1. Are Geologic Strata the Result of the Biblical Flood?

Many people who revere the Bible, both in the church and outside, assume that most of the earth's sedimentary strata were formed by the Flood at the time of Noah. Is this really the origin of the earth's strata?

Or are earth's strata the result of two floods: one at the time of Satan's rebellion and another at the time of Noah? Is it possible that the earth's sedimentary strata are not the result of catastrophic, worldwide floods at all?

Christians have proposed various explanations. We now have adequate information to indicate which of these explanations were right and which were wrong. We will examine the strata and find what is revealed about their origin.

Importance of this subject

Why should this question be important to us? Why should we care how strata were deposited?

This issue is central to an accurate understanding of both the age and history of the earth. It is a major key to understanding the history of life on the earth and how God went about creating it.

In addition, evolution, the leading philosophy of the modern world, influences how hundreds of millions view the purpose and value of human life. Understanding the claims of evolution requires understanding how the earth's strata were deposited.

This is not a mere exercise in academic trivia. It is a key question for anyone who must deal with the realities of the history of the earth and the life forms that have lived on it.

In the 17th and 18th centuries, before the rise of evolution, many religious people rejected the then new understanding of the true structure and size of the physical universe because it contradicted their traditional understanding of the Bible and some of their other religious biases. They were unwilling to look at the facts and adjust their understanding of the Bible in the light of those facts.

Traditional creationists today are now facing a similar situation. However, today the issue is the history of the earth and of life on it, not the nature and structure of the universe.

A major aspect of this issue concerns how the strata of the earth were deposited. In this article we will look at some of the physical evidence found in the strata to determine their mode of deposition.

If they were deposited rapidly, under a worldwide mantle of water, they will have certain characteristics because of that environment.

If, on the other hand, they were generally deposited in noncatastrophic, ongoing environments, they will show characteristics of those environments. This latter situation is what we find for most strata in the geologic record.

We will examine seven lines of evidence that clearly show that many strata were not deposited rapidly (such as under presumed flood conditions). These seven factors were selected because they present simple and straightforward evidence that will be clearly understandable to the nonspecialist. There are many other evidences that could be used.

These seven are by no means exclusive. They seem, however, to be the best for our purpose and audience.

Limestone structures built by living algae

First we will consider one of the most obvious indicators that strata were deposited over a long time period during which life continued its normal operations. Some species of algae precipitate layers of lime (calcium carbonate) on the surface they are attached to. As these small particles of lime build up, they form structures that take on a variety of shapes, but all show a characteristic pattern of concentric layers or ``laminae.''

Structures similar to these are found in many strata throughout the geologic record, from very young strata to some of the oldest in which abundant remnants of life are found. Though these strata were deposited in water, the evidence is clear that they were not deposited rapidly, under flood conditions.

Coral reefs are often made up of a large quantity of limestone deposited by algae as well as that deposited by coral polyps. Most limestones deposited directly by algae have the characteristic undulating pattern of bands, or laminae, that allows their origin to be readily identified.

When these telltale structures are found interbedded with marine or lake strata, it is clear that the strata were deposited under normal life conditions. Algae were living and precipitating lime while surrounding sediments were being slowly deposited.

In some strata, limestone deposited in this manner reaches a thickness of 60 feet or more. This would take hundreds, if not thousands, of years at the rates of buildup normally experienced in modern situations. Clearly such deposits were not formed under flood conditions in a year or two. They are not rolled or turned upside down, nor do they show evidence of being deposited by swiftly moving currents. They are in growth position and location.

Standing, fossilized tree trunks

Though far less common than algal limestone, standing tree trunks are a clear indicator of at least tens of years having passed during the deposition of the sediments in certain strata.

In the middle of some strata, and even at different levels within some of them, are found standing fossil tree trunks. The roots of these fossil trunks are firmly attached to the underlying sediments that had been deposited prior to the growth of the trees and into which the roots grew. Enough time passed for large trees to grow before they were covered by overlying sediments.

Some have been found over 15 feet in diameter. Many are found one or two feet in diameter. Floods may indeed have deposited the sediments that covered the tree trunks to fossilize them. But since the roots are growing into strata below, it shows that the strata below were not deposited by the same flood. The strata that buried the trees are usually less than 20 feet of strata in a sequence of strata that may be hundreds or even thousands of feet thick. Some strata contain multiple layers of standing trees.

Salt deposits

Common table salt, sodium chloride, is often found bedded in sedimentary strata. Under flood conditions, dissolved salt would be carried away and dispersed in the waters, not deposited with other sediments.

The quantities of deposited salt that are often found would require large amounts of seawater to have been evaporated to concentrate such thick deposits. These deposits are not on top of all other strata, as you would expect if they were the result of ``leftover'' floodwater evaporating. They are in the middle of strata sequences with strata deposited above and below them.

Salt is not the only soluble mineral found in strata resulting from evaporation. There are many others: potash, trona, borax, epsom salts. One other mineral in this category that we should consider is gypsum (calcium sulphate). Many of us would be familiar with this mineral because of its use in making wallboard for home construction. It is even more commonly found in sedimentary strata than salt.

Tremendous deposits of gypsum are common in the sedimentary strata of the American West. Gypsum, like salt, can be concentrated and precipitated by the evaporation of sea water. Under flood conditions it, too, would be carried away in solution and widely dispersed, not concentrated and deposited in layers in sedimentary strata.

Fossil oyster beds

A fourth example of strata being deposited over time and with natural living conditions going on at the same time is fossil oyster beds. These are found in numerous localities in the western United States in strata that have been deposited in shallow marine environments. The beds are often 10 feet or more thick. Sometimes the beds are composed of nearly 100 percent oyster shell. They typically contain only one dominant species of oyster.

It seems clear that the shells are buried where they lived. They are not indiscriminately mixed with other species of oysters or other shells. Nor are they worn by being transported from distant locations. One would expect such mixing and wear if they were tumbled and buried by floodwaters.

Some oyster beds are so thick and contain such pure deposits of oyster shells that they have been used in place of gravel to surface roads. In different beds, different species of oysters dominate. This situation would be caused only by natural living conditions. It would be impossible for it to occur as a result of any selective sorting action of floodwaters.

Fossil animal tracks

Throughout the stratigraphic record are found many strata that contain tracks of land animals. If the earth were covered with water it would be impossible for land animals to be walking around and making tracks.

Fossil mud cracks

In a similar way, fossil shrinkage cracks are found throughout the geologic record in strata that have been deposited on land (as opposed to those deposited in lakes or in the sea). They are very common features of the geologic record.

They are formed when mud dries out and produces characteristic cracks that are then rather quickly buried by another layer of sediment.

This only occurs on a land surface that is subjected to periodic times of drying. They are certainly not formed underwater. Some strata contain layer upon layer of fossil mud cracks. They often occur over and over in many vertical sequences of strata. Frequently they occur with animal footprints preserved in a manner similar to the mud cracks.

Fossil deserts

Some strata were not laid down by water at all, but are deposits of wind-blown sand. In southern Utah, 2,000-foot-thick strata were deposited in this manner.

There are characteristics common to wind-blown deposits. Fine-grained particles have been winnowed out of the larger sand grains. The grains are of more uniform size and more rounded shape than are sand grains deposited under lake or marine conditions. The bedding structure is considerably different as well as the type of fossils found in the strata.

The contact between the sand and the underlying strata is often sharp and clear-cut. This is especially true where layers of mud are found underneath wind-blown sandstones. If the sand had been deposited by water, you would expect the mud and sand to be mixed together. It is not. Clearly the sand was blown onto the mud, deposited by wind rather than water.

The fossils found in such desert strata are generally limited to animal tracks. These strata are definitely not deposited under flood conditions.

Other factors

The factors we have considered clearly indicate that much of the earth's strata was deposited over an extended period of time, under nonflood conditions. One could cite additional factors like fossil soil layers showing that weathering and soil-forming processes had occurred at multiple levels in some strata.

One could also cite weathering and erosion surfaces between strata showing that there was a time break between the deposition of the two strata. The buildup of fossil coral reefs in marine strata is another. There is much additional evidence, but the evidence already given should be sufficient to prove the point.

Conclusion

It is clearly a mistake to consider the strata of the earth's geologic record to be the result of one, two or a number of cataclysmic, destructive floods. The physical evidence overwhelmingly shows that this is not the case. It shows deposition going on over extended periods of time and in many different environments. The earth has been around for a long, long time, in water and out.

This does not imply that the Flood mentioned in the Bible didn't happen. It means that the effects attributed to the Flood by some are in error.

The Bible nowhere states, or even implies, that the earth's strata are the result of floods. Concluding that they are is an error due to improperly understanding the physical evidence. If we fail to recognize this error, we will draw a grossly distorted picture of the earth's history. And we will fail to appreciate the rich understanding that can be obtained by correctly deciphering the geologic record. We may even lay a stumbling block before some if we insist that the Bible teaches something that is in direct contradiction to the physical evidence.

Does the existence of extensive time periods before Adam give more credence to the concept that mindless evolution is responsible for the creation of life forms? Absolutely not! But it forces us to expand our concepts and understanding of how and when earlier life forms were created. We must learn to understand the few biblical references to geological phenomena in the light of the true geologic record, not force a pseudo-biblical meaning that is contrary to that record.

2. An Overview of the Geologic Record

"You can prove anything from the Bible" may seem to be true to someone who is vaguely acquainted with the Bible. Such a person may have heard quotes taken out of context that seem to give contradictory facts and advice. When a person understands the clear meaning and purpose of the Bible, however, such a statement becomes ridiculous.

Similar statements may be made about the geologic record. A person vaguely familiar with it may feel it presents information that may be interpreted however one chooses. This is not the case. There may be things difficult to understand in the geologic record, just as there are in the Bible. However, as with the Bible, when one has a sound basic understanding, the overall meaning is simple, clear and consistent. It is not subject to multiple or contrasting meanings.

Does a complete geologic record occur anywhere?

A previous article showed that the internal evidence of many strata discussed the evidence that showed they were neither deposited rapidly nor under worldwide flood conditions. In this article our primary goal is to give a tangible overview of what the geologic record is like.

Creationists who believe the earth is very young often raise the issue that a complete geologic record doesn't exist anywhere on earth. They imply that the existence of long periods of geologic time is a fabrication made by piecing together concurrent geologic events from many different geographic areas. This conclusion can be misleading to people not familiar with the geologic record.

Technically, a complete geologic record doesn't occur anywhere. For such a record to develop would require the area to have been receiving sedimentary deposits continually ever since the origin of the earth. Nowhere is such a situation known to exist. If it did exist, we could not effectively look at the strata because they would still be buried, and modern strata would continue to be deposited on top of them.

The earth's surface has been far too dynamic to allow that to occur anywhere. No area has been in such a static condition throughout the earth's long history. Areas that have had sediment deposited on them at one time are later uplifted and eroded. In some places this has occurred many times. There is ample evidence to prove such a sequence of events.

We have to take the geologic record as it is, not as we wish it might be. As with the Bible, we may wish certain things were plainer and more specific, but we have to work with what exists, not what we wish were available. In spite of any drawbacks, however, a good understanding of the history of the earth and fossil life forms can be obtained from the geologic record.

The purpose of this article is to give a simple and clear overview of the geologic record. The best way to do this is to examine a unique area in the western United States where an extensive record of the earth's geologic history can be observed. It's not 100 percent complete, but it is probably without equal in the rest of the world for our purpose.

All four major geologic time divisions (Precambrian, Paleozoic, Mesozoic and Cenozoic) are represented here in clear superposition order. Each division is represented by great thicknesses of strata. The area is like a giant layer cake. The relative age of each of the stratified layers — their age in relation to one another

— is absolutely certain. Most of the layers contain fossils that allow us to identify the type of animal life living when the layer was deposited.

The Colorado Plateau

The area we will examine is known to geographers and geologists as the Colorado Plateau. [Map available at http://www.epa.gov/docs/ecoplaces/part1/site4.html] The area has been fairly stable for long periods of time. It has been near or below sea level for long periods. Because it was low, it was able to receive sediments from higher areas around it. This allowed an extensive geologic record to be deposited and preserved. More recently (geologically speaking) the area has been lifted. Because of its current high elevation, it is eroding rapidly. The erosion strips away overlying material and allows us to see what lies below.

The magnitude of the record found in this area is phenomenal. It contains miles of strata that were deposited before there were abundant living organisms on earth. More miles of strata record the time when primitive living organisms were first abundant. Later times of the dinosaurs are represented by more than two miles of strata. The times of the mammals, after the demise of the dinosaurs, are also represented by more than two miles of strata.

A cross section of the Colorado Plateau strata

If we were to cut the strata of the Colorado Plateau as if we were cutting a giant layer cake, we would obtain a cross section. [There is a graphic available at http://www.kaibab.org/gc/geology/gc_stair.htm] Some of the strata are so extensive that they can be traced over the whole area and even into regions beyond the Colorado Plateau. Others cover only portions of the area. Those that cover the whole area give a solid time marker for comparisons when the other strata were deposited. By using these, we can tell the sequence of the strata shown in the diagram.

The strata are systematically laid out and show clearly the sequence of deposition. The important thing is to fix in mind the simplicity of determining the sequence of events. Lower strata are always older, having been deposited before the overlying ones. Exactly how old they are and how much time passed between their periods of deposition must be determined by other means.

Some strata at the bottom of the Grand Canyon are tilted. These strata (nearly two miles thick) were not deposited in their current inclined position. Strata are normally deposited horizontally. In this example, significant earth movements

took place after deposition to uplift and tilt the strata. After that, tremendous amounts of material were eroded away before the next layers were deposited.

The strata lying on the flank of the Uinta Mountains reveal when the Uinta Mountains were raised. It is possible to tell which strata were deposited before the uplift of the mountains and which strata were deposited after their primary period of uplift.

We know the mountains were uplifted after, or near the end of, the time the dinosaurs lived. How do we know? The strata containing dinosaur remains are strongly bent by the upward movement of the mountains, while overlying strata are deformed very little.

An additional fact supporting this conclusion is that some of the overlying strata were formed by material eroded from the older strata and from material that forms the heart of the mountains themselves. This would not have been exposed until erosion had removed a considerable amount of strata from the top of the uplifted mountains.

The geologic time periods of the strata

The key concept to understand is that the geologic time periods are not arbitrary ideas. If they were incorrect concepts, a scientist could easily make a name for himself by studying this area and revealing any problems and inconsistencies. But such gross inconsistencies don't exist.

The fossils found here fit the worldwide pattern and framework. Where to place the exact boundary between each of the time periods can be a matter for continued discussion among geologists, but the broad, general pattern is clear and consistent.

The fossils found in these strata will be the subject of a future article. They are a vital part of the geologic record and of our understanding of it.

The geologic column

Erosion or lack of deposition in part of an area may prevent a full complement of strata from occurring at any one location. However, strata whose superposition and / or relative ages can be clearly proven may be correlated and stacked one on top of the other to create a geologic column. This is done for clarity, efficiency and convenience. It is much easier to illustrate and discuss the strata in this manner.

However, if one is not aware of how or why it is done in this way, wrong conclusions can be easily drawn. For instance, if one had seen only a drawing of the geologic column, he might feel he should be able to walk to a cliff in the Colorado Plateau and see all these strata in one grand pile as shown in the illustration. On the other hand, he might think the geologist was trying to mislead him by saying strata existed that really don't. Neither of these is true. It is just a convenient manner of presenting the data. It allows much data to be summarized in a very little space.

Strata are usually named for geographic locations or features near their most complete outcrop. Sometimes they are named for some obvious characteristic, e.g., the stratum labeled "Redwall" is named for its exposure in the Grand Canyon, where it forms a sheer red cliff or wall. It is actually composed of gray limestone, but the overlying red shales have given its surface a red color — hence the name "Redwall."

Summary

There is no 100 percent complete geologic record. It is not the nature of geologic forces to allow such an area to exist. However, the area of the Colorado Plateau in the western United States has a very clear and extensive record preserved. It is probably one of the most complete available. There, miles of strata exist for each of the four major geologic time periods. The strata are in observable superposition, one lying physically on top of the other.

Evidence for extended periods of depositional time occur throughout the stratigraphic sequence. Though there are gaps in the record, the record reveals a tremendous amount about past geologic activity. The strata contain fossil organisms that correspond to the standard sequence of life forms found in the geologic record throughout the world.

We can waste much time looking for the "loose brick" in the factual understanding of modern geologists and paleontologists. The loose-brick approach is typical of many modern creationists, but it is a fruitless search. When the facts are carefully studied, it is not the geologist, but rather this type of creationist who is in error.

There really is a long history to the earth and a sequence of life forms that have lived on it. This is clearly evident from the geologic record. This, however, does not exclude a Creator, nor does it prove that the changes and progression observed in the fossil organisms are the result of evolution. Jesus said, "My Father has been working until now, and I have been working" (John 5:17).

This brief overview should help dispel many of the misconceptions some may have had about the nature of the geologic record. In our next article we will begin exploring the nature of the changes that have occurred in the life forms that are found as fossils in the strata of the Colorado Plateau.

Richard Burky, 1990

3. How Plants and Animals Have Changed Through the Geologic Eras

Summary: If we could enter a time machine and travel millions of years back in time, what would we see? Would the plants and animals be much the same as those now on earth? Has God's creation stayed the same? Certainly not!

Fossils, which give us a sampling of the life forms we would be likely to find, demonstrate that the variety of living creatures today is vastly different than the types of creatures that lived when Paleozoic strata were being deposited. Most of today's common animals are not represented in fossils of that era, and most Paleozoic plants and animals are now extinct. Many of them are not even similar to anything living today. Biological variety has changed considerably through the eras.

Individual types of organisms are also different. The skeletons of modern fish, for example, are often considerably different than the fish fossils of the Mesozoic strata. A few types have remained much the same, but the morphology of most types has changed through the eras.[1] This article describes changes in plants and marine animals.

The geologic record gives us a fascinating glimpse into the history of the earth and the forms of life that have lived on it. This information is not available to us from any other source.

In previous articles we corrected two misconceptions about the geologic record. First, the geologic strata were not produced by catastrophic worldwide floods.[2] Rather, they were usually deposited over extended periods of time. The existence of long geologic time periods can be proven by mechanical, chemical and biological processes that occurred before, during and after the strata were deposited.

Second, geologic strata lie on top of one another, and the layers indicate relative age — the bottom layers are much older than layers near the top. This is

especially obvious in the Grand Canyon, where a large sequence of layers is exposed.

Radiometric dating techniques, which measure elapsed time based on the uniform rate of disintegration of radioactive elements, also indicate that the time involved is very long. These methods also give quantitative estimates of the time involved.[3]

Different strata, different environments

We will now examine a few variations witnessed in living organisms from one geological time to subsequent times. As in the past article, we will use the fossils found in strata of the Colorado Plateau as a basis for our discussion, since this area gives us a simple and direct correspondence between vertical sequence and chronological sequence.[4]

By comparing the plant and animal fossils of a sequence of geologic layers in the Colorado Plateau, we can get a picture of how plants and animals changed over the millions of years.

Individual strata are usually deposited in a single environment — for example, marine, desert, delta, swamp, etc.[5] The vast majority of fossils in each layer are from one type of environment. The earth, however, is made of many different environments, each containing a different mix of plants and animals. We cannot expect to find fossils of all animals alive on the earth at one time in any one strata.

In a stratum dominated by fossils of clams, for example, we would not expect to find fossils of mice, though it is of course remotely possible. If we are examining fossils deposited in an ancient desert, we do not expect to find ocean-dwelling animals.

Each stratum gives us only a geographically, environmentally and chronologically isolated segment of life on earth. It is only a partial picture of what was happening worldwide. This concept is simple, but sometimes we can forget it when we ask what type of organisms lived on earth when a certain stratum was deposited. Our knowledge is limited by the circumstances of the strata.[6] Fortunately, the Colorado Plateau strata contain enough of a variety of fossils to confirm the general pattern of plant and animal life throughout the geologic eras.

Fossil organisms found in Colorado Plateau strata

A close examination of the Colorado Plateau strata reveals that the type of fossils found in succeeding strata indicates many changes in type of depositional environment.[7] Ocean-living organisms are deposited in layers completely separate from those that occur in continental environments — environments that occur on land rather than in water.

Examples of continental environments are deserts with windblown sand and sediments, river floodplains and lake sediments. River deltas, lagoons and mud flats that border an ocean often contain a mixture of continental and marine fossils.

Separation of environments also explains why we can't expect to find a continuation of each line of organism in all the overlying strata. This separation of environments is additional evidence that geologic strata are not the result of one or two worldwide floods. Such floods would have mixed material from all environments and buried them together.

We will now more specifically examine the type of fossil organisms that are found in the strata.

Algae

Algae are the first life forms we encounter in the oldest, deepest strata of the Colorado Plateau. We do not necessarily find fossils of the actual algae — what we find are the limestone structures that algae build. These structures show little change with time. Throughout the geologic record, and continuing even today, algae are still depositing limestone in a manner similar to that found in the earliest rock strata in the bottom of the Grand Canyon.

This *lack* of significant change, which we also find in a few other plant and animal types, illustrates a dichotomy in the history of life on earth. Most fossil organisms were considerably different from their modern counterparts, or they became extinct with no modern counterparts. A few have changed hardly at all; they are known as "living fossils."

A few organisms even seem to degenerate and retrogress in design and function with time. The details of the story are far more complex than we may have hoped, yet there are some generalizations and major trends that are quite clear.

Trilobites

In one of the bottom strata we encounter a fossil almost everyone has heard of, the trilobite. Trilobites are marine bottom-dwellers that first show up in this area in the strata of the Tapeats Formation. They are found in most of the overlying

marine layers until the top of the Kaibab Formation, which is the last time trilobite fossils are found, even though there are many overlying marine fossil layers.

Some creationists have stated that trilobites are found in deeper layers because of "density sorting" by flood waters. The idea is that trilobites were buried in lower layers because they are bottom dwellers and, being heavier than other animals, sank into the sediments of the flood waters faster than other organisms.

However, consider how many overlying strata contain fossil clams. Clam shells are far denser and heavier than trilobites. If the creationists' theory were valid, all the clams would be deposited with or below the trilobites. This is far from true. Clams occur throughout the strata, even in some near the top of the chart.[8] The creationists' density-sorting concept is not valid.

Other marine life

Sea life has been fossilized in marine strata throughout the record. It is abundant in both variety and quantity.[9] Most modern forms of marine organisms are considerably different from the types found in the lower strata. Many of the early forms are long since extinct. Only two instructive examples of changes in marine animals will be mentioned: the brachiopod *Lingulella* and the ammonite group.[10]

The brachiopod *Lingulella* found in the Bright Angel Formation at the bottom of the Grand Canyon is quite similar to brachiopods (*Lingula*) that are currently dug for food along the Japanese coastline. This organism has changed very little in design throughout an incredibly long period of time.

But most types of organisms have changed substantially, if not dramatically, from the time they first occur in the fossil record. An excellent example of rapid change is found in the ammonites, members of the cephalopod group. These marine organisms, similar to the modern *Nautilus,* looked much like giant snails. They lived in the oceans worldwide and were common during the time of the dinosaurs.[11]

The ammonites became prominent in the seas before the dinosaurs began to dominate the land. The whole group multiplied rapidly and spread widely before coming to an abrupt end along with the dinosaurs, suffering total extinction. To my knowledge, the first stratigraphic level in the Colorado Plateau that contains ammonites is the Moenkopi Formation.[12] Ammonites are common in the Curtis Formation and are especially numerous in the Mancos.

Fossil plants

The fossil land plants show a considerable change as we progress upward through the strata of our study area. The first significant land plants are encountered in the Supai Formation. Though the plant fossils in this formation are poorly preserved and fragmentary, they represent types of plants that are well preserved in abundance in the coal beds in other parts of the world.

Four large plants commonly occur in coal beds formed during a time roughly equivalent to the deposition of the Redwall and Supai Formations. These are *Lepidendron, Sigallaria, Cordaites,* and *Calamites.* In the Colorado Plateau, *Cordaites* and *Calamites* are found as fossils in the Supai Formation. All four plants are different from any modern plants. Only *Calamites* is of a type represented by modern plants, the horsetails. Modern horsetails, however, grow only a few feet tall and have stems the size of a thick pencil. *Calamites* grew up to 40 feet tall and had a trunk nearly a foot in diameter. All these plants had large trunk cores made of pith, totally unlike the wood of modern trees.

The Hermit Formation contains a notable collection of fossil plants. These include fern-like plants, seed ferns and extinct conifers, but do not include *Cordaites* or *Calamites.* The conifers were "cone bearers," but they were not similar to the pines, firs and spruces we are familiar with today.

The flowering plants, the angiosperms, prevalent today, have never been found as fossils at this time, neither in the Supai, nor in the coal beds of equivalent age in the rest of the world.

In other geographic locations land plants are found as fossils much earlier than they are in the Colorado Plateau strata. Nearly all the previous strata in our study area are marine. We would not expect to find land plant fossils in a marine environment.

In the Moenkopi Formation are a few fossils of "horsetails" — plants much like the modern genus *Equisetum,* somewhat like the previously mentioned *Calamites.*[13] Horsetails are common fossils from this time forward.

The Chinle Formation contains abundant remains of fossil plants. Its strata are exposed in the Petrified Forest National Park in Arizona. Petrified wood and remnants of other plants are found at many locations in the Chinle. Impressive huge logs preserved in the National Park represent several species of conifers that are similar to some obscure forms living today.

In all, 50 or more species of plants are found in the Chinle. These include fungi, conifers, ginkos (another ancient line with modern representatives), horsetails, cycads and others, but still *not* the flowering plants, the angiosperms.

Fossils of flowering plants, the angiosperms, are first found in a formation deposited about the same time as the Carmel Formation.[14] By the time of the Dakota Formation, angiosperms were abundant. Many trees and plants that you would recognize were present — such as oak, fig, willow, palm, sassafras, poplar and holly. During this time the dinosaurs were the most prevalent land animals and would continue to be for some time to come. Early mammals were present, but they were small in both size and number.

Plant fossils are found in many of the formations overlying the Dakota. They are abundant in the Blackhawk, where they form extensive, commercially exploited coal beds. The Green River Formation is especially well known for its fossil flora. These are predominately flowering plants. Many of them, perhaps most, we would recognize as modern plants.[15]

The Green River strata were deposited after the demise of the dinosaurs but still a very long time ago. Mammals were the prevalent land animals. However, these were not the type of mammals you and I are familiar with. They are types long since extinct.

I will briefly summarize what we have witnessed in the fossil algae and plants. Algae are the oldest; they lived throughout every level of the fossil record and continue to have living representatives thriving today.

The earliest land plants found in the Colorado Plateau strata are now extinct, though a few have similar types living today. A little later in the fossil record we find the living-fossil plants, including the ginkos, horsetails and cycads. However, these examples of long-lived types are the exceptions in the record, not the rule.

Angiosperms, the flowering plants, show up in the record during the later times of the dinosaurs. They soon become the dominant type of plant throughout the rest of the fossil record and in the modern landscape. There is a definite progression in the type and design of the flora as we move upward through the strata of the Colorado Plateau.

Changes observed in fossil fish

Another familiar group of organisms that clearly shows a significant pattern of change is the fish. The first fossils of fish are found in the Temple Butte Formation, which lies fairly low in the Grand Canyon.[16] These fish are nothing like the kind you would pull out of a modern stream, lake or even the ocean. They belong to a class of fish known as placoderms or "armor skinned" fish.

The chief characteristic of this group is the bony armor plates that cover a major portion of their body, especially the head. They lack an internal bony skeleton, which is present in most modern fish. The placoderms' body support was more like that of an insect (having an exoskeleton) than like a modern fish. Their fins do not have bony spines for support. Their tails are decidedly asymmetrical.

There were many varieties of placoderms, but they were all extinct by the time the Redwall Formation was deposited.[17] The genus of the type found in the Temple Butte is *Bothriolepis*.

Some fish fossils are in the Moenkopi Formation, but they are generally so poorly preserved that identification is difficult. However, the overlying Chinle provides a clearer picture of the freshwater fish of that time period, considerably later than the time the Temple Butte was deposited.

The design of the fish of the Chinle might be considered somewhat intermediate to modern fish. They had bony supports or "rays" in their fins to give them more strength. They had a bony skeleton, but most did not have a fully ossified backbone.

The scales were generally thicker and rhomboid in shape, more like those found in earlier fish. The scales were made of layers of bone, covered with a material like tooth enamel. The tail's exterior appearance was more symmetrical, but the internal bone structure was still asymmetrical. Earlier forms had functioning lungs; Chinle and later fish had air bladders. A fossil lungfish in the Chinle is quite similar to a modern lungfish in Australia.

Another living-fossil fish found in the Chinle is the well-publicized coelacanth. It was thought to have been extinct since dinosaur times until a fishing boat brought one in from the waters east of Africa in the 1930s. Please keep in mind, though, that the living fossils are the exceptions, not the rule. They get more publicity because they are exceptional rather than ordinary. The majority of fish from the Chinle are now extinct, intermediate in design when compared to the earliest fish and modern fish.

The Green River Formation, famous for its fossil fish, has fish that are quite modern in design and appearance. Their skeletons are fully ossified (composed fully of hard bone rather than being part of cartilage). Their scales are rounded in shape, made of a thin, light bony material. Their tails are symmetrical in both internal structure and exterior appearance.

The history of fish is complex. However, this sequence of forms represents the general changes that took place in the fish group. The fish fossils in the Colorado Plateau strata clearly reflect significant changes in design with time.

Summary

During the extensive time period taken to deposit the strata of the Colorado Plateau, life forms went through major changes. In many cases that change was progressive in nature, as shown by fish and plant fossils. In contrast to these, some few organisms, dubbed living fossils, experienced little or no change during the same time period. Their original design was one that remained viable and successful. Modern representatives of these organisms are alive today. Other organisms simply became extinct and were eventually replaced with new organisms.

Changes in different types of organisms occurred throughout the geologic record, not just at a few junctures. The major changes made in the plants did not correspond in time period to the major changes in the fish or the land animals. The history is one of great complexity, not one of a few simplistic changes.

The next article will continue this topic. It will examine the changes that have occurred in the land animals. Then we will consider the possible meaning and importance this understanding gives us about how God has developed life forms we find on earth.

Endnotes

[1] Fish of the Mesozoic era were considerably different than fish that live today. But that does not mean that ancient forms *evolved* into modern forms. *Evolution,* as the word is commonly used, implies genetic connections through the eras and a gradual development caused by survival of the fittest. However, it cannot be proven that there has been any genetic connection between similar forms of different ages. The fossils reveal differences and similarities, but the fossils do not reveal whether or how one form is associated with similar forms of later eras. Evolution is an interpretation of the evidence. We reject that interpretation, but we cannot reject the evidence. Our beliefs lead us to interpret the evidence in a nonevolutionary way.

[2] Some layers of bedded rocks may have been deposited by floods, but certainly not the majority of strata.

[3] Radiometric estimates of age may seem to be simpler reference points than geologic formation names. However, all strata do not have rocks that lend themselves to radiometric dating and thus have to be dated by extrapolation

from datable rocks that lie above or below them. To avoid the complexities and questions involved with radiometric dates I feel it is better and more straightforward to use the actual formation names. This allows the reader the tangible realization that he can consult a geologic map and find the actual body of rock strata being described. Though the multiplicity of names may make it seem more complex, it is really simpler. There are no theoretical or hypothetical adjustments that need to be made in fitting the facts to reality. Radiometric dating and the ages of the Colorado Plateau strata may be covered as a separate topic in a future article.

[4] Thus we do not have to deal with the complicated issue of correlating disconnected strata in widely separated geographic areas.

[5] Some strata contain mixed environments, such as those produced in river deltas, which contain both aquatic organisms and terrestrial organisms washed into the river.

[6] It is also good to remember that very few organisms are ever preserved as fossils. Most simply die and decay, and there is no enduring record of their existence.

[7] If there is a question of how we know these strata are in this order, please refer to the previous article, "An Overview of the Geologic Record."

[8] Rocks are even denser than clams. If the density-sorting concept were true, all the rocks would be deposited in the lowest strata. It is definitely not true.

[9] There are brachiopods (shellfish that look somewhat like a clam), pelecypods (clams), gastropods (snails), crinoids, sponges, corals, cephalopods (similar to the living *Nautilus* and squid), foraminiferans (one-celled animals with shells, usually microscopic), bryzoans, ostracodes, etc.

[10] Most marine fossils involve technical descriptions and obscure organisms that many readers do not know and may have difficulty relating to. It seems better to devote most of our time to examining the history of organisms that are more familiar to our readers.

[11] The ammonites ranged in size from a diameter of less than an inch up to six feet! They are grouped into more than 300 genera and thousands of species. One could spend a lifetime studying only the ammonites!

[12] They are known to occur in earlier strata elsewhere in the world.

[13] The modern horsetails are also known as scouring rushes because the pioneers in America used them to scour pots and pans. Their tough, abrasive stems are durable, which is why they are often found as fossils.

[14] Some scientists feel they have found the earliest evidence of flowering plants in a formation in central Utah called the Arapien Shale. It was deposited about the same time as the Carmel Formation. Whether fossils of the first true angiosperms are in the Arapien Shale is not significant for us. What is significant is that they begin to show up as fossils *about* this time.

[15] The varieties found include pine, alder, fir, birch, cedar, hemlock, maple, sweet gum, sequoia, oak, sycamore, cottonwood, willow and many others.

[16] Fossils of these fish are found around the world in strata of similar age and position in the record. Notable localities for them are in Britain and eastern Canada.

[17] They have been extinct, based on radiometric dating, for nearly 300 million years.

Richard Burky

Richard Burky holds master's degrees from Ambassador College and California State University, Los Angeles. When he wrote this article in 1991, he was in a doctoral program at the University of California, Riverside, specializing in prehistoric archaeology, with additional work in physical anthropology and paleontology.

4. How Land Animals Have Changed Through Geologic Time

Few groups of organisms have changed as dramatically through geologic time as have backboned animals that live on land. In this article we will examine changes reflected in fossils in the strata of the Colorado Plateau.

In the Colorado Plateau, the strata clearly lie on top of one another. There is no question of relative age. Bottom strata were deposited first; they are older than those on top. Second, these strata contain abundant evidence for the passage of time during deposition and for time lapse between the deposition of various strata. Third, the range of the geologic record in this area is outstanding. Each of the four major geologic periods is represented by strata miles long.

By limiting our examination to one geographical area, we limit the complexity, confusion and the uncertainty of time correlation that is often introduced when jumping from one geographic area to another. Staying within the Colorado Plateau makes the logic of the geologic record simpler and easier to understand. Once we prove the sequence of the fossils here, we can examine other geographic areas that contain better fossil records of select groups of animals.

Previous articles in this series have covered the topics of geographic location, strata sequence, depositional history and evidence for long time periods. The previous article of the series explored the changes observed in a few marine shellfish, land plants and freshwater fish.

Fossil land animals

As we examine changes in the land animals, we find patterns similar to those found in other fossil organisms. Most have become extinct. Some have been changed with time. Some have become extremely specialized. A few seem to have degenerated. And, as always, there are "living fossils" that have remained relatively unchanged for long periods of time. (Examples of these among land animals are turtles and crocodiles.) Perhaps the most prevalent pattern is that new forms show up continually as we progress up through the stratigraphic sequence, and older forms simply disappear from the record.

In other parts of the world, some land-living vertebrates are found in strata deposited about the same time as the Temple Butte Formation. In the Colorado Plateau, however, no land-animal fossils are found at this level. The strata being deposited then were primarily marine strata, so we would not expect to find remains of land animals.

The first continental strata (as contrasted to strata deposited in marine environments) after the Temple Butte are the Supai strata. Many land-animal tracks have been found in those strata, but so far no remains of the actual animals have been found. This is also true for the overlying Hermit and Coconino strata.

Amphibians and reptiles

The earliest known fossils of actual animals in the Colorado Plateau are in the Moenkopi Formation. The animals of the Moenkopi are reptiles and amphibians that have been extinct for a long time. Few of the 10 or so forms found there are common enough that you would expect to find them on display in a museum. One of these amphibians, however, was relatively common — *Metoposaurus.* It is unlike anything alive on earth today. Some of these extinct amphibians reached

more than 10 feet in length. Definitely not your typical modern toad, frog or salamander! These large amphibians soon became extinct as early dinosaurs appeared.

The next formation up, the Chinle, contains many fossil land animals. Here are found a substantial number of fossil amphibians and reptiles that are much better known than those in the Moenkopi. In the Chinle we find the first dinosaur, *Coelophysis*. Even on a worldwide basis, it is among the earliest of the dinosaurs. This dinosaur has a simple design and, relative to later dinosaurs, is small — only 8 feet long from nose to tip of tail.

Living with the first dinosaurs was an alligator-like animal called a phytosaur. Superficially, it resembles an alligator or crocodile, but it is neither. The latter breathe through nostrils on the tip of their snouts. Phytosaurs breathed through a hole in the top of their skulls, between and a little in front of their eyes.

Two other reptiles are also found in the Chinle — *Desmatosuchus* and *Placerias*. Both are extinct, and quite peculiar. *Metoposaurus*, which we encountered in the Moenkopi Formation, continued to live in Chinle times.

Many of the formations between the Chinle and the Morrison contain some evidence for dinosaurs, particularly footprints. However, they are poor in actual skeletal material. Evidence of early crocodile fossils is reported from the Moenave. Of course, several of the formations were deposited in marine environments, so we would not expect to find land-animal fossils in them.

The Morrison Formation is an entirely different situation. It is a widely distributed formation composed of land-deposited sediments. Named for the small town of Morrison, Colorado, outside of Denver, it stretches from Montana to New Mexico. Extensive quarries of dinosaur bones occur in the Morrison Formation in Wyoming, Utah and Colorado. The variety is extensive.

The last dinosaur fossils in our strata are in the lower portion of the North Horn Formation. They are considerably different from those found in the Morrison Formation.

Mammals

The Morrison also contains some of the first evidence for fossil mammals. Full skeletons have not been found; only jaws and teeth reveal their existence. They were probably about the size of mice and rats.

In the upper portion of the North Horn are mammals that are larger than and far different from those found in the Morrison, but they would still be unrecognizable in terms of modern living mammals.

The next animals I will mention are from formations that are stratigraphically equivalent to the Colton Formation, though they are not specifically from the Colton. The first is *Hyracotherium,* more commonly known as "Eohippus." This is the famous early "horse" with four hoofed toes on the front feet and three on the rear feet.

From the same time period is *Phenacodus.* This mammal superficially looks like a dog about the size of a collie. But it is not a dog — its teeth are much like those of "eohippus" and vastly different from those of a modern dog. It had five toes on each foot. Each toe had a small "hoof" on the end, not a claw like a dog.

Living with these two mammals was *Coryphodon,* a hippo-shaped herbivore with large dagger-like canine teeth. All three of these animals are found as fossils in strata of the same age in Europe as well as in other parts of North America. None of the three are like any living animal.

Green River

The next formation, the Green River, is primarily lake deposits. Fish fossils are extremely abundant in places. There are crocodiles and turtles, "living fossils" that lived with the dinosaurs and continue with little change even today. Fossil snakes are found here.

A few land animals are found as fossils, but they are not abundant. A notable one is the giant flightless bird *Diatryma.* It was nearly 7 feet tall! Its massive build and beak reminds one of a dinosaur. Similar fossil birds are found much later in the fossil record of South America.

Perhaps the most notable fossils from this formation are early primates much like modern lemurs (*Notharctus*) and tarsiers (*Tetonius*).

A variety — about 100 kinds — of early mammals are found in the Uinta Formation and the Duchesne River Formation. There is an "advanced" form of "eohippus" called *Epihippus.* It is quite similar to "eohippus," with the major difference being changes in the teeth.

Rhino-sized beasts

Some fossils in the Uinta and Duchesne are similar to rhinos. One of the common larger animals is *Dolichorhinus,* a mammal from the Uinta Formation that belongs

to an important and common group of this time period known as the titanotheres. There were considerable changes in this group from about the time of the Colton Formation until after the deposition of the Duchesne River. By the time of the deposition of the Brown's Park, they were all extinct. A massive two-volume work on the group was completed by a leading American paleontologist early in this century.

The end of the titanothere line, a form known as *Brontops,* is found in Wyoming and South Dakota in strata deposited after the Duchesne River and before the Brown's Park. *Brontops* is massive — 12 feet long and 8 feet tall!

Uintatherium, another large and common herbivore of the Uinta Formation, is also a giant and near the end of its line. Its skull is grotesque, covered with large bony bosses, and possessing huge saber-like canine teeth. The end of this group came a little later with a still larger form known as *Eobasileus.* It stood 7-8 feet tall and was built like a rhinoceros.

Brown's Park oddities

It should be emphasized that a significant time gap occurs between the deposition of the Duchesne River and the Brown's Park. There is a major difference in the type of mammals. Though the record of the changes that occurred in mammal types is missing here, it is recorded in strata in other areas of the western United States.

The fossils of the Brown's Park are sparse, and the ones that are found are considerably different from the earlier mammals. Three forms are quite interesting. *Gomphotherium* is one of the earliest members of the "elephant family" that is found in North America. It has four tusks, and its lower jaw not only has tusks, but the jaw is also much longer than that of an elephant. Its teeth are of a completely different design from those of the elephant. Its teeth are more like those of the later mastodons, yet still considerably different from theirs.

A curious creature found in the Brown's Park is *Moropus,* a mammal the size of a modern horse and superficially resembling a horse. However, instead of hooves it has toes with large claws on them. Early fossil hunters thought that the claws came from an entirely different animal until they found undisputable evidence that the two features belonged together.

A more familiar mammal is also found in the Brown's Park, the true rhino, *Aphelops.*

More modern mammals

After the deposition of the Brown's Park, there is another very long time break with no strata being deposited or fossils preserved to record what was happening. The area was uplifted, and strata were, for the most part, being eroded away rather than being deposited. Later, during the time of the Ice Age, small deposits occur at various places, for example, in swampy areas around springs, in caves, in gravel pits, on river terraces and flood plains.

The fossils found in these places are a mixture of modern and recently extinct types. From the Colorado Plateau these include: camel (*Camelops*), *Bison*, mammoth (*Mammuthus*), ground sloth (*Nothrotherium*) and the modern horse (*Equus*). These are the more common animals, but they are only a sampling of the many mammals that are found during this time period.

Summary

The dominant land animals change as we progress through a long period of geologic time. The story starts with early amphibians and reptiles, then progresses through an extensive period when dinosaurs dominated the land fauna. The dinosaurs were not unchanging, however. They changed dramatically as time progressed. The variety is mind-boggling. It is in strata deposited during the dinosaur period that the first mammal fossils have been found.

Following dinosaur times was a long stretch of time in which mammals dominated and were gradually developed. At first the mammals were totally unlike any modern forms. As time progressed, more and more similarities to modern mammals show up in the fossils. Groups appear and are developed. Some of these groups continue today, but many have long since become extinct. By the time of the Ice Age, the mammals are essentially modern in design, with only a few strange forms still around.

The view this article gives is, of necessity, only a general one. It should, however, be sufficient to make one realize that there is much history to take into account before making conclusions about what has happened on earth in the past. The story is considerably more complex than may have been imagined or than is pictured in many "creationist" reconstructions.

In the next article, I plan to present some possible *reasons* for the sequence of changes observed in the fossil record. The facts presented in these articles should greatly expand our understanding of God's creation process. This understanding should give us a much deeper appreciation for the design, patience and work involved in the development of this marvelous world we live in.

Richard Burky, 1992

5. Creative Development: A Better Explanation Than Evolution

The four previous articles on geology and the history of life on earth presented evidence that contradicts the conclusions of most modern "scientific creationists." The geologic record unmistakably reveals large amounts of time and definite progressive sequences of living organisms throughout that time. Should this realization shake our faith in a creating God? Does it in any way give more credence to mindless evolution than to purposeful creation? It should not.

Rather, we should use this information to help clarify the history of the past, the nature of God and the real meaning of the early chapters of Genesis. Rather than fight facts and reality, let us use them to broaden our understanding of God and the Bible. The God defined by the Bible is a God of truth. We must, in humility, realize that we do not yet have the full truth from either the Bible or the physical record. We still "see through a glass, darkly."

How can the realities of the geologic record be understood from a biblical, creative perspective?

Genesis doesn't reveal everything

Some aspects of the history of the earth and fossil life forms are not even hinted at in Genesis. This should not surprise us. We know that the nature, structure and size of the universe are not explained in the book of Genesis. That is not its purpose.

Nevertheless, some people concluded from the Genesis creation account that the earth was the center of the universe with all other heavenly bodies revolving around it. People believed this for hundreds of years because they believed that the Bible taught it. People changed their understanding of the Bible because they reexamined it in the light of facts gathered through scientific investigation. The facts helped them realize that people had misinterpreted the Bible by making it say more than it was meant to.

We must be willing to do the same with the geologic record.

Is using information from the physical record to help understand the meaning of Genesis somehow sacrilegious? Are the physical facts deceptive, while what we read *into* the Genesis record is the truth? Should we try to defend the God of truth with explanations that are physically erroneous? This is what some well-

meaning "scientific creationists" are unwittingly striving to do. We must not follow their error.

If physical facts appear to contradict religious beliefs, we should re-examine both. The physical and spiritual facts should fit when we understand both. We must be able to correlate the physical and the theological if we are to make our message meaningful to knowledgeable people and if we are to give our children a solid basis for belief, a faith that will not be weakened when they learn scientific facts.

It is clear from the geologic record that God did not invent and create for the first time all the world's animals 6,000 years ago (or 10,000 or 40,000 years ago). Most modern animals were living on earth long before that. We might hypothesize that God recently *re*created certain animals after the pattern of animals that had lived long before. Such a "re-creation" theory would be almost impossible to prove or disprove from the physical record.

The nature of science

To understand the problem we are dealing with, we should briefly review the nature of scientific investigation. Science, by definition, deals only with the physical -- whatever can be detected and measured by physical means. It cannot prove or disprove a spiritual realm. Spiritual matters are totally outside the reach of its investigations and out of its frame of reference. With science you may be able to prove what type of organism existed, when it existed and how it changed through time. But you cannot prove how it came *into* existence, or why, or what made it change.

Faith, on the other hand, is a conclusion or decision based on judgment. Faith must be modified and redefined by truth, whether that truth comes from physical or spiritual sources. It should be based on the best evidence available. (For example, we do not have faith that the earth is flat, even though some biblical verses have sometimes been interpreted to imply such.) Faith is generally not susceptible to proof or disproof by scientific methods. Faith is the substance of things not seen. Science is the substance of things seen.

Consider John 20:26: Thomas was given physical evidence to bolster his faith. A step removed from this is those who believe even though they have not seen (verse 29). They believe because they hear about it from another source. They cannot verify it by their own experience, but this does not mean their faith is invalid. Christ's disciples were to be witnesses of physical events to build others' faith (Acts 1:8).

Pure science does not accept something as proof unless the measurements and observations can be repeated. Faith requires judgment as to what evidence is acceptable, since direct, firsthand physical evidence is not always available. Abraham believed that he would have a son, despite the physical (scientific) improbability. He had faith that God had the ability to make it happen and that his promise was reliable. Technically, I may not be able to scientifically prove that it was actually Abraham Lincoln who delivered the Gettysburg Address, but, based on the facts available, there is no basis for doubt in my mind that he did so.

One of the basic ground rules of the scientific method is that any direct spiritual or supernatural involvement in any system is automatically excluded from consideration. It doesn't mean that it is not a part of reality, it just means that it is not a part of science. Note the honest and candid statement of a prominent American vertebrate paleontologist (now deceased):

Philosophers and other non-scientists have often suggested that evolution may have been due to some supernatural agency or some mysterious "drive" within the animal itself. *No one can prove, of course, that this is not the case.* But as scientists we attempt to explain the phenomena of nature in terms of natural laws before resorting to supernatural interpretation (A.S. Romer, *The Vertebrate Story,* page 5, emphasis mine).

Functional science, however, is not without a large measure of faith, bias and personal judgment. The game of science is to be played only with physical facts, repeatable observations and physical rules. It cannot consider, prove or disprove a Creator's existence. One may, however, look at the objects studied by science and make a judgment about the existence of a Creator.

We must admit that the scientific process of eliminating the supernatural from consideration has allowed much superstition to be eliminated from Western society. The universe indeed functions by natural law without the constant need for supernatural intervention to cause every little thing to happen.

Rational vs. scientific

But has the scientific approach been extended too far? While it may be "scientific" to eliminate a Creator and the supernatural from consideration in studying the natural world, is it *rational* to do so? No! Denying consideration of the supernatural and spiritual realm is not rational if there is a clear possibility that they exist.

While God and the supernatural do not interact with the physical functioning of the material world in the way thought by medieval theologians and alchemists, that does not rule out their existence. It would be illogical to say that past misunderstandings about a spiritual realm in general, and the story of Genesis in particular, should be reason to totally eliminate God and the supernatural from our thinking. But this is what many scientists have done.

What if we retain God in our knowledge?

Creative development -- a better explanation than evolution

The creative process may have been much more complicated and lengthy than previously believed. The story told in Genesis may cover only a small portion of the total creation process. (Or it may have a completely different meaning. That will have to be explored elsewhere.)

I propose that it makes more sense to evaluate the fossil record as the record of a creative-development process by a supernatural mind (or minds) over a long period of time.

Most groups of organisms in the fossil record show *much* modification and change through time. Horses and the elephant family are examples of this change over time. Dinosaurs progressed through similar changes. Fish, birds and other mammal groups did likewise. ("Living fossils" are the exception, not the rule.) Even the physical body of humans seems to have been developed through a very long time span, based on the fossil record of hominids. It is beyond the scope of this article to illustrate the changes in any group, but such material is available from many books on geology, paleontology and anthropology.

An apt analogy of the changes observed in the fossils can be made with the development of nearly any human technology. The first automobiles, for example, were carts with engines. Later ones had fenders, enclosed bodies, spring suspensions, braking systems, advanced steering mechanisms, transmissions, etc. One by one, additions were made: electric starters, automatic transmissions, air conditioning, etc. This was a developmental process that took time. It did not develop itself -- it was the product of many creative minds thinking, designing, and building.

Living organisms are different from machines in that they reproduce themselves (an even greater feat than man's technological developments), but, contrary to what the theory of evolution teaches, reproduction does not guarantee improvement and development of new models without outside intervention. The patterns of change shown in the fossil record are similar to the development seen

in nearly all human inventions. The development patterns in the fossil record make more sense if evaluated from the standpoint of changes having been made by a rational mind rather than by random chance.

Did God have *other beings* working on developing the creation under his supervision? Possibly so; this would mean that God was not the author of developmental dead ends. Were other purposes being fulfilled by such a developmental process? Could this have been the best way for God to go about fashioning a complex, interrelated biosystem? These questions about the Creator are unanswered. But we do have some answers about the creation.

The fossil record reveals that the general design of modern animals was carried out over a long time span. Many other types were developed and then allowed to go extinct -- some after considerable modification. The creation and development of forms was an ongoing, interactive process. In some cases it appears that genetic changes were made in such a way that allowed almost a continuous developmental sequence of fossil forms. Other lines have many "missing links" (some of which may be due only to lack of a fossilizing environment). Others may be due to true design "jumps" similar to those seen in technological developments.

The fossil record of a creative-development process, including both gradual developments and creative jumps, would probably look much the same as the one left if evolution had occurred.

When we look at many major classes of living organisms in the fossil record and consider their change over time, a common pattern emerges. There is a progressive development. This is seen in many groups of fish, amphibians, reptiles, dinosaurs and mammals. Individual groups like the horses, elephants, primates, rodents and whales allow an even more precise picture of the development process.

The nature of the changes over time vary with each group and line of organisms. Any specific group would have to be studied individually to understand its unique pattern. However, the general model of progressive development with time is the nearly unanimous pattern observed in numerous groups of fossil organisms.

The question is not whether such changes occurred. The fossil record abundantly verifies that they did. The important question is, What caused the changes we observe? Are they the product of random genetic change, operated on by natural selective processes, as evolutionists would have us believe? Or are they the result of conscious, directed change by supernatural intelligence?

For both scientist and layman, the answer selected will most likely be based on faith and judgment rather than on scientific fact. By judgment I concur with David, "Only the fool has said in his heart, There is no god." However, the facts do not fit an *ex nihilo* (from nothing) creation 6,000 or 10,000 years ago. Nor can all the facts be fitted to a "two-flood model," as some have attempted to do.

The ultimate question is, Which conclusion is the most reasonable, logical and likely to be true? Which conclusion do the physical and biblical facts *best* fit and support? That calls for judgment, guided by faith. The just must live by faith -- but so must the evolutionist, the agnostic and the atheist. They each live by their own particular faith.

Correlating the physical record with the Genesis record

How can we correlate a creative-development process, clearly seen in geology, with the Genesis 1-2 creation accounts? That is not entirely clear to the theologians and scientists studying the question, but a number of options have been offered.

- Genesis 1 and 2 may be poetic or parabolic in nature, and God may not have intended these chapters to to be taken as a literal historical narrative. Jesus spoke many parables. Were they all real historic events? Do we demand a literal historic interpretation of each story? Or were his parables merely reasonable stories carefully constructed to illustrate a specific spiritual point? Was the emphasis on historicity or on meaning and lesson to be conveyed? Should the early chapters of Genesis be viewed from a similar perspective?
- The Genesis creation story may be a coded account that can encompass millions of years when properly interpreted and decoded. Many have worked on schemes to extend the meaning in such a fashion. Some make the individual days stand for a thousand years or even a geologic age. Others have worked up similar schemes in which the Genesis day indicates the termination of a specific creative process that may have been going on for many thousands of years. Under this scheme the creative events of some of the individual days were concurrent, not linear. (Most suggestions I have seen, however, multiply the correlation problems with the physical record rather than solve them.)
- The primary purpose of Genesis 1 and 2 may have been merely to tell the Israelites that it was God who created what others were worshiping as gods (sun, moon, animals of various sorts, etc.). Its statements may not have been meant to be a literal historic description of the creation process. This is only slightly different than the first point. In this case, the purpose

was to explain that God was Creator of all, not to give a blow-by-blow description of the creation chronology.

- Genesis 1 and 2 may be referring to only a limited area of the earth's surface, to a select group of humanity and to a limited group of animals, "recreated" at that time.

We are a great distance from the cultural setting of the writings of Genesis 1 and 2. There are still more ways to understand the meaning of the Genesis accounts.

Conclusion

We should not put a meaning on the Genesis account that directly contradicts physical evidence from geology and paleontology. To do so would discredit the Bible to those who are aware of the geological evidence. Darwin was driven to evolution by erroneous religious dogmas on the meaning of the book of Genesis. We should not lay such a stumblingblock before a world we hope to reach. We cannot represent the God of truth with proposals that are obvious scientific error.

Richard Burky, 1993