geological-Theory*.

According to Prior Adam Sedgwick (1785-1873), believing the Earth to be very recent has had at least the merit of forcing the defenders of modern ideas to clarify their observations and to sharpen their arguments. This man was a friend of Darwin, whose ideas on evolution he did not share.

But, before concluding this chapter on the age of the Earth, we must admit that the principle of the actuality of causes, explained above, suffers a major exception. This is the case where an asteroid comes to hit the Earth, transforming brutally the climate, triggering terrible fires, covering everything with ashes and killing most of the living beings. The geologists of the 20<sup>th</sup> century, who did not want to introduce the hazard as a cause of the evolution of the Globe, had difficulty in admitting this. Now, the idea is accepted: at least five mass extinctions linked to celestial bodies have occurred since the beginning of the primary era. And, there have been other cosmic and/or volcanic catastrophes, hardly less terrible for our planet. Nothing is simple in science in general and in geology in particular.

## **2. FLOOD AND DILUVIUM**

The first geologists thought they had three material proofs concerning the Flood.

### **2.1. Lands of the Flood**

The first evidence corresponds to what has been called diluvial terrains and, in particular, *alpine diluvium*. This terminology was introduced by the Reverend William Buckland (1784-1856) in his book *Reliquiæ diluvianæ* in 1823.

In France, these deposits are found around Lake Lemman, and also in the Rhone valley near Lyon and at the outlet of the Isère and Durance rivers. They are still which constitute the Costières du Gard near Montpellier and Nîmes. The materials are identified as coming from the Alps. They are mainly mixtures of pebbles from limestone, siliceous and crystalline rocks (Fig 3).



Fig. 3. Alluvial deposits previously known as “Alpine diluvium”. Pebbles (granite, calcareous stones and quartz mixed with calcareous sand). Here in Durance valley.

These deposits are now located well above the levels reached by the current river floods. It was therefore tempting to make of them a manifestation of the Flood. This last would have brutally carried away, out of the Alps, elements of different sizes and different natures petrographic. But, as early as 1830, the doubts are considerable, Boué, already quoted, writes: *“The alleged diluvium covers only large plains, the banks of large rivers and some low plateaus”* [in GOHAU, 1987]. Sub-understood: they are ordinary fluvial alluvium! It is now known that the rivers sink with time, and this explains the relatively high position of the corresponding ancient deposits. The variety of constituents has been explained by specialists of the Rhone valley and in particular by my colleague, Michel Bornand, in his thesis [1978]: After the transport, in situ alterations take place which were not understood by the ancient observers (Fig. 4).



Figure 4: Evolution of alluviums in the Rhône valley after their deposition.

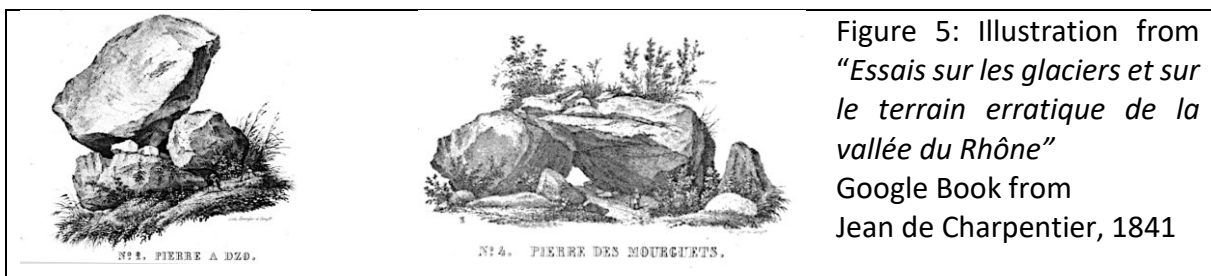
After 100,000 years, the limestone pebbles disappear, by dissolution in situ, in the deposits. In the 100 000 years which follow, the pebbles of granite are transformed into red clay. An initial mixture of calcareous, granite and quartz pebbles is thus transformed into a red clay containing isolated pebbles of quartz. It is incredibly different from the initial material. It corresponds, for example the vineyard of Châteauneuf-du-Pape. Then the weathering continues. The clays are destroyed. The red color is removed. Locally and on top of all these

materials, yellow silts are layered. They are loess and lehms, brought by the wind. And these fluvial and eolian layers showing different transformation stages were repeated several times during the Quaternary era. For lack of a good understanding of the underlying mechanisms, the first geologists believed in a generalized disorder and invoked the Flood.

Some specialists still speak today of the Alpine diluvium. It is a coquetry of language and a wink to the great ancients. This does not mean that modern scientists still believe in the role of the Flood in the formation of these alluviums.

## 2.2. Erratic blocks

The second possible proof of the Flood is constituted by the erratic blocks. One found in our mountains and on their periphery some isolated blocks whose petrographic nature does not correspond to their immediate environment. For example, on the Jura limestones, there are blocks of protogine (granite type) that come from the Mont Blanc! The most important ones were described (Fig. 5). The explanation seemed to be ready and was defended until 1840: water deluges would have led blocks everywhere. But it was shown that the hypothesis of transfer by water is not correct for various reasons. First of all, water deluges, which ravage a country, should leave traces. However, one hardly sees them. Then, the blocks should have been eroded or even polished. This is not the case. Finally, to obtain a deluge, it is necessary to have colossal reserves of water, mobilizable in one go. We did not find them, at least if we leave aside the hypotheses that made them emerge from the interior of the Earth, which was supposed to be rich of immense pockets of water or internal ocean<sup>5</sup>.



Finally, it was shown that ancient glaciers could have transported these erratic blocks. The first heroes of the adventure were Ignace Venetz, Jean de Charpentier and Louis Agassiz [LEGROS, 2019]. These men ended up convincing the main geologists of their time: Charles Lyell (1777-1875), Adam Sedgwick (1785-1873) and William Buckland (1784-1856), who was

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<sup>5</sup> Note, however, that there is potentially water in the bowels of the Earth. The measurements and calculations show that the core of the Globe is lighter than expected. In other words, it does not contain only nickel and iron. It is not clear whether the extra element is hydrogen (probably) or oxygen (less likely). In any case, the hydrogen and oxygen incorporated below the Earth's crust, in the core and mantle of the Planet, potentially represent a mass of water 70 times larger than all the oceans combined.



mentioned above as having written a book on the traces of the Flood. This was a turning point in the history of geology.

But any geological reality admits exceptions. One is seen in the Columbia River valley (USA, Washington State) where the soils present strange giant ripples. In addition, in some places, the rocks are free of any soil cover as if they had been cleaned with a giant Karcher. This can be explained by torrents of water that rushed across the landscape and represented up to 2,000 m<sup>3</sup> per second. This is the result of the sudden rupture of a natural dam made of ice. There were thus in nature terrible effects of instantaneous flushing but local. Stephen Jay Gould in his book "*The Panda's Thumb*", indicates how much the modern geologists had difficulty in accepting this idea of a setting in in a few hours, whereas they had taken the habit of reasoning in millions of years! In homage to the principal discoverer, J. H Bretz, one speaks now about "*Bretz flood*".

### 2.3 Fossils

The third possible manifestation of the existence of the Flood is the presence of marine fossils in rocks located high in altitude. Didn't the water come up to there? In reality, this argument was used rather late because, in the early days of geology, until the middle of the 17<sup>th</sup> century, one did not understand well what a fossil was. To find an "object" in a hard rock did not evoke systematically a living being, because the forms were not necessarily current. By example, one observed in the break of a hard limestone a rostrum of belemnite in the shape of bullet of rifle.



Figure 6: Rostrum of Belemnites

Moreover, it would have been necessary to know the rules of the fossilization, namely the astonishing but common replacement of the organic matters by calcium carbonate or metallic elements. Indeed, the objects that scholars saw were made of stone or metal.

Finally, they did not know that sedimentary rocks are for the most part muds hardening at the bottom of the seas, which makes possible the trapping of animal corpses. However, since the Antiquity, one suspects the biological origin of the fossils because some resemble current living beings. The brilliant Leonardo da Vinci (1452-1519) understood this. Idem for the English scientist Robert Hooke (1635-1703) who uses a microscope and understands that these witnesses of the past life were pushed in altitude by tectonic movements. Nicolas Sténon - again - writes in 1669 (in short): *These bodies have the same origin as the plants and animals they resemble.*

In 1766, Guillaume Rivière (1655-1734), member of the Royal Society of Sciences of Montpellier, endeavors to prove that the "glossopetres" (stones in the shape of tongue) of the

quarry Boutonnet (Montpellier), are not other thing than teeth of sharks fossilized (after Fabio Colonna that understood this in 1616!).

The nature of the fossils being finally understood, they were then associated with the Flood, in particular when they were found in mountain. But nobody could explain from what source came the masses of water necessary to the phenomenon of total submersion of the Globe. Some have therefore supported the hypothesis of local floods, grouped under the name of *mosaic flood*. That required less water and stuck better with disparate buried faunas. The Flood of the Bible was somehow adapted, i.e. reduced in intensity.

From 1820, and especially 1830, many geologists are convinced of the impossibility of this type of phenomenon, universal or even local. In addition, in most of the cases, everything, in the strata, attests a regular, gradual and quiet deposition of the elements that compose them. Moreover, there is a link between the various strata and the enclosed fossils. These things cannot be explained by a convulsive and violent catastrophe [JÉHAN, 1848].

At the present time, one knows well that the deposits, initially marine and rich of beings fossilized, emerged and were carried in altitude by tectonic phenomena. They are not contemporary and cannot materialize a biological catastrophe of unique and of recent intervention<sup>6</sup>.

However, rapid submergence phenomena have undoubtedly existed locally. For example, the Black Sea, previously dried up, seems to have filled up suddenly, 7,500 or 8,000 years ago from a gigantic waterfall fed via the Bosphorus Strait. The water would have risen at the rate of 15 cm per day and the basin would have filled in two years. And this kind of phenomenon has also happened in the Mediterranean region and elsewhere. It is not impossible that the local populations, affected by cataclysms of this type, have kept the memory by oral transmission, then written. Indeed, it is astonishing to see that the myth of the flood is also present in Asia and South America in non-Christian populations.

### 3. EVOLUTION OF LIVING BEINGS

The fossils being recognized, one began to study them systematically in addition to the living forms. One realized then the extraordinary diversity of the plants and animals and, at the same time, the similarities that there could be found between some of them.

The similarities did not hinder, on the contrary. One saw a divine order in the continuity of the species as if the creator had filled all the possible boxes for the living. It was the point

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<sup>6</sup> Prior Sedgwick, of whom we have already spoken, had at first believed in the Flood. He changed his mind and confessed it in 1831 in a recantation so superb that it counts in the history of science. *Having been myself a believer and, to the best of my power, a propagator of what I now regard as a philosophical heresy, and having more than once been quoted for opinions I do not now maintain, I think it is right, as one of my last acts before I quit this Chair, thus publicly to read my recantation.*

of view of Henri Hollard (1801-1866), member of our academy. Born in Switzerland, he taught in Lausanne, Paris, Poitiers and Montpellier.

Many specialists were then *fixists* (species do not change) and *creationists* (they were created by God at the same time). Let us add immediately that this last term (creationism) is later than the corresponding idea.

But, if God created all living forms on the same day, it is necessary to justify the disappearance of some of them with time. Georges Cuvier (1769-1832) believed in the existence of catastrophes intervening periodically. He thought of the sudden withdrawal of the sea which would have made perish the aquatic species and, in other cases, he supposed its fast rise which would have made the terrestrial species disappear. This school of thought became the *catastrophism*. Charles Lyell, one of the thinkers of uniformitarianism, is on the contrary *gradualist*. He wrote that catastrophes were only apparent. For example, when a region collapses gradually and continuously, if it is only perceived after a million years, one can believe in the brutality of the phenomenon whereas it is slow.

The disappearances were thus explicable. But how to justify the presence of species of which one does not find the trace in the old times? It was more difficult! There were even geologists who claimed, like the Englishman William Smith (1769-1839), that each layer of land contained specific fossils found neither in the preceding layers nor in the posterior ones. The idea of an evolution of the living forms was going to impose itself. It will be the *transformism*. Jean-Baptiste de Lamarck (1744-1829) is the father of this idea of the evolution of living forms even if he did not understand the mechanism. Étienne Geoffroy Saint-Hilaire (1772-1844) is on the same line of thought. He observed that most animals are built on the same anatomical plan concerning their skeleton: vertebral column, four limbs or fins, etc. He ended up opposing Cuvier who believed in the fixity of forms and had invented catastrophism to justify it.<sup>7</sup>

Darwin's Origin of Species appeared in 1859. However, the author avoids taking man into account in his evolutionary scheme of the living world, because it is too delicate. In 1875, transformism was condemned at the Council of Cologne. It was not until 1880 so that the majority of the French scientists support the evolutionist vision [GRIMOULT, 2000].

Yet the subject of man was impossible to ignore. From 1835, the prehistorians, Casimir Picard (1806-1841) then Boucher-de-Perthes (1788-1868), make observations which throw the confusion. In a site of the Somme French region - which will allow later to define the Acheulean - they find flints cut by man in geological levels containing remains of animals now

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<sup>7</sup> This attitude of Cuvier, which seems outdated today, was normal at the time. Stephen Jay Gould (The Panda's Thumb, 1982) explains the reason in his theory of punctuated equilibrium. In paleontology, we find well identified species and not many intermediate forms. Evolution first appears in one or a few individuals as a result of a mutation. If these individuals live within a large non-mutant population, their modifications will disappear by crossing with the others. So, for there to be evolution, it is necessary that the mutations touch first of all small and isolated populations (case of the islands for example). Then, these better adapted populations will spread and replace the others. There is therefore little chance that fossilization will surprise these rare primo-mutant individuals. Cuvier therefore believed what he saw in terms of animal evolution; we cannot hold this against him rigorously. In botany, at Montpellier, Candolle had the same attitude [RIOUX, 2011].

extinct, thus in principle antediluvian. Boucher-de-Perthes, a not very rigorous and self-taught scientist, is not taken seriously by the Academy of Sciences. But English researchers make similar observations in their country. They come to validate in-situ the discovery of the Frenchman. Some human populations are therefore prior to the Flood while the Bible reports less than twenty men having lived before Noah... We speak then *pre-Adamite man*. We will come back to this.

Thereafter, the discovery of the Neanderthal man, in 1856, brought to light a population of ancient men quite different from modern men. One saw their supra-orbital bulges! However, it is written in the Bible that God created man in his own image (verse 27 of chapter 1). There was therefore no room for several human lines. We could temporarily get away with claiming that the skull of this man was ordinary and similar, for example, to that of Maréchal Grouchy, who had been buried in 1847. But, as the discoveries multiplied, it was necessary to accept the idea of an evolution of the human lineage.

At the present time, the question of evolution has advanced a lot, but still hurts many minds. However, we have to face the evidence: recent paleontological excavations have multiplied the discoveries validating the concept, even if difficulties remain. For example, one wondered for a long time why dinosaurs, with a few feathers but still unable to fly, would have gained a selective advantage allowing evolution to continue in the direction of a flight ability. The answer to the question is still speculative: the first feathers would have had an aesthetic function for the males in the nuptial parades, or they would have thickened the silhouette and frightened away enemies. Indeed, some birds that do not fly, ruffle their feathers in fights. In short, the purpose, recognized a posteriori, might not be perceived during the evolution that leads to it. In any case, Darwinian evolution, invisible on the scale of a human life and impossible to prove directly, is a coherent model of the transformation of the living world in time. This model is compatible with so many disparate observations that it has become very solid:

- strong morphological and genomic similarities between almost all living things,
- discovery of intermediate fossil forms between fish and batrachians, reptiles and mammals, dinosaurs and birds,
- compatibility with the geological history of the Earth, because the divergence of forms corresponds to the separation of the continents,
- temporal compatibility with the recently developed molecular clocks (Darwin had well seen that evolution required millions of years),
- the mutations observed in the world of micro-organisms and insects as a result of the use of antibiotics or phytosanitary treatments illustrate selection. The resistant forms develop, replacing others that have become unsuited to the new environment,
- artificial selections, animal and vegetable, led by man, go in the direction of Darwin's ideas; for example, in the dog, the Saint Bernard and the Chihuahua were quickly differentiated.



Teilhard de Chardin accepts this evolution of the living and tries to demonstrate that it is part of an ascent towards God [GIRON, 2018].

#### 4. THE CURRENTS OF THOUGHT

A schematic classification shows that four main currents of thought have intervened in the past:

##### 4.1. Scriptural geologists

*And the poor biblical text will be taken hostage* [DENIZOT, 2002]. This concerns scriptural geologists, the partisans of the *geology of the Scriptures*. In their ranks, there are few real geologists, except for George Young (1777-1848)<sup>8</sup>. The leader of this school of thought was Granville Penn (1761-1848). For him, the God of the Scriptures is also the God of Nature. There can be no divergence. More than that: looking for convergences between the Bible and Geology is already to doubt the first one, it is thus of impiety. Joseph de Maistre (1753-1821) and Victor de Bonald (1780-1871) are on this extremist line. As Bernard Chédozeau [2012] reports: *If the word is obscure, it is because God wanted it to be so*. This current of thought was important between 1820 and 1840, in reaction to the emergence of modern geology led by Charles Lyell (1797-1875) and also by William Buckland (1784-1856), who was a diluvianist until 1836, when he changed his views.

##### 4.2 Concordists

Many people have accepted *Concordism*, a school of thought that which seeks to reconcile the teaching of the Bible and the discoveries of geology. The idea is old. It dates at least from Francis Bacon (1561-1627) who saw the work of God as materialized in two books that one had to learn to decipher and reconcile: the Scriptures on the one hand, Nature on the other. Then, this vision developed in the 18th and early 19th centuries. Most of the analysts were invited to find an explanation to reconcile Genesis, which sees the formation of the world in seven days and the geology which counts time in million years. A great number of scientists were concordists, each introducing his own vision of things<sup>9</sup>.

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<sup>8</sup> Many followers do not understand the discipline at all [MORTENSON, 2011]. From 1850 on, this school of thought, which saw the Earth as very young, lost much of its strength. The geologists stopped fighting against it. This was scientifically useless.

<sup>9</sup> The Swiss André Deluc, Calvinist and geologist (1727-1817), reader of the Queen of England, wrote 6 volumes between 1778 and 1780 to show that the facts of geology are compatible with the text of the Genesis. Marcel de Serres (1780-1862), member of the Academy of Sciences and Letters of Montpellier, supports similar theses [1859]. It is the same of Champollion (1790-1832) and of Cuvier (1769-1832). Same thing still for the English William Buckland (1784-1856), the Americans Benjamin Silliman (1779-1864) and Edward Hitchcock (1793-1864).



Figure 7: Some well-known Concordists

Some think that between the first verse of Genesis and the second, God took his time and allowed a formless world to evolve under the rule of Satan, before that angel was fallen. This is the time of chaos or Tohubohu, then developed the geological eras, during millions of years. At the end, that is to say only a few thousand years ago, a first deluge sometimes doubled by an ice age, would have put an end to these dark times and God would have created the world in six days of 24 hours. This interpretation is ancient and was first given in 1655 by Isaac de Peyrère (1596-1676) in his book "*Praeadamitae*" (men before Adam). It gradually became fashionable, after 1813, thanks to the writings of the Scottish Pastor Thomas Chalmers (1780-1847) [ROBERTS, 2007]. Thus, instead of being identical biblical times and geological times are concatenated. This current of thought is known under the names *gap theory*, *gap creationism* and *ruin-restoration creationism*. In some unsympathetic versions of this line of thought, humans are created in two stages, which makes it possible to distinguish between the good guys and the bad guys, including Jews and blacks. In this context, one understands better the title that Louis Figuier (1819-1894), member of our academy, gave to his work to avoid any problem: *La Terre avant le Déluge* [1862]. He popularizes modern geology and barely touches the Flood that he believes in mosaic.

Other thinkers will assimilate the "days" of creation to longer durations, years or even geological eras, thus representing up to hundreds of millions of years... It is the *day-age-theory*. For some, we want to stretch the biblical time as if it were elastic! For others, like Stephen Jay Gould, accepting biblical days of more than 24 hours was already a big step in the right direction.

#### **4.3. Advocates of a separation**

The third current of thought brings together those who believe that the Bible, a spiritual source, does not have to be evaluated on the basis of considerations relating to the physical world. Many Protestants are on this line, including the early geologists Hutton, Playfair and Lyell [KULIKOVSKI, 2007 - PIZANIAS, 2013]. We also find Baden Powell (1796-1860), father of the founder of scouting, and Alexander von Humboldt (1769-1859) or Immanuel Kant (1724-1804). It is the "positivism-spirituality" pact evoked by Pastor Gounelle [2009].

#### **4.4 Materialists**

Finally, there are the materialists. They are not concerned with religion, for example the naturalist Carl Vogt (1817-1895) and the philosopher Bertrand Russell (1872-1970).

Today's scholars fall into one or the other of the last two types of attitudes. God is not necessarily denied but invoking his action, in sciences, is not an accepted explanation, because it is like saying: I don't know. Let us think of the Ancients who, because they did not understand gravitation, believed in the role of Apollo in the maintenance of the course of the sun!

#### **4.5. Current survivals**

Let us now quickly look at the current survivals of ancient visions.

Some still believe, or rather believe again, that the Earth is 6,000 years old. For prove it the Young-Earth-Creationists have to compress geological time. They are working on it. Stratigraphic data are reinterpreted to obtain accelerated time. The data of the Paleontology are neglected because the evolution of the living beings is not admitted. The principles of physics are violated so that the radioactive chronometers are discredited. Even the Paleoclimatology is contested since, in the short time allotted, there is no room for several ice ages [HEATON, 2009]. All this becomes very acrobatic.

According to Stephen Jay Gould, the reference work of modern creationism is "*The Genesis Flood*" published in 1961 by John Whitcomb and Henry Morris. It would take pages and pages to report the bad opinions of the scientists who read it. This did not prevent the book from having at least 44 editions and 250,000 readers who are powerful because of their number. They come from the Evangelical Church, Jehovah's Witnesses, Seventh Day Adventists, Mormons. They have set up a creationist society and organize international congresses. Since 1925, they have formed a movement that regularly attacks the American government to obtain that Darwinism would be teaching in school curricula only as a theory. Sometimes the American "Bible Belt" states, otherwise known as the southern states, support them. It is not clear what motivates these people. There may be a sectarian phenomenon here, which is surprising since we are talking about the Bible. But being part of a small elite of

"knowers" is perhaps a pleasure. In some cases, it is more. It is to gain a reputation as an international lecturer who is regularly invited to speak in front of groups of insiders.

On the other hand, valuable scientists refer more or less to William Paley (1743-1805) and his famous argument of the watch, published in 1802 (in short): "If I come to a desert and find a watch, it is because there is an intelligence to have created it". Nature being more complex than a watch, it proves, by its very existence the intervention of a creator. The modern version of the idea of a watchmaker creating the World is the *Intelligent design* that appeared after 1980. Evolution is not denied but it is supposed to be directed by a superior intelligence. It is God, but he is not named. It is precisely pointed out that the probability of the construction by chance of a DNA chain is zero, and a fortiori of a superior being. This is certainly true but it is to forget the "necessity" which perhaps comes to the rescue of "chance". In particular, the spatial and electrical properties of atoms and molecules, make that such a combination is obligatory and that such other is impossible. But this is another subject...

## CONCLUSION

The Genesis did not deserve an interpretation in the first degree as could have been the text of Victor Hugo quoted in the introduction. Pastor Gounelle gives us some keys to interpretation [2003]. It is necessary to refer to it. Written many centuries ago the Bible had first of all the object to affirm monotheism (only one God is behind all things). Against the apocalyptic sects of the past and the future, it instilled a confidence in life (God says: this is good). Finally, it proposed a coherent, if not realistic, scheme of the history of the world. What man can live happily and comfortably without this? Creation is of the order of myth, in the sense of a story carrying a message [GOUNELLE, 2001]. The Bible is not a book of universal science. Otherwise, why stop at the contradictions encountered when confronted with natural sciences or astronomy? What does the Bible say about nuclear physics? It is clear that all this is absurd.

On the other hand, the fight to impose modern geology was not mediocre. On the contrary, it was exemplary. The whole University was reforming itself; it was freeing itself from the ancient authors, Hebrew, Greek, Latin and of the Renaissance, to submit itself to direct observation and experimentation [MORTENSON, 2011]. But it is nevertheless necessary to underline the naivety of the ancient geologists who seeking to prove the reality of the Flood, wanted to deduce the validity of the Bible and, why not, the proof of the existence of God! And this naivety has its exact equivalent in the current attitude of some other specialists who, having proved that some pebbles naturally piled up on our planet, would like to deduce the absence of God in all the galaxies. The level of generalization seems high (sic)!

The present time shows tensions that announce, perhaps, new religious wars. In the past centuries, science was taught by intellectuals, including many churchmen. Moderation was the rule in the opinions, at least those of the scholars. Today, anyone can improvise himself as a teacher on the internet. This gives free rein to people whose esoteric or pseudo-scientific certainties are all the more asserted that they are without reference baggage.



The academics hardly intervene in the corresponding quarrels because they have neither the taste nor the time, Moreover, it is not sure that their supervisory bodies think that to educate the crowds is in their mission! In this context, there is still work to be done. We can be satisfied to observe that within the Academy of Montpellier, no less than a dozen members have taken up the subject of the relations between science and religion.

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