
A table of contents for *Bibliotheca Sacra* can be found here:

https://biblicalstudies.org.uk/articles_bib-sacra_01.php

THE NEW CATASTROPHISM IN GEOLOGY

BY GEORGE M'CREADY PRICE

PACIFIC UNION COLLEGE, CALIFORNIA

IN *Harper's Magazine*, June, 1922, is an article by James Harvey Robinson, under the title, "Is Darwinism Dead?" This article is merely one more contribution to the animated controversy which is now going on through the magazines and newspapers. But it may be taken as a sample of many others. In answering his question, Mr. Robinson first separates the theory of Darwinism from the general doctrine of organic Evolution, which, of course, is not hard to do, as Darwinism properly speaking is merely a sub-theory under the general doctrine of organic development. After making this distinction, Mr. Robinson admits that the theory of natural selection and sexual selection, as formulated by Charles Darwin, has had to be given up, in so far as these theories were supposed to furnish us with the *method* by which one form of life could become transformed into another type of life. And he goes on to say that "in this sense 'Darwinism' is perhaps as dead as Mr. Bryan or Senator Rash of Kentucky would care to see it."

Another subdivision of the general development doctrine which has been dead for a considerable time, is what is commonly known as the theory of the inheritance of acquired characters, this theory being also known as Lamarckism.

But Mr. Robinson goes on to express his confidence that the general doctrine of organic Evolution is still very much alive. For he says that in spite of our advancing knowledge having disproved these theories of Darwin and Lamarck, disproof of these theories does not mean that most modern scientists "have any doubts that mankind is a species of animal, sprung in some mysterious, and as yet unexplained, manner from extinct wild creatures from the forests and plains."

He goes on to explain that "this they simply take for granted,"—an expression which sounds very much like

that used by Dr. D. H. Scott before the Edinburgh meeting of the British Association for the Advancement of Science, September 9, 1921, when he spoke of believing in Evolution "as an act of faith." Dr. William Bateson also, in his notable address at Toronto, last December, spoke of believing this doctrine by faith,—"the foundation of things hoped for, the evidence of things not seen."

However, Mr. Robinson proceeds to give some concrete arguments in support of the theory of man's animal origin, which, of course, is the whole point in any theory of organic Evolution,—it would be mere academic pedantry to spend sixty years of time and write whole libraries of books as to whether or not the birds evolved from the reptiles and the latter from the amphibians, if all such discussion did not involve much more than this.

The first of the arguments adduced by Mr. Robinson is that from geology, and this argument is generally conceded to be far and away the most important of all in favor of some method of organic development. It will be convenient to postpone the consideration of this point until the rest have been discussed, by which time it may appear that this argument from geology may not prove to be as strong as it is usually regarded.

The second argument adduced by Mr. Robinson is that from Man's structure, which admittedly resembles the structure of some of the higher mammals. This, however, is no new line of facts. This similarity of structure has been quite well studied for the last two or three generations; and it is pretty well agreed among all clear thinkers that a similarity of structure can prove nothing more than a similarity of structure. It should not even remotely suggest a blood relationship. For if a similarity in structure really indicates a kinship because of common descent, then a Ford automobile must be a blood relative of a Dodge or a Packard, and an adobe hovel must be the true genetic ancestor of a bungalow and a brownstone mansion. Most modern scientists take some training in logic and general culture before beginning their various specialties, and accordingly this supposed argument from morphology, or comparative structure, which

was so greatly overworked some twenty or forty years ago, has not been so much in evidence in recent years.

The third argument adduced by Mr. Robinson is that from embryonic development, and this, he declares, "is perhaps the most striking of all." The chief facts in this connection are that all the higher types of life begin alike from the single cell, or fertilized ovum, which is usually less than one one-hundredth of an inch in diameter. This single cell by multiplication soon becomes two cells, then four, eight, sixteen, and so on. And it is a very interesting fact that in these early stages it is quite impossible for even an expert to tell by its appearance whether this developing ovum is going to turn out to be a guinea pig, a collie dog, an elephant, or a philosopher. Of course, it is soon more easy to separate the one from the other, and it is also true that even in comparatively early stages there are essential differences between the methods of development among the different classes of animals. But it has often been asserted that all the higher forms of life, such as the developing human embryo, pass through stages which resemble the more mature forms of some of the lower animals. For instance, it has been asserted that at a certain stage of the human embryo there are visible in its neck certain markings which have been thought to look like the gill slits of certain fishes. Several other structures have also been spoken of as resembling some of the more mature forms of one or more of the animals lower in the scale than man. And this alleged similarity between the developing embryos of man or of the other higher animals, and the more mature forms of those still lower in the scale of existence, has been appealed to as one of the strongest evidences that man and all the higher kinds of animals must have evolved from the lower ones. It has been asserted that there is no physical or physiological reason for these points of similarity; but that these similar structures appear in the human embryo, because, forsooth, this embryo is recapitulating, as if from memory, the abridged history of its slow rise through the ages, the history of its ancestors.

This "recapitulation theory," as it is often called, was also greatly overworked during the days of Ernst Haeckel and his devout followers. Of late years, however, in following out in more detail the development of both man and many other types of life, so many clear exceptions to this rule have been found that the theory for explaining them has been quite largely abandoned. That is, dozens and hundreds of examples have been found of structures appearing in the embryonic development which could not possibly be interpreted as ancestral recapitulations; and accordingly it is now acknowledged that such structures must of necessity be explained in some other manner.

The following quotation from a recent number of the *Scientific American Monthly* will serve to show the present attitude of biologists toward this recapitulation doctrine, which was called by Haeckel "the fundamental law of biogenesis":—

"The critical comments of such embryologists as O. Hertwig, Keibel, and Vialleton, indeed, have practically torn to shreds the aforesaid fundamental biogenetic law. Its almost unanimous abandonment has left considerably at a loss those investigators who sought in the structure of organisms the key to their remote origin or to their relationships." (February, 1921; p. 121.)

Such authors as Thomas Hunt Morgan, of Columbia University, have often pointed out that this recapitulation theory, so long the favorite argument of Haeckel, is wholly false and unscientific. Quite obviously, if all the higher types of life start alike from single cells which are apparently almost identical with one another, it must result that during the earlier stages of their development, all these embryos might be expected to continue to develop along what might be termed parallel lines. All of the railway lines running out of Chicago to California are more or less parallel with one another for a considerable distance. That is, since each embryo begins with a single cell, this dividing into two cells, then into four, eight, and sixteen, it is not a matter for wonder or for some far-fetched explanatory theory that they continue

to resemble one another for a considerable period during this embryonic development. All houses begin first with a foundation. In all cases the walls have to go up before the finishing is put on inside or the paint on the outside. And not even an expert architect can always tell from the foundation alone whether the house is going to be a bungalow, a colonial, or a Swiss chalet.

In reality, this theory of recapitulation was started in the early days of biology, when all these matters were very new and strange. In this case, as in so many others, the theory ran far ahead of the facts. Many a scientific Ahimaaz, the son of Zadok, has started to run when he had no tidings ready. But as the facts of embryology have been slowly and carefully worked out, we have seen that the development of the embryo does not correspond to the early crude theory which was propounded to explain it. And it would be safe to say that this recapitulation theory has few if any defenders among those really qualified to speak on the subject. In other words, we now know that certain peculiar forms do not appear arbitrarily, nor merely because nature has got in the habit of making her organisms in this way, as the Chinese, according to Charles Lamb, always thought they had to burn a house down whenever they wanted to have roast pork. I have always felt too much respect for nature to think she had no more wit than *Ho-ti* and his relatives of Charles Lamb's story. All of the structures which appear in the development of the chick or the elephant or man, have doubtless a meaning and a definite reason for existence. They are not useless, and are no mere whimsical acts on the part of nature. There was once a time when such structures as the pineal gland and the thyroid gland were looked upon as useless to their owner, mere vestigial and dangerous souvenirs handed down as hoodooed heirlooms from man's brute ancestors, and not yet sloughed off. But our modern anatomists and physiologists have learned better. Just so with the peculiarities of the developing embryo. We are learning that, if we begin by assuming that all the peculiar structures which we find in the developing embryo have a real physi-

ological meaning, it would be a more scientific way to study the subject, and that we would be treating nature with far more respect. And I think that this is the attitude of practically all modern embryologists.

Of course, there is another reason why this recapitulation theory has been kept in the foreground, in fact, it is the only reason why this theory was ever suggested in the first place, and the reason why it has survived as long as it has. This is because the geologists and the paleontologists *have used this embryonic development as their guide in settling the exact order in which the fossils ought to be arranged.* For instance, in the ammonites, creatures somewhat like the pearly nautilus, with a flattened spiral shell somewhat like a gigantic snail shell, it has been found that in the earlier stages of their development the serrations or markings on the shell are quite smooth and regular; but as the animal grows older these serrations become more and more wonderfully complex. But some ammonites have comparatively smooth serrations even in the full-grown form; accordingly it is assumed that all those ammonites with comparatively smooth serrations in the mature state, must be geologically *earlier* than those other ammonites which have complex serrations. As all of the ammonites are extinct, and found only as fossils, there is no way of checking up on the matter in an independent way, to see whether this theory is true or not. But this theory is used in every department of paleontology, in fact, as Grabau puts it: "this doctrine of the recapitulation of ancestral characters has become the corner stone of philosophic (?) paleontology." ("Textbook of Geology," Part II, p. 55, 1921.)

But a brief attention to the logic of this argument will reveal a very curious state of affairs, and incidentally may tell us just how "philosophic" this method of reasoning really is. For as the geologists and paleontologists, ever since the days of Hyatt and Agassiz, have always used this theory of the recapitulation of alleged ancestral characters *as their guide* in determining which fossils ought to be classed as *early* and which ones *later* in "geological time," it is hard to see how we can now appeal to

the modern development of the embryo, and *prove* our theory of a gradual development through "geological time" by showing that the modern embryo now develops according to this (artificial) geological arrangement. A very "philosophic" and scientific method this! It has been supposed that the logical trick of first assuming a major premise and then proving it by means of a conclusion, has long since been discarded by those accustomed to clear thinking. But in reality this is all there ever has been to this long popular argument in favor of organic evolution, which was adduced from this doctrine of the alleged recapitulation of ancestral characters, even granting all the examples of such phenomena which were ever presented by Haeckel and his disciples, though we now know that the majority of these examples were founded on blunders—or worse.

But we are now better able to estimate the high scientific and "philosophic" value of this recapitulation argument, which, Mr. Robinson says, "is perhaps the most striking of all."

At the close of his argument, Mr. Robinson declares that those who prefer to depend upon legends that originated in Mesopotamia several thousand years ago, still have "the whip hand" over those who deal in modern facts, and that "no publisher of textbooks for the schools would venture to permit a writer to give children the best and most authentic knowledge that we have today."

Such a statement, however, is about as far from the accurate truth as it would be possible to make. The fact is, the Evolution theory is securely intrenched in all our educational systems and also in our great publishing houses; and the really modern facts which refute and disprove these now time-honored theories have scarcely a ghost of a show for presentation before the public. It is the evolutionists who "have the whip hand;" and no author can get a hearing today who has anything serious to say in criticism of, not perhaps the doctrine of the ape origin of man, but the more general doctrine of organic Evolution. And it is because of this concerted

conspiracy of silence that these modern facts along the lines of embryology, and along the line of paleontology and geology, to be presently presented, are not allowed expression. Books like those of Wells and Van Loon that fairly drip with reactionary dogmatism based on the supposed "science" of a past generation, are sold by the carload and are advertised in the most widely circulated journals, while the real modern facts along these lines have as hard a time to gain recognition as did Mendel's revolutionary discoveries, which even today are scarcely referred to by the stand-pat reactionary scientists whom Wells and men of his style rely upon for their "facts." On every side we hear the loud dogmatic assertions of the reactionary evolutionists, the men who are living on a past scientific experience, to the effect that all competent scientists are with them, and that all modern discoveries tend to confirm their theory; while in reality modern discoveries do *not* confirm their theory; and large numbers of competent scientists who know these recently discovered facts are being brow-beaten and denied expression through the magazines and educational publications, solely because they cannot any longer continue to uphold this theory which has now become an almost universally accepted dogma.

In this last remark I am not referring to men who merely repudiate Darwinism, but to men who repudiate the whole scheme of organic evolution as a scientifically established account of the origin of things. Several decades ago we were told by a very prominent advocate of the evolution doctrine, that if the theory of organic evolution is not of universal application throughout the realm of life, the germs of decay are in it. This I believe most sincerely. But it would also follow from this that if the theory is false in one department of life, it is probably false in other departments as well. And we have now proved its falsity in so many various departments of the subject, that some of us who are on the inside have been compelled to discard the theory altogether. Personally I cannot believe that the evolution theory furnishes us with any help whatever in understanding the contem-

porary processes of nature, or in understanding the origin of the forms which we see so variously displayed around us in plant and animal life. And I have good company, small, but widely scattered over the world, and rapidly increasing.

Mendelism has given us a wonderful help in understanding how a wide diversity of plants and animals could have been derived from comparatively few originals. Thus Mendelism is of great service in helping us to see how the modern diversity of life has possibly come about. But Mendelism is not Darwinism; on the contrary, it is the absolute refutation of Darwinism.* Today it stands before the bar of modern science petitioning for a receivership to be appointed for the old theory, on the ground of its bankruptcy. Moreover, Mendelism is not Evolutionism, in any just or proper sense of the word. Mendelism deals with unit combinations in biology, just as chemistry deals with combinations of the elements; but it is only a charlatan who would claim that chemistry points out how the elements originated, and the man who claims that Mendelism tells us how the biological units originated deserves to be called by the same name.

If we say that, in the light of modern biology, we can now understand how very much of the diversity around us has probably arisen from a comparatively few originals, in conformity with what we are accustomed to term Mendel's laws, this is by no means to concede the truth of the theory of Evolution in even its broadest sense. This is what needs to be remembered in this connection: *The skeleton or outline of every scheme of evolution must*

---

*Alfred Russel Wallace was sharp enough to see the true relationship between Mendelism and Evolution. On this point he says: "But on the general relation of Mendelism to evolution, I have come to a very definite conclusion. This is, that it has no relation whatever to the evolution of species or higher groups, but is really antagonistic to such evolution! The essential basis of evolution, involving as it does the most minute and all-pervading adaptation to the whole environment, is extreme and ever present plasticity, as a condition of survival and adaptation. But the essence of Mendelian characters is their rigidity. They are transmitted without variation, and therefore, except by the rarest of accidents, can never become adapted to ever varying conditions" (Letter to Dr. Archdall Reid, December 28, 1909; *Alfred Russel Wallace, Letters and Reminiscences*, by James Marchant, p. 340).

be furnished by an evolutionary arrangement of the fossils in an unquestionable historical order; and as we shall presently show, this alleged historical order of the fossils has now been shown by modern discoveries in geology to be one of the worst blunders made by scientific investigators in the past hundred years. And it is because these modern geological discoveries are crying out so loudly against this blunder, that some of us are now compelled to protest the current assertions that all scientists still believe in evolution as having occurred somehow or in some way. No; all do not.

This simply confirms the truthfulness of the following statement of Dr. Wm. E. Ritter, of the Scripps Institution, a branch of the University of California, as given in a recent number of *Science*:

"If one scans a bit thoughtfully the landscape of human life for the last few decades, he can hardly fail to see signs that the whole battle ground of evolution will have to be fought over again; this time not so much between scientists and theologians, as among sicentists themselves." (*Science*, April 14, 1922.)

With this much in mind, let us now advance to a study of the geological aspects of this question, which, the reader will remember, was the *first* point given by Mr. Robinson in the article which was mentioned at the opening of the present study.

In the notable address of Dr. William Bateson, at Toronto, this illustrious scientist suggested the problem of how we can really be sure that mammals were not living on the land while the trilobites and graptolites were living in the sea. Or how can we be certain that the trilobites may not have been contemporary with the ammonites and dinosauras? Professor Bateson acknowledges that it is hard to prove the current theory of a real chronological order in the case of these fossils. But he takes for granted that this historical order is correct, and on the basis of his faith in this alleged historical order he thinks that the general outline of Evolution is clear enough. But it is this alleged historical order which is now under fire; and it will be worth our while

to examine into the foundation facts of geology in order to get our bearings with reference to these elementary theories, which not only underlie the whole science of geology, but also constitute the absolutely indispensable outline for any rational theory of biological development.

We may further preface our study with the statement that we accept the geological classification of the rocks into the various *systems*, such as Cambrian, Ordovician, Silurian, and Devonian, and so on to the Pleistocene. This classification is a good one, so far as it merely represents a classification of the rocks of the globe into groups each of which is characterized by some particular set of fossils. In other words, by Cambrian, Ordovician, Silurian, etc., we mean merely rocks containing certain types of fossils, no matter whether these rocks are limestones, sandstones, or shales; and accordingly these names are convenient handles when dealing with these various fossiliferous deposits. We also know that such a system of rocks as the Silurian, for example, has been made up by grouping together a great many different sets of strata from all over the globe, strata which are all so separate from one another that it is utterly impossible to show any stratagraphical relationship between them, some being from the Arctic regions, some from England, some from South Africa, some from India, and so on around the world. But it has been claimed that this arrangement of these beds into the order as given us by geology, really represents a true historical sequence; and it will be our object now to study this matter for a little while to see if this alleged historical order is reliable, or, in other words, to see if the geological outline of successive ages is built upon a solid scientific foundation, remembering all the while that this geological outline is also the outline of the theory of biological evolution, without which no theory of development or evolution would be possible.

As already remarked, we may accept this geological classification as a good and convenient one, representing the various types of life that used to live in the ancient world, this classification being merely the taxinomic or

classification series of the life of this ancient world. But we have set out to examine the logical and scientific basis on which rests the idea that this series represents a real *historical order;* and in doing this we need to ask ourselves whether the Cambrian forms of life really lived before the Devonian or the Cretaceous. In examining this subject we shall need to consider the matter under two quite distinct heads:

(a) How can we be sure that the Cambrian faunas were universal over the globe, or at least that no other faunas (and floras), such as those of the Devonian or the Cretaceous systems, could have been living contemporaneously in distant localities?

(b) Do the rocks always occur in this relative order of sequence?

In taking up the first of these two points, we see at once that it deals with the abstract idea of a past condition of affairs. And if we analyze this idea somewhat, we can see how impossible it is for us to prove that various diverse types of life could *not* have been contemporary in the long ago. For instance, how can we affirm, how can we be sure, that the Cambrian animals and sea weeds were the *only* forms of life on the globe for a long period, or at least that such animals as the Cretaceous dinosaurs and the Tertiary mammals could not possibly have been living on the lands contemporaneously with the trilobites and other Cambrian sea creatures?

To deny that these diverse types of life could have been contemporary in the long ago, is to deny the reality of zoological provinces and districts in the ancient world. But the world in which we live, which is the only world of which we have actual scientific knowledge, is characterized by distinct floras and faunas in various habitats which we term provinces and districts. And how are we to be qualified to say that this condition of things *did not prevail* in the long ago? To some people it may seem axiomatic that the lower types of life lived first for long periods of time, monopolizing the globe during their existence, and that they were followed by other and higher

types of life, these latter in turn to be succeeded by others still higher. But it is scarcely worth while to remind the reader that this is merely begging the whole question of Evolution. What is the use of any scientific investigation of the problem, if we already *know* that certain types of life came first and others afterward?

To deny that very diverse floras and faunas could have existed contemporaneously is, however, the very thing that the current geology attempts to do; but logically this involves either the one or the other horn of the following dilemma:

(1) Either we must assume a supernatural knowledge of the past, and deny the possibility of biological provinces and districts in the long ago; or

(2) We must assume the biological form of the old onion-coat theory, making each of these particular faunas and floras absolutely universal over the globe one after another in time.

These are the only two logical possibilities in this connection. There is no third choice.

But I do not think that any man who cares for his reputation would venture openly to defend either of these two ideas. It is true each of these ideas has been assumed or defended in the past, in the early days of the science of geology, and before the spirit of scientific methods had gained possession of the world. In fact, it was on just such absurd and unscientific assumption that the scheme of evolutionary geology was built up some hundred years ago. And it seems quite pertinent to remark that it is because of this early inherited taint of pseudo-scientific assumptions that our modern geology is in such a predicament as it is today. But because of the wide diffusion of education, and because of a general acquaintance with the true methods of scientific investigation, no educated man would be willing to risk his reputation by openly defending either of the two horns of the logical dilemma mentioned above.

It follows from this that there is no *a priori* method of defending the idea that the Cambrian forms of life really lived and died before the Devonian or the Cre-

taceous. But with this much settled, we may pass on to consider the second of the heads of our subject, namely, Do the rocks always occur in a definite relative order of sequence all over the globe?

On an affirmative answer to this question has been built the whole structure of "historical" geology as currently taught and understood. And this is the problem which we have now to consider.

We may first ask ourselves how we are to *begin* this alleged chronological series? That is, how shall we fix on certain rocks containing fossils, or fix on certain fossil types, which are undeniably older than all others hitherto discovered? In the early days of the science, it was confidently believed that only certain types of life occurred in the rocks next to the granite, or next to the old crystallines. But this is merely the old form of the onion-coat theory; and as we have discarded this theory because of its being unsupported by objective facts, in that we do not find any such sets of strata extending all around the world, we must consider this matter in some other light. But if we decide that certain "Pre-Cambrian" beds in the Rockies or elsewhere are the oldest fossiliferous rocks hitherto discovered, how are we to explain our reasons for calling these the oldest?

It is one of the elementary facts of geology that each stratified formation is of only limited horizontal extent. That is, instead of encircling the globe, like a universal onion-coat, each formation occurs only as mere scattered patches here and there. For instance, the Triassic and the Jurassic rocks are absent over most of North America; while over the larger part of Asia there are no Cretaceous strata. The Tertiary beds also are absent from most of Asia. In very many localities these Triassic, Jurassic, Cretaceous or Tertiary rest directly on the Archaean or old crystalline rocks. Over the larger part of northeastern America the Pleistocene, or "drift," reposes directly on the Archaean. Large areas of South America, and practically all of the great interior of Africa, have no fossiliferous rocks at all,—nothing but the Archaean or Primitive. How, then, shall we fix on

certain typical fossils which are really older than all others? In other words, since we do not have fossiliferous onion-coats to work with, but merely isolated patches of strata which rest here and there on the granite or Primitive rocks, how are we to find the real *bottom* of the fossiliferous series? And when we do find these bottom beds, how are we to know that they are the first of the fossiliferous series, and that when they were laid down in any certain locality, no other different types of life were being buried on the other side of the globe?

Here we find ourselves right back where we started. But it is evident that from this method of examining the subject we are making only negative progress. Perhaps we should rather descend from the clouds of these *a priori* speculations, and formulate a few facts about the fossils which we can actually demonstrate. Our space will not permit us to give extensive examples of all that we affirm; but the reader will find this subject treated at considerable length in the author's "Fundamentals of Geology."*

I. The first fact which we need to notice in this connection is that any kind of fossiliferous rock, Tertiary, Cretaceous, Jurassic, Triassic, etc., may rest (nonconformably) upon the Archaean *directly*, without any so-called younger strata being in between; and these strata thus resting on the Archaean, though called very "young," may themselves be crystalline or wholly metamorphic in texture.

This fact means that Tertiary or Cretaceous strata are about as likely to be found at the bottom or next to the Primitive as are Cambrian, Ordovician, or Silurian; and that these so-called "young" rocks may by every physical appearance, as well as by their position, resemble the so-called "oldest" fossiliferous rocks. The Eocene limestones and schista of the Alps and the Himalayas, and the Miocene of California, are examples to the point. Geologists are accustomed to speak of these instances as examples of "overlap," and they assume that if these upper strata were followed out far enough laterally, other

*"The Fundamentals of Geology," Mountain View, California; 1913.

so-called younger strata would be found intervening between them and the Archaean. But this is only theory; for in many instances no such intervening strata can be proved to exist, the upper strata giving out before they can be traced sufficiently far in any direction to prove a superposition on any other fossiliferous rocks. From this it follows like a mathematical demonstration that when Cambrian, Ordovician, or Silurian strata are found resting on the old crystalline or Archaean rocks, they cannot be proved to be intrinsically and necessarily older than those Tertiary, Cretaceous, Jurassic, or Triassic strata which are found in an exactly similar situation elsewhere. Hence it is hard to see how we have any sure scientific facts with which to *start* our geological series. And it also follows from this that these facts do not help us to prove that anyone of these systems of fossiliferous rocks is really older than any other system.

II. But the converse of this fact which we have been considering is also worthy of attention, and may be stated as follows:—Any kind of fossiliferous strata may not only constitute the surface rocks over wide areas, but may consist of loose non-consolidated materials, thus in position and texture resembling the "late" Tertiaries or the Pleistocene.

As examples of this fact, we have the soft muds and clays and unconsolidated sands of the Cambrian strata around the Baltic region of Russia and in Wisconsin. Similarly the Ordovician rocks over a large part of Russia also consist of very recent looking sediments, for "the sands and clays are as soft and incoherent as the similar rocks of Tertiary age are in the south of England." (J. A. Howe, "Encycl. Brit.," Vol. XX, page 236.) The soft Cretaceous beds of the southeastern Atlantic seaboard might be referred to in this connection; but many other examples might be given from eastern Asia and from other parts of the world.

Having now considered the relationship between the fossiliferous strata and the Archaean, we must next turn our attention to the relations between the fossiliferous beds themselves, and see if there are any clear distinc-

tions as to relative age in the manner in which they are now found lying upon one another.

Two principles serve to guide us in this investigation, that of *superposition* and that of *conformity*. By the first of these terms we merely mean that in any undisturbed vertical section the lower one of any two beds must have been deposited before the one above it. This is so much a matter of common sense and elementary facts that it needs no further elaboration. But when the upper one of two distinct layers is parallel with the lower one and there is no physical evidence of a disturbance of the lower beds or of any erosion of its surface before the upper one was laid upon it, the upper layer is said to be *conformable* with the lower, or there is *conformity* between the two beds. In case the lower of the two has been tilted up at an angle before the upper one was deposited upon it, or even if the lower bed shows distinct signs of erosion upon its surface, there is said to be a non-conformity between them. In the latter case it is usually assumed by geologists that a long lapse of time must have intervened between the deposition of the two layers, and that after the lower one was formed it was lifted above the sea and exposed to weathering and atmospheric erosion, and then by submergence or by a transgression of the sea it was again covered with the waters and a new layer was deposited above it. But it is mere assumption to say that the interval of time in even this case was a long one. If there were earthquake disturbances affecting the sea bottom, thus tilting the strata and producing submarine erosion, there might have been no great lapse of time between the laying down of even these two non-conformable strata. But on the other hand it seems quite evident that a strict conformity in sequence between two sets of strata indicates *substantial continuity of deposition*, with merely enough interval of time to mark a slight break, this break having been caused possibly by a mere change in the marine currents. In other words, two successive conformable strata *may* merely indicate the interval between two tides, an ebb and a flow; and certainly no great interval of time could possibly have

elapsed between the laying down of the first set of beds and that of the second.

The examples which I am here referring to are termed "disconformities" by many geologists, that is, where a "young" set of beds is found occurring in apparent conformity on a very much "older" formation. Professor W. B. Scott, of Princeton, calls such an example a "deceptive conformity," with very obvious expressiveness. For when a formation classed as "young" occurs in obvious conformity upon one called much "older," the beds supposed to be properly intervening being absent and not even represented by erosion or by any disturbance of the lower beds, it is surely a case to "deceive" all except those who are well fortified with a preconceived theory as to the true "historical" order. But it may be permissible in us to question the good taste of the advocates of this "deceptive conformity," in implying that they know more about the true historical order than nature herself does, or in implying that nature has here "framed-up" a trap to deceive us, or to test our ingenuity in inventing an explanation.

Let us take a few examples.

One was reported a great many years ago by Murchison from northern Russia, at Ust-Waga, on the Dwina, where Pleistocene or "late" Tertiary beds are found occurring in "absolutely conformable superposition on the horizontal Permian sediments" (Suess, "Face of the Earth," Vol. II, p. 543). This is perhaps an extreme case; but there are literally hundreds of examples where one or two *systems*, or parts of one or two, are absent. However, in even such a case, the time interval, as estimated by the evolutionary geologists, could be reckoned only in hundreds of thousands or even millions of years.

There is a large area, near Lake Athabasca, Canada, where a Devonian limestone is conformably covered by Cretaceous beds. The "remarkable persistence" of this "deceptive" conformity, according to an officer of the Canadian Geological Survey, extends in one direction for fully 150 miles; and yet, over this wide area, according to this very competent authority, "the vast interval

of time which separated the two formations is, so far as observed, unrepresented either by deposition or erosion" (*Annual Report*, New Series; Vol. 5, Part D, p. 52). Indeed, this same succession of strata, Cretaceous upon Devonian, extends nearly to Lake Manitoba, some 500 miles away, though it would be quite unreasonable to expect even the most honest conformity to extend to any such distance.

But very evidently, if we can only rid ourselves of the traditional order in which the fossils *ought* to be found, we could say with confidence that over this wide area the Cretaceous beds were laid down quite quickly after these Devonian ones; and hence it is clear that the long millions of years supposed to have intervened between these two Systems, listed as the Carboniferous, Permian, Triassic and Jurassic "ages," cannot have had any real existence.

Another good example occurs near Banff, Alberta, where Lower Cretaceous overlies Lower Carboniferous, "without any perceptible break; and the separation of the one from the other is rendered more difficult by the fact that the upper beds of the Carboniferous are lithologically almost precisely like those of the Cretaceous" (above them). And the illustrious Director of the Geological Survey of Canada, A. R. C. Selwyn, from whom I have been quoting, adds the further very enlightening statement, that, "were it not for fossil evidence, one would naturally suppose that a single formation was being dealt with" (*Ib. Id.*, Vol. 2, Part A, p. g.). These words are surely full of meaning, especially when we remember that they do not come from some youthful novice, but from one of the most distinguished geologists of modern times.

In the Bear Grass quarries at Louisville, Ky., a Middle Devonian coral limestone lies directly upon another similar coral limestone classed as Middle Silurian; and yet "the absolute conformability of the beds can be traced for nearly a mile," and "the parting between these two zones is like that between any two limestone beds; but this insignificant line represents a stratigraphical hiatus

equivalent to the last third of Silurian and the first third of Devonian time" (Chas. Schuchert, *Textbook*, pp. 587, 588).

Throughout four provinces in northeastern China, Upper Carboniferous beds, chiefly shales, repose directly and in evident conformity upon Lower Ordovician limestones, with all of the Silurian, the Devonian, and the Lower Carboniferous wanting entirely, absolutely nonexistent. And yet, according to the closest scrutiny, as Bailey Willis tells us, "the Ordovician and the Carboniferous strata are strictly conformable" over all this region where observations could be made. Indeed, Richthofen, who first examined these rocks, described them as belonging to one and the same formation, a Carboniferous limestone.

But it would be tiresome to go on giving examples. As for their numbers and frequency, one of the most experienced geologists in America recently told the writer that he himself had seen and examined probably a thousand instances of this character, some of them covering areas as large as a State or two. But all this only confirms what Sir Arch. Geikie has told us regarding these examples of "deceptive conformity," for he says that they are "not merely local, but persistent over wide areas. . . . They occur abundantly among the European Paleozoic and Secondary rocks," and are "traceable over wide regions" (*Textbook*, p. 842). And we can well agree with this illustrious author when he admits that "it is not so easy to give a satisfactory account" of these things.

The late Professor Eduard Suess, of Vienna, in speaking of the "numerous examples" of this sort, says that they "may well be cause for astonishment." However, it seems to me that our astonishment should be evoked at the amazing power of a preconceived theory to blind the eyes and hypnotize the reasoning powers of the shrewdest observers, when confronted with a series of facts for which their theory has made no provision. I know that of late years, with the rapid multiplication of examples of this nature, some ingenious wits think they have worked out a partial explanation of these facts

by a delicate combination of diastrophism and base levelling, each of precisely the right amount and extending over half a continent or so. But the plain, common-sense view of the matter, which would make all such elaborate theories unnecessary, would be that these conformities *are exactly like all other conformities,* an ocular proof that these strata followed one another in quick succession, *with no great time interval between.* On this simple basis, the alleged time-distinctions between these apparently closely related strata are all a mistake, and no such distinctions in age should be imagined at all. This would solve the whole difficulty. We can then take these conformities at their face value, just as we do all the others. We do not need to insinuate that nature has here been trying to trick or deceive us. A wrong theory has made a mountainous difficulty, when in reality there is no difficulty whatever.

We must now turn to another class of facts. These are examples of "deceptive conformity" also, *but upside down!* And if Professor Suess found "cause for astonishment" in the ordinary cases of "deceptive conformity," what would be his feelings in the presence of a great tract of country like that in Alberta and Montana, at least 10,000 square miles in extent and perhaps twice this size, but with old Paleozoic and Algonkian rocks on top, *resting in apparent conformity on Cretaceous beds!* That is, the "older" rocks are on top, and the "younger" are below, but with every physical appearance of having been *laid down in this order.* In other words, the rocks are wrong, or the theory is wrong; but the contact line, as observed in so many widely scattered localities, is so perfectly natural, so highly "deceptive," that no one would possibly think of there being anything wrong, if it were not for the fossils found in the various formations.

What is to be done in cases of this sort? Will our theorists still have the courage of their convictions? Will they be brave enough to hold to their theory, inherited from the days when only a little corner of western Europe had been examined geologically, and here give the direct lie to the rocks, on the strength of this previous convic-

tion? The history of human thought gives few examples of perverse ingenuity comparable to the methods adopted by evolutionary geologists to explain away the force of these perfectly obvious and unequivocal facts.

There are plenty of examples of these phenomena. They are listed among the curiosities of the science of geology, being termed "thrust faults," or simply "thrusts"; and the theoretical explanation of why we happen to find these rocks in the wrong order, has been termed "one of the triumphs of modern geological research" (Pirsson). Perhaps it is a triumph of research; but it may be that the reader will conclude, after a study of the facts, that these "thrusts" should rather be listed with the notorious "epicycles" of Ptolemy and other examples of the power of a theory to hypnotize the logic and the common sense of men otherwise logical and scientific.

The example already alluded to runs from the Sun River, near the middle of Montana, up to the Yellowhead Pass in Alberta, Canada. This district is over 500 miles long from north to south, and of quite indefinable width, though at the international boundary line it is some 30 to 40 miles wide at least, running back to and including the valley of the North Fork of the Flathead River, at the west of the Glacier National Park. All of the Park is thus included within this area. North of the international boundary, it includes some four or five parallel ranges of mountains running north and south, with the intervening valleys, the valleys being composed of a floor of Cretaceous beds running up to and underneath all the mountains, the latter being Paleozoic.

Thus this area includes some of the most picturesque and famous scenery in America, such as that around Banff and Lake Louise, with such famous outliers as Chief Mountain, Crowsnest Mountain, and Mount Assiniboin, which is termed the "Matterhorn of the Rockies." It also includes the great continental divide, or what may be termed the very roof of North America; for from a point within the Glacier National Park the streams flow in three directions, to Hudson Bay, to the Gulf of Mexico, and to the Pacific.

Over all this wide area, the mountains present a very striking uniformity of appearance, and doubtless under a more rational system of nomenclature would be classed together into some common grouping. They consist quite uniformly of quartzites, argillites, and jointed limestones; though to the south of the boundary line they are classed as Algonkian (Pre-Cambrian), while in Alberta they are classified as Cambrian or Devonian or Permo-Carboniferous, according to the locality. *But the valleys are all Cretaceous*, at least wherever the rivers have dug out their channels deep enough; for the Cretaceous strata always appear approximately horizontal wherever exposed, and evidently underlie the whole area just as naturally as the soil lies under a building. Of course, it would be quite unreasonable to expect an absolutely *conformable* contact between the upper and the lower beds throughout all this wide area; but yet just such apparently conformable contact-lines or bedding-planes are visible here and there over this whole district, appearing all along the front range of the Rockies, under Chief Mountain, Crowsnest Mountain, Gould's Dome, and far to the north, in fact, appearing everywhere that a good exposure can be found, and being especially conspicuous and unequivocal in the case of those outliers, like Chief and Crowsnest mountains, which stand out alone by themselves.

Occasionally minor disturbances are to be found here and there, as might be expected over an area of these dimensions. However, the undisturbed character of most of these mountains is quite remarkable. A gentle dip here and there is about all that one sees in the strata running from peak to peak along the sky-line, the whole area looking like quite undisturbed strata worn away into mountains of erosion. Were it not for the fact that the strata are here in an order of sequence contrary to the popular theory, no one would ever dream of anything else than that the Cretaceous beds were laid down first, and that the Paleozoic and Algonkian strata were laid down quite quickly afterwards.

R. G. McConnell, of the Canadian Survey, speaking of

the naturalness of the stratigraphical section near Kananaskis Station, on the Canadian Pacific Railway, says that the line between the upper and the lower strata "acts exactly like the line of contact of two nearly horizontal formations," while in another exposure in the banks of the Ghost River a few miles away, he says that the two sets of beds "appear to succeed one another conformably" (*Report* for 1886, Part D, pp. 33, 34).

Other examples of strata in a similarly reverse order are now being found almost everywhere. Strange, we never before doubted that "Strata" Smith, and Cuvier, and Lyell had been gifted with some supernatural knowledge of just how the rocks would be found occurring on the other side of the globe in regions which they had never seen.

We cannot even list all the examples which are now being discovered. One is in the State of New York, and runs across Vermont into Quebec. Another in the southern Appalachians involves parts of Georgia, Alabama, and Tennessee, with Cambrian and Silurian lying in apparent conformity upon Carboniferous, the area involved being about 375 miles long. The so-called "Bannock overthrust" covers an area some 270 miles long, over parts of Utah and Idaho to the northeast of Great Salt Lake. The Hart Mountain "overthrust" lies further north, in the northern part of Wyoming.

In the Highlands of Scotland are other examples, now grown famous in the history of geology, because Sir Archibald Geikie, one of the first to examine these localities, described these strata as normal and naturally conformable. After fossils had been found which forbade this "normal" sequence, Geikie, then Director of the Geological Survey of Great Britain, excused the former descriptions of himself and others by saying:

"Had these sections been planned for the purpose of deception, they could not have been more skillfully devised . . . and no one coming first to this ground would suspect that what appears to be a normal stratigraphical sequence is not really so" (*Nature*, November 13, 1884, pp. 29-35).

It is now several decades since the first examples were discovered in the Alps of strata in the "wrong" order. Since then large numbers of learned treatises in German, in French, and in English have been written to explain in detail the mechanics of these great "displacements." Wonderful diagrams have been drawn, with great arcs of circles miles high to show where the rocks are supposed to have once been, these diagrams being worthy of a place alongside of the very similar ones by the Ptolemaic astronomers which pictured cycles and epicycles invented to reconcile the known facts with a theory believed to be infallible. Pressure boxes were constructed to see how various kinds of materials would behave under lateral pressure. Based on the results of these experiments and on the possibilities of drawing diagrams, the theories invented to explain these findings in the Alps and elsewhere have gone through many vicissitudes, and have been repeatedly revised. At the present time, the theory generally accepted is that the rocks now composing the Lepontine Alps (to give a specific example) were once lifted up several thousand feet and pushed northward bodily some 60 miles into the Helvetiac region, where erosion has since carved them up into the mountains as we now find them. The Matterhorn and several other of the most famous peaks of the Alps are parts of the great masses thus hypothetically pushed across the country. In the region of Alberta and Montana, it is supposed that the part to the west was lifted up some two or three miles, or high enough to bring the Algonkian on a level with the Cretaceous; then the whole thing was pushed over on top of the Cretaceous, after which the upper part was conveniently removed by erosion, leaving only the bottom of the "thrust block" (the Algonkian and Paleozoic beds) which is now found lying in such apparent conformity upon the soft Cretaceous shales, though the latter show absolutely no physical evidence of the sliding of this incredible mass over on top of them.

Of course, back of all these inventions of "overthrust folds" and flat-lying "thrust faults," back of the pressure boxes and the diagrams, is the primary conviction that

there has been a gradual development of life on the globe, and that the various fossils have been pigeonholed in the strata to give us the details of just how this development (or evolution) came about, that is, the historical order of the events connected with this progression or evolution. In other words, it is deemed axiomatic that there has been a succession of different types of life on the globe, and the strata are examined here and there in order to work out the exact details. And, of course, also, the present must be taken as the measure of the past, and the measure of all the past; and thus all the geological changes of the past must be interpreted in terms of the processes alleged to be going on in our world at the present day.

It is hardly necessary to point out that all this begs the whole essential question at issue between the evolution doctrine and the Christian doctrine of a real Creation and the subsequent ruin or partial destruction of that primitive world by a great aqueous catastrophe. But I do not wish to bring any theological matters into this discussion. I think we shall be quite able to work out a rational view of this whole matter in a strictly scientific way and with nothing but the recognized tools of science. —demonstrated facts and correct methods of reasoning.

But it is hard to recognize modern scientific methods in any of this geological talk about "thrust faults" and "overthrust folds," when confronted with great areas with the rocks in the "wrong" order. It seems to me that this method of reasoning belongs to the Middle Ages, not to the twentieth century. We all know that each particular set of stratified beds is extremely local or limited in its extent; and on this account we profess to have discarded the onion-coat theory even in its fossiliferous aspects. And everyone acquainted with the history of geology knows how the strata from many scattered localities have always been required to make any of the Systems complete, such as the Cambrian, Devonian, or Cretaceous,—or to make complete even any large subdivision of one of these Systems; and accordingly he must know the purely artificial make-up of these Systems, just as every compiler of a library catalogue knows the

artificial or purely constructive character of his card index. In reality, the geological series is a very convenient classification or card-index system of the rocks according to their fossil contents; but we all know that when a new set of beds is discovered near the South Pole, or in Siberia, or Madagascar, or Panama, it is simplicity itself to find a place for it in this card-index system; and this place for these new beds would be determined wholly by the fossils it contained, and irrespective of its color, its lithologic texture, or even its stratigraphic relationship with the beds above or below it in the field. If, long after it has been thus filed away, someone comes forward to show that it has been wrongly catalogued, it is also very easy to shift such a set of beds up or down, as may be required; and such readjustments are constantly going on. But it would surely be amusing if any librarian should take his card index so seriously as to assert that all the books listed under *A*, *B*, and *C* were actually printed long before those under *X*, *Y*, and *Z*. We should probably think that he ought to have a guardian appointed to look after him.

But why may we not be permitted to believe that over this area of Alberta and Montana the Cretaceous faunas and floras were buried first and the Paleozoic afterwards? What would happen to us or to our intellectual posterity as the penalty for such rashness, such scientific temerity? But is it safe to follow metaphysical methods of reasoning in natural science, at the sacrifice of logic and common sense, merely because if we do not thus distort the evidence to suit our theory we cannot avoid the conviction that our world must have passed through some awful aqueous convulsion in the long ago? And is this idea of a great world catastrophe, as the probable cause of a large part (an indefinitely large part) of the geological strata, so utterly unscientific, so taboo a suggestion, that it must never be mentioned in polite scientific circles?

My training in natural science will never permit me to deny plain physical facts, on the excuse that if we take these facts at their face value we may reach conclusions quite at variance with the uniformitarian prejudices which have been taught to us for over half a century in

the name of Hutton and Lyell, of Darwin and Huxley and Haeckel. Perhaps more things may have happened to our earth in the long ago than any of these men had dreamt of in their philosophy. At any rate, I am sure that we now have abundant evidence to prove that the theory of organic evolution does not have an absolutely sure outline of a proved historical order among the fossils, though such an unquestioned and accurate outline of successive forms of life must, in the very nature of things, be the prerequisite, indispensible and imperative, for any scheme that attempts to tell us the order and the method of the origin of our plants and animals.

On the other hand, if someone now says that perhaps all the great leading types of life were created at about one time, and that the world was afterwards wrecked by some sort of aqueous convulsion, I am sure I do not know how to reply to him, except to say that according to modern uniformitarianism such a world catastrophe would be impossible. Or if such a person were to say that he believed that the dinosaurs may have been living on the land in certain regions contemporary with the Tertiary and Pleistocene mammals, and all of these creatures contemporary with the trilobites, the graptolites, and the ammonites, I do not know of any solid scientific facts with which to refute his belief. And if such an one grows hotly indignant at the whole evolution doctrine, saying that it is only a gigantic anti-Christian prejudice, and that for his part he prefers to believe the record in his Bible and to take this record at its face value, again I have to shut my lips in silence, or it may be frankly to acknowledge that there are no certainly proved objective facts which modern science can adduce to convict him of his error.

The above is an outline of the negative aspects of the New Catastrophism. For a presentation of the positive side of the case—for there is a positive or constructive side also—I must beg the reader to postpone judgment until my second article to appear in another issue of BIBLIOTHECA SACRA.