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Fundamentalism and the Fundamentals of Geology

INTRODUCTION

With increasing astonishment, I read through the book *The Genesis Flood – The Biblical Record and Its Scientific Implications*, by Henry M. Morris and John C. Whitcomb, Jr.[1] If I had been told a few years ago that an apparently serious attempt would be made to reintroduce the diluvialistic theory on Biblical grounds as the only acceptable working hypothesis for the major part of the geological sciences I would not have believed it. I would have considered it just incredible that a professor of Old Testament and a professor of Civil Engineering would write it, and that the Foreword would be written by a professional geologist.

The serious fact is that it has been written and published in a volume of more than 500 pages of excellent paper and illustrated with 28 photographs. To stress the pretended scientific value of the work, favourable comments of a theologian and various representatives of natural sciences – a geologist, a geophysicist, an archaeologist, a biologist, a geneticist, a chemist, and an engineer – are printed on the cover.

It is almost incredible that such an effort, which must have cost an enormous amount of work and money, has been made for such a bad procedure as this. I have felt very reluctant to write against it, but finally agreed to do so, yielding to stress from different sides.

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[1] Published by the Presbyterian and Reformed Publishing Company, Philadelphia, Penna., 1961.

There are two main reasons for this article. The first is that the authors of *The Genesis Flood* have written on the basis of their belief in the Holy Scriptures as the reliable Word of God. This belief I share. Second, it is my sincere conviction that it is a fundamental and extremely dangerous mistake to think that our belief in the reliable Word of God could ever be based on or strengthened by so-called scientific reasoning. Any attempt to harmonize the historical geology of today with the account of the first chapters of Genesis represents a colossal over-estimation of science – as well as a misunderstanding of the Genesis record – an over-estimation which is as great as that of those scientists who completely reject God as the Creator. If we thus over-estimate science, we lose the battle before it is started. The Bible does not give outlines of historical geology nor accounts of scientifically controllable creative acts of God. If we think the Bible does provide these, we have brought God's creative work down to scientific control, down to the visible things, contrary to the teaching of the Bible that 'through *faith* we understand that the worlds were framed by the word of God' (Heb. xi. 3a). We deal a death-blow to the Christian religion when we bring the Holy Scriptures down to scientific level by teaching that the Bible should give us a kind of scientific world-picture or axiomata of historical geology, or of Western science of history, or physics, biology, jurisprudence or whatever science it be. Thus, we lose the Bible as a reliable Word of God completely, because we then make its teachings dependent on the poor state of our scientific knowledge today . . . which will change tomorrow.

The over-estimation of science fails to see its possibilities and its limits. It means the corruption of true scientific working, both in the evolutionistic thinking of those who do not believe in God, and also in the thinking of Christians who do believe in God. These latter corrupt scientific work thoroughly when they start from a pretended biblical (in fact, imposed by them on the biblical teaching) elementary historical geology, into which then the geological data will have to fit. This is no less pseudo-scientific than that kind of evolutionistic reasoning that ignores God, and therefore presents truly a very bad case for orthodox Christianity today.

Scientific Pretension and Scientific Foundation

Before I start a more technical treatment of a few important geological questions, I want to make a few critical remarks of a general character concerning the pretended scientific value of *The Genesis Flood.*

First, writing a book with such significant claims or conclusions requires a thorough knowledge of the geological sciences and their principles. Neither author – one a theologian, the other a civil engineer – is a geologist. Everybody knows that in the present state of scientific development it is practically impossible for one person to master more than one branch of science. Now, the list of modern publications cited in the book is impressive but at the same time misleading. The way in which part of this literature is used proves that the real problems have often not been understood. A theologian should know how dangerous it is to lift a text out of the context and to treat it separately. This is true not only for interpreting the Bible but also for explaining scientific publications. To lift a certain sentence out of a publication, and to use it for something quite different than the original author meant, is scientifically dishonest. I realize that the authors of *The Genesis Flood* did not *intend* to do this at all, and in a few cases they even admit that the author they cite used his words in a slightly different way, but in others they give evidence of not having understood the exact bearing to which they refer. Thorough scientific work makes extremely high demands on professional knowledge.

The Essential Importance of the History of Science and Theology

Second, it is really astonishing that the authors of *The Genesis Flood* do not seriously take into account the history of the 'warfare between theology and geology'. They sound as if this were the first time that the idea was put forward that the deluge was responsible for the major part of the fossiliferous strata in the earth's crust, whereas this idea was perhaps a respectable hypothesis early in the history of the development of geology but was soon shown to be false by evidence accumulated as the science of geology began to grow. This *history* of geology is an essential part of the study to be made, and has to be taken into

account as an event which God has revealed to us in the middle of the twentieth century.

Is it any wonder, if we neglect this history, that we make the same mistakes as our fathers did one, two, three or even more centuries ago? When I saw the pictures of the pretended – but definitely not – human footprints in Cretaceous strata of Texas with the comment; 'Note the tremendous size which immediately reminds one of the Biblical statement that there were 'giants in the earth in those days' (Genesis vi. 4),[2] I was immediately reminded of the times before Cuvier when bones of elephants found in the earth were also considered to be evidence of the Genesis flood and declared to be remains of the giants of those days. Even the undeveloped science of that time was thought to confirm the reliability of Scriptures, and it is said that these bones were nailed to the doors of churches for the sake of strengthening the faith of simple Christian believers[1] I recall the days when Scheuchzer found his famous fossil which he named '*Homo diluvii testis*', the 'man witness of the deluge'.

But Cuvier, the father of comparative vertebrate anatomy, by scientific methods ascertained elephant bones to be elephant bones and Scheuchzer's "Homo" to be the skeleton of a Miocene salamander. Where then was the foundation on which those simple Christian believers built their faith? And what are Professors Whitcomb and Morris doing now for those Christians who do not know about geology but believe in the Holy Scriptures as the reliable Word of God? The so-called scientific foundation which they want to lay under the Christian's faith can be easily shown by unbelievers to be no more than loose sand. They could have known it too, if they had simply made a *serious* study of the history of the (largely man-made) problems between the Bible and geology.

Uncritical Criticism of Geological Principles

Third, the last general remark I want to make concerns the uncritical attitude of the authors regarding their own reasoning. The whole book intends to levy a fundamental attack on the

[2] *The Genesis Flood*, Text of Fig. 11, p. 175.

so-called uniformitarian principle in the geological sciences. They do not realize that, in part, their reasoning is based on the same starting point. In part, also, they fight against windmills, because most present-day geologists do not accept this principle exactly in the sense as it was understood by Lyell (who was no evolutionist when he wrote the first edition of his *Principles*[3]), but use it in the sense of a constancy of physical and biological laws, which does not at all exclude, for example, periods with climates differing from that which we know presently, or alternating longer quiet periods with shorter 'catastrophic' or paroxysmal episodes.

Besides, one could even agree that Lyell himself was not dogmatic in presenting his uniformitarian principle. His uniformitarianism is what Professor Dr. R. Hooykaas has called a 'methodological principle',[4] but not one that pretends to have 'eternal validity'. In the third Volume of the first edition of his *Principles*, Lyell wrote on page 6:

> In our attempt to unravel these difficult questions, we shall adopt a different course, restricting ourselves to the known or possible operations of existing causes; *feeling assured that we have not yet exhausted the resources which the study of the present course of nature may provide, and therefore that we are not authorized, in the infancy of our science,* to recur to extraordinary agents.

Now, in order to do justice to Lyell, it is necessary to know what he meant when he wrote these lines, and what he meant by extraordinary agents. The answer is not difficult, because on pp.3–6 of the same volume he offers examples. First of all, Lyell refers there to the controversy respecting the origin of fossil shells and bones – were they organic or inorganic substances? To this point he remarks:

> That the latter opinion should for a long time have prevailed, and that these bodies should have been supposed to be fashioned into their

[3] Charles Lyell, *Principles of Geology, being an attempt to explain the former changes of the earth's surface by causes now in operation.* 1st Ed. Volumes I-III, London 1830-1833.

[4] Hooykaas, *Natural law and divine miracle, a historical-critical study of the Principle of Uniformity in geology, biology and theology.* E. J. Brill, Leiden, 1959.

> present form by a plastic virtue, or some other mysterious agency, may appear absurd; but it was perhaps, as reasonable a conjecture as could be expected from those who did not appeal, in the first instance, to the analogy of the living creation, as affording the only source of authentic information. It was only by an accurate examination of living Testacea, and by a comparison of the osteology of the existing vertebrated animals with the remains found entombed in ancient strata, that this favourite dogma was exploded, and all were, at length, persuaded that these substances were exclusively of organic origin.

As a second example, the controversy concerning an aqueous origin of basalt and other crystalline rocks is mentioned. This was an essential point in the early controversy between Neptunists and Plutonists. Lyell says:

> All are now agreed that it would have been impossible for human ingenuity to invent a theory [the Neptunist theory] more distant from the truth; yet we must cease to wonder, on that account, that it gained so many proselytes, when we remember that its claims to probability arose partly from its confirming the assumed want of all analogy between geological causes and those now in action.

And then Lyell put the important question concerning the methodological principle in these words:

> By what train of investigation were all theorists brought round at length to an opposite opinion, and induced to assent to the igneous origin of these formations?

And the answer is:

> 'By an examination of the structure of active volcanoes, the mineral composition of their lavas and ejections, and by comparing the undoubted products of fire with the ancient rocks in question.'

He concludes with a third example, the question of whether the great alteration of the level of sea and land, proved by the occurrence of marine fossils in strata forming some of the loftiest mountains in the world, has resulted from the drying up of an ocean covering the whole earth or from the elevation of the solid land. 'A multitude of ingenious speculations' failed to explain the former hypothesis. But when 'in the last instance' the

> question was agitated, whether any changes in the level of sea and land had occurred the historical period . . ., it was soon discovered that considerable tracts of land had been permanently elevated and depressed, while the level of the ocean remained unaltered. It is therefore necessary to reverse the doctrine which had acquired so much popularity, and the unexpected solution of a problem at first regarded as so enigmatical, gave perhaps the strongest stimulus to investigate the ordinary operations of nature. For it must have appeared almost as improbable to the earlier geologists, that the laws of earthquakes should one day throw light on the origin of mountains, as it must to the first astronomers, that the fall of an apple should assist in explaining the motions of the moon.

After having given these examples, Lyell says that the geologists of his time are, for the most part, agreed on questions 'as to what rocks are of igneous and what of aqueous origin – in what manner fossil shells, whether of the sea or of lakes, have been imbedded in strata' etc. and are 'unanimous as to other propositions which are not of a complicated nature: but when we ascend to those of a higher order, we find as little disposition as formerly to make a strenuous effort, in the first instance [repeated here!], to search out an explanation in the ordinary economy of Nature'.

Sound Theorising in Geology and the 'Spirit of Speculation'

In chapter I of Volume III of his *Principles*, entitled 'Methods of Theorising in Geology', Lyell simply distinguishes two opposite ways of thinking. One starts from scratch with geological reasoning without first making a careful study of the 'ordinary economy of nature'. This method has led to untenable speculations and even absurdities: the history of geology provides several examples. This lesson of history should finally be accepted, not merely on incidental points (such as the nature of fossils, the igneous origin of various crystalline rocks etc.), but as a principle. The second method in contrast starts with a careful study of the present economy of nature, and then sees if the results of the geological processes of the past are really different from those of those going on at present. This methodological principle has to be applied to every aspect of geology and his reproach to Cuvier and his school, for example, is that

they apply it only partially but not consistently. Such critics are described in the following:

> We hear of sudden and violent revolutions of the globe, of the instantaneous elevation of mountain chains, of paroxysms of volcanic energy, declining according to some, and according to others increasing in violence, from the earliest to the latest ages. We are also told of general catastrophes and a succession of deluges, of the alternation of periods of repose and disorder, of the refrigeration of the globe and of sudden annihilation of whole races of animals and plants, and other hypotheses *in which we see the ancient spirit of speculation* revived and a desire manifested to cut, rather than patiently to untie, the Gordian Knot.

I repeat that Lyell's uniformitarianism was not dogmatic: he did not exclude the possibility that paroxysms or proceesss differing from those presently operating might have taken place in geological history. Note the important restriction in his words, 'in the infancy of our science'.

This restriction we also find in the concluding remarks of the Chapter:

> But since in our attempt to solve geological problems we shall be called upon to refer to the operation of aqueous and igneous causes, the geographical distribution of animals and plants, the real existence of species, their successive extinction, and so forth, we were under the necessity of collecting together a variety of facts, and of entering into long trains of reasoning which could only be accomplished in preliminary treatises. These topics we regard as constituting the alphabet and grammar of geology; *not that we expect from such studies to obtain a key to the interpretation of all geological phenomena*, but because they form the ground work from which we must rise to the contemplation of more general questions relating to the complicated results to which, in an indefinite lapse of ages, the existing causes of change may give rise.

Lyell had indeed been looking for the methodological basis on which a sound geological science could be built, rather than a geology full of the uncontrollable speculations which had been current for a long time prior to his writing.

Basic Uniformitarianism and the Authors of 'The Genesis Flood'

Lyell's starting point, like that of Cuvier and many others, is the constancy of law, of structural order in created things.

This, of course, is the only basis on which we can hope to speak reliably on the geological past. On this point, the authors of *The Genesis Flood* stand on exactly the same methodological basis as does Lyell. A few examples will illustrate.

There is no doubt that they consider fossils to be remnants of animals and plants which actually lived on earth under circumstances comparable to those we know presently. It is only on the basis of structural constancy that the authors can suggest that huge, but in form superficially human-like, footprints in Cretaceous strata are considered as evidence for the contemporaneity of man and dinosaurs.

A second example is the way in which the authors of *The Genesis Flood* argue in favour of what they call 'the most significant of these Biblical inferences', which is 'a universally warm climate with ample moisture for abundant plant and animal life'[5] before the deluge. For the sake of confirming this inference, the results of present day geology concerning ancient climates are good enough apparently to indicate that there were some periods when there existed a mild and warm climate over the greater part of the world. But these results are based entirely on uniformitarian reasoning. How can we ever infer a warm climate in the geological past, except on the basis of criteria which we derive from studies of the fauna and flora, or physical or chemical processes, which are characteristic of areas of warm climate we know on earth today? The distribution of coral or other reefs, for example, in the marine environment, and the absence of annual rings in the secondary wood of trees, are only two of these criteria.

A third example to show how the authors of *The Genesis Flood* depend in their reasoning on the *priori* assumption of the constancy of law, structure and even processes, is found in their speculation that the 'superficial appearance of evolution' of similar organisms in successively higher strata could be the result of the 'hydrodynamic selectivity of moving water'. After a reference from Krumbein and Sloss[6] about criteria on which the settling velocity of large particles is dependent, they write:

[5] *The Genesis Flood.* p. 243.

[6] W. C. Krumbein and L. L. Sloss, *Stratigraphy and Sedimentation.* 1st Ed. 1951.

> These criteria are derived from consideration of hydrodynamic forces acting on immersed bodies and are well established.
> Particles which are in motion will tend to settle out of proportion mainly to their specific gravity (density) and sphericity. It is significant that the organisms found in the lowest strata, such as the trilobites, brachiopodes, etc. are very 'streamlined' and quite dense. The shells of these and most other marine organisms are largely composed of calcium carbonate, calcium phosphate and similar minerals, which are quite heavy; heavier, for example, than quartz, the most common constituent of ordinary sands and gravels. These factors alone would exert a highly selective sorting action, not only tending to deposit the simpler (i.e., more nearly spherical and undifferentiated) organisms nearer the bottom of the sediments but also tending to segregate particles of similar sizes and shapes, forming distinct faunal stratigraphic 'horizons', with the complexity of structure of the deposited organisms, even of similar kinds, increasing with increasing elevation in the sediments.

And further:

> Of course, these very pronounced 'sorting' powers of hydraulic action are really only valid statistically, rather than universally. Local peculiarities of turbulence, habitat, sediment composition, etc., would be expected to cause local variations in organic assemblages, with even occasional heterogeneous agglomerations of sediments and organisms of wide variety of shapes and sizes. But, on the average, the sorting action is quite efficient and would definitely have separated the shells and other fossils in just such fashion as they are found, with certain fossils predominant in certain horizons, the complexity of such 'index fossils' increasing with increasing elevation in the column, in at least a general way.[7]

These are only three out of a hundred or more examples which could be given of this use of uniformitarian (the present is the key to the past) reasoning to argue for a catastrophist conclusion.

The geological nonsense in the above reasoning is so flagrant that I don't want to discuss it. Speculative hypotheses are dangerous enough already when brought into connection with the Bible, but this is even worse than speculation. What the authors of *The Genesis Flood* should learn from Lyell's example is the fear of speculation and the necessity of a serious

[7] *The Genesis Flood*, p. 274.

search for the foundation on which a reliable geological science could be based.

A little-noticed fact is that the antagonism between uniformitarianists and catastrophists (like, for example, Lyell and Cuvier) is not nearly so fundamental as it would seem. Both geologists agree that the laws of chemistry, physics, and biology – as we know them – are applicable also for historical-geological times.

This is an unavoidable *a priori* for a science that presumes to speak at all about the history of the earth. How paradoxical it may sound: only on the basis of the constancy of law and structure can we reliably speak about changes in the development of the earth's crust and its fossil content. In other words, the processes of which the geologist studies the results must be (perhaps not in intensity and scale) essentially of the same created order as that which we actually live in and form part of. If this were not so, the whole of historical geology would be in principle beyond the scope of human scientific possibilities.

On this fundamental point, the authors of *The Genesis Flood* agree with modern geologists, at least as far as the process of forming the fossil-bearing strata in the earth's crust is concerned. The tragedy is that they have not realised that in this way they have fused the dynamite under their pseudo-scientific building, exploding their so-called 'Scriptural framework for historical geology'.

On the basis of this principle, the fundamental question is to be answered by careful observation and analysis of the world's sedimentary strata and structural relationships. Are these the result of a catastrophic process, such as the authors of *The Genesis Flood* conceive? Or are they the result of processes whose intensity and scale are generally comparable to those going on today, as modern historical geologists have concluded?

There is no doubt about the answer in the present state of our knowledge; the broad lines of present-day historical geology are to be considered as well-observed facts.

The Trustworthiness of the Geological Time-Scale Disputed

Let us now turn to a few fundamental facts and principles of

present-day geology. First of all, consider those that concern the stratigraphic column and the geologic (relative) time-scale.

As an introduction, note a few quotations from the summary of the chapter, 'Modern Geology and the Deluge' in *The Genesis Flood.*

We read on page 206:

> The geological time series is built up by a hypothetical superposition of beds upon each other from all over the world.

That this superposition should be 'hypothetical' (which here clearly means 'not factual') is argued with a quotation from a geological text book:[8]

> If a pile were to be made by using the greatest thickness of sedimentary beds of each geological age, it would be at least 100 miles high. . . . It is, of course, impossible to have even a considerable fraction of this at one place. The Grand Canyon of Colorado, for example, is only one mile deep. . . .
> By application of the principle of superposition, lithologic identification, recognition and unconformities, and reference to fossil successions, both the thick and the thin masses are correlated with other beds at other sides. Thus there is established, in detail, the stratigraphic succession for all the geologic ages.

Then the authors of *The Genesis Flood* continue:

> This frank statement makes the method by which the geologic time-scale was built up quite plain. Since we have already noted that lithologic identification is unimportant in establishing the age of a rock, it is clear the "fossil successions" constitute the only real basis for the arrangement. And this means, in effect, that organic evolution has been implicity assumed in assigning chronological pigeonholes to particular rock systems and their fossils.

There follows a second quotation from Von Engeln and Caster, which apparently should confirm this conclusion:

> The geologist utilizes knowledge of organic evolution as preserved in the fossil record, to identify and correlate the lithic records of ancient time.[9]

[8] A. D. von Engeln and K. E. Caster, *Geology*, 1952, pp. 417, 418.
[9] A. D. von Engeln and K. E. Caster, *Geology*, 1952, p. 423.

This is commented on as follows:

> And yet this succession of fossil organisms as preserved in the rocks is considered as the one convincing proof that evolution has occurred! And thus have we come round the circle again.

The trend of this reasoning is clear; historical geology is basically unsound because it has been trapped in circular reasoning. First, geologists determine the order of successsion of fossils in the earth's crust on the basis of the superposition of the strata, but at the same time they declare the position of the strata reversed – by some tectonic process – when at another place the succession of fossils is found reversed. What is more, and even worse: Behind this is the 'hypothesis' of evolution, of 'a gradual progression of life from the simple to the complex, from lower to higher' (pp. 132, 134).

Moreover:

> . . . quotations from outstanding evolutionary authorities both in geology and biology, demonstrate the great importance of the paleontological record to the theory of evolution. In turn, the principles of evolution and uniformity are seen to be of paramount importance in the correlation of the geologic strata. These principles are absolutely basic, both from the point of view of the history of the development of modern geology and from that of present interpretation of geologic field data. The circular reasoning here should be evident and indeed is evident to many historical geologists (p. 134).

How corrupted and preconceived present-day historical geology really should be is then formulated in the following words:

> The basis for the apparent great strength of the present system of historical geology is here clearly seen. Provision is made ahead of time for any contrary evidence that might be discovered in the field. The geologic time scale has been built up primarily on the tacit assumption of organic evolution, which theory in turn derives its chief support from the geologic sequence thus presented as actual historical evidence of the process. Fragments of the sequences thus built up often appear legitimately superposed in a given exposure, but there are never more than a very few formations exposed at any one locality, occupying only a small portion of the geologic column. Formations from different

> localities are integrated into a continuous sequence almost entirely by means of the principle of organic evolution (p. 136).

I give these rather long quotations in order to show in what light such a sentence as 'The geological time series is built up by a hypothetical superposition of beds upon each other from position of paleontological criteria which has been proved to be all over the world' should be read, and furthermore to give an example of the mixing up of truth and untruth in the way of arguing of the authors of *The Genesis Flood* when it concerns one of the fundamentals of geological science.

The Natural Exposure of Normally Superimposed Rock Sequences

The actual situation is that the geological time-scale is based on a factual superposition of rocks yielding a factual superposition of paleontological criteria which has been proved to be the same all over the world. In order to make this clear, we will have to deal first with natural exposures – with the way nature exposes the sedimentary rocks, which contain those documents of the history of the earth's crust which the stratigrapher investigates.

When Von Engeln and Caster state that 'if a pile were to be made by using the greatest thickness of sedimentary beds of each geological age, it would be at least 100 miles high' and that it is 'of course impossible to have even a considerable fraction of this at one place', it should be noted that they are speaking of 'the *greatest* thickness of *each* geological age'.

Two qualifying remarks should be made about this point. First, the *average* thickness of sediments of a certain age is far less than the value of the greatest thickness. Second, if at one place a geological age is represented by its greatest thickness, it is very unlikely that sediments of another age would attain their maximum thickness at the same locality.

However, it is extremely unlikely – virtually impossible – to have a considerable fraction of a pile of sediments reduced in this way, and representing all geological ages, at one place.

For example, consider the world famous example of the Grand Canyon of the Colorado River, where Paleozoic rocks,

still in horizontal position, unconformably overlie tilted Algonkian or intensely folded and metamorphosed Archean Rocks at one locality. As a result of what geologists call epeirogenic movements, this area has been uplifted vertically without changing the original horizontal position of the Paleozoic rocks. Following the uplift, the Colorado River has cut deeply into the rocks to expose, in the steep walls of the canyon, the beautiful vertical succession of more than 1,000 metres of Paleozoic strata. In this exposure of a normal uncomplicated succession, the superposition is simple and clear. The Archean basement rocks lie at the bottom of the canyon. Progressively higher up on the walls within the canyon we found the Algonkian sedimentary rocks, then the older Paleozoic rocks, and finally – around the canyon rims – the younger Paleozoic rocks.

Very often, however, things are more complicated. Frequently, the original subhorizontal position of the sediments at the time they were deposited has not been preserved; as a result of differential movements in the earth's crust, the sedimentary sequences have been tilted, broken, or folded, so that the layers usually show a dip (varying from a few degrees up to a vertical position). Topographically, these differential movements may give rise to subaerial elevations (mountains) and depressions (lowlands). The mountainous areas are subjected to erosion, which results in the development of new topographic surfaces cutting the bedding planes of the layered sedimentary rocks at an angle. Eventually, erosion may lead to so called 'peneplains' or sub-horizontal erosion surfaces of vast extent. These peneplains thus may expose thick sequences of sedimentary rocks, in thickness far exceeding those of the Grand Canyon, and of which superposition is as undoubtedly established.

In the Grand Canyon, we find a sequence (some 1,000 metres thick) of horizontal Paleozoic rocks exposed – in the steep canyon walls – in only the very short lateral distance traversed as we ride from the bottom of the canyon to the high rim overlooking the canyon.

In a large region of subhorizontal topography (a peneplain) underlain by nonhorizontal – dipping, folded, or basinal – sedimentary layers, on the other hand, nature may have

exposed sequences of rocks amounting to many thousands of metres in thickness. In such a situation, we can no longer speak of a *local* superposition. We can, for example, walk for hundreds of kilometres across a series of low-dipping sediments in the 'Paris Basin', from Triassic rocks in Luxemburg to Middle Tertiary rocks in Paris. Local differences in topographic elevation (a few up to perhaps 100 metres) are insignificant compared to the distance of a few hundred kilometres and the thickness (about 2,000 metres) of the sediments which are exposed at or near the surface. In the case of the Paris Basin, which covers a great part of France, we have a huge bowl-shaped structure, consisting of strata dipping gently towards the centre, which implies of course that the younger strata are exposed in the central, the older in the peripheral, parts of the basin. There can be no doubt about the superposition of the strata in the Paris Basin. The formations are only very gently deformed, and a tectonic reversal is entirely excluded.

A comparable but much larger structure, with low-dipping Mesozoic and Tertiary strata, is found in the Gulf Coast Area of Mexico, Texas, Louisiana, and Florida in North America. This is a huge structure of low-dipping strata, in which the superposition is unquestionably normal and also very well known (as a result of thousands of bore holes which have been drilled in the search for oil in these areas). Again, here we cannot reasonably speak of just one locality or one place. But surface and subsurface data permit an unquestionable correlation, layer by layer, and thus the establishment of the sequence of normally superimposed strata attaining a thickness of many thousands of metres.

No evolutionary theory whatsoever could or would ever suggest a reversed position of the strata in the Paris Basin in Europe or in the Gulf Coast Basin in North America. The paleontologist would thereby saw through the branch on which he sits.

The stratigraphic column has been built up essentially on the basis of sedimentary sequences in many relatively stable areas where tectonic disturbances and metamorphism played a minor role and where therefore a reversed position of the strata could *a priori* be eliminated. On the basis of solid knowledge from

these simple areas, the tools have been obtained which permit us to understand more complicated regions. This is an example of the procedure followed by every geologist when he enters a new or unknown area: he first looks for the simpler structures which permit the establishment of the stratigraphic sequence, which in turn is a basic tool for unraveling complicated tectonic structures.

In summary. I want to emphasize that the way nature exposes huge sequences of strata is usually not by cutting deep canyons or valleys into highly upheaved horizontal strata at one place, but instead by differential crustal movements followed by peneplaining erosion (which uncovers older strata in mountainous area and also furnishes sedimentary materials which are then deposited – often containing fossils – to form younger strata). As a result of such tilting and other crusta movements, great areas of dipping, but unquestionably normally superimposed, strata are now found at or near the surface, and are therefore accessible to the geologist. The huge sequences of sedimentary strata which can be studied in such relatively undisturbed positions over great areas all over the world form the solid factual basis for the establishment of the time stratigraphic column.

The Primary Superposition in Highly Disturbed Areas

However, much more is to be said. When discussing what they called 'Methods of resolving contradictions', the authors of *The Genesis Flood* write

> Furthermore, even where superposed strata are exposed, it rather often happens that the fossils appear to be in reverse order from that demanded by the evolutionary history, which paradox is commonly explained by the assumption that the strata have been folded or faulted out of their original sequence (p. 135).

It is an old story which is told here. It was already elaborated in Professor Aalders' book.[10] And it seems that this favourite

[10] Dr. G. Ch. Aalders, *De goddelijke openbaring in de eerste drie hoofdstukken van Genesis*, Kampen, 1932.

argument of professors of Old Testament is supported even by some geologists; the authors of *The Genesis Flood* give the citation of C. H. Rastall, lecturer of Economic Geology at Cambridge University, saying;

> It cannot be denied that from a strictly philosophical standpoint geologists are here arguing in a circle. The succession of organisms has been determined by a study of their remains embedded in the rocks, and the relative ages of the rocks are determined by the remains of organisms that they contain (p. 135).[11]

Now, Mr. Rastall may be a good economic geologist: he is definitely not a good philosopher because his statement is simply not true.

What are the facts? A reversed position of strata is the result of strong disturbing movements after deposition. Complicated tectonic deformation occurs when the sediments are deposited in an area which is or becomes highly mobile, in contrast with relatively stable regions.

Since the reversed position of the layers, and, of course, the inverted succession of fossils, is not of primary or stratigraphic origin, but of secondary or tectonic origin, we should find (and we do) completely independent tectonic evidence (in addition to the fossil evidence) for a reversed position of a sequence of strata. Surely, we prefer simple structural relations when establishing a stratigraphic column in an area, but we do not finally depend on them.

In many instances, we can follow a certain sequence of strata from a less to a more intensely disturbed area, and observe, for example, how in this direction the dips increase to a vertical position, and somewhat further on have turned more than 90° from the original horizontal position so that they are then 'overturned' and the sequence of layers has become in fact inverted or reversed. A gradual transition from a normal to an inverted position is in fact a phenomenon which is often encountered in folded areas. It has nothing to do with theory; it is just a matter of observation.

[11] C. H. Rastall, *Geology*. In: *Encyclopaedia Britannica*, Vol. 10, 1956, p. 168.

When in a mobile area we find with the help of fossils that a sequence of strata lies in reverse position, this conclusion if reliable implies that the strata are folded and that there must be a hinge zone along which the layers have been turned up. Such hinges, along which layers are sometimes turned over 180 degrees so that they are now in a perfect upside-down position, are perfectly visible, for example, in some deep valleys in the Swiss and Austrian Alps. Now, if our index fossils are reliable, the paleontological evidence, the succession of the fossils, must be in accordance with the tectonic-structural evidence for whatever, normal or reversed, position the strata are in. But if this is the case, and this is in fact what we find, then both evidences do mutually confirm each other. The reversed sequence in which the fossils are found locally therefore does not invalidate, but, on the contrary, fortifies their value as time markers, because we know from independent tectonic evidence that the layers there are in overturned position.

The same situation holds when, as a result of tectonic causes following differential movements in the earth's crust, rock masses are pushed up and over on top of neighbouring areas: in this way also, older rocks will lie on top of younger strata. If such an abnormal succession is of tectonic origin, we should find the fault plane, the overthrust plane, exactly at the place where the older strata appear above the younger formations. Such a situation will usually be characterized by tectonic criteria related to the overriding phenomenon. At such an overthrust plane, we often find a tectonic breccia, consisting of broken and crushed rock fragments of usually heterogeneous material. In other instances, depending on overburden and fluid pressure at the overthrust plane, friction may have resulted in such high temperature that the anomalous contact indicated by our fossils is characterized by a 'burned' or a dynamometamorphically altered zone. And here again, this is exactly how we find it. Tectonic and paleontologic evidence point in the same direction. Instead of contradicting, they confirm each other, and here again we may speak of convergent evidence.

Top and Bottom Engraved in Individual Layers

To find an answer to the question of whether we are dealing with strata in normal or reversed position, a third criterion can usually be found. It is of stratigraphic-sedimentologic character, and involves sedimentary structures found in individual layers.

Let me give a few simple examples to demonstrate the principle. On a sandy bottom, running or waving water may cause characteristic ripples in the sand which we call ripple-marks. They are often found in a fossil state. Wave ripplemarks, for example, form sharp ridges and rounded troughs. When we find in a sequence of layered strata that these sharp ridges point downwards, we therefore know that this sequence lies in an overturned position. In case the external form is not clear, the internal lamination may provide decisive evidence.

Another example, seen by almost everybody at some time, is that when a puddle or a muddy ditch desiccates, a pattern of cracks appears in the drying mud, the so-called 'mud-cracks'. Such mud-cracks also have often been fossilized as a result of the filling of the wedge-shaped openings between the polygons with other material, e.g., sand. In this manner, again, the layer was marked for top and bottom during the process of sedimentation. The points of the wedges indicate the direction in which the older layers are to be found.

A great number of comparable stratigraphic-sedimentologic criteria, so-called top-and-bottom features, are known. Usually very small structures, they often give an unmistakable answer to the question whether the position of a layered sequence is normal or not, completely independent of tectonic or paleontologic evidence. In practice, the field geologist working in complicated areas is constantly concerned about the question 'normal or reversed position?' He therefore is very keen on finding such top-and-bottom features, the more so when fossil evidence is not immediately, not sufficiently, or not at all available.

It will be clear that when we add the stratigraphic-sedimentologic evidence of the sedimentary structures to the already convergent evidence of tectonics and paleontology, here remains no trace, not even a glimpse, of circular reasoning

whatsoever. Quite the opposite is true; the reliability of the fossils for relative age determination of geological formations is not denied by local occurrences in reversed order, but on the contrary confirmed. For with the help of two other criteria, independent from each other and independent of those fossils, we can irrefutably demonstrate that the layers there indeed occur in overturned position.

The Question of Correlation

With the possibility of establishing the normal succession of strata in the earth's crust, we have in principle a factual basis for the establishment of the order of succession of the fossils they contain. In order to make clear now that the order of succession is the same all over the world, and that fossils therefore may be used as time-characteristic index-fossils I have to go into a little more detail about the local and regional successions of geological formations, the gaps they necessarily contain, and the question of regional and intercontinental correlation.

When we look at a geological map of France, we can see that the relatively undisturbed sediments of the Paris Basin overlie more intensely folded sediments of Paleozoic age outcropping in various areas around the actual basin boundary. When we look now at the succession of rocks from Paris, then moving outward from the centre of the Paris Basin, to Charleroi in Belgium, we observe that the lowermost sediments of the Paris Basin, inconformably overlying the folded Paleozoic strata of the Ardennes Massiv, are Upper Cretaceous. Around the basin's edges, at the surface of this angular unconformity there is in this sequence a huge gap, because practically the whole Mesozoic and part of the Paleozoic are missing. But when we follow this contact, the outcrop of this important unconformity, in an East-South-Easterly direction we gradually encounter successively older formations appearing in the Paris Basin above the unconformity surface; these formations have been called: Lower Cretaceous, Jurassic, and then Triassic.

When we look at the geological map of the United States, we

see that (in Tennessee, Alabama, and Georgia) the folded Paleozoic sediments of the Appalachians plunge down underneath essentially undisturbed sediments of the Atlantic and Gulf Coastal Province, the oldest of which are here Cretaceous, at least at the surface.

There is a striking similarity in the position of the Coastal Plain sediments as regards the folded Paleozoic rocks of the Appalachians on one side of the Atlantic and those of the Paris Basin with respect to the folded Paleozoic Rocks of the Ardennes on the other, particularly when we look at the Paris-Charleroi section.

That identity is not only structural; it is much more complex. There is a succession of Upper Mesozoic and Cenozoic strata which, notwithstanding all kinds of differences due to locally differing sedimentation conditions, can be compared and correlated with that in the Paris Basin, on the basis of the fossil faunal contents of the sediments. That is to say, when we compare the sequences of strata on both sides of the Atlantic Ocean, where the superposition is unquestionably known, there appear to be differences in the faunal content of successive layers; these differences allow for a descriptive stratigraphic subdivision, and they occur in the same order of succession. And when we look now at the underlying folded rocks and establish therein the stratigraphic superposition, we find, first of all, that the faunal content of these layers is totally different from the overlying strata, but very similar to that of the folded Paleozoic formations of the Ardennes. Furthermore that comparison of the sequence in the United States and in Europe *also* reveals faunal characteristics for a subdivision *in the same order* in America and Europe. All this has nothing to do with evolutionary theories. We simply find a factual superposition of faunal elements (in the strata) which occurs in the same order on both sides of the Atlantic. On the basis of such experience in comparing or correlating stratigraphic columns all over the world, we can then finally say that fossils may be used for indicating the place of the formation in the sequence. This experience of correlating the superposed strata all over the world is essential; every index fossil is constantly being checked on its guide value by new stratigraphic field work, by

the many bore-holes of the oil companies, etc., all over the world and every day.

The basis of our subdivision of geological time is found in the fact of a worldwide complex identity of the succession of sedimentary strata. The 'older' or 'younger' can without any doubt be established in both the locally and the regionally exposed strata. The 'as old as', the 'time correlation', on a regional to continental scale has its base in the identity in the complex succession of stratigraphic series in different places, a complex succession which practically eliminates any other interpretation than that of 'same age' (on a certain scale and with a certain degree of accuracy, of course).

We take the example of the Paris Basin/Ardennes and Gulf Coastal Plain Province/Appalachians again. It is clear that the unconformable superposition of unfolded Cretaceous and Tertiary sediments on folded Older and Younger Paleozoic sediments (which, both in relative detail, show comparable faunistic similarity on both sides of the Atlantic) reveals a complex identity structurally and stratigraphically to the effect that a geologist can give no other interpretation than; an older period (Paleozoic time) in which sedimentation took place in the areas; then folding, mountain building and erosion at or towards the end of this time; finally, renewed sedimentation in at least part of these areas in Mesozoic and Cenozoic times.

We could go a little bit further now and ask about so-called Jurassic and Triassic sediments which appear under the Cretaceous of the Paris Basin. What about their equivalents in the South eastern States of the United States? Do they really exist, and are they in a position comparable to those in Europe? The map shows that the oldest deposits of the Gulf Coastal province outcropping at the contact with the Appalachians are of Cretaceous age, which implies a gap here for Jurassic and Triassic. Is this implication correct? Yes, because for example away from this surficial contact, from Yucatan to Florida, the oil-well bore has struck older deposits underneath the Cretaceous, showing paleontological characteristics of Upper Jurassic age. Normally underlying sediments, possibly Lower Jurassic, Triassic or Permian, could not be identified as such because of lack of fossils. But when we go, for example, to the

Southwestern part of the United States we find a normal superposition of dated Permian, Triassic, Jurassic and Cretaceous sediments covering very large areas in Utah, Colorado, Arizona and New Mexico. The same order of paleontologic criteria in the succession of strata – in Europe, in America, in Asia, Africa and Australia, all over the world – this is a fact which simply cannot be denied except by those who do not know or do not want to know. But the factual situation is there for everyone who wants to go and see.

Parenthetically, I want to point out that therefore evolution (in the descriptive sense that flora and fauna on earth have been subject to change almost continuously in the course of geologic time) is also to be considered as a well observed fact, which is of course something quite different from a theory of evolution and from an evolutionistic philosophy.

Reworking: Mixing of Fossils of Different Age

But, the authors of *The Genesis Flood* might react by saying that we are still dishonest with our representation of the fossil succession as an observed fact, because in several instances mixed faunas are found, which would therefore represent a mixture of older and younger fossils. Then, they might say, we come along with a complicated interpretation of reworking or comparable phenomena, but that interpretation is only an interpretation, and the *fact* is that these fossils do occur together in the same bed. And we would have to answer that that is true, but truth and simplicity do not always go together.

When fossil-bearing sediments become subject to erosion, one must expect not only redeposition of the inorganic components but also those of organic origin. This general consideration already implies that a mixing of fossils of differing ages as a result of reworking processes must occur. But, reworking or redeposition in general results in characteristic features by which it can be determined as such.

In the Netherlands, we find silicified Cretaceous sea urchins as elements in Pliocene fluviatile gravels. Marine animal remains in fluviatile beds is of course already anomalous, but furthermore the silicified tests are rounded by their having been

transported, and we know the place where they have been washed out of the sediments in which they were originally embedded.

A second example is that, in muds of the Wadden Sea, Cretaceous Foraminifera are found together with the recent foraminiferal assemblage. These Cretaceous elements, however, are found in the smallest fraction (smaller than 0.15 mm) of the washed residues. They are washed out of Cretaceous deposits of the Paris Basin exposed in the Channel, sorted by longshore current action, and only the finest material reaches the Dutch Wadden Seas. Here, although differing preservation already demonstrates the correct conclusion, the uniform size indicates sorting and proves the allochthonous character of these elements in the faunal assemblage.

We found a very interesting example of mixed faunas when working as stratigraphers for an oil company of the Royal Dutch Shell group in North Borneo. The washed residue of a shale sample appeared to contain a normal assemblage of beautifully preserved Paleocene (Lowermost Tertiary) Foraminifera, but also a few very poorly preserved *Miogypsinas*, larger Foraminifera of Miocene (Lowest part of Upper Tertiary) age. At first sight, the perfect preservation, absence of sorting, and normal assemblage of these Paleocene Foraminifera, mixed with some 30–40 million years younger *Miogypsinas* which were in part pyritized and very badly preserved, was astonishing. From the field geologist, we knew that big 'exotic' blocks of probably Paleocene age occurred scattered in the shale. We then looked at the part of the sample which had not been washed, and the solution of the problem was found. The sample consisted of a dark grey shaly matrix, in which a great number of angular fragments of a light coloured marl were disseminated. It was clear that the angular fragments were redeposited fragments of an older formation and that they appeared indeed to contain the Paleocene fauna. The autochtonous sediment – the dark shaly matrix – was apparently formed under more or less anaerobic conditions, as a result of which sulphuric acid was formed, which in turn attacked and in part pyritized the calcaeous shells of *Miogypsina* during or shortly after deposition. The Paleocene Foraminifera in the

original sediment of the angular elements were perfectly protected against such chemical activity in the Miocene basin.

Stories like this may sound complicated, but in fact they are not. Again here, the way in which the resedimentation process was written down in the structural relationships of the younger sediment did not deny, but on the contrary again confirmed or corroborated the reliability of the fossils – in this case pelagic and larger Foraminifera – as index fossils.

Structural Uniformity and Actual Experience

Within the scope of this article it is impossible to deal with everything which the authors of *The Genesis Flood* have presented. There is one important and fundamental thing, however, concerning which I want to spend a few sentences – the practical meaning of the so-called uniformitarian and actualistic principles in geology.

As a first remark, I don't like -isms. A term ending in -ism usually means an overestimation of the aspect, modus, state of affairs or whatever is meant by the term. The question which has to be answered, however, is this: have those people who are considered to be the fathers of uniformitarianism or actualism seen something fundamentally essential for our geological scientific knowledge, even if they may not have correctly defined, not fully understood, or over- or underestimated what they had seen?

As a historical geologist, who always has to do with *documents* of a geologic past in the earth's crust, I cannot pretend to speak even one reliable word about geological history except on the basis of what I called above 'structural constancy'. 'Structural' is meant in a very large, generalized sense. The only way to distinguish differing processes in the documents is by means of the differing structures they may reveal. Sedimentary processes produce typical, characteristic structures, and tectonic processes produce other differing, but also characteristic structures in the rocks of the earth's crust. There are, of course, also many kinds or types of sedimentation processes, the results of which can be differentiated on the basis of the differing structural characteristics produced – such as lithologic and

paleontologic criteria, texture and structure (in a restricted sense).

The general rule will be that the more detailed the interpretation, the more detailed also our structural analysis will have to be. The general starting point for an interpretation of the sedimentation processes in geologic history on a really, and the only possible, scientific basis will therefore be the assumption that a catastrophic sedimentation process would have to show characteristic structural relationships, and that, on the other hand, the normal, actual sedimentation processes necessarily result in different characteristic structural features. In other words, when our analysis of fossil sediments reveals in great detail the same structural relationship as that which is actually formed under present day condition, the only conclusion which can honestly be drawn is, 'It is the same process'. Ascribing comparably structued sediments to catastrophic processes would be something like declaring that fossil fish which we have found on the basis of fossil remains to look in detail like actual fish, were not really fish living in water but birds flying in the air.

The example may sound silly, but it clearly shows the basic role of structural *uniformity* even for the determination of fossil remains, and demonstrates also the link with actual life' *experience*. What could we say about the function of the organs of fossil fishes, or about the environment they lived in, if we did not know the living fish in its environment today?

Now, in view of the need for more detailed reliable interpretation of depositional environments of fossil sediments, one branch of geological sciences, called sedimentology, has grown very rapidly during the last decades. A major part of the work done by the sedimentologist was and still is a detailed analysis of actual sedimentation processes and their results in modern depositional environments. Of course, when we want to know what the characteristic features are of sediments found in a middle neritic marine environment (the zone of approximately 40–100 metres depth [20–50 fathoms] on the shelf), we shall first of all have to obtain samples of the modern sediments in this area, examine them in detail and study all kinds of physical, chemical, and biological conditions in the zone. In addition, we

shall also have to study the bordering (inner neritic, and outer neritic) environments to be able to specify their characteristics also in a differential diagnosis.

Modern analyses of these sediments 'in formation' are done in very great detail, in both the physicochemical and biologic criteria, with the result that a very detailed classification of sediments as related to their depositional environment appears to be possible. But it also appears that this 'key of the present' indeed fits into the sediments of the past, because most of them show, often in astonishing details, the same structural relationships. The identity is there. The uniformity is written down in the fossil sediments themselves. There is no way out unless one wants to declare, to pick up the above examples, that the fish is a bird. The identity may exist on a small scale (e.g., the number of Foraminifera *per gram* of sediment, and the precentages of different species or genera with respect to the total foraminiferal assemblage) but also on a large scale. To conclude I would like to give one example of the latter.

The authors of *The Genesis Flood* try to deny the evidence for deposits which required a very long time to form, such as coral reefs. Some of them at least are explained as being redeposited during the Flood (pp. 408, 409).

Now there are different types of reefs and different organisms which can build reefs, in addition to corals. Reefs have played a very important role in the geological history of the earth's crust, and sedimentologic research is particularly active in investigating the depositional environments of reef limestones and those immediately related to the reefs.

Let us look at a barrier reef. It lies at a certain distance from a shore, and separates a lagoonal environment (between barrier-reef and shoreline) from the open marine environment. At the sea-side of the reef body, we distinguish a fore-reef area, on the land-side a back-reef zone. The reef-body itself consists of a core of unlayered, massive limestone, built up by the sedentary reef-building organisms still in original life position; it is bordered by coarse, and farther away finer reef detritus, which, particularly the latter, are often very well bedded. Now, we do find barrier- and other reef bodies at many different levels in the stratigraphic column. But we do not find, say, the

core of a barrier-reef body, as a strange element in other deposits. On the contrary, in Silurian reefs in Gotland, in Devonian and Lower Carboniferous reefs in Belgium, the Jurassic reefs in the Jura Mountains, and Cretaceous reefs in the Apennines, etc., etc., we can recognize and locate, in addition to the reef bodies themselves, the associated depositional environments with their characteristic sediments and faunas; the lagoon, the fore- and the backreef zones, and the open marine environment.

On a small scale and on a large scale, there is no question whatsoever of some catastrophic mixing-up; on the contrary, everything is found exactly in the place where it should be, compared with actual sedimentation conditions in reef and associated environments. We find structural constancy in detail, even when we consider variation as a result of different reef-building organisms (such as calcaceous algae, stromatoporoids, bryozoans, corals, rudistids, or combinations).

These are the facts of stratigraphic and sedimentologic research, which are at the basis of the major results of the geological sciences. This basis makes it possible indeed to say that the broad lines of present-day historical geology dealing with the formation of the earth's crust in geological times in the order of hundreds of millions of years, are correct, and are to be accepted as a well established fact.

Science and the Bible: Not the Fundamentalistic Way

It may seem as if I have written very little about fundamentalism so far. However, I was fighting against it all the time, but silently and indirectly until now.

The book of Whitcomb and Morris was written on the basis of what we usually call a fundamentalistic or biblicistic viewpoint. This standpoint implies the belief that the Bible teaches us principles, fundamentals or elements of human science in general and of historical-geological science in particular.

For the fundamentalist, therefore, the reliability of the Bible as the Word of God is related to *scientific* reliability. For him this is particularly true with respect to the first eleven

chapters of Genesis. This conception, however, implies inevitably that science and God's Revelation in the first chapters of the Bible are placed on the same (scientific) level, on the basis of which scientifically obtained data about the history of the earth and man will have to fit into the 'Biblical scheme or framework'.

The 'question' of the reliability of the Holy Scriptures can thus be fought out on the scientific field, and, as a consequence we then see theologians enter this field, as Professor Whitcomb now does as Professor Aalders did in Holland a few decades ago, and as so many before them have done since the end of the Middle Ages.

But these 'scientific' battles for an infallible Word of God have been lost right from the start. In constant retreat, the theologians have had to surrender every position they had once taken in this struggle. That's what the history of the warfare between science and theology should have made conclusively clear. The tragedy of men who wanted to defend the reliability of the Word of God 'scientifically' should have taught us that this entire approach was wrong. It should have convinced us that this science is a very bad ally, because its word had only temporal and no eternal value.

The most tragic aspect of the fundamentalist conception seems to me that his standpoint requires *scientific* proof, so that he must somehow live in fear of the results of developing scientific work, because indeed this development could then also *disprove* the reliability of the Holy Scriptures. And this leads to the cardinal question whether in this way the fundamentalist's conception does not reveal an implicit faith in science, which is far more dangerous for Christian religion than is the scientific development itself.

A few years ago, I was speaking to a conference of Reformed ministers in the Netherland about some fundamental facts of geology. In the discussion, one of them arose and declared that, if he were convinced that what I had told them was true, he would immediately abandon his ministry. But I ask myself what kind of a religion is Christianity when scientific geological facts can prove or disprove the reliability of God's Revelation to man? What then do we really believe in? In *our* own 'image',

conceptions or ideas about an infallible Bible? In an interpretation of the first chapters of Genesis with the help of current natural scientific knowledge just as earlier theologians did with the help of a world picture, incidentally, usually already out of date in their own time? Does the message of the Bible then really necessarily change with the changing world picture? It surely does as long as we continue trying to accommodate Genesis and geology.

Instead of giving human scientific work its proper place in the light of Scripture, fundamentalism indeed implies, as I indicated already in the beginning of this article, a colossal over-estimation of natural science. Neither geology nor any other natural science can ever be a direct exegetical tool, as they have been used, and still are used in fundamentalistic conceptions.

However, the history of the natural sciences and the results of modern geology, for example, could play a far more modest role, the role of an indirect exegetical tool. Such would be not a tool to test, to prove or to disprove the reliability of Scriptures, but to test the reliability of our ideas and conceptions about the Bible, the inspiration, and the historicity of the first chapters of Genesis.

The reliability of the Word of God spoken in this world through his prophets and apostles is beyond the reach of scientific control, because the Bible is not a scientific book. As such, it is not vulnerable to the results of science. Therefore, Christian astronomers, geologists, and biologists can work without fear as long as they respect the limits of their own scientific field.

Our ideas and conceptions concerning the Bible may indeed appear to be vulnerable to the results of scientific development. This state of affairs seems to be difficult to accept, particularly for many evangelical Christians. It cannot be denied, however, that there is 'revelation' (be it of a different kind than that of the Bible) in the development of this created world, also in the results of human scientific and technical advances during the last centuries. It cannot be denied and should not be denied that, as a result of this development, our (scientific) world picture (Weltbild) has obtained huge dimensions, both in

time and space and has become entirely different from that of the authors of the Bible. But, this is the world God has wanted us to live in, we and our children.

The fundamentalistic view, conservative in an erroneous sense, requires us to accept a so-called 'biblical world picture' which should be normative for scientific work. This is a poor predicament indeed for contemporary Christianity, because it tends to transform twentieth century Christians into aliens, standing, as it were, in Old Testament times. Since this is, of course, not possible, the fundamentalistic view tends to deprive them of their belief in a reliable Bible. It alienates us from the words of Eternal Life, which we understand through *faith* and not through *science*, and which stand firm in this rapidly changing world.