CREATIVE DEVELOPMENT

A Better Explanation Than Organic Evolution

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Chapter 1: INTRODUCTION

A misapplication of the material in the early chapters of the Biblical book of Genesis has led many people to misunderstand the true nature of the geological record. Instead of examining the geologic record and letting the factual evidence speak for itself, many erroneous ideas have been read into the geologic evidence by well meaning believers attempting force preconceived ideas into the evidence. In recent times this has lead to a rift between science and religion similar to that which developed several centuries ago over the true nature and size of the physical universe.

For example, the flood that occurred at the time of Noah may have had a prime impact on the family of Adam, but it did not make the major changes in the geology of the earth's surface that many fundamental believers wish to attribute to it. This becomes abundantly evident when one closely examines the strata and other aspects of the geologic record. Interestingly, the Bible itself does not attribute any major geologic change to that Flood. Such a conclusion is an invention of the readers of the book.

One of the purposes of this paper is to present a basic understanding of the true nature of the geologic record. Most strata were not caused by "a flood," or by many floods, for that matter. Of course, there is no biblical requirement to draw the conclusion that they were. The subject is not so much as mentioned in the Bible. In most instances the earth's strata record slow geologic processes in operation over long periods of time. Whether modern radiometric time dating methods are accepted or not, or ultimately prove to be 100% accurate or not, the earth materials themselves witness the passage of extremely long time periods. To force a six to ten thousand year age on the earth is to guarantee a conflict between fact and belief; just as much as demanding that the earth is flat or that the sun circles it rather than vice versa.

On the other hand, the geologic record does not disprove the existence of a supreme designer and creator. It doesn't prove, or even indicate, that all living organisms have arrived at their present state through a mindless, directionless evolutionary process that was brought about by purely natural processes. This is a conclusion that has been reached, not based on factual evidence, but rather based on the philosophic approach to the study of the subject.

The prime purpose of this paper is to introduce an alternative way to evaluate the

evidence from geology and paleontology. It retains the concept of creation by a nonphysical, supernatural being, or group of beings, that are revealed in the Bible. This "theory of creation" is in full harmony with the facts of the geologic record and, in reality, makes a much better fit of the facts than does directionless, mindless, organic evolution. It is the basic judgment of the author that the modern biologic world is far too complexly engineered and designed to ever have been fashioned by mere random mutation and natural selection functioning over long periods of time.

Modern science owes its success to the application of the "scientific method" to the study of the natural world. One of the basic principles of the "scientific method" is the elimination of any supernatural influence. Such an approach is very effective for studying the physical world. It was absolutely necessary to overcome the medieval superstition and the concept that there was arbitrary spiritual intervention in all the purely physical or "natural" functioning of the universe. By eliminating such superstition a marvelously law abiding universe was discovered and man's knowledge and understanding enormously expanded. However, this methodology has rational limits that can be exceeded. By rigorously applying the scientific method beyond these limits, requires that the concept of a supernatural Creator be absolutely eliminated from our thinking. This is an unreasonable, irrational approach to take, though it may be a technically "scientific" one. Reason would demand examining the possibility of creation by a supernatural being or beings. Such has generally not even been seriously considered by the scientific community. In fact, there is an extremely strong bias against it, even though it is a definite possibility.

The facts of the geologic record in no way prove that such a Creator does not exist. Thinking scientists recognize and acknowledge this fact. A statement by one of the most prominent American vertebrate paleontologists of this century clearly illustrates this point.

> "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 in not the case. But as scientists we attempt to explain the phenomena of nature in terms of natural laws before resorting to supernatural interpretations." Alfred S. Romer, The Vertebrate Story, fourth edition, page 5.

I have read with appreciation much of this man's work. He has come across many unexplainable things in vertebrate paleontology, but **never** have I witnessed his "resorting to supernatural interpretations." There is an underlying anti-supernaturalistic bias that many scientists themselves do not fully comprehend.

Long time periods are witnessed by the geologic evidence and progressively developed organisms are found in the successive strata deposited throughout the geologic

Chapter 2: WHERE DID THE EVOLUTIONISTS GO WRONG?

When one thinks of evolution the name Charles Darwin automatically comes to mind. This is certainly for good reason. No other single individual has made such a profound and lasting contribution to the development and acceptance of the theory of evolution as Darwin has. For this reason his life seems to be the most logical place for us to begin our search to find out where the evolutionists went wrong.

Though his ideas revolutionized the scientific world, one would not have predicted his remarkable impact had he known Charles as a youth. In school he was a lackluster scholar. He preferred hunting birds and collecting beetles to work of a more practical nature. When it came time for him to enter the university, his father, a highly successful physician, sought to press him into the same profession. After two years at Edinburgh the effort proved futile.

Since Darwin failed to adapt to a medical profession, his father decided the next best thing was for him to become a clergyman. With some reservations, and no doubt considerable coercion from his father, the idea of becoming a country preacher was accepted by young Charles. It would at least be a profession that afforded free time for hunting and studying the natural history that he loved. With this somewhat dubious motivation for entering the clergy, Charles was off to Cambridge. Three years later he obtained the necessary degree.

But his plans to be a clergyman were postponed. In late December of 1831, the year he had received his degree from Cambridge, Darwin set off on a trip that proved to be his real education. He had been chosen to be expedition naturalist on the now famous five year exploratory voyage of the H.M.S. Beagle. This was the turning point in Darwin's life.

It was on this trip that Darwin began to discover that the natural world did not fit the one described by the creation dogmas impressed upon him in his theological studies. Had he not been so thoroughly indoctrinated with those wrong concepts about creation, he probably would never have pursued the contradicting evidence so long or so vigorously. Thus Darwin's training for the clergy played an important, though negative, role. It was the conflict between religious dogma and scientific reality that prodded Darwin into his lifelong work.

Though he did not originate the concept of evolution, Charles Darwin must certainly be given credit for implanting the theory firmly into our modern society. Did he do this maliciously? Did he purposefully seek to upset the faith of his contemporaries? A study of his life and writings would indicate otherwise. His concept of evolution developed slowly as a result of his studies of the natural world. Why did he trade creation by a supernatural Being for naturalistic evolution?

As Darwin studied he came to see that the creation concepts he had been taught were wrong. The earth was far older than 6,000 years. It showed evidence of having gone through natural geologic processes for long periods of time. "Species" of animals similar to living ones were found as fossils. However, some were not exactly like the living ones. They showed significant differences. This proved to Darwin that the species had not been created with "once and for all" fixed characteristics. It proved the current view of creation was wrong. It proved the view of rigid fixation of species was wrong. The reality of the natural world was dramatically different than the theological interpretation and theory that Darwin had been taught. The Bible did not require this interpretation, but the theologians and many scientists of the day had decided that was the meaning of Genesis. Of course, this conclusion was drawn without adequate knowledge of geology and paleontology.

Did Darwin scientifically prove that God doesn't exist? No. Did the facts of geology and paleontology that he studied absolutely prove that there was no supernatural intervention in either the origin or development of life on earth? No, again. What his studies did prove is that the **interpretation** of Genesis that Darwin had been taught, and that was commonly believed even by scientific men of the day, was absolutely wrong.

Darwin had several options open to him after discovering this contradiction. He could have rejected his observations of the true nature of the physical world and retained the theological dogma. This would have pleased the theologians but would have required Darwin to be intellectually dishonest, which he apparently was not. Another option would have been to retain the concept of the Creator God portrayed in the Bible, but reject the current theological interpretation of Genesis. The physical evidence had proved this interpretation was wrong. He could have developed a new understanding of Genesis based on the new evidence. This he could, and should have done, but didn't. Instead, Darwin chose to reject the concept of the God of the Bible creating and developing the living "species." He chose rather to explain the development of life in terms of purely "natural" processes. **This is where he went wrong.**

It is the same mistake Greek "scientists" made in the apostle Paul's day. "They did not **choose** to retain God in their knowledge" (Romans 1:28). This is also where the modern evolutionists have gone wrong today! They have done it by personal choice, not because the scientific facts demand it.

Is It "Scientific" to Eliminate God?

Scientific methodology has produced great advancement in man's knowledge over the past several hundred years. By applying rigid logic and rejecting occult or other supernatural intervention in physical laws and processes a great veil of superstition and ignorance has been removed in many areas of knowledge. By eliminating the possibility of supernatural intervention in areas where there was none gave great enlightenment on the physical mechanisms and laws involved.

But does it follow that we can rationally eliminate God from all discussion of the origin and development of living organisms? Absolutely not. It is infinitely rational to consider that the physical world around us is the product of a creative, supernatural mind. To arbitrarily throw out this possibility is the irrational approach many evolutionists have chosen.

Ask yourself this question. Is it rational to believe that a creating God exists and has created all that we see around us? Yes. Can you prove this by the scientific method? No. Can you prove scientifically that such a Creator doesn't exist? No, again. Why not? By strict definition the scientific method eliminates all non-physical influence. This automatically eliminates the consideration of God. The scientific method is limited to acquiring physical knowledge about physical things that are here and working--a limited tool for a limited use. The problem is that it has worked so well for its proper, but limited use that some have tried to extend it beyond its proper limits. You will, therefore, neither prove nor disprove God's existence by the scientific method. So while you can prove the existence of God by rational processes, it is a contradiction of terms to do so by "scientific" processes.

Science vs. Faith

Science is the substance of things seen. Faith is the substance of things not seen (Heb. 11:1). This does not mean that faith is, or should be, blind. On the contrary, it should be completely rational. It should be based on the best possible explanation of the best possible data. But it is not science, it is faith. Of course, faith must be in harmony with all true facts or it is a false, empty faith.

Faith may be based on personal experience, factual knowledge or historical evidence. We have faith that when we turn on a light switch the light will come on. Past experience has proved this to be true. However, it is not "fact" until the light actually comes on. The bulb could be burned out, the switch broken or the electricity off.

Faith is needed in areas that scientific facts do not cover. The evolutionist has **faith** that variation in the reproduction processes and natural selection are adequate processes to produce the magnificent variety of life forms around us. The evolutionist does not **know** that this is how the changes were made. The creationist, on the other hand, believes (has faith) that the physical world was created by supernatural design. The fossils and the geologic record are reality. How they came to exist is still a matter of faith. The geologic facts, while not contradicting the existence of a Creator God, do contradict how many Christians still **think** the creation took place. This subject will be addressed in detail later.

Charles Darwin ended his life an agnostic but not an atheist. His religious training on creation didn't fit what actually occurs in the natural world. In addition, the religious dogma he was taught was too rigid to allow for change based on new evidence. Because of these problems he all too hastily discarded the God of the Bible. He clearly saw that the type of creation he had been taught was wrong.

Where have the typical evolutionists gone wrong? They have irrationally discarded the possibility of creation by the Supernatural Being described as "God" in the Bible. Instead they **chose** to have faith in the creative powers of "natural" processes. They did this by personal, philosophical choice, "by faith" ...not because the facts demanded it.

Future pages will give in-depth examination of the evidence for a supernatural Creator. For now consider the following conclusions of two prominent scientists. The first conclusions are from noted scientist Sir Fred Hoyle:

> "I was constantly plagued by the thought that the number of ways in which even a single enzyme could be wrongly constructed was greater than the number of all the atoms in the universe. So try as I would, I couldn't convince myself that even the whole universe would be sufficient to find life by random processes--by what are called the blind forces in nature. . .
>
> "Rather than accept the fantastically small probability of life having arisen through the blind forces of nature, it seemed better to suppose that the origin of life was a deliberate intellectual act. By 'better' I mean less likely to be wrong. . .
>
> "A common sense interpretation of the facts suggests that a superintellect has monkeyed with physics, as well as with chemistry and biology, and that there are no blind forces worth speaking about in nature. The numbers one calculates from the facts seem to me so overwhelming as to put this conclusion almost beyond question." (Engineering & Science, November 1981)

Second, is a statement that has been attributed to biologist Edwin Conklin:

"The probability of life originating from accident is comparable to the probability of the unabridged dictionary resulting from an explosion in a print shop."

If your mind is open, you can have faith in the God of the Bible. But to do so you have to be able to throw out prejudice and accept truth where you find it. You must be willing to accept new facts even if they modify or destroy old concepts and beliefs. Few are willing to do this. Are you?

Chapter 3: THE MODERN "SCIENTIFIC CREATIONISTS" DO NOT HAVE THE RIGHT ANSWER EITHER

Modern "Scientific Creationists" are not right either. Their basic premises are that the earth is very young, perhaps anywhere from six to ten thousand years old; that the majority of the geologic strata of the earth were caused by the flood in Noah's time; and that all species were individually created in an absolutely fixed manner at the time of the creation of Adam and similar forms had not existed before. In most instances they are simply twisting the factual evidence from the geologic record in an attempt to make it fit the very same religious dogmas that Darwin saw were wrong. In reality, they reject the truth found in the geologic record because it conflicts with their religious dogma.

They are repeating the same error committed by the Church in the days of Copernicus and Galileo. The Church flatly rejected the clearly observable scientific evidence that proved the error of their dogmas about the nature of the universe. By rejecting observable truth, they set themselves up for ultimate failure. The Creationists are doing likewise. Let's take a look at some specific historical examples.

Near the end of the 16th century Galileo reportedly climbed the leaning tower of Pisa and dropped two iron balls to the ground. How could such a simple act possibly have any religious significance whatsoever?

Galileo's society was dominated by the Church. Religious dogma and tradition were the guiding principles of the day. Certain religious concepts were considered above question. Many of those religious dogmas were based on misinterpretations of the scriptures. Others were based on ideas not even found in the scriptures. What they all had in common was that they were directly contrary to observable facts and scientific reality.

An additional interesting twist of history had occurred. The writings of certain Greek philosophers, who have since come to be looked upon as the fathers of modern science, were given status closely akin to scripture. The Greek teachings and concepts actually entered into both the religious and intellectual dogmas of the day. To seriously question the veracity of the statements of either the church fathers or the Greek intellectual fathers was tantamount to heresy.

Enter the "heretic" Galileo. He challenged the flawed dogmas of the power-bearing elite of the day. Galileo, being both brilliant and brash, was destined to play a key role in the developing science/religion controversy.

Why should such a simple act as dropping two iron balls from a leaning tower be cause for argument and contention? How could this be heresy? The answer is simple. The accepted Greek authority on the subject, Aristotle, had stated that heavier bodies fall faster than lighter ones. Because Aristotle stated it, the intellectual community accepted it as true. Galileo discovered it was false. Being an outspoken individual, he didn't hesitate to teach this new truth with fervor. We don't know that he really made a grand public display of dropping the two balls from the tower at Pisa to prove the point. We do know he performed similar experiments and was convinced of Aristotle's error.

Galileo went on to far greater "heresy." He discovered there were mountains and craters on the moon. He had seen them through a telescope. The religious leaders "knew" the moon didn't have mountains because God had made celestial bodies perfect. Perfection to them could be nothing less than a perfect sphere, an idea from the Greek philosophers, not from the Bible. Galileo also discovered the sun had spots. This too was impossible according to 16th century religious dogma. Yet, the Bible is absolutely silent on the matter.

Galileo committed "heresy" once more when he observed that the planet Jupiter had moons that revolved around it. The religious and intellectual leaders "knew" the earth was the center of the universe. There could be only one center. It was impossible that any heavenly body could revolve around anything else. A biblical teaching? Of course not! It was a conclusion based on the model of the universe developed by Ptolemy, an Egyptian Greek. Another "heretical" discovery was the moonlike phases the planet Venus goes through. These could be understood only if the sun were at the center of the system and the planets revolved around it. But this structure of the solar system was "known" to be false because there had even been a major Church decree issued against the concept!

Galileo was not fighting concepts that can actually be found in the Bible. Rather, he was fighting a hybrid mixture of misdirected religious dogma and ancient Greek philosophy.

But how does all this compare with the "Scientific Creationist" situation today?

Over the last 150 years major scientific discoveries have been made about the geologic history of the earth and about the life forms that have populated it. Many of the facts that have been uncovered do not square with some religious people's interpretation of early chapters of the biblical book of Genesis. All too often, they simply reject scientific facts so they may cling to their previous interpretations and conclusions.

As 16th and 17th century religionists rejected the scientific discoveries that conflicted with their religious bias, so many Creationists are rejecting factual knowledge of the geologic and paleontologic records. By rejecting this knowledge, they are cutting themselves off from a more accurate and complete understanding of God, the meaning of the Bible, and the history of the earth and life upon it.

Truth is the cornerstone of true religion. The God of the Bible is identified not only as the supernatural Creator, but also as the lover and supporter of truth. He is exemplified as truth itself! It is inconceivable that one would have to reject the true nature of the physical world in order to accept and worship the God that created it all!

Man's "truth" is seldom absolutely perfect. This applies as much to revealed knowledge of the scriptures as it does to understanding truth which is scientifically discerned. The apostle Paul clearly pointed out this fact in I Cor. 13:9-10. "For we know in part, and we prophesy in part. But when that which is perfect is come, then that which is in part shall be done away." In verse 12 he further explains, "For now we see in a mirror darkly..." The quest for truth is the goal of both true religion and true science. Bad science is not an asset to true religion!

As we look at the earth's geology and the fossil record of life they may force us to alter our previously held understandings and beliefs. They should not shake our confidence in the Creator, the God of truth. Instead, they should inspire awe, respect and give greater understanding of that Creator!

We would never deduce the nature and size of the universe from merely reading the Bible. This is self-evident. In a similar manner we would not understand the vast history of the earth without looking into the geologic record. As we do not expect to understand the structure and mechanics of the universe from the Bible, neither should we expect to understand the extensive history of the earth from the Bible alone. To reject a right and thorough understanding of the physical geologic record is to commit oneself to error.

If the physical record overwhelmingly indicates that the earth is much older than 6,000 years, would we do God a favor by claiming it is not? Would we not rather break the ninth commandment? Should we be false witnesses for God's sake? This would be the supreme contradiction in the worship of the God of truth.

We evaluate the geologic record in light of the biblical record to understand the origin and cause of what we find. Should we not also examine the biblical record in the light of the geologic record to enhance and clarify our understanding of its meaning? Is God not the author of both the biblical and geologic records? Does one contradict the other? Do we accept one and reject the other? Do we not rather have two independent and true records that complement and explain one another? We need to use them both to unveil an accurate picture of the past.

We can misinterpret the Bible by not understanding how it's written and meant to be understood. Some biblical wording is poetic. Jesus taught by parables. While a literalist might demand that each parable was an absolute historical happening, it seems more likely that they were stories carefully constructed to clearly illustrate vitally important spiritual lessons. Some biblical statements may be understood only when we thoroughly understand the context in which they were given. Lacking this background we may misunderstand the meaning entirely. We can make serious mistakes by applying 20th century logic, context and understanding to writings made 35 or more centuries earlier in a vastly different context. Likewise we can misread the geologic record. We must allow room for human frailties and mistakes in both areas but be willing to correct them as they are discovered. In spite of many possibilities for error there is still much we can know about the past history of this planet and of the life that has lived upon it.

Chapter 4: WHAT DOES THE GEOLOGIC RECORD REALLY SHOW?

Part I: Strata Sequence and Depositional Time

Perhaps one of the best places in the world to examine the nature of the geologic record is in the western United States in an area known to geographers and geologists as the Colorado Plateau. This area and its adjoining geographic provinces contain absolute text book examples of the geologic features and geologic time periods. The Colorado Plateau itself covers an area of approximately 140,000 sq. mi. It includes parts of four states: Arizona, New Mexico, Utah, and, as you would expect, Colorado. The outline of the Colorado Plateau is shown in figure 1.

Within the boundaries of the plateau the strata are generally lying horizontally or only moderately tilted and faulted. The structure is usually so simple that a layman can clearly discern the sequence of major geologic events. Another benefit of the area is that it is semi-desert. Vegetation does not usually conceal the structure of the strata.

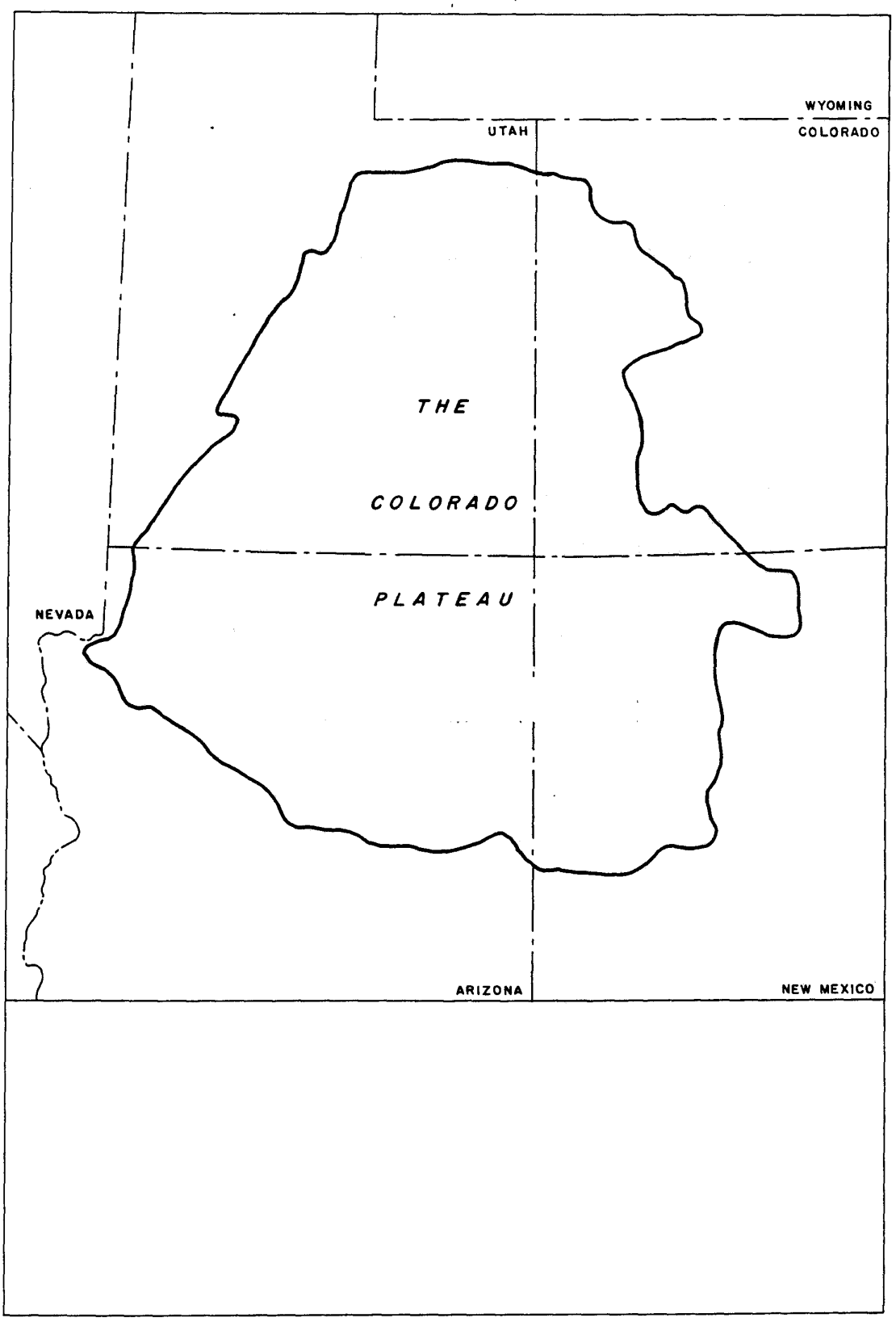
The Colorado plateau and its bordering areas have a remarkably thick stratigraphic record for each of the four major divisions of geologic time: Precambrian, Paleozoic, Mesozoic and Cenozoic. There are literally **miles** of thicknesses of strata for every one of these major time periods.

The strata are lying in superposition; one on top of the other like the layers of a giant layer cake. This structure is illustrated in figure 2. The order of deposition is absolutely and clearly demonstrated by mere observation. They are literally, physically stacked one on top of the other.

Figure 2 diagrammatically illustrates the strata that occur in the western portion of the Colorado Plateau. If you were to cut the strata along the line indicated in the inset, as if you were cutting a cake, the resulting cross section would be like that pictured. Note that the vertical thickness has been greatly exaggerated in relation to the horizontal distance so the diagram can be made readable.

The geologic time periods to which these strata are assigned is shown in figure 3. This graphically illustrates how the geologic time periods are not mere theoretical constructions but are reality. While this diagram shows there is a true sequence or

FIGURE 1.


WYOMING
UTAH
COLORADO
THE
COLORADO
PLATEAU
NEVADA
ARIZONA
NEW MEXICO

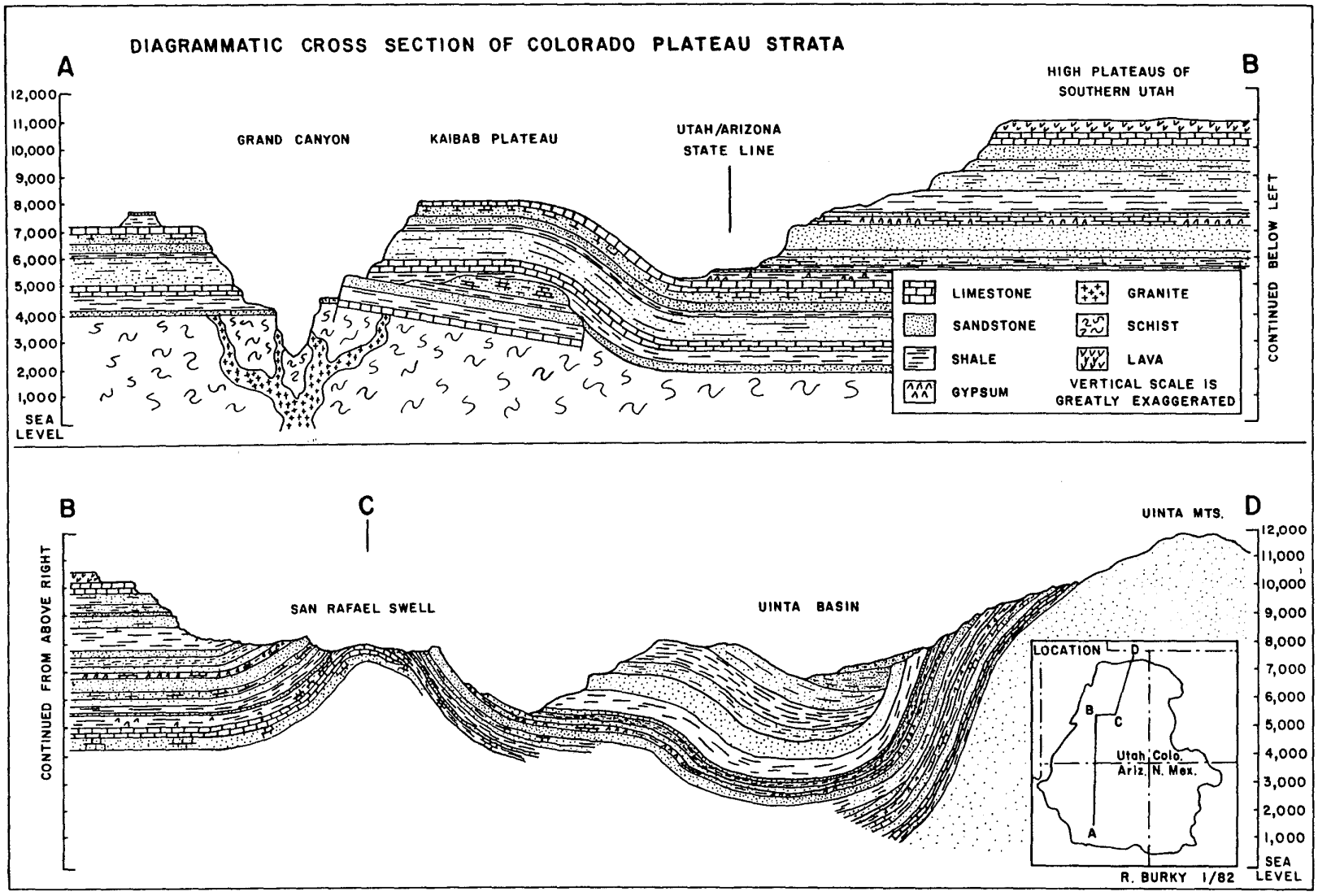

DIAGRAMMATIC CROSS SECTION OF COLORADO PLATEAU STRATA
A
B
C
D
HIGH PLATEAUS OF SOUTHERN UTAH
GRAND CANYON
KAIBAB PLATEAU
UTAH/ARIZONA STATE LINE
SAN RAFAEL SWELL
UINTA BASIN
UINTA MTS.
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
SEA LEVEL
CONTINUED BELOW LEFT
CONTINUED FROM ABOVE RIGHT
LIMESTONE
SANDSTONE
SHALE
GYPSUM
GRANITE
SCHIST
LAVA
VERTICAL SCALE IS GREATLY EXAGGERATED
LOCATION
Utah Colo. Ariz. N. Mex.
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FIGURE 2.

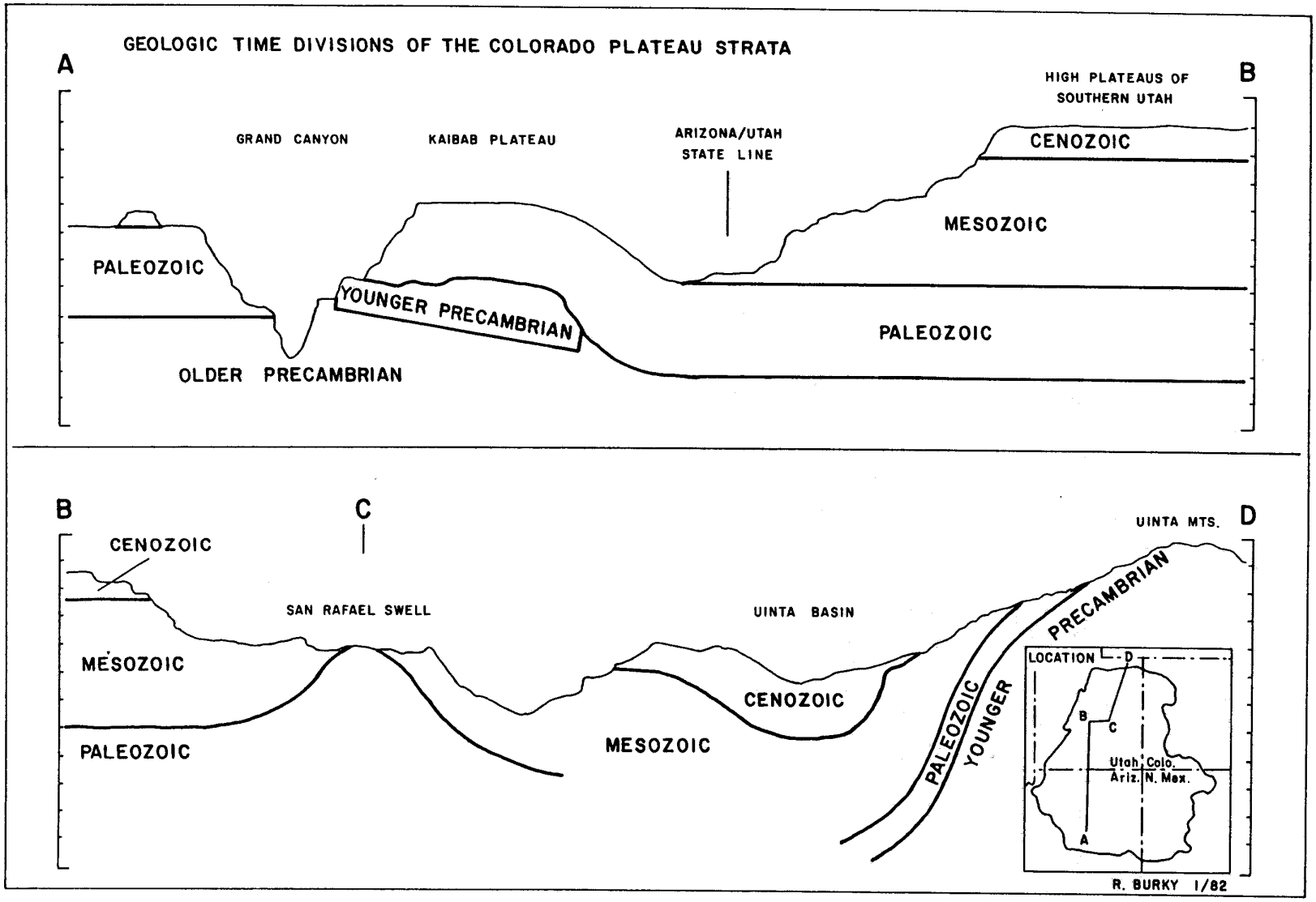
GEOLOGIC TIME DIVISIONS OF THE COLORADO PLATEAU STRATA
A
B
HIGH PLATEAUS OF SOUTHERN UTAH
GRAND CANYON
KAIBAB PLATEAU
ARIZONA/UTAH STATE LINE
CENOZOIC
MESOZOIC
PALEOZOIC
YOUNGER PRECAMBRIAN
PALEOZOIC
OLDER PRECAMBRIAN
B
C
D
UINTA MTS.
CENOZOIC
SAN RAFAEL SWELL
UINTA BASIN
MESOZOIC
CENOZOIC
PALEOZOIC
MESOZOIC
PALEOZOIC
YOUNGER PRECAMBRIAN
LOCATION
D
B
C
Utah, Colo, Ariz, N. Mex.
A
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FIGURE 3.

superposition of strata, it does not reveal how much time is involved in their deposition. We must examine the actual strata to get a better grasp of that factor.

To facilitate our discussion of the strata we need to take one more step. We need to construct a "geologic column." This is a common tool for communication among geologists. It summarizes a great deal of geological information into a small amount of space and greatly facilitates discussion. The geologic column is a single vertical column in which all the geologic strata of the area under discussion are illustrated in the sequence they are known to occur. This has been done for the strata of the western Colorado Plateau in figure 4.

You will note that figure 4 indicates names for each of the major strata. As in any scientific endeavor, or any other endeavor for that matter, we must name the object of our study or we cannot talk and write to others about it. This is true in geology as well. Geologists give the designation "formation" to individual strata that are unique and different enough from adjacent strata that their limits can be determined and mapped. Each formation is carefully given a unique name, usually based on the area in which the greatest exposure of that formation is located. This may seem to add a bit of complexity to our diagram but it is the only effective way to be able to discuss each individual formation or group of strata.

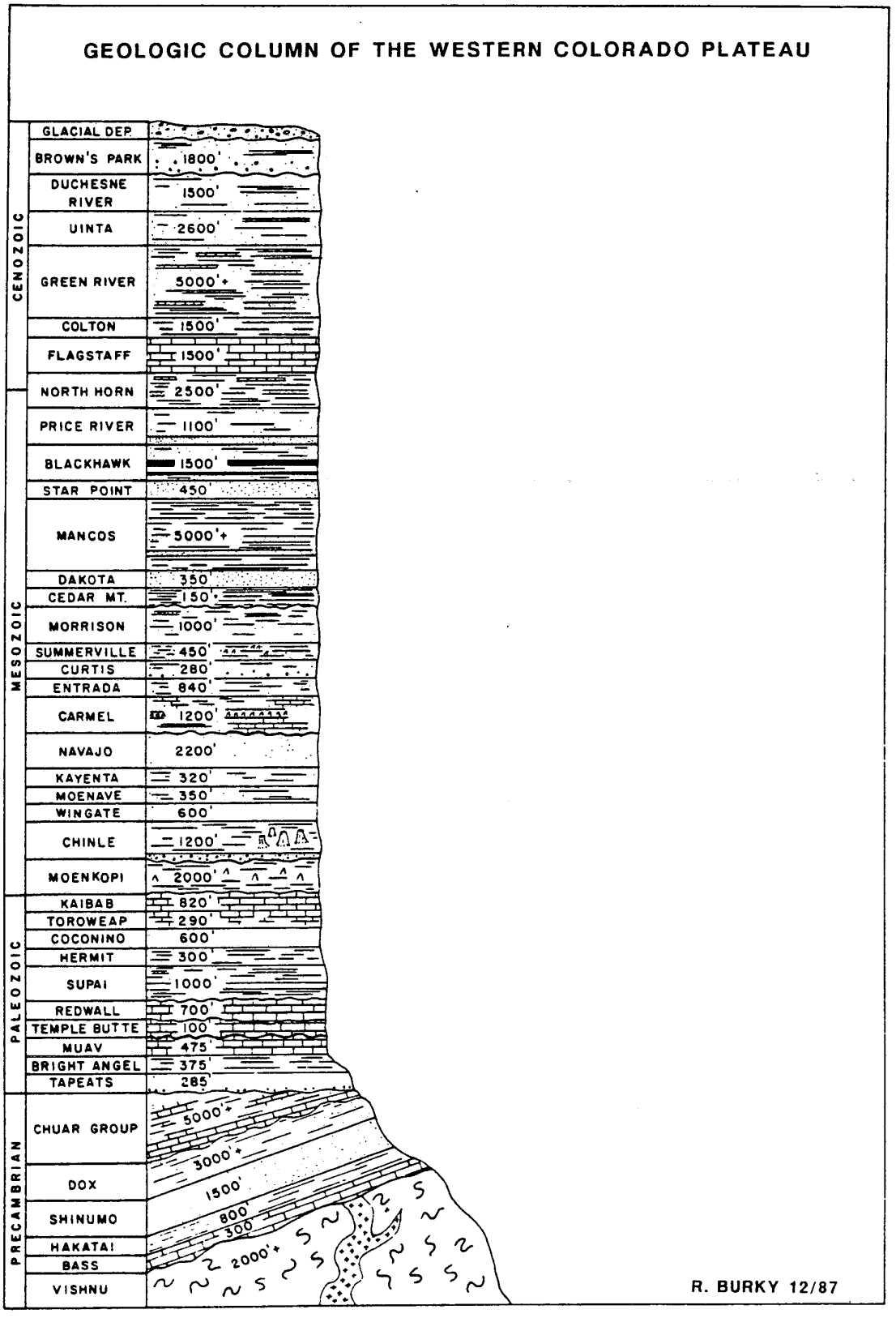
Figure 4 lists the greatest thickness of the individual formations. Exhaustive study was not made to find the absolute maximums in every instance. The idea was to convey the relative thickness of the strata we are discussing. The most prevalent type of rock that composes the formation is illustrated by the symbols in the column. These are explained in the legend in the upper portion of figure 2.

Major Time Indicators

We are now ready to discuss the key issue of this chapter. Do the sediments in the strata indicate rapid deposition? Or do they indicate slow moving geologic processes working over a long period of time?

At the base of the geologic column (Fig. 4) we find the oldest rocks in the area. They make up the formation that has been named the Vishnu. These are crystalline rocks, dramatically different than the softer sedimentary rock strata overlying them. One's first conclusion might be that these were the original crust of the earth. But this is not so. Closer examination reveals that this formation is composed of metamorphic rock. This rock type has been altered into its current form by heat and pressure. Its original mineral constituents have been remelted and recrystallized. Further exploration of the Vishnu reveals a few areas that have not been fully altered. Here remnants of sedimentary rock structures are found, proving that at least part of the Vishnu had been

FIGURE 4.


GEOLOGIC COLUMN OF THE WESTERN COLORADO PLATEAU
CENOZOIC
MESOZOIC
PALEOZOIC
PRECAMBRIAN
GLACIAL DEP.
BROWN'S PARK
1800'
DUCHESNE RIVER
1500'
UINTA
2600'
GREEN RIVER
5000'+
COLTON
1500'
FLAGSTAFF
1500'
NORTH HORN
2500'
PRICE RIVER
1100'
BLACKHAWK
1500'
STAR POINT
450'
MANCOS
5000'+
DAKOTA
350'
CEDAR MT.
150'
MORRISON
1000'
SUMMERVILLE
450'
CURTIS
280'
ENTRADA
840'
CARMEL
1200'
NAVAJO
2200'
KAYENTA
320'
MOENAVE
350'
WINGATE
600'
CHINLE
1200'
MOENKOPI
2000'
KAIBAB
820'
TOROWEAP
290'
COCONINO
600'
HERMIT
300'
SUPAI
1000'
REDWALL
700'
TEMPLE BUTTE
100'
MUAV
475'
BRIGHT ANGEL
375'
TAPEATS
285'
CHUAR GROUP
5000'+
3000'+
DOX
1500'
SHINUMO
800'
300'
HAKATAI
2000'+
BASS
VISHNU
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made up of sedimentary rock prior to its having been recrystallized. Other parts of it, because of mineral content, are thought to have been lava flows.

Consider the amount of time and the geologic processes it would take to produce the Vishnu. First sediments had to be deposited. Where did they come from? Did they weather from igneous rocks like granite or from previously existing sedimentary rocks? If so, this took considerable time. The next required step is that the sediments had to be buried deep enough to be altered by heat and pressure. Such conditions would not have been present on the surface of the earth. After the heat and pressure had altered the rocks, the overlying material had to be eroded away. Certainly this whole process would have taken a lot of time. Millions of years? Probably. That would seem reasonable to expect if it is all done through natural processes. We know from experience that hundreds of feet of crystalline rock do not weather away in a few thousand years. Scientists have dated the time of the re-crystallization of the Vishnu at 1.7 billion years ago by radiometric dating (Rb/Sr method).

Rock monuments of ancient civilizations have stood for thousands of years and, in many cases, show only slight deterioration due to weathering. Yet, the surface of the Vishnu was weathered almost level before the later sediments were deposited upon it. Peneplained, a geologist would say. This certainly took a considerable amount of time.

Upon this leveled surface the first unaltered sedimentary rocks were deposited. The evidence for depositional time within the individual formations will be considered later. For now we want to consider the whole unit made up of the formations: Bass, Hakatai, Shinumo and Dox, as well as the Chuar group of formations. (See figure 4).

Notice that this group of strata are tilted in relation to the strata overlying them. Were they deposited in this inclined manner? No. Sedimentary strata are, for all practical purposes, always deposited horizontally. After the deposition of these strata major faulting occurred. This was followed by a long period of erosion. How do we know? Over much of the area all of the strata are eroded off the Vishnu. In a few areas where they were protected from erosion by having been downfaulted, they are preserved. In addition, the whole surface area was reduced to a fairly level surface with just a few remaining hills, probably none of which were more than several hundred feet high. The Vishnu had previously been covered with nearly two miles of sedimentary rock! It must have taken considerable time to deposit the sediments as well as to erode them off again.

Note a simple proof that a long period of time elapsed after the faulting and even after most of the erosion had occurred. Severe weathering of the uppermost Vishnu took place prior to the deposition of overlying layers that currently remain in the horizontal position in which they were deposited. In places the crystalline rocks of the upper surface of the Vishnu are severely weathered to a depth of 12-20 feet or more. It requires a considerable amount of time to weather the crystalline rocks to this depth. However,

remember that this weathering represents only an extremely small fraction of the total time in the major erosional interval. The evidence shows that hundreds, if not thousands, of feet of this material have been removed. It is clear that this sequence of events did not occur rapidly.

Depositional Time Indicators Within The Individual Strata

We will now systematically evaluate a few of the depositional time indicators within the sedimentary strata themselves. We will use the local geologic column to graphically illustrate these features. It will simplify the process if we evaluate one type of evidence at a time and point out where it occurs throughout the entire column of strata. Seven major phenomena will be examined. These are not all inclusive. There could be many more. These were chosen because they are easily understood and commonly occur. Of course, not every place (stratigraphic level) where they occur will be noted. Some are so common it would be nearly impossible to do so. Others, though they may occur relatively often are not necessarily recorded in the literature. And, it is physically impossible for a person to examine all the outcroppings of all the strata. As one examines the strata and reads the literature more of these time indicators are continually discovered. One could not hope to find them all. But we have more than enough to prove our point.

The seven phenomena we will be examining to show depositional time are:

1. Limestone structures formed in situ by living algae

2. Other "living surfaces"

3. Wind blown sand deposits (fossil deserts)

4. Evaporation deposits

5. Weathering and erosion surfaces between strata

6. Separation of depositional environments

7. Fossil mud cracks

Our primary purpose is to show that the strata were not rapidly deposited in a few years or in a few thousand years. The amount of time it actually took is more difficult to determine. It seems reasonable to accept the time indicated by methods based on the radioactive decay rates of elements. But it is beyond the scope of this article to adequately examine and evaluate these methods.

#1 Time Evidence: Limestone Structures Formed In Situ By Living Algae (Figure 5)

Certain algae precipitate lime (calcium carbonate) as they grow in lakes or in the ocean. These algae can build up sizeable limestone structures over a long time period. In the tropical oceans what we commonly think of as "coral reefs" (technically called bioherms) are often made up of a large proportion of lime deposited by algae. The structures algae form are uniquely characteristic. They consist of thinly laminated, concentric layers of lime, usually with undulating, domed, or rounded surfaces. These are common in many parts of the geologic record.

Their significance to us is to show that the sediment in which they are found was not deposited rapidly. The algae were living and depositing their thin laminae of lime layer by layer for a long time. In some strata in the area we are discussing, these lime deposits are in layers up to 15 or 20 feet thick. In addition, there are many thinner layers above and below the thicker ones. The layers are sometimes scattered through several hundreds of feet of strata. These hundreds of feet of strata are thus shown to have been deposited over an extended time period.

Figure 5 indicates several different formations which contain substantial algal deposits. In most of these, the algal limestone layers also occur at many different levels within the formation.

#2 Time Evidence: Other "Living Surfaces" (Figure 6)

These are surfaces within the strata that show evidence of being on-going living "floors" during the time when the strata was being deposited. Perhaps the most obvious of these are surfaces on which there are petrified tree trunks standing in their growth position. Their roots reach into the underlying, previously deposited strata. Their trunks are covered by strata that were deposited later. The time the surface existed as a "living surface" was at least as long as it took the tree or trees to grow. Though they are not necessarily common, standing petrified tree trunks occur in many different locations around the world. Some are 13 feet or more in diameter.

Another obvious indicator are fossil oyster beds. These are commonly six to eight feet thick. Some are scattered through beds of 20 feet or more thickness. In some areas the shells are so pure and plentiful they are scooped up and used for maintaining roadways in place of gravel! These beds of shells are not mixed with foreign sediments or abraded by extensive transport. They are buried on the surfaces where they lived and died.

Dinosaur, four-footed animal and bird footprints (see figure 6) occur in many formations, and at different levels within those formations, throughout the strata sequence.

FIGURE 5

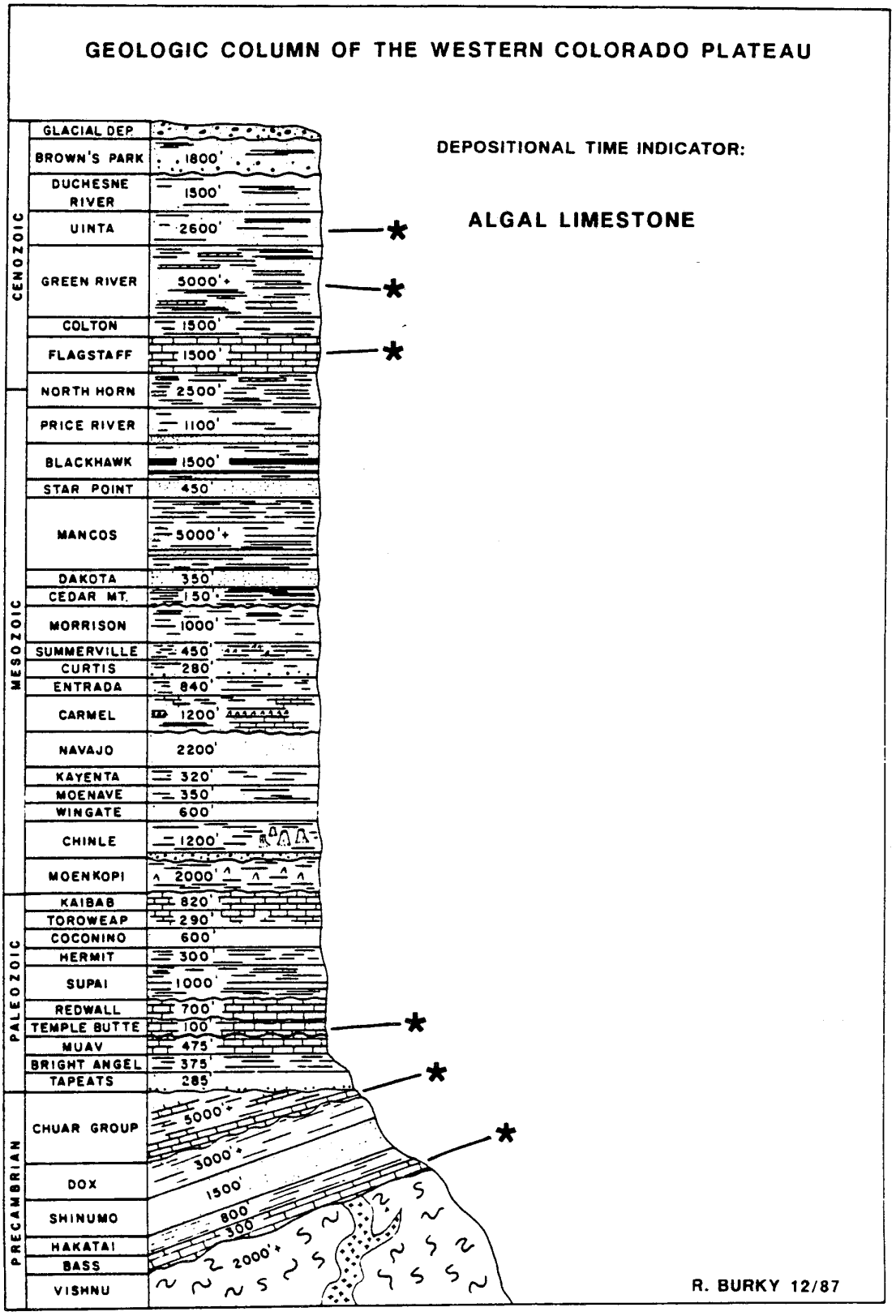
GEOLOGIC COLUMN OF THE WESTERN COLORADO PLATEAU
DEPOSITIONAL TIME INDICATOR:
ALGAL LIMESTONE
CENOZOIC
MESOZOIC
PALEOZOIC
PRECAMBRIAN
GLACIAL DEP.
BROWN'S PARK 1800'
DUCHESNE RIVER 1500'
UINTA 2600'
GREEN RIVER 5000'+
COLTON 1500'
FLAGSTAFF 1500'
NORTH HORN 2500'
PRICE RIVER 1100'
BLACKHAWK 1500'
STAR POINT 450'
MANCOS 5000'+
DAKOTA 350'
CEDAR MT. 150'
MORRISON 1000'
SUMMERVILLE 450'
CURTIS 280'
ENTRADA 840'
CARMEL 1200'
NAVAJO 2200'
KAYENTA 320'
MOENAVE 350'
WINGATE 600'
CHINLE 1200'
MOENKOPI 2000'
KAIBAB 820'
TOROWEAP 290'
COCONINO 600'
HERMIT 300'
SUPAI 1000'
REDWALL 700'
TEMPLE BUTTE 100'
MUAV 475'
BRIGHT ANGEL 375'
TAPEATS 285'
CHUAR GROUP 5000'+
3000'+
DOX 1500'
SHINUMO 800'
300'
HAKATAI 2000'+
BASS
VISHNU
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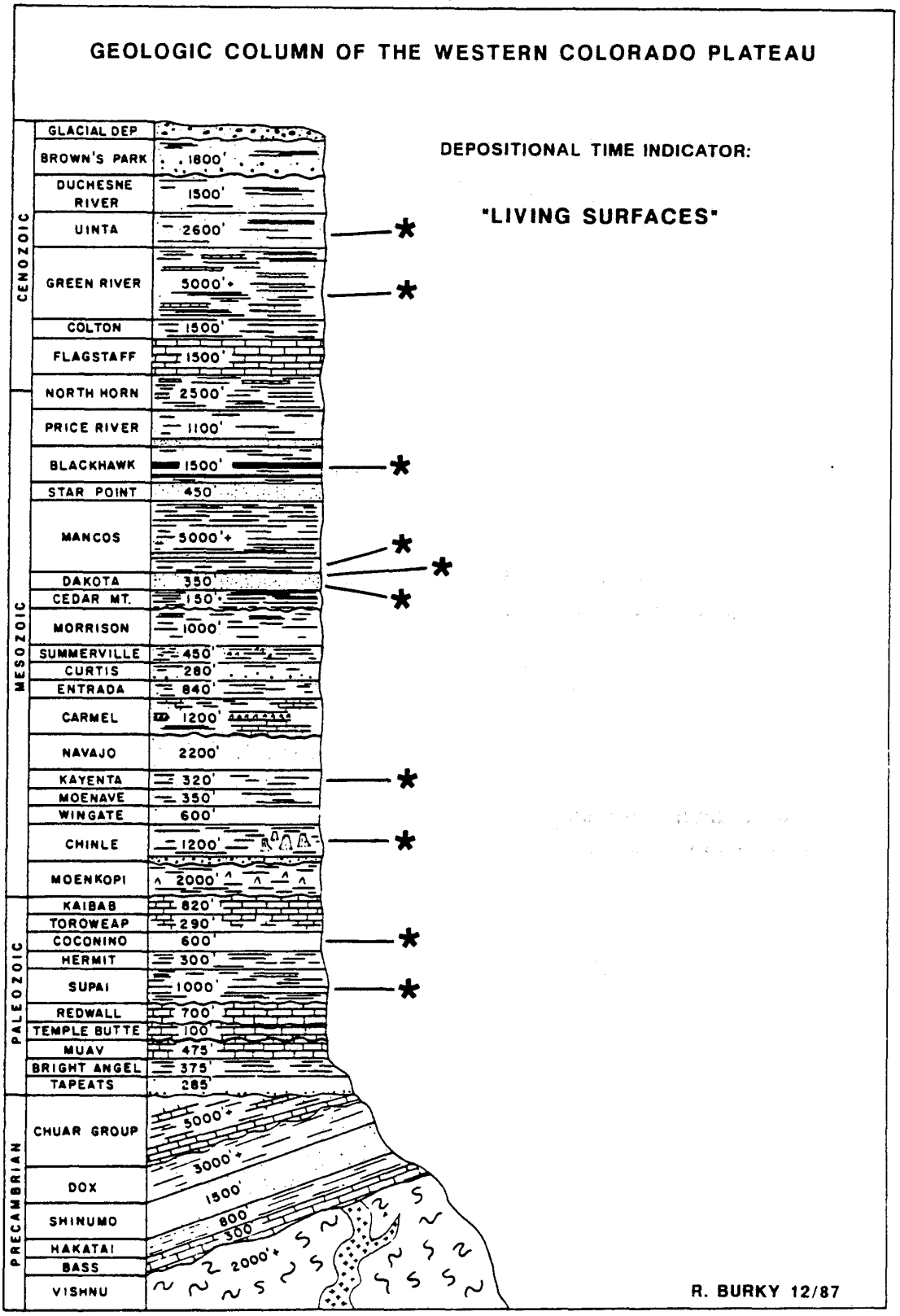
FIGURE 6


GEOLOGIC COLUMN OF THE WESTERN COLORADO PLATEAU
DEPOSITIONAL TIME INDICATOR:
"LIVING SURFACES"
CENOZOIC
MESOZOIC
PALEOZOIC
PRECAMBRIAN
GLACIAL DEP
BROWN'S PARK 1800'
DUCHESNE RIVER 1500'
UINTA 2600'
GREEN RIVER 5000'+
COLTON 1500'
FLAGSTAFF 1500'
NORTH HORN 2500'
PRICE RIVER 1100'
BLACKHAWK 1500'
STAR POINT 450'
MANCOS 5000'+
DAKOTA 350'
CEDAR MT. 150'
MORRISON 1000'
SUMMERVILLE 450'
CURTIS 280'
ENTRADA 840'
CARMEL 1200'
NAVAJO 2200'
KAYENTA 320'
MOENAVE 350'
WINGATE 600'
CHINLE 1200'
MOENKOPI 2000'
KAIBAB 820'
TOROWEAP 290'
COCONINO 600'
HERMIT 300'
SUPAI 1000'
REDWALL 700'
TEMPLE BUTTE 100'
MUAV 475'
BRIGHT ANGEL 375'
TAPEATS 285'
CHUAR GROUP 5000'+
3000'+
DOX 1500'
SHINUMO 800'
300'
HAKATAI
BASS 2000'+
VISHNU
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Had the strata been deposited by a worldwide flood, which would have to be at least several hundred feet deep, animals would not have been walking around and making tracks!

#3 Time Evidence: Wind Blown Sand Deposits (Fossil Deserts) (Figure 7)

Three of the formations listed are interpreted to be fossil deserts. The materials that comprise the strata of these formations were deposited by the wind. The sand grains are of relatively uniform size. The finer material has been winnowed out and blown away. The coarser material could not be picked up and moved by the wind currents. The grains are often well rounded and pitted in a way common to windblown sand. Virtually the only record of life is the footprints preserved on some of the bedding surfaces. The bedding pattern of the sand is characteristic of that laid by the wind. Typical sedimentation structures and characteristics observed in strata deposited in water are missing. However, in some of these fossil desert areas there were apparently temporary lakes. In these areas the bedding of the sand is markedly different, even though the composition of the sediments remains the same. This illustrates the point that one can often easily tell the difference between wind and water as a depositional medium.

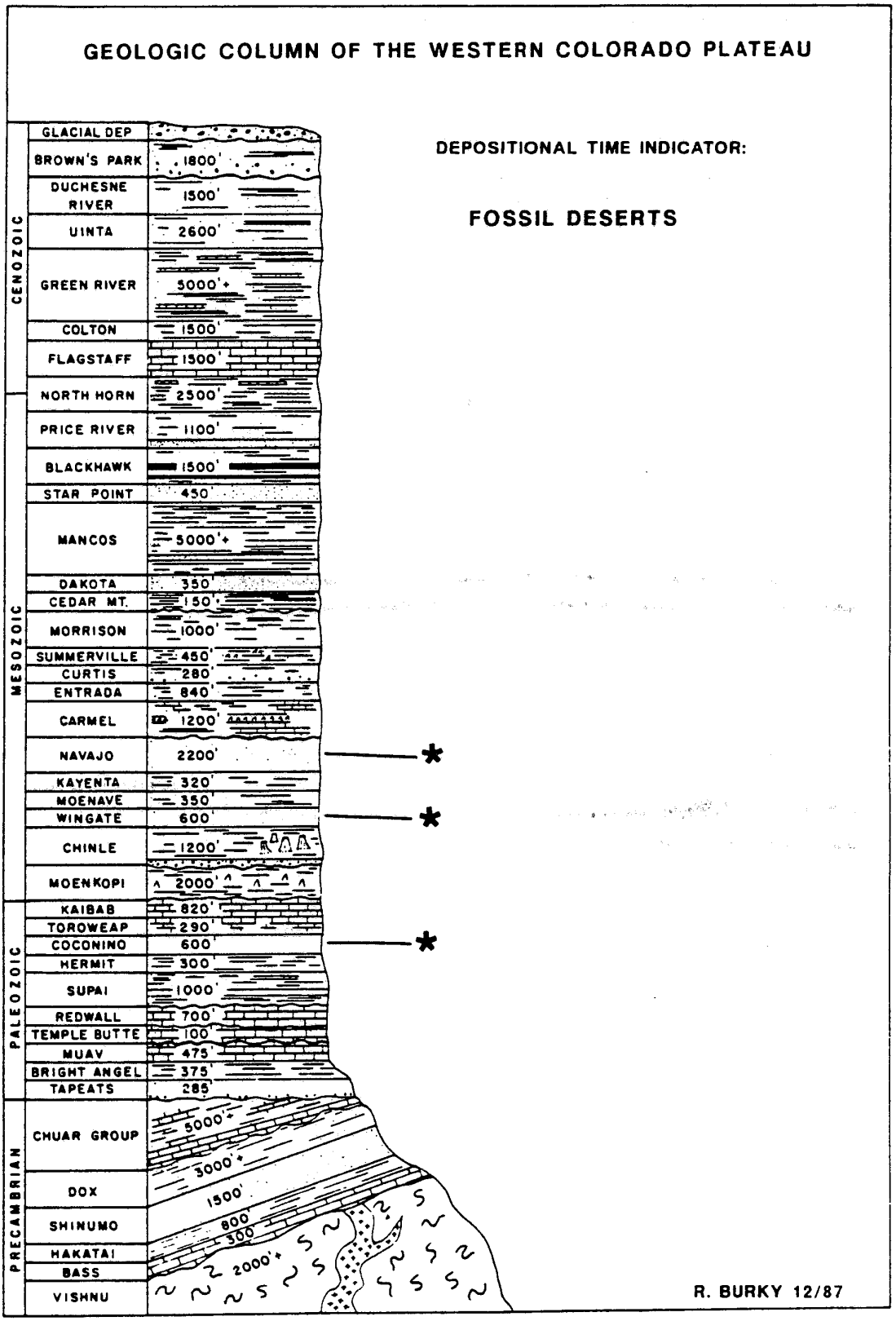
The conclusion should be obvious. One would not expect to find wind deposited sediments in the middle of those deposited during a catastrophic flood.

#4 Time Evidence: Evaporation Deposits (Figure 9)

Within many strata are found thick beds of water soluble minerals. The most common of these are salt (NaCl) and gypsum (CaSO4). If the sediments in which they occur were deposited under worldwide flood conditions, the water soluble minerals would not have been deposited. They would rather have been dispersed widely by the excessive amounts of water. The only reasonable explanation for the concentration and deposition of these minerals is the evaporation of large quantities of water. This could only have occurred during the depositional time period because the evaporate deposits are covered by thousands of feet of overlying sediment.

Figure 8 illustrates how the three most common water soluble minerals in seawater precipitate out when it is evaporated. As the volume of seawater is reduced 15% by evaporation, calcium carbonate begins to precipitate out. When the volume is reduced to 80%, the mineral gypsum (calcium sulphate) is precipitated. When the volume is reduced 10% further, common table salt (sodium chloride) begins to precipitate out of solution. The bottom part of the illustration in figure 7 shows the relative amounts of each of the three minerals that can be dissolved in seawater.

FIGURE 7


GEOLOGIC COLUMN OF THE WESTERN COLORADO PLATEAU
DEPOSITIONAL TIME INDICATOR:
FOSSIL DESERTS
CENOZOIC
MESOZOIC
PALEOZOIC
PRECAMBRIAN
GLACIAL DEP
BROWN'S PARK
1800'
DUCHESNE RIVER
1500'
UINTA
2600'
GREEN RIVER
5000'+
COLTON
1500'
FLAGSTAFF
1500'
NORTH HORN
2500'
PRICE RIVER
1100'
BLACKHAWK
1500'
STAR POINT
450
MANCOS
5000'+
DAKOTA
350
CEDAR MT.
150'
MORRISON
1000'
SUMMERVILLE
450'
CURTIS
280'
ENTRADA
840'
CARMEL
1200'
NAVAJO
2200'
KAYENTA
320'
MOENAVE
350'
WINGATE
600'
CHINLE
1200'
MOENKOPI
2000'
KAIBAB
820'
TOROWEAP
290'
COCONINO
600'
HERMIT
300'
SUPAI
1000'
REDWALL
700'
TEMPLE BUTTE
100'
MUAV
475'
BRIGHT ANGEL
375'
TAPEATS
285
CHUAR GROUP
5000'+
3000'+
DOX
1500'
SHINUMO
800'
300
HAKATAI
2000'+
BASS
VISHNU
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PRECIPITATION OF MINERALS BY THE EVAPORATION OF SEA WATER

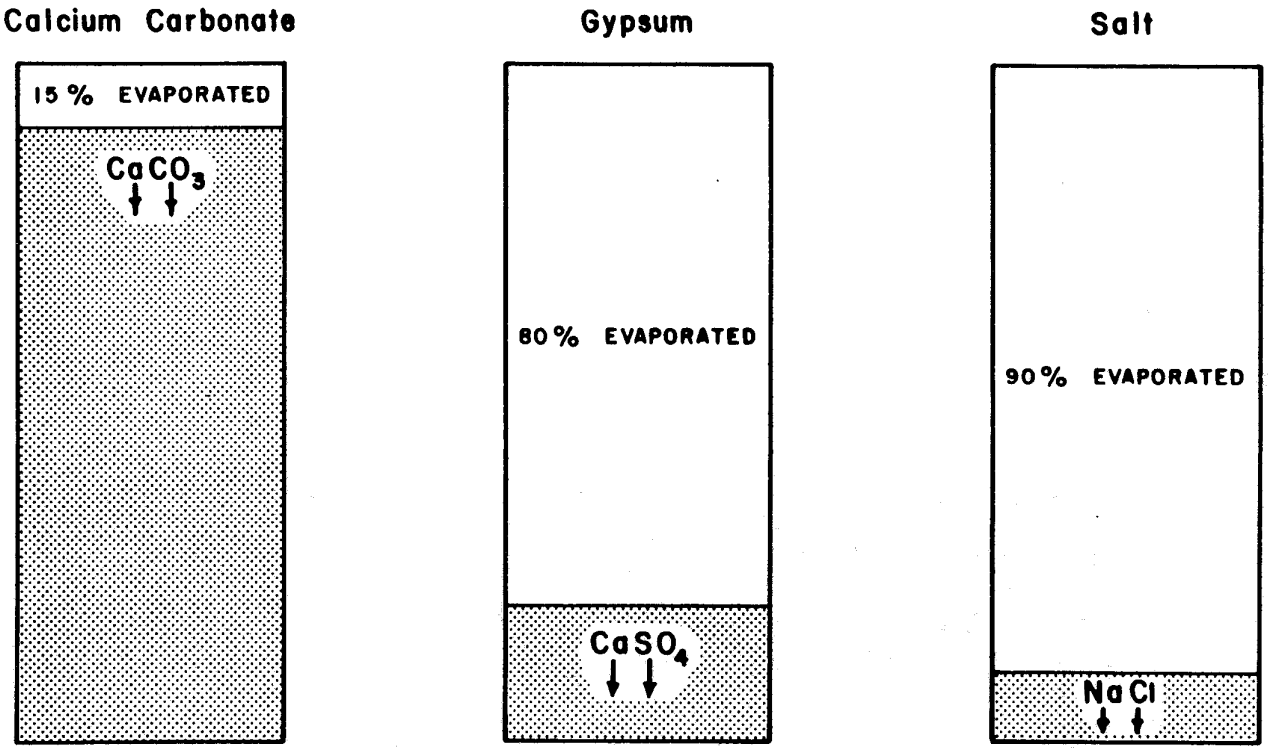
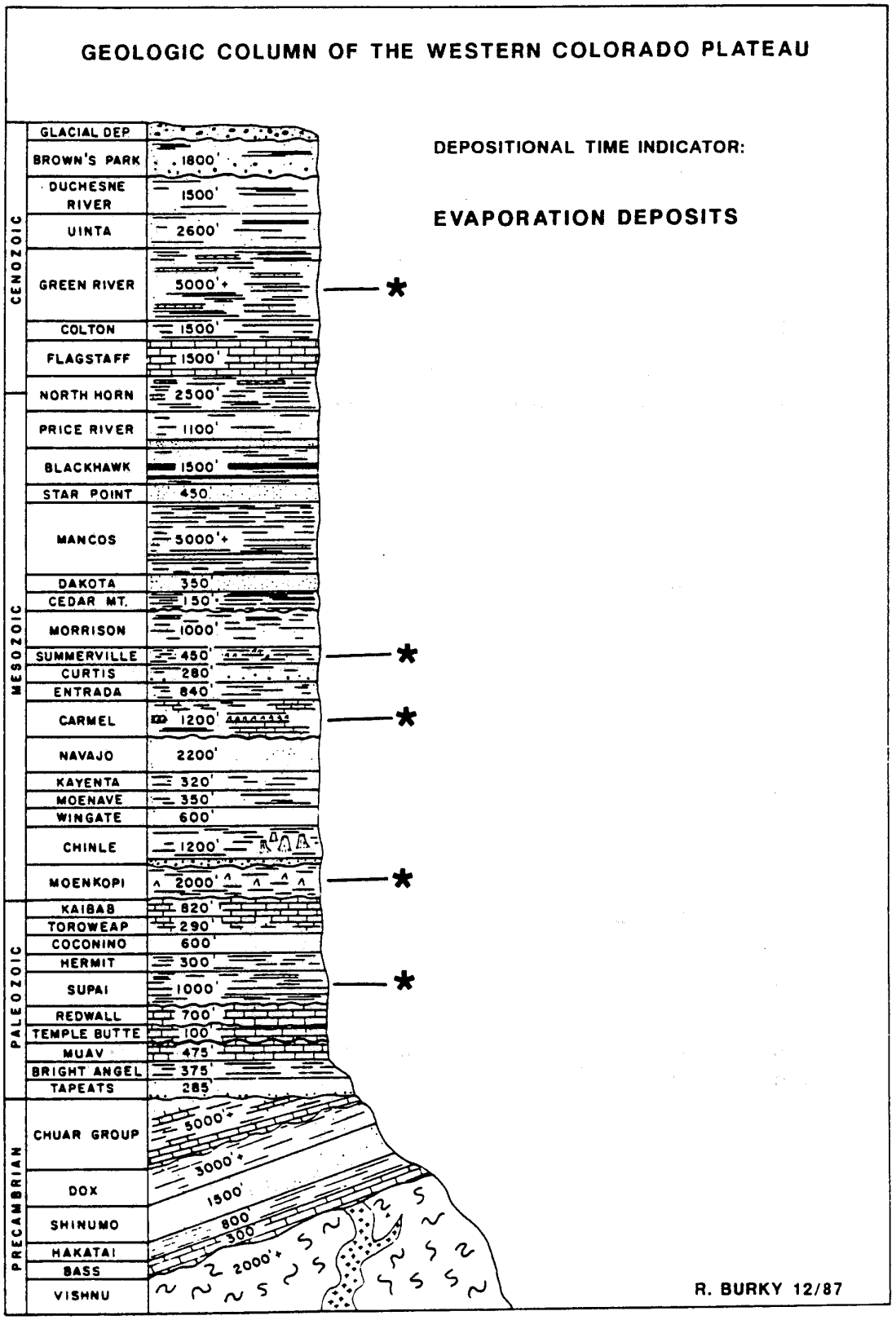


FIGURE 8

FIGURE 9


GEOLOGIC COLUMN OF THE WESTERN COLORADO PLATEAU
DEPOSITIONAL TIME INDICATOR:
EVAPORATION DEPOSITS
CENOZOIC
MESOZOIC
PALEOZOIC
PRECAMBRIAN
GLACIAL DEP
BROWN'S PARK 1800'
DUCHESNE RIVER 1500'
UINTA 2600'
GREEN RIVER 5000'+
COLTON 1500'
FLAGSTAFF 1500'
NORTH HORN 2500'
PRICE RIVER 1100'
BLACKHAWK 1500'
STAR POINT 450'
MANCOS 5000'+
DAKOTA 350'
CEDAR MT. 150'
MORRISON 1000'
SUMMERVILLE 450'
CURTIS 280'
ENTRADA 840'
CARMEL 1200'
NAVAJO 2200'
KAYENTA 320'
MOENAVE 350'
WINGATE 600'
CHINLE 1200'
MOENKOPI 2000'
KAIBAB 820'
TOROWEAP 290'
COCONINO 600'
HERMIT 300'
SUPAI 1000'
REDWALL 700'
TEMPLE BUTTE 100'
MUAV 475'
BRIGHT ANGEL 375'
TAPEATS 285'
CHUAR GROUP 5000'+
DOX 3000'+
SHINUMO 1500'
HAKATAI 800'
BASS 300'
VISHNU 2000'+
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In the strata of the Colorado Plateau bedded layers of the minerals salt and gypsum occur quite often. The formations in which they occur most often are noted in Figure 9. Sediments that lie east of the Grand Canyon in a stratigraphic position equivalent to the Supai formation contain a thousand feet of salt and gypsum deposits! These were encountered in wells drilled in search of oil and gas. This is perhaps the thickest deposit of evaporite minerals in the area. However, they also occur at many different stratigraphic levels and geographic locations. Beds 10 to 20 feet thick are by no means rare. In Emery County, Utah the Carmel formation alone is estimated to contain 9.7 billion tons of gypsum!

#5 Time Evidence: Weathering and Erosion Surfaces (Figure 10)

If the geologic strata were indeed caused by a worldwide catastrophic flood, one would not find weathering surfaces and certain erosional features between the strata. Figure 10 points out prominent levels where these occur in the area. The ones indicated are some of the more prominent ones. This is by no means a comprehensive chart. In some formations boulders are found that were formed from the erosion of lower (older) solidified formations. This shows that the older formation was deposited, lithified (sediments cemented together), later eroded, and then worn into rounded boulders prior to the deposition of the overlying formation.

In other places, such as between the Redwall and the Supai in the Grand Canyon, the limestone of one formation was dissolved and formed collapsed caverns prior to the deposition of the overlying formation.

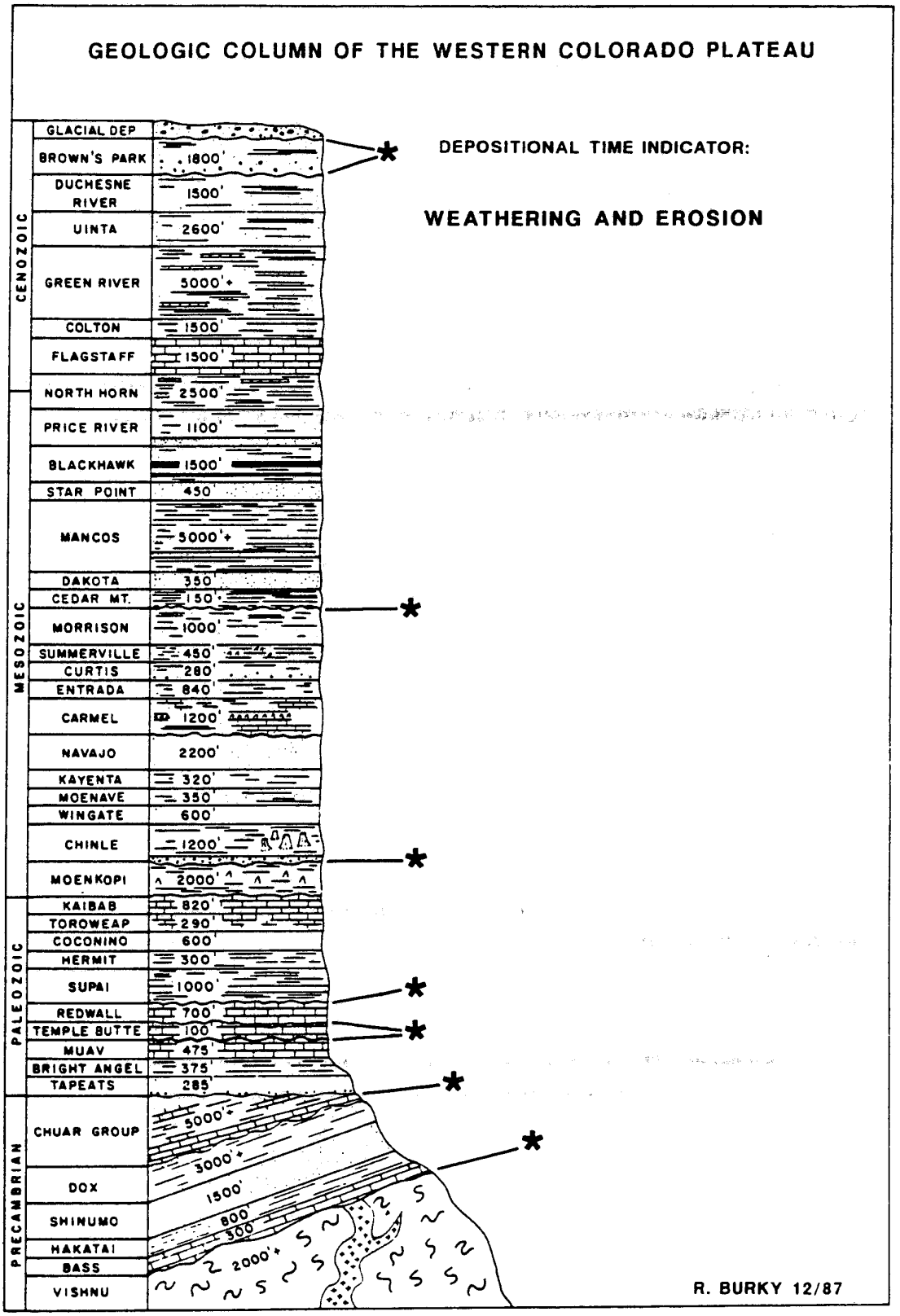
#6 Time Evidence: Separation of Depositional Environments

Different strata contain evidence showing they were deposited in different environments. The nature of this evidence can be structural, compositional, chemical and/or biologic. Terrestrial deposits, those formed on the land as opposed to those formed in the ocean, often contain plant fossils, land animal fossils, footprints, and a total absence of marine fossils and depositional features. As an extreme example, one does not find fossil coral reefs in the middle of terrestrial sediments!

If the strata were the result of catastrophic floods one would expect elements of all these different environments to be mixed thoroughly and buried together. Such a jumbled mix is **not** what you find in the geologic record. Different environments are clearly deposited separately.

A specific example of a formation deposited under marine conditions might help emphasize the point. In central Utah the lower 300 feet of the Mancos formation is

FIGURE 10


GEOLOGIC COLUMN OF THE WESTERN COLORADO PLATEAU
DEPOSITIONAL TIME INDICATOR:
WEATHERING AND EROSION
CENOZOIC
MESOZOIC
PALEOZOIC
PRECAMBRIAN
GLACIAL DEP
BROWN'S PARK
1800'
DUCHESNE RIVER
1500'
UINTA
2600'
GREEN RIVER
5000'+
COLTON
1500'
FLAGSTAFF
1500'
NORTH HORN
2500'
PRICE RIVER
1100'
BLACKHAWK
1500'
STAR POINT
450'
MANCOS
5000'+
DAKOTA
350'
CEDAR MT.
150'
MORRISON
1000'
SUMMERVILLE
450'
CURTIS
280'
ENTRADA
840'
CARMEL
1200'
NAVAJO
2200'
KAYENTA
320'
MOENAVE
350'
WINGATE
600'
CHINLE
1200'
MOENKOPI
2000'
KAIBAB
820'
TOROWEAP
290'
COCONINO
600'
HERMIT
300'
SUPAI
1000'
REDWALL
700'
TEMPLE BUTTE
100'
MUAV
475'
BRIGHT ANGEL
375'
TAPEATS
285'
CHUAR GROUP
5000'+
3000'+
DOX
1500'
SHINUMO
800'
500'
HAKATAI
BASS
2000'+
VISHNU
R. BURKY 12/87

made up of very uniform, fine grained sediment that is almost black in color. Throughout this section of the formation microscopic marine organisms called foraminifera are extremely abundant. Each gram of the sediment averages between 1,000 and 5,000 fossils of these organisms. (There is about 28 grams in an once.) Fossils of terrestrial organisms are totally absent. With such a concentration of purely marine organisms it is difficult to consider any other environment or mode of deposition than that of a sea bottom receiving sediments over a long period of time.

#7 Time Evidence: Fossil Mud Cracks (Figure 11)

The implication of this depositional feature should be obvious. Mud does not dry out and shrink while it is under water! It has to be exposed to the surface and drying conditions for a while before it even begins to crack. If the earth were covered with water, mudcracks would not be forming while the strata were being deposited.

The small number of levels indicated for mudcracks in Figure 11 does not do justice to the number of levels at which they actually occur. Mudcracks are quite common in formations. They probably occur at hundreds of different levels within some formations. They occur in nearly every major terrestrial formation. However, they are so common they are not particularly noteworthy. Hence, many writers do not make particular mention of them except in passing. The ones indicated are those most familiar to the author or that are particularly noted in the literature. The number and vertical location of the ones listed, however, are quite adequate to prove the point being made.

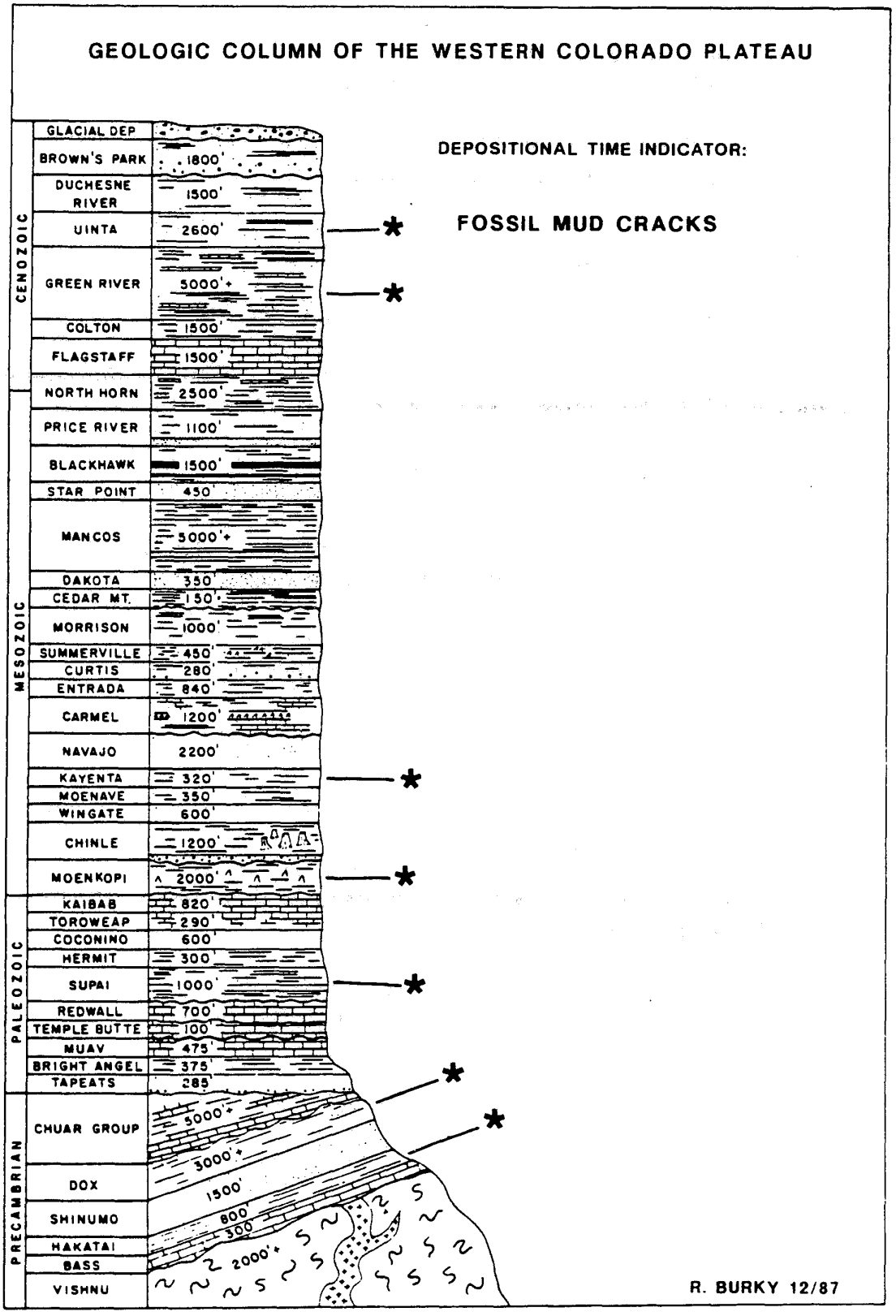
Summary

The geologic record clearly indicates that the earth has been in existence for a long, long time and that slow geologic processes have been at work throughout that time. The major strata have been deposited in a relatively slow manner under a variety of different environmental conditions. They are not the result of one or more cataclysmic floods of worldwide proportions.

A secondary purpose is to verify that the geologic time periods are not hypothetical constructions based merely upon theoretical concepts and ideas. They are instead based upon the observed reality of the physical record.

In the next chapter we will examine the life forms found as fossils within these strata.

FIGURE 11


GEOLOGIC COLUMN OF THE WESTERN COLORADO PLATEAU
DEPOSITIONAL TIME INDICATOR:
FOSSIL MUD CRACKS
CENOZOIC
MESOZOIC
PALEOZOIC
PRECAMBRIAN
GLACIAL DEP
BROWN'S PARK
1800'
DUCHESNE RIVER
1500'
UINTA
2600'
GREEN RIVER
5000'+
COLTON
1500'
FLAGSTAFF
1500'
NORTH HORN
2500'
PRICE RIVER
1100'
BLACKHAWK
1500'
STAR POINT
450'
MANCOS
5000'+
DAKOTA
350'
CEDAR MT.
150'
MORRISON
1000'
SUMMERVILLE
450'
CURTIS
280'
ENTRADA
840'
CARMEL
1200'
NAVAJO
2200'
KAYENTA
320'
MOENAVE
350'
WINGATE
600'
CHINLE
1200'
MOENKOPI
2000'
KAIBAB
820'
TOROWEAP
290'
COCONINO
600'
HERMIT
300'
SUPAI
1000'
REDWALL
700'
TEMPLE BUTTE
100'
MUAV
475'
BRIGHT ANGEL
375'
TAPEATS
285'
CHUAR GROUP
5000'+
3000'+
DOX
1500'
SHINUMO
800'
300'
HAKATAI
2000'+
BASS
VISHNU
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Chapter 5: WHAT DOES THE GEOLOGIC REALLY SHOW?

Part II: Fossils and the Faunal Succession

Do the fossils found in the geologic strata reveal a progressive development of living organisms from older to younger strata? Is the faunal succession that is often cited as the "proof" of evolution a true feature of the geologic record? ...or, is it only a theoretical idea? These are the questions we will explore in this chapter.

In the last chapter a geologic column was developed for the strata found in the western portion of the Colorado Plateau. We will refer back to this column and examine the fossils that are found in the individual strata. While doing this we will compare these fossils to those forms of the commonly accepted faunal succession. The geologic column we will be discussing is illustrated in figure 12.

It will be remembered from the last chapter that the different strata represented deposition in many different on-going environments. We obviously do not expect to find the fossil marine organisms of a marine environment in overlying terrestrial sediments. Even terrestrial environments that succeed one another will not necessarily contain the same kind of animals. For example, only a few thousand years ago mastodons and mammoths roamed the area around Los Angeles where I am now sitting. Fossils of these are found in the world famous Rancho La Brea tar pits and elsewhere in the vicinity. Today the closest natural occurrence of similar animals is in Africa, nearly half a world away! Yet, geologically, the area has changed very little since that time. If future strata are deposited on the La Brea site, someone in the distant future might wonder why no elephant-like creatures are found in the immediately overlying strata, just a few feet above the ones with an abundance of fossils. It might appear that only a little time had elapsed between the deposits, although evidence of a weathering surface and other evidence for depositional change should be present.

This example should warn us to beware how we interpret missing evidence. Dramatic changes in the depositional environment often keep us from being able to trace specific animal lines step by step through overlying strata. To follow lines of animals through sequential strata often requires being able to examine known sequential strata over wide spread geographical areas. Perfect knowledge of any

FIGURE 12

FOSSIL ORGANISMS FOUND IN COLORADO PLATEAU STRATA

	GEOLOGIC FORMATIONS	FOSSILS
CENOZOIC	GLACIAL DEP.	BISON
	BROWN'S PARK	NO FOSSILS
	DUCHESNE RIVER	EARLY MAMMALS (CARNIVORES, HERBIVORES, RODENTS AND INSECTIVORES), FISH, TURTLES, CROCODILES, LIZARDS
	UINTA	
	GREEN RIVER	EARLY MAMMALS, FRESH WATER SNAILS AND CLAMS, MANY FISH, ALGAL LIMESTONE STRUCTURES, ABUNDANT FLY LARVA, INSECTS (MOSQUITOES, BEETLES, ANTS, FLIES, BEES), LIZARDS, TURTLES, CROCODILES, OSTRACODES, LEAVES
	COLTON	EARLY MAMMALS AND "HORSES" (PHENOCODUS, CORYPHODON, "EOHIPPUS")
	FLAGSTAFF	FRESH WATER SNAILS AND CLAMS
MESOZOIC	NORTH HORN	UPPER STRATA - EARLY MAMMALS LOWER STRATA - LAST OF THE DINOSAURS
	PRICE RIVER	
	BLACKHAWK	DINOSAUR TRACKS, COAL BEDS, LEAVES (FIG, WILLOW, SEQUOIA)
	STAR POINT	
	MANCOS	SNAILS, CLAMS, OYSTERS, SHARK TEETH, FISH SCALES, CEPHALOPODS, FORAMINIFERA, OSTRACODES, COAL BEDS
	DAKOTA	500+ SPECIES OF PLANTS, INCLUDING FIG, OAK, WILLOW, PALM, SASSAFRAS, POPLAR
	CEDAR MT.	PETRIFIED WOOD
	MORRISON	FIRST MAMMALS, MANY DINOSAURS, CROCODILES, TURTLES, SNAILS, FRESH WATER CLAMS
	SUMMERVILLE	
	CURTIS	CORAL, SQUID-LIKE ANIMALS
	ENTRADA	
	CARMEL	OYSTERS, CLAMS, SNAILS, CRINOIDS
	NAVAJO	DINOSAUR TRACKS
	KAYENTA	CLAMS, DINOSAUR TRACKS (RARE)
	MOENAVE	EARLY CROCODILES
	WINGATE	
	CHINLE	FIRST DINOSAURS, EXTINCT LARGE AMPHIBIANS AND REPTILES, EARLY BONY FISH, SNAILS, CLAMS, INSECTS, MANY PLANTS AND LARGE TREES
	MOENKOPI	EXTINCT AMPHIBIANS, COELACANTHS, SNAILS, CLAMS, SEA URCHINS, CEPHALOPODS, OSTRACODES
PALEOZOIC	KAIBAB	EARLY SHARKS, SNAILS, CLAMS, SPONGES, CORALS, SEA URCHINS, TRILOBITES, CRINOIDS, BRYZOANS, BRACHIOPODS, CEPHALOPODS, FORAMINIFERS, OSTRACODES
	TOROWEAP	
	COCONINO	ANIMAL TRACKS (20 VARIETIES), INSECT TRAILS — NO ACTUAL FOSSILS FOUND
	HERMIT	PLANTS (SEED FERNS), ANIMAL TRACKS, INSECTS
	SUPAI	BARREN OF FOSSILS IN THE GRAND CANYON AREA
	REDWALL	SNAILS, CLAMS, EARLY SHARKS, CORAL, SEA CUCUMBERS, TRILOBITES, ALGAE, BRYOZOANS, BRACHIOPODS, CRINOIDS, BLASTOIDS, SPONGES, CEPHALOPODS, FORAMINIFERS, OSTRACODES
	TEMPLE BUTTE	PRIMITIVE ARMORED FISH, ALGAL LIMESTONE STRUCTURES
	MUAV	TRILOBITES, SNAILS, SPONGES, BRACHIOPODS (MARINE SHELLFISH, MOSTLY EXTINCT), EARLY CRUSTACEANS, CYSTOIDS
	BRIGHT ANGEL	
	TAPEATS	
PRECAMBRIAN	CHUAR GROUP	ALGAL LIMESTONE STRUCTURES, SOME FOSSILS OF UNCERTAIN IDENTITY
	DOX	
	SHINUMO	
	HAKATAI	
	BASS	ALGAL LIMESTONE STRUCTURES
	VISHNU	NO FOSSILS

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"line" of animal is practically impossible because of such environmental and depositional changes. However, even from our limited study area certain progressions can be verified and broad generalizations can be validated.

Now let us briefly examine the types of fossils found in the strata of our study area. We will start with the lowermost strata in the column and work upward. Refer to figure 12.

Vishnu

In the recrystallized sediments and lava flows of this formation no recognizable fossil life forms have yet been found. Strata of equivalent radiometric age in other parts of the world have produced evidence of life in the form of bacteria and algae.

Bass

The first fossils in the area are found in these strata. The fossils are algae. These were mentioned in the last chapter as an evidence for time. They have built up limestone formations layer by layer. In these strata the algae themselves are not preserved, only the characteristically layered limestone formations that they produce remain.

Hakatai through Dox

No fossils are reported from these formations.

Chuar Group

Algal limestone structures occur at several levels in these strata. Also reported are some small scale-like circular structures that seem to be fossils of living organisms but are the subject of considerable debate and many different interpretations. Algae is the only clearly identifiable fossil life form that is found here.

Tapeats through Muav

With these strata we at last reach the first strata with abundant fossils. There is a wide variety of fossil marine organisms found in them. Perhaps the most

notable of these are the trilobites. Others that occur are primitive snails, brachiopods (a type of marine shellfish that looks superficially like a clam), sponges, early crustaceans, and some other less familiar marine organisms.

Temple Butte

In this formation are found the first fossils of vertebrate animals in our study area. These fossils are the bony plates of a primitive armored fish. Complete fossils of this type of fish have been found in strata of equivalent age in eastern North America, Britain and elsewhere. It is at this stage of geologic time that fish are found in relative abundance. They are such a dominate fossil form in this part of the record that it has become known as the "fish age," technically labeled the Devonian.

These fish are definitely not of modern design. They are decidedly different and primitive.

Redwall

The next formation in our local geologic column is the Redwall limestone. It contains a great number and variety of fossils, but they are all of marine organisms. There are teeth of early sharks which have long since become extinct. Many of the fossils are recognizable in general type such as snails, clams, corals, bryozoans, trilobites, crinoids, algae, fish, cephalopods, brachiopods, etc. Some of these are extinct, but many are still alive today. However, the living varieties of most are vastly different than those found as fossils. This is especially true for the fish, snails, clams, and cephalopods.

Supai, Hermit and Coconino

These three formations are terrestrial, that is deposits which have formed on the land rather then in the ocean. Some are wind blown deposits, others are deposited in intermittent lakes and streams, still others are river flood plain or mud flat deposits.

Fossils are extremely rare in the Supai. The depositional environment was vastly different than that of the marine limestone below it. In the Supai a few footprints of land animals have been found but no actual bones.

The Hermit is noted for fossil ferns and other terrestrial plants. Tracks and

trails of at least 20 different types of animals have been found there.The Coconino is a fossil desert. Tracks and trails are the only fossils found in it.

Toroweap and Kaibab

Once more we find strata that have been deposited in a marine environment. Both formations contain an abundant variety of marine fossils. Sponges, clams, snails, brachiopods, crinoids, etc. The last known fossils trilobites are found in the Kaibab. They have never been found in any of the overlying strata. Teeth of early or primitive sharks are found in these sediments as well. The Kaibab is the formation that forms the rim of the Grand Canyon.

Moenkopi

Once again there is a major change in the depositional environment though the sea was probably not far away. The strata in this formation are primarily terrestrial, however, there are some layers in the western portion of the area that were deposited in a marine environment. The majority of the Moenkopi strata were probably deposited in a low-lying area located near the ocean. There is environmental evidence for lakes, rivers, dry lakes, lagoons and flood plains... as well as for mud flat and marine conditions. The sediments found are characteristic of these environments and the fossils represent types of organisms that would live in these environments.

Two types of fossils from the Moenkopi are of special interest to us, large extinct amphibians and a type of fish called the coelacanth. The fossil amphibians were a type that is totally different than anything on earth today. Some were up to eight and ten feet in length. A similar type was found in Europe in strata of the same age had a skull which alone was four feet long! Soon after the deposition of the Moenkopi and a few succeeding formations, these giant amphibians are no longer found in the fossil record. Nothing like them has lived since. This is true for the strata of the Colorado Plateau, and for the geologic strata worldwide.

The coelacanth fish found here are a different story. It was a relatively common fish in that day and continued to be found in the fossil record through the period of the dinosaurs. For years paleontologists thought they had gone completely extinct, since they are not found as fossils after the time of the dinosaurs. However, in the first half of the current century a fisherman caught a coelacanth off the east coast of Africa. Since that time several more have been caught. One can even observe preserved specimens of the actual fish in some museums today. This example points out how careful one must be of the

conclusions he draws from the geologic record. A worldwide lack of fossils would indicate that the animal was extinct, but would not prove it. However, we must remember that the coelacanth is an exception, not the typical situation.

Chinle

The Chinle strata mark the beginning of a very significant time period in the history of life on earth. In this formation has been found the oldest fossil of a dinosaur in the Colorado Plateau, and possibly in the world. These were small reptiles of a basic skeletal design we have come to call "dinosaur" when we find much larger ones in later strata. At least one dinosaur genus of the Chinle, Coelophysis, is also found in similar age strata in the northeastern United States.

The Chinle strata were deposited in a terrestrial environment. In addition to early dinosaurs, which were obviously land dwelling, we find many other land dwelling animals. The giant amphibians mentioned in the last section continue to live in Chinle times. There are "alligator-like" reptiles called, phytosaurs, which are neither alligators nor crocodiles, but a totally different type of reptile. Other four legged reptiles of considerable size, but now long extinct, were common.

There are many fossils of fresh water fish. The coelacanths were still abundant. Teeth of a lungfish quite similar to living lungfish from Australia have been found. This fish has been considered one of the "living fossils" of the world so it is not surprising to find its remains in such old strata. All the fish in the Chinle have a very definite primitive appearance when compared to modern fish. Their appearance is illustrated in figure ___.

Being a terrestrial environment with a tropical, swampy character, one would expect to find fossil plants. This is indeed the case. At least 58 species of plants have been identified. A few of these are "living fossils" types, e.g., ferns, ginkgos, cycads, Equisetum, etc. which are still living today, but there were not the modern angiosperms that are so familiar to us. Here too then we find a plant and animal world of primitive design.

It is the Chinle formation that contains the giant petrified trees (some standing where there they grew) of the Petrified Forest National Park.

Wingate, Moenave and Kayenta

These three formations were all deposited in terrestrial environments, but those environments were not all identical. The Wingate is a fossil desert much like the

Coconino we have already discussed. The Moenave and Kayenta sediments were deposited primarily by water rather than wind. Reported fossils are few. Some dinosaur footprints and a few clams are found.

Navajo

The Navajo strata record a very extensive desert environment with massive sand dune deposits. At Zion National Park the formation reaches thicknesses of 2200 feet. It forms sheer cliffs hundreds of feet high. These desert deposits can be traced from southern Nevada to Northwestern Wyoming. Rare dinosaur footprints and a few bones are about the only fossils found.

Carmel

The environment once again changes to marine conditions. The topmost sands of the Navajo desert are mixed with an abundant marine fossil assemblage and redeposited in a manner that shows water, not wind, as the medium of deposition. Many thick deposits of gypsum occur within this formation. These are formed by the evaporation of large quantities of sea water. In some area there are even thick deposits of salt (sodium chloride). Though the contrast in environments is dramatic, the evidence that it occurred is clear.

The fossils, though abundant, add little new to our story. They are species that are typically extinct but belong to types or groups of organisms that continue to exist.

Entrada, Curtis and Summerville

These formations contribute little additional information to what has already been said. The first was deposited under terrestrial conditions. The next two under marine conditions. The Entrada contains few fossils. The Curtis contains abundant
marine fossils.

Morrison

The Morrison is a widespread and important formation. It is traced from northern New Mexico to southern Canada and from the high plains in the Dakotas to western Montana. It has produced abundant dinosaur remains. Many museums

have quarried specimens from its sediments. The Morrison represents a time during the middle of the dinosaur "reign" on earth. There is an extensive variety of dinosaurs found in it. These are considerably "advanced" in design and variety over those found in the Chinle Formation.

Even more important, it is in this formation that the bones of the first mammals were found.

Cedar Mountain

This formation is the only representation of deposition for the long time period called the Lower Cretaceous. The period is represented by great thicknesses of strata in other areas, but is barely represented in the study area. The Cedar Mountain is a thin formation and is not known to contain any particular fossils of significance to this study.

Dakota

The Dakota is likewise is a very widespread formation. It is predominately sandstone. In vast areas of the High Plains it can be drilled for the water it has carried from the Rocky Mountains. Its chief importance to us is the immense number of plant fossils found there. Over 500 species have been identified. Many modern angiosperms appear for the first time. The fossils found include figs, oaks, willow, palm, sassafras, poplar, etc. Dinosaur foot prints are found in the Dakota.

Mancos

Once more there is a major change of environment. These strata represent the western edge of an extensive strata that were deposited in a sea that extended across the central interior of the United States, from the Gulf of Mexico to the Arctic Ocean. Dinosaurs roamed the highlands and fringing swamps. These swamps produced vegetation that later was buried and turned to coal. Casts of dinosaur foot prints are found in many of the coal mines of central Utah. Giant sea turtles plied the sea. So did swimming reptiles. Oyster beds lined the shoals. A great variety swimming mollusks, called ammonites, akin to the modern nautilus, lived in the sea. Some of these had coiled shells, others had straight ones. Some reached rather enormous sizes. They were of worldwide distribution but all became extinct about the same time as the dinosaurs.

The fossils found in the Mancos all represent a shallow sea environment.

Shark's teeth are abundant at certain locations.

Star Point, Blackhawk and Price River

These three formations were deposited in basically terrestrial environments at the edge of the inland sea. They are composed of sediments that eroded from the highlands to the west. The Blackhawk is the major coal producing formation in central Utah. Dinosaur footprints are encountered in the coal mines. Of course, plant fossils abound.

North Horn

This formation marks an important turning point in the history of life on earth. It is during the time of the deposition of these strata that the dinosaur realm was ended and the primitive mammals replaced them. In the lower portion of the formation are found fossil dinosaur bones, in the upper portion, mammal bones.

The mammals found here are considerably different than those found in the Morrison formation. These are much bigger and of a more modern design. However, you still could not define them in terms of modern day mammals. To do so would be like asking if Henry Ford's first four wheeled, self propelled "car" was a Fairlane, Escort or Thunderbird.

This major change in life forms was made without any dramatic changes in the ongoing geologic processes that were depositing the strata. While this is true for the immediate area, it may or may not be true on a worldwide basis.

Flagstaff

Strata of the Flagstaff were deposited in extensive freshwater lakes. There is little of significance to note. The common fossils are algae, clams and snails. Some 37 species of mollusks have been identified. It is strata of this age and environment that have been eroded to fashion the exquisitely beautiful landforms seen at Bryce Canyon National Park and Cedar Breaks National Monument.

Colton (Wasatch)

A few fossils of the early horse "eohippus" are found in the strata named the Colton. However, nearby in southern Wyoming there are extensive strata deposited

at this time period. These contain "eohippus" along with quite a variety of fossils of other early mammals, including tapirs and primates. Most are not as primitive as those which were encountered in the North Horn formation, but they are significantly different than modern mammals.

Green River

Once again we find an extensive series of lake deposits. The Green River contains vast reserves of oil shale. It is also especially noted for its fine fossil fish. Except for a few "living fossil" types, these fish all have a very modern appearance to them. Some look practically identical to their modern counterparts. The formation contains many layers of algal limestone which show that it was deposited over a long time period. There are also well preserved fossil leaves of typically modern types of plants, many insects, bird and duck tracks. Since the sediments were primarily deposited in a lake, we would not expect to find many land animals. Fossils of crocodiles and snakes are found, however.

Uinta

The Uinta formation was probably deposited primarily on river flood plains. It contains a substantial number of fossil land mammals. Among other early mammals is a lemur-like early primate and an early rhinoceros. At this time there lived large, grotesques herbivores known as uintatheres. They had giant spade-like canine teeth and large bony protuberances on their heads. In size they compared to a modern African rhino. The whole line went extinct long ago, apparently soon after the deposition of the Uinta Formation. Crocodiles are also found in these strata. The climate thus appears to have continued to be tropical.

The Unita contains some layers of algal limestone.

Duchesne River

The origin of the sediments of this formation is quite obvious. They come directly from the slopes of the Uinta Mountains to the north. Many of the boulders can be traced directly back to source formations from which they came. The strata contain many "fossil" river channels which, at one time or another, carried the water away from the mountain slopes, eroding the mountains and depositing Duchesne River.

The fossils found include several different early rhinos, other extinct early

mammals and crocodiles. One important fossil found here is an advanced form of the fossil horse eohippus, called Epihippus.

Brown's Park

This formation was deposited considerably later than the Duchesne River. The sediment in it contains much "dust and ash" from volcanic activity. Fossils are rare.

Summary

After the deposition of the Brown's Park the whole area was uplifted to considerable elevation. The Uinta Mountains eventually reached elevations that were high enough to support glaciers during the "Ice Ages." By that time fully modern types of animals were living on earth along with some extinct types like the sabertooth cats, mastodons, mammoths, giant sloths, etc.

Thus we see that these geologic strata record a progression of life forms that correspond to the generally accepted faunal succession. If we expanded the geographic area of our study we would find that we could trace the progressive development of many individual animal lines as we progressed upward through the geologic record. There is a very definite faunal succession found in geologic strata. It is not a theoretical or arbitrary conclusion, it is reality.

Chapter 6: FAUNAL "LINES" IN THE GEOLOGIC STRATA

As we have seen, most fossil organisms show change in structure and design as we progress upward through the strata. A few remain virtually unchanged for extremely long periods of time. These are the exceptions, however, not the rule. Land animals especially seem to show remarkable changes with time.

In Paleozoic time amphibians were the dominant land animals, by the Mesozoic the amphibians had been greatly diminished and reptiles became the dominant form. During the Cenozoic mammals predominated. During each of these major time periods the animals were made up of groups of organisms. Each of these groups had certain "family" characteristics that gave reason to classify them together. These groups or "families" show progressive feature development with time. Among the Cenozoic mammals some of the better known "families" that show progressive development with time are the horses, "elephants" (proboscideans), camels, rhinos, cats and dogs. The progressive characteristics are most commonly shown in the design of the teeth, skull, and feet. The "families" mentioned all have modern representatives. There are many other "family" lines that have simply ceased to exist. Some, after living for very long periods of time and going through considerable developmental change. Many dinosaur lines could be cited as examples. But there were many mammal lines as well that are now completely extinct. Most of these are animals identified only by their scientific names and totally unknown to the typical person.

In this chapter we want to examine in more detail several of these "family" lines to better understand the true nature of the fossil record and the type of the changes that have occurred through time within "families" of organisms. We will be looking at the horses, "elephants" (more accurately the proboscideans - animals with well developed trunks), and the hominids.

The Horse Family Line

We will start with one of the most well known and best documented fossil animal lines, that of the horse. Some, particularly those with a fundamental religious orientation, have misapplied statements by paleontologists and feel the fossil evidence for the development of the horse is purely hypothetical or fictitious. Such is not the case. Some

of the earlier concepts of orthogenesis (development in a simple, direct, straight line) that had been applied to the horse line were found to be in error. Fossils of the horse family do not show a direct, single line from eohippus (Hyracotherium) to the modern horse, Equus, as was originally thought. The story ended up being far more complicated than that. It is usually the paleontologist's statements against this straight line (orthogenesis) concept that some fundamentalists misinterpret. They feel that the paleontologists are saying the physical evidence for progressive development in fossils of the horse family doesn't really exist in the geologic record. This conclusion is entirely wrong as we will see.

The first fossil organism attributed to the horse line by most paleontologists is Hyracotherium, better known to most by its now disqualified name, "eohippus." Some may question assigning this form to the horse family. In many ways it certainly doesn't look like a horse. It's teeth, feet and size do not come close to the resemblance of a modern horse. However, they do not look that dramatically different than an early member of the horse line called, Mesohippus. The structural development of Mesohippus can be traced step by step up through the geologic record to the modern horse. Therefore, the assignment of Hyracotherium to the horse family is not as unreasonable as it might appear on first consideration.

Hyracotherium (Eohippus) had four toes on the front feet and three toes on the rear feet. Each of the toes had a small hoof on it. In later, and physically overlying strata, other similar forms are found. These forms are known as Orohippus and Epihippus in the respective stratigraphic order. They still retain four toes on the front feet and three on the rear. The major change is in the teeth. In Orohippus the premolar next to the first molar is squared off to make it function as a molar, rather than being its normal triangular shape. In Epihippus two premolars next to the first molar are squared off to function as the molars.

The next form in the sequence is called Mesohippus. It has only three toes on it's front feet and retains three toes on the rear. It is larger than eohippus. Three premolars are squared off and function as molars. This situation remains the same in the modern horse. The first, and remaining premolar, is still there but is greatly reduced, and almost non-functioning, tooth. Hence, this feature is complete in its change in the horse Mesohippus.

There is considerable difference between Epihippus and Mesohippus. But there is also a major change in the depositional environments in the areas of the American West where most of these forms have been found. Strata containing fossils of the time period between Epihippus and Mesohippus are either missing or very scarce in the areas where intermediate forms would most likely be found. There may have been more intermediate forms for which a fossil record does not exist; or has not been found. Therefore, we do not know the complete situation at this time.

Fossils of Mesohippus are very abundant in certain strata found in South Dakota, Nebraska, and Wyoming. Mesohippus fossils are also found in strata in Southern California of equivalent age.

After Mesohippus a slightly larger form called Miohippus occurs. Other than in size it is not that much different than Mesohippus. After Miohippus are found several different types of horses that appear to be taking several different directions. These all, however, retained three-toed feet. In a sequence of forms called Anchitherium, Hypohippus and Megahippus the teeth generally just increased in size, but remained of the identical design. The animals themselves increased considerably in size. A fourth form of this line that lived about the same time as Anchitherium, is named Archeohippus. It retained the same tooth design as Anchitherium, but was much smaller. It was a true miniature horse. Some were almost as small as certain Hyracotherium (eohippus) forms.

In the next form of the line, Parahippus, substantial design changes occur. This form is found in strata of the age of the latest Miohippus fossils, . There is an increase in size but this is not all that unique, many other horses did the same. The most dramatic change is found in the teeth. The crowns are substantially heightened. More importantly, there are changes in the basic design of the tooth. The enamel fold pattern on the grinding (occlusal) surface of the tooth becomes more complex. This is the first step in creating a much more durable and effective grinding tooth.

This horse still had three toes on its front and rear feet. If you saw it, you would probably immediately recognize it as a horse in spite of its three toes and different teeth. Fossils of Parahippus are found in the strata overlying those containing Mesohippus fossils in South Dakota, Nebraska, Wyoming and California. They are also found in many other areas of the American West. Some are even found in Florida.

In about the middle of the time during which Parahippus is found as a fossil, a new horse, Merychippus, begins to be found. It has a fully developed new style of tooth that will be used in all the "progressive" forms from then on. The teeth were shorter, and more curved, but of essentially the same design as those found in our modern horses. The enamel folds have been greatly increased. A new substance called "cement" has been added to the deep valleys in the tooth to prevent food from trapped in the valleys which would promote tooth decay. It is also added to the outside of the tooth to support the otherwise brittle, exterior enamel walls. This made the tooth a very effective grinding tool. Merychippus was, however, still a three-toed horse.

Toward the later end of the time Merychippus is found in the fossil record another new variety of fossil horse is found. This horse was the first to have but a single functioning toe. It is called Pliohippus. The single toe is the most obvious progressive feature. (However, a few specimens in this genus still retain the additional toes in a greatly reduced, vestigial form.) Its teeth also showed some progressive features. They

were considerably longer, generally quite slender, curved, but were of the same basic design as the teeth of Merychippus.

The modern horse, Equus, is found in the record after fossils of Pliohippus. There does not appear to be much overlap in the range of the two forms. Equus usually has a more robust skeleton. Its teeth are straighter, longer and more massive than those of Pliohippus. The skull of Equus also had some different features than that of Pliohippus.

A characteristic of the skull that made considerable change through the sequence from Hyracotherium to Equus is the bony bar immediately behind the eye. This bar was little more than a bony knob in Hyracotherium. In Mesohippus it closed about half of the open space behind the eye. A few specimens of Parahippus have the bar complete, but in most it is a bony protrusion that covers perhaps half to three quarters of the space behind the eye. The genus Merychippus and all later fossils of that "family line" have a solid bony bar behind the eye. The Anchitherium-Megahippus sequence, however, did not have a solid bar behind the eye even though some of the line lived at the same time as the latest Merychippus.

This presentation has simplified the real situation a bit. It concentrated on those horses that were in the design line tending more and more toward the modern horse. There are several more types of fossil horses that we should mention to complete the horse record. During the long time period in which the horses Parahippus, Merychippus, and Pliohippus are found, there were additional horses. All of these had three toes on both their front and rear feet. We have mentioned already mentioned Hypohippus, Archaeohippus, and Anchitherium. All of these retain the "old" style tooth. So did a similar form, called Megahippus, that had teeth of gigantic proportions. Hypohippus and Megahippus continued to live even during the time of the early single toed horses.

Hipparion, which lived at the time of Merychippus and Pliohippus, had a fully modern style tooth. It differed from the progressive Pliohippus in that it had three toes and had a different enamel pattern on the occlusal surfaces of its teeth. But it lived a long time and its fossils are wide spread geographically. Its teeth are even found with the tools and bones of the early hominids in Africa and Israel.

There was also Neohipparion which was quite similar to Hipparion but with a different pattern on the tooth's occlusal surface. A pygmy horse, Nanippus, with teeth designed like both Hipparion and Neohipparion only much smaller, lived for a long time and left an abundant fossil record. Another pygmy horse, called Calippus lived in the early part of the same period. Though it lived before Pliohippus, it had a tooth with an enamel fold design on the occlusal surface which was the same style as Pliohippus.

All these variations tend to complicate the picture, but in no way negate the development pattern that is visible in the "progressive" line.

The fossils of the horses mentioned are found in sequences of strata that are in direct physical superposition. That means one strata layer is lying physically in contact with the overlying one. These fossil horses were not all living at the same time even though some had overlapping ranges. Eohippus is never found in situ in the same strata as Equus, Merychippus, or even Mesohippus. Nor are Mesohippus, Parahippus, or Miohippus found with Pliohippus. There is a sequence of geologic strata and of fossil horses found in them. This sequence shows a development in quality of form and design. Such sequences are found both in the central United States in the area of the High Plains as well as in the Pacific coastal areas. These sequences are far from being mere theoretical constructions. They are known from thousands of fossil specimens.

The Proboscideans (Elephants)

The elephant line is not nearly so familiar to the average person as that of the horse. It is, however, very instructive in considering the development of an animal group in the fossil record. Unfortunately the fossils of the proboscideans are found all over the world. This means that we do not have a simple direct sequence of strata in physical superposition to prove the relative age of the fossils as we did with the horse line. General ages of the fossils can be established based on the worldwide faunal sequences that have been developed over years and years of study. Radiometric dating techniques can also be used to further corroborate the time periods that the various forms lived.

The first fossils that have definite and obvious proboscidean structure are found in Egypt. The site is about 50 miles southwest of Cairo in an area called the Fayum Depression. The age of the strata in which they are found is estimated to be 30-35 million years, or about the age (Oligocene) of the Mesohippus horse fossils in North America. Two forms of proboscideans are found in these strata, Phiomia and Palaeomastodon. The first is about four and a half feet high, the second about seven and a half feet high. Each have protruding tusks on both the upper and lower jaws. These tusks are considerably smaller than those of modern elephants. The tooth design is simple and, though smaller, compares generally to that of the mastodons, which is dramatically different than that of the modern elephant or the "Ice Age" mammoth.

Tooth, tusk and head structure, along with overall size, are the most variable features of proboscidean line. We need to be aware of the differences in these features as we examine the development of the group.

Middle and late Oligocene time periods are not well represented by geologic deposits in Africa. After early Oligocene time virtually no fossil proboscideans are found until the next major geologic time period, the Miocene. However, in strata of the Miocene period are found quite a remarkable variety of forms. It is toward the end of

this time period that the first proboscideans are found as fossils in the New World. The multitude of forms found in the Miocene and since have been grouped into four basic categories: the mastodons, deinotheres, gomphotheres, and elephants.

The mastodons seem to carry on the basic appearance and structure of Paleomastodon. They were geographically widespread, having lived in Africa, Asia, Europe and North America. They generally had short lower jaws without tusks or with extremely little ones. They had sizable tusks on their upper jaws. More recent mastodons had extremely long and massive upper tusks. The mastodons heads were short and high. The progressive features we find in the mastodons, from Paleomastodon to those forms that died out only a few thousand years ago are worth noting. Paleomastodon had five teeth in each side of its lower jaw and six in each side of its upper jaw. Recent mastodons generally have only two teeth at a time in either their upper or lower jaw. This is our first introduction to the typical trend for teeth to erupt sequentially rather than all at once. This was developed to more of an extreme in the elephants. Paleomastodon had only three ridges on the rear molar. The number of ridges increased with the passage of time. First there were three, then four, and in the last of the American mastodons there were five ridges. The teeth greatly increased in overall size. The lower jaw and its tusks shortened with the passage of time. In contrast the tusks on the upper jaw were lengthened dramatically and turned upward through time.

The second group of proboscideans, the deinotheres, was certainly a unique one. It was the only group which had no tusks in the upper jaw. The tusks of the lower jaw were curved downward and backward like a rake! There are no known ancestral forms of this animal. It simply shows up in the fossil record with its unique features in the early Miocene. Then it continues in the same basic form for a long, long time. The early hominids of East Africa were familiar with this proboscidean. Its teeth were and forever remained of a low crowned, two ridged design. Its overall body appearance was that typical of the proboscidean group. The earlier forms tended to be smaller, but later forms were even larger than modern elephants. They lived in Europe, Asia and Africa.

The third group that start showing up in strata of the Miocene is the gomphotheres. The two early Oligocene proboscideans, Paleomastodon and Phiomia are often placed in this group. Sometimes only Phiomia is placed here while Paleomastodon grouped with the mastodons. Obviously it is a judgment decision and not absolutely evident from the facts.

The gomphotheres generally had long flat heads. Many had substantial tusks in both upper and lower jaws. Some had lower jaws as much as six feet long! Others had lower jaws without tusks, but the jaw itself was shaped like a giant elongated spoon! Still others had broad flat lower tusks that gave the lower jaw the function of a giant scoop shovel. They were aptly called the "shovel tuskers". Some even had flattened and rounded lower tusks giving a slight variation to the "shovel tusks". Many of the exotic features of this group failed to continue into the later geologic periods.

The gomphothere group seems to have made the greatest changes of any of the proboscidean groups. There were a great variety of types. The teeth are made up of many cross ridges with multiple cones on each ridge, often in a complicated pattern. With time, the number of ridges were increased, from three in earlier forms to seven or eight in some of the later ones. The other major trend in the gomphotheres in the shortening of the lower jaw and the loss of tusks on that jaw. Upper tusks reached gigantic proportions in some types. One later form even had upper tusks in the form of a spiral. Some paleontologists trace the design line leading to the elephants through the gomphotheres. The rationale for that reasoning is based primarily on tooth structure and design, but is too technical and detailed to explain in this paper.

The final proboscidean group, the elephants, made its appearance a bit later than the other three groups. In strata of the latest Miocene (estimated to be 10 to 12 million years ago) in Africa is found a form that is like a gomphothere but also similar in many ways to the first elephants. This genus, Stegotetrabelodon, is considered by some to be the first in the elephant line. Most of the "full" elephants are found in considerably later times (the Pleistocene, estimated to extend from ten thousand to approximately two million years ago).

Stegotetrabelodon had four major tusks, two on the top jaw and two on the bottom one. Modern elephants only have major tusks in the upper jaw. Its teeth had six or seven traverse ridges, or "plates". Later elephants have well developed teeth plates, often numbering into the twenties or thirties. Included in the elephant group are the two living species and the numerous species of mammoths of late geologic times. These are pictured in the caves of southern France by the later hominids that lived in that area.

A remarkable change was made in the teeth of some of the proboscidean groups. In concept it was quite similar to the change that was made in the teeth of the horse Merychippus. The enamel folds of the tooth were greatly multiplied and the substance called cement added outside the enamel to bind the tooth together and fill in the vacant areas of the enamel folds. In the case of the proboscideans, enamel folds were added in the form of tooth plates. Some had a greater number of plates and some a lesser number. The general trend was to add more plates as time progressed.

Thus, we see another major group of animals that has gone through a major development process while they have been living on the earth. There have been major modifications and improvements in design. The older designs have be allowed to go extinct. Tracing design lines through the maze of different types of proboscideans is a technical task beyond the scope of this paper and its projected audience. What this explanation is intended to illustrate is the great diversity of the group and the general changes that have occurred in the group throughout the latter half of the Cenozoic time period.

The Homo Line

It is now important that we consider one more line of fossil organisms found in the geologic record. These are those organisms that show a design line that leads up to that of the modern human skeleton. They occur in the geologic record after the time during which the major strata have deposited and many of the major geologic changes made in the surface of the earth. All these fossils occur in the very uppermost parts of the geologic record. By traditional radiometric dating methods this is within the last four million years. Physical geologic processes that have occurred in the earth's surface seem to verify these dates. At least the times are reasonable in light of the events that have occurred as shown in the geologic record.

I do not intend to define what is "man" and what is not "man", nor what is before and what is after "Adam". We will merely examine what fossils are found and their approximate age. The fossil hominids are skeletons (or fragments of the same) that resemble the skeleton of man more closely than they resemble any other living or fossil organism on earth. They look more like man than they look like apes.

We want to discuss these organisms by considering those fossils that have been grouped into six basic classifications based on the design and form of their skeletons. Those groups are:

The Australopithecines
Homo habilis
Homo erectus
Early Homo sapiens
The Neanderthals (Homo sapiens neanderthalensis)
Modern man (Homo sapiens sapiens)

An unbiased but keen observer could take the known skulls (At least those that are relatively complete.) and group them by general form. The skulls would fall generally into these groups. Some observers would make eight or nine groups, others might make only three or four, but the point is, these are natural groupings of like features. They are not an artificial or forced classification. Modern human skulls would not be grouped with Homo erectus or the australopithecines by an alert observer. They are substantially different than one another.

Setting the bounds of each group is subject to human judgment and thus varies. The whole process is not unlike sorting a quantity of potatoes into classified piles of large, medium and small. Ten different individuals would each have a slightly different definition of the terms large, medium and small. Endless arguments would occur if you forced these

ten people to come to an absolute consensus on each potato. The fact that they may not agree on many of the borderline potatoes does not negate the fact that the potatoes range in size from small to large. The same is true for the fossils in this line. They have certain characteristics that tie them together as all one group, they stood upright, their teeth and jaw structures are more like each other then they are like any other living or fossil organisms, their skulls are generally similar, their limbs and body structures are also similar.

But, on the other hand, within the group some are much more alike than others in the group. By grouping like together, we obtain the naturally occurring groupings listed above. An alert observer would also notice that some are more primitive and less "advanced", or human-looking, than others. With one possible exception, the more primitive and less modern looking would also be the ones found in the oldest geological contexts. The one exception is in the Australopithecines. The untrained observer might feel the reverse to be so in the "robust" line of this group. But aside from this single exception, we see a general progression in the design of these organisms with time.

There is also a progression in the design of the cultural objects and tools found with the skeletons. In Africa many of these fossils are found in actual physical superposition in the geologic strata. This occurs in the Olduvai Gorge/Laetoli area of northern Tanzania and in northern Kenya/southwestern Ethiopia. Over far wider areas the sequences of tools and cultural objects are found in correct time and stratigraphic order, but not necessarily in direct physical superposition in relation to one another. This occurs in many areas of Africa, Asia and Europe. We are dealing with well documented factual material, not mere hypothetical constructions. Thousands of hominid fossils and associated tools have been found, not just one or two "bones".

Ape vs. Hominid

What is the difference between an ape and a hominid?

We have stated that a hominid looks more like a man than like any other living or fossil organism. If man didn't exist, they look more like apes than any other organism. Specifically then, how do they compare to man and apes? Six characteristics are especially diagnostic.

1. Bipedal, upright stance and walking
2. Considerably increased brain size
3. Heavy brow ridges
4. Protruding jaws
5. Reduced size of canine teeth
6. Shape of the dental arc

Typically an upright, bipedal walking habit separates the hominids from the apes. The upright stance has necessitated many additional skeletal changes that we find in the hominids but will not elaborate on here.

Along with an upright walk, the increase in brain size is substantial. Man's ratio of brain weight to body weight is about four times that of the anthropoid apes. The brain size of a chimp is between 320 to 480 cc. The brains of a Gorilla range from 350 to 685 cc. That of modern man ranges between 1350 and 1500 cc.

The oldest hominids had a brain size between 380 and 450 cc. The brains of the later australopithecines ran around 500 cc. That of Homo habilis is estimated to range between 500 and 800 cc. The Homo erectus brain was between 900 and 1200 cc. The neanderthals' brain averaged about 1450 cc. (Note that nearly every author gives a slightly different figure for actual or "average" brain size. The magnitudes of the differences quoted by the different authors are not significant for our purpose.)

Another notable difference between the apes and the hominids is the heavy brow ridges over the eyes. In the apes they are extremely heavy. The earlier hominids also had these heavy ridges, but they became less and less prominent as we progress, time-wise, through the hominid line. The "robust" australopithecines are the one exception to this otherwise uniform trend.

A fourth feature that helps separate ape and hominid is the protruding jaws that are found in the apes. Like brow ridges this becomes less and less of a prominent feature in the hominids as time progress. In modern man the face is quite vertical.

Another obvious feature is the size of the canine teeth. In modern man and the hominids these are greatly reduced in size and length. They do not extend above the rest of the teeth in most cases. In the apes, and in most other primates, the canines are large and extend considerably beyond the biting surface of the rest of the teeth.

The last feature is the shape of the dental arcade or row of teeth. In apes the rows of side or cheek teeth (the molars and premolars) are essentially parallel to one another. This gives the jaws a deep "U" shape, making it look almost rectangular in shape when viewed from the biting (occlusal) surface. Man and the later hominids have more rounded jaws. When observed from the biting surface they are more arch or "rainbow" shaped.

We will now take a look at the individual groups of hominids in the order they appear in the fossil record.

Dating the context of the fossil hominids

In Africa they are often dated by radiometric methods, especially the potassium/argon method. In Europe they are most often dated in relation to the glacial advance periods. This is because the glaciers and the associated phenomena have left the most marked change in the surface of the land in the last million or so years. Fossil finds can often be physically related to the surface features related to a specific glacial advance. For example: during a glacial period there is an increased amount of water flowing in the rivers. This increase often results in a prominent terrace being built at a certain level. If hominid remains are found in the gravels of a particular terrace level, the glacial period with which they are associated becomes obvious.

In both Africa and Europe knowledge of the type of animals with which the hominids are found can be used to relatively date their fossils. Often the dates and progression of other animal lines are well enough known to give an approximate age determination to the hominid fossil.

Usually the dating and sequence determination for hominids are far more intricate and technical than the simple record we observed in the geologic strata of the western United States. It is well beyond the scope of this paper to prove each age of each group we will be examining. The work of dating has generally been done by competent men working with reasonable dating systems and is probably relatively accurate. A few dates may be poorly based and substantially wrong. One or two loose bricks do not cause a brick house to fall down. A few wrong dates will not destroy the veracity of the sequence we are about to examine. The overall picture is consistent.

The Australopithecines

These are the oldest and least "human-like" of the six groups. But they still look more like man than they do any other living organism, even the modern apes. They occur in the fossil record from about three and a half million to about one million years ago. So far they have only been found in Africa. There are three basic subgroups generally recognized within the australopithecines. Stone tools are first found associated with australopithecine remains.

The oldest, but most recently discovered of these groups has been given the name Australopithecus afarensis. It is found in Ethiopia at a site called Hadar and in Tanzania at a site called Laetoli. The fossils at Hadar are dated radiometrically and by associated animals. This is true as well for those at Laetoli. In addition, the beds at Laetoli have been shown to physically underlie the famous Olduvai Gorge strata that are nearby. This helps to substantiate the dates.

At Laetoli is found a famous bed of volcanic ash that has fossil hominid footprints that are radiometrically dated at three and a half million years. This bed also records the footprints of one of the latest three toed horses, the "reversed tusk" proboscidean, Deinotherium, and many other living and extinct animals. The tracks of the extinct animals help to confirm the date as well.

The famous skeleton known as "Lucy" belongs to this group. Her skeletal remains strongly indicate that these hominids walked upright and had a general man-like form. Of course the footprints in the volcanic tuff layer confirm that fact. To my knowledge a full skull of afarensis has not been found. There are a number of loose teeth, palates, jaws and some critical postcranial skeletal material. Comparisons and conclusions are based on these limited materials. The age and general nature of the hominid seem relatively certain, however.

Next we will consider another australopithecine group that has come to be known as Australopithecus africanus. These are the most "human looking" of the group. Some authorities would even place them in the same genus, Homo, as modern man. They are known from an abundant amount of fossil material from South Africa. Their occurrence in East Africa is somewhat questionable. They were the first australopithecines discovered but not the oldest. Their fossils are generally dated from about 2.8 million to about 2.4 million years ago. The cave deposits in which many of them are found are difficult to date accurately. Fossil evidence shows they definitely walked in an upright position. Cranial capacity is around 500 cc. They had fairly heavy brow ridges and jaws that protruded considerably. The teeth looked much more like a human than like an ape.

About a million years later are found two hominids that have many skeletal similarities to Australopithecus africanus. One type named Australopithecus robustus is found in South Africa. The other, Australopithecus boisei, is found in East Africa. Most authorities now lump these two together under the name robustus. These have about the same size brains, similar but larger teeth, and much more grotesque facial features than africanus. They looked almost like they were being transformed back into an ape, but still with many human like features. They were upright standing, had teeth more like a man than an ape, and a brain larger than one that would be expected in an ape. All authorities agree that this was an aberrant offshoot of the australopithecines that, though abundant for a long time, died out about one million years ago.

Homo habilus

Living with the robust australopithecines in East Africa about 1.5 to 2.0 million years ago is found a form called Homo habilus. Some authorities would include it in the Australopithecus africanus group. Its brain capacity was substantially more, 500 - 800 cc.

In structure it apparently does not greatly differ from Australopithecus africanus. Crude stone tools are found in the strata with Homo habilis remains.

Homo erectus

Fossils of this hominid are found in geologic contexts from about 1.5 million to about 500,000 years old. They are unique and important fossils. Their brain size had increased substantially, with a range from 900 to 1200 cc. There is other evidence of increased mental capacity. A much more highly refined type of tool, the hand axe, is found associated with them. There is evidence that they controlled fire as well. Homo erectus was a wide ranging hominid. Fossils are found in Africa, Eastern Asia, and Europe. At Olduvai Gorge Homo erectus remains are found in some strata that also contain remains of Homo habilis. It would appear that at least for a limited time they were both living in the same area at the same time.

Homo erectus had heavy brow ridges and it jaws protruded substantially in front of its face. These features, along with a smaller brain case, made it look substantially less than a modern human being. On the other hand, however, it would not have appeared to be an ape either. In form it was something definitely in between, and looking structurally much more like a man.

We should note that a direct, physical, superposition relationship occurs within the strata at Olduvai Gorge and nearby Laetoli for the forms Australopithecus afarensis, Australopithecus robustus, Homo habilis, and Homo erectus. Within these strata are volcanic lavas and tuffs at many different levels that can be dated radiometrically. It has been a good place to validate the sequence and time frame of these fossils. Of course, associated with the hominid fossils are fossils of many living and extinct animals that can also be used to test, in a relative manner, the dates obtained radiometrically.

Early Homo sapiens

Early (sometimes referred to as archaic or primitive) Homo sapiens is a category that includes forms that lived between approximately 500,000 years ago and the time when fully modern skeletons are found, about 30,000 years ago. Their brains tended to be smaller than modern man and they seemed to retain relatively heavy brow ridges. Hominids from this period are not abundant. Often the specimens elicit much controversy because they seem to combine features of Homo erectus, the neanderthals and modern man. It is not our purpose to enter the argument of what hominid specimen should be placed in what category, but merely to explain the situation as it exists.

The Neanderthals

Fossils of Homo sapiens neanderthalensis are relatively abundant as far as hominids go. The group is known for its heavy brow ridges, large cranial capacity (average 1450 cc., larger than modern man: average 1350 cc.), long bun shaped head, and noticeably receding chin. The time span during which they are found as fossils is between about 130,000 years ago and 30,000 years ago. One site indicates that they buried their dead with flowers, other sites indicate burial of ritual objects with them. Some have concluded from this that the neanderthals had a "sense of the spiritual."

Many tools are tied in directly with the neanderthals. They had a relatively sophisticated method for utilizing stone to make tools. By utilizing flakes and blades which they stuck from large piece of rock, they were able to make more efficient use of their stone and to make more effective tools. A flake type of tool is typical where neanderthal fossils are found.

Modern Man

About 30,000 years ago skeletons begin to be found that are anatomically equivalent to modern man. They have fully modern brain capacity, vertical faces, square chins, virtually no brow ridge over the eyes, and more subtle features shared only with modern man. The tools and cultural items found with their fossils are highly advanced. Associated with this advanced type of hominid are cave drawings, carved figures, and even painted figures, primarily in red and black. Clearly a physical as well as a mental threshold had been crossed in these hominids. Here is something very close to modern man.

Summary

Thus we see major development has taken place in three totally different lines of organisms throughout long periods of geologic time: the horses over a period of 50 million years, the proboscideans through 35 million years, and the hominids through about 4 million years. Progress was not always in a direct line, sometimes there were even reversions. In the overview, however, steady forward progress was made continually.

The evidence presented clearly shows that we are dealing with reality, not mere theories, ideas or hypothetical animals that never existed. The fossils and their change with time are undeniably verified in the geologic record. The question that remains to be answered is, "How were these changes brought about?"

Chapter 7: CREATIVE DEVELOPMENT... A Better Explanation Than Evolution

We have seen in past chapters, that there is a true succession of strata in the geologic record and that it has been deposited over long time periods. This deposition has taken place in many different environments even though they occur in the same geographic location. Within this succession of strata are found the fossil remains of many organisms that exhibit progressive development over the long periods of geologic time. These facts are scientific, true and verifiable. But how were these changes made? What caused the developmental progression that we find throughout the fossil record?

Because of anti-supernatural bias and rigid application of the "scientific method," the conclusion of many workers in the field is that these changes were made without any outside direction, design, engineering or intervention of any kind. They believe that random genetic changes occurred naturally with time. The changes that happened to be beneficial were selected and retained by the group through purely natural processes. It is their conclusion that this method was adequate to produce all the plant and animal life we find on earth today. Thus, we have a creation that has created itself... the modern theory of organic evolution.

It is the conclusion of many others, the author included, that the fine tuned design, complexity, the intricate interrelationships, the beauty, etc. of the natural world completely excludes the rational possibility of such a happenstance origin, no matter how much time was involved.

It is my purpose in this chapter to suggest an entirely different process for the origin and development of living and fossil organisms; a creative development process that was directed by supernatural intelligence. **Not** theistic evolution, in which a creator is responsible for the creation of simple life forms, after which they were left to a process of random mutation and natural selection to complete the job. Rather active, ongoing, creative involvement to bring about the development process. A process of supernatural design occurring over periods of time of geologic magnitude.

Evolution is generally based on the proposition that there is no guiding force or "supernatural" intelligence involved in the developmental process. That the development we see was without purpose, plan or design. But this is pure theory, not provable fact. Science has not, and indeed cannot, prove that such a "superintellect", a creator, God ...does not exist. This is an important fact many people overlook.

If we consider just the opposite proposition, that a "super intellect" does indeed exist and has designed what we see about us, as well as, what is in the geologic record, there is absolutely no conflict with scientifically obtained facts. Actually, such an explanation fits the physical evidence considerably better than does the concept of organic evolution.

Consider the development of any technology of man, ancient or modern, from stone tools to computers. There is a progression of design. There is improvement starting with the time of its invention or introduction and usually continuing throughout its useful lifetime. If we apply this analogy of man's technical developments to the development of the fossil organisms we find in the geologic record, the similarity of development is startling. Of course there are always exceptions to the general trends. This is true of both developing technologies as well as with the paleontological record. There are "living fossil" technologies as well as "living fossil" organisms. We know the development of technology has taken place in the human mind. Yet, there is not a record of what went on in the minds of the inventors. There is only the physical record of what was actually made. The same is true of the fossil record.

In any technological line there are gaps and "missing links" just as there are countless missing gaps in the lines of organisms we find as fossils. In the technological lines, the forms that fill these gaps existed only in the mind or on the drafting board of the designer. They may have been produced as a model, but they never became a production item. New ideas obsoleted them before they could be produced. The same could well be true for the missing links in the fossil record. However, given the sketchy nature of the fossil record, it is probably impossible to determine with which never existed, and which were merely not preserved in the fossil record, or if preserved, not yet found.

The technology of man, at least up to this point, does not reproduce itself. The fact that the living forms reproduce themselves make the issue a little complex but in no way alters the possibilities. A self-reproducing organism is of a far more marvelous and complex design than a non-reproducing piece of technology.

A conclusion on the subject of origins is a matter of approach, judgment and faith. It is a matter of taking all of the best data possible and drawing the best possible conclusions from it. Origins are historic events that are not reproducible in a scientific laboratory. They cannot be reduced to scientific equations. Only the fossil trail of the origins can be traced. It is a matter of trying to deduce what **actually** happened. It is not merely trying to find what may be theoretically, or even physically possible. Of course, any conclusions that contradict physical or historical facts are invalid.

Some religious people feel the Bible alone should be used to obtain evidence on origins. This is does not make good sense when there is so much additional evidence in

the physical record to enhance and expand our understanding. The physical record is not some sort of diabolical construction to fear or ignore when considering what really happened. It is supplemental evidence to fit into the picture to give more detail and to help avoid drawing wrong conclusions. If the "Bible alone" were used to determine the size and extent of the physical universe, our knowledge and understanding of it would be limited indeed!

On the other hand, others take an entirely opposite approach and reject the important understanding unique to the Bible. They judge the Bible to be a mere secular book without any claim to inspiration above that drawn from its human writers. It is judged to be no more authoritative than any other religious writing. This approach does not make sense when there are impelling rational reasons for believing in the existence of a supernatural creator, and the Bible is the one book that strongly makes a case for such a creator.

Science, by definition and method, eliminates the possibility intervention from any supernatural source. Science deals only with the physical. On questions where only the physical is being dealt with, this is the ideal approach. It clutters thinking and conclusions to suspect that supernatural forces are actively manipulating and changing the way things work when the reactions are merely responding to natural law. On the other hand, where there is a possibility of supernatural intervention, and only the physical laws and forces are even considered, one is following an irrational, though not by definition "unscientific", approach.

The purpose of this chapter is to introduce the concept or theory of creation by supernatural intervention through a developmental process over long periods of time. Perhaps the best way to grasp this concept is to examine the development of a common technology and compare that development to the physical evidence of the developmental process in action in the fossil record. A convenient and commonly known developmental technology is that of the automobile.

One might go as far back as the development of the wheel in looking for the foundational concepts that led to the modern automobile. The line of development might lead from a rolling log or stone under a heavy object to help move it, to ox carts, on to chariots, and four wheeled wagons. The next step would be to make these wheeled vehicles self propelled. This was first done with steam. With the development of the more effective internal combustion engine, the pace of development increased rapidly.
Figure 13 gives a conceptual view of how one might graph the development of wheeled vehicles. This chart closely parallels the appearance, expansion, and demise of groups of living organisms as they are found in the geologic record.)

Both in the United States and in Europe automobile design progressed from primitive to ultra modern in a period of less than one hundred years. Different "families"

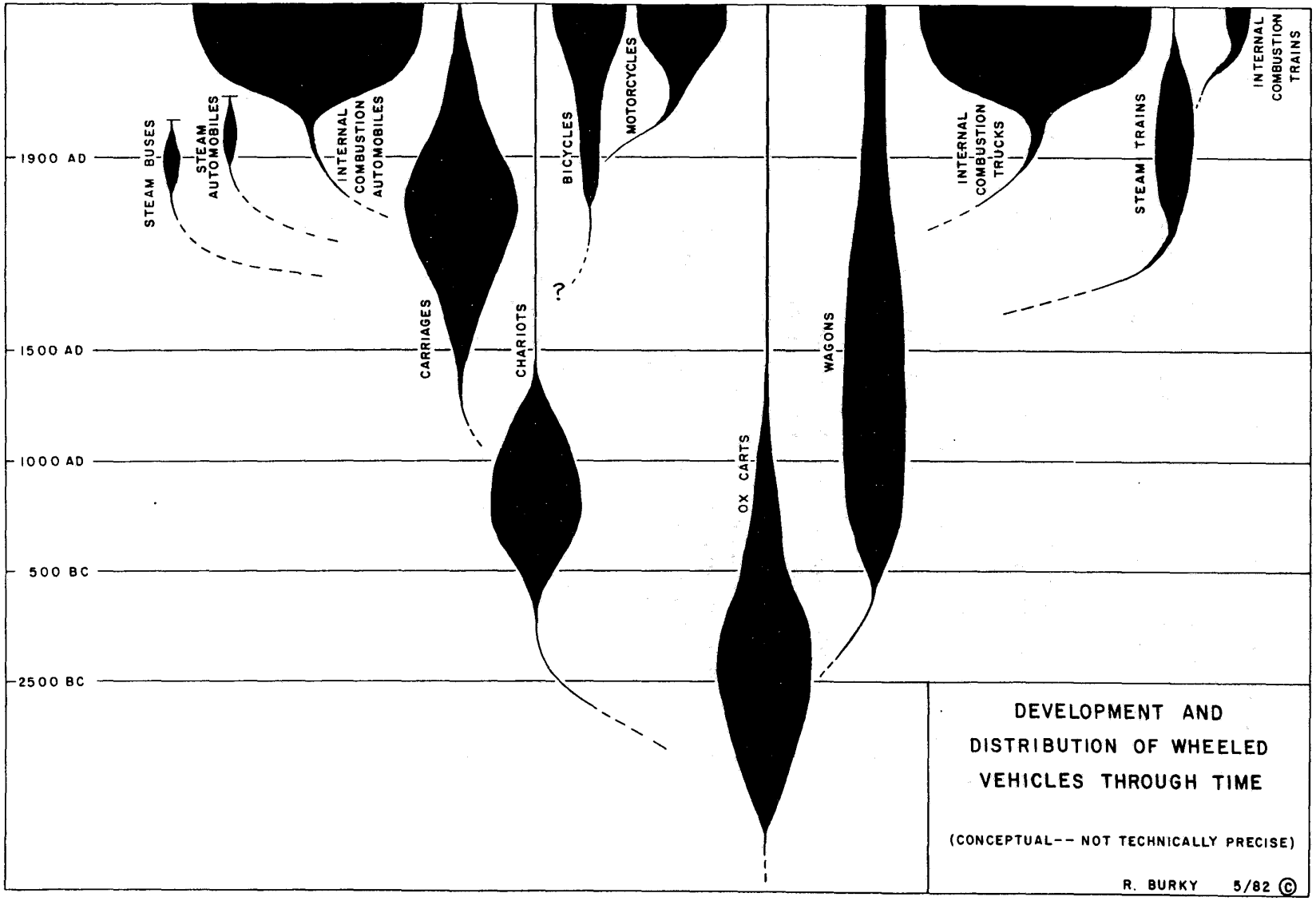
1900 AD
1500 AD
1000 AD
500 BC
2500 BC
STEAM BUSES
STEAM AUTOMOBILES
INTERNAL COMBUSTION AUTOMOBILES
CARRIAGES
CHARIOTS
BICYCLES
MOTORCYCLES
?
OX CARTS
WAGONS
INTERNAL COMBUSTION TRUCKS
STEAM TRAINS
INTERNAL COMBUSTION TRAINS
DEVELOPMENT AND DISTRIBUTION OF WHEELED VEHICLES THROUGH TIME
(CONCEPTUAL-- NOT TECHNICALLY PRECISE)
R. BURKY 5/82 ©

FIGURE 13

of vehicles developed with similarity of design because they had similar, or closely related, designers. Major technological advances such as electric starters and automatic transmissions were introduced in nearly all automobile lines or families worldwide about the same time because of the information exchange between the designers.

One extremely familiar with the history of the automobile can look at old pictures of busy city streets filled with automobiles and tell approximately when the pictures were taken. Because design was changing rapidly, the newest automobiles on the street would be a good indication of the date. For example, if the newest car in the picture were a vehicle only produced in 1925, and there were many vehicles in the picture that were produced from 1920-1924, one could reasonably estimate that the picture was likely taken about 1925 or possibly 1926. Condition of the vehicles would also enhance the ability to determine when the picture was taken.

The fossil record exhibits most of these same characteristics. There is an advancement of design in fossil organisms as one progresses through the geologic time. Certain lines of fossil organisms went through rapid changes with time. By being very familiar with the changes and with the relative time period when they occurred, a paleontologist can determine approximately when certain sediments enclosing a fossil were deposited. Dating geologic strata by this method is usually supported by studying several different organisms to make such relative dating more secure.

A brief review the development of the horse tooth structure will more fully explain the types of changes that have occurred in organisms over geologic time spans. These teeth went from a simple, short, low crowned type not all that different from the human tooth, to a large (about 3 inches long) square tooth with complex folds of enamel. This made the tooth many times more effective in its job as a long lasting and effective grinder. These changes were made in a step by step fashion throughout what appears to be approximately 30 million years. (Geologic processes show that it was a long time. Radiometric dating techniques would indicate that it was more specifically 30 million years.)

The final tooth did not occur all at once. The height of the crown was first increased substantially in the genus, Parahippus. But this tooth had deep valleys that could allow food to become lodged and cause decay. Also, though it was higher, its structure was essentially the same. There was more tooth to grind down, but it ground down at about the same rate as before. The next step, found in the genus Merychippus, was to add complex foldings of enamel, make the tooth still higher, and to add a new material to the tooth. That new material is called cement. It fills the deep valleys in the tooth to prevent food from being wedged there. It also surrounds and supports the hard but brittle enamel to prevent it from being broken.

At this stage of horse tooth development, the tooth is essentially complete in design,

but it is lengthened in the genus, Pliohippus. In the final stage, genus Equus, the tooth is straightened, perhaps made even longer, and definitely made of greater cross section. The enamel pattern on the biting surface of the tooth was also different for each genus. Fossil horse teeth are useful items in identifying relative ages of strata because of the development process through which they passed and the different enamel patterns during the different time periods. This is identical in principle to the forementioned example of determining the age of a photograph by the type and age of automobile that is in it.

The fossil record shows that these changes were made. It does not tell us how they were made. If we deny that such changes were made over time, we reject the physical evidence. Such a denial will only lead us away from the real truth of the matter, even though it may contradict what we believe is true. Rejecting this truth is like rejecting the fact that the earth revolves around the sun. It is illogical and unreasonable to do so. But to believe the development of the tooth was designed and guided by a supernatural intellect is neither illogical nor irrational. In fact, in light of human experience, it is far more rational to believe it was being guided than to believe it is all the result of fortunate genetic accidents and natural selection.

Each of the three fossil lines examined in the last chapter show a progressive development. Each line shows step by step design changes with time. These changes are not unlike the changes found in the development of manmade technologies like the airplane, computers, ships, trains, even buildings. All technologies have gone through a similar step by step creative development process. The fossil record indicates that fossil organisms went through similar creative developmental processes.

Human technologies were fashioned and formed by rational and creative human intelligence. The living and fossil organisms are far more complex and sophisticated than any of man's technologies. Is it illogical or unreasonable to consider that they are the product of rational and creative supernatural intelligence? I think not. It is quite reasonable to believe the biological world we see about us is the result of a rational, Creative Development process, not a mindless, directionless, evolutionary one. This is in full harmony with the facts of the geologic and paleontologic records.

APPENDIX A

GEOLOGIC AGE OF KEY SEQUENTIAL STRATA OF THE COLORADO PLATEAU

EST AGE (MILLIONS OF YEARS)	GEOLOGIC ERA	OTHER GEOLOGIC TIME DIVISIONS		INDIVIDUAL STRATA (FORMATION) NAMES	MAXIMUM THICKNESS (IN FEET)
0.01	CENOZOIC	QUARTERNARY	RECENT		
3			PLEISTOCENE	GLACIAL DEPOSITS	
9		TERTIARY	PLIOCENE		
25			MIOCENE	BROWN'S PARK FM.	1,800
35			OLIGOCENE	DUCHESNE RIVER FM.	1,500
54			EOCENE	UINTA FM	2,600
				GREEN RIVER FM.	5,000+
				COLTON FM.	1,500
				FLAGSTAFF LIMESTONE (CLARON FM. - SO. UTAH)	1,500
63			PALEOCENE	NORTH HORN FM. (KAIPAROWITS FM. " ")	2,500
	MESOZOIC	CRETACEOUS		PRICE RIVER FM (WAHWEAP FM. " ")	1,100
				BLACKHAWK FM. (STRAIGHT CLIFFS FM. " ")	1,500
				STAR POINT SANDSTONE	450
				MANCOS SHALE (TROPIC SHALE " ")	5,000+
				DAKOTA SANDSTONE	350
128				CEDAR MOUNTAIN FM.	150
		JURASSIC		MORRISON FM.	1,000
				SUMMERVILLE FM.	450
				CURTIS FM.	280
				ENTRADA FM.	840
				CARMEL FM.	1,200
185				NAVAJO SANDSTONE	2,200
		TRIASSIC		KAYENTA FM.	320
				MOENAVE FM	350
				WINGATE SANDSTONE	600
				CHINLE FM.	1,200
				MOENKOPI FM.	2,000
225	PALEOZOIC	PERMIAN		KAIBAB LIMESTONE	820
				TOROWEAP FM.	290
				COCONINO SANDSTONE	600
				HERMIT SHALE	300
280		PENNSYLVANIAN		SUPAI FM	1,000
320		MISSISSIPPIAN		REDWALL LIMESTONE	700
345		DEVONIAN		TEMPLE BUTTE LIMESTONE	100
405		SILURIAN			
458		ORDOVICIAN			
515		CAMBRIAN		MUAV LIMESTONE	475
				BRIGHT ANGEL SHALE	375
				TAPEATS SANDSTONE	285
600	PRECAMBRIAN	YOUNGER		CHUAR GROUP	5,000+
				DOX SANDSTONE	3,000+
				SHINUMO QUARTZITE	1,500
				HAKATAI SHALE	800
				BASS LIMESTONE	300
1,500±		OLDER		VISHNU SCHIST	2,000+

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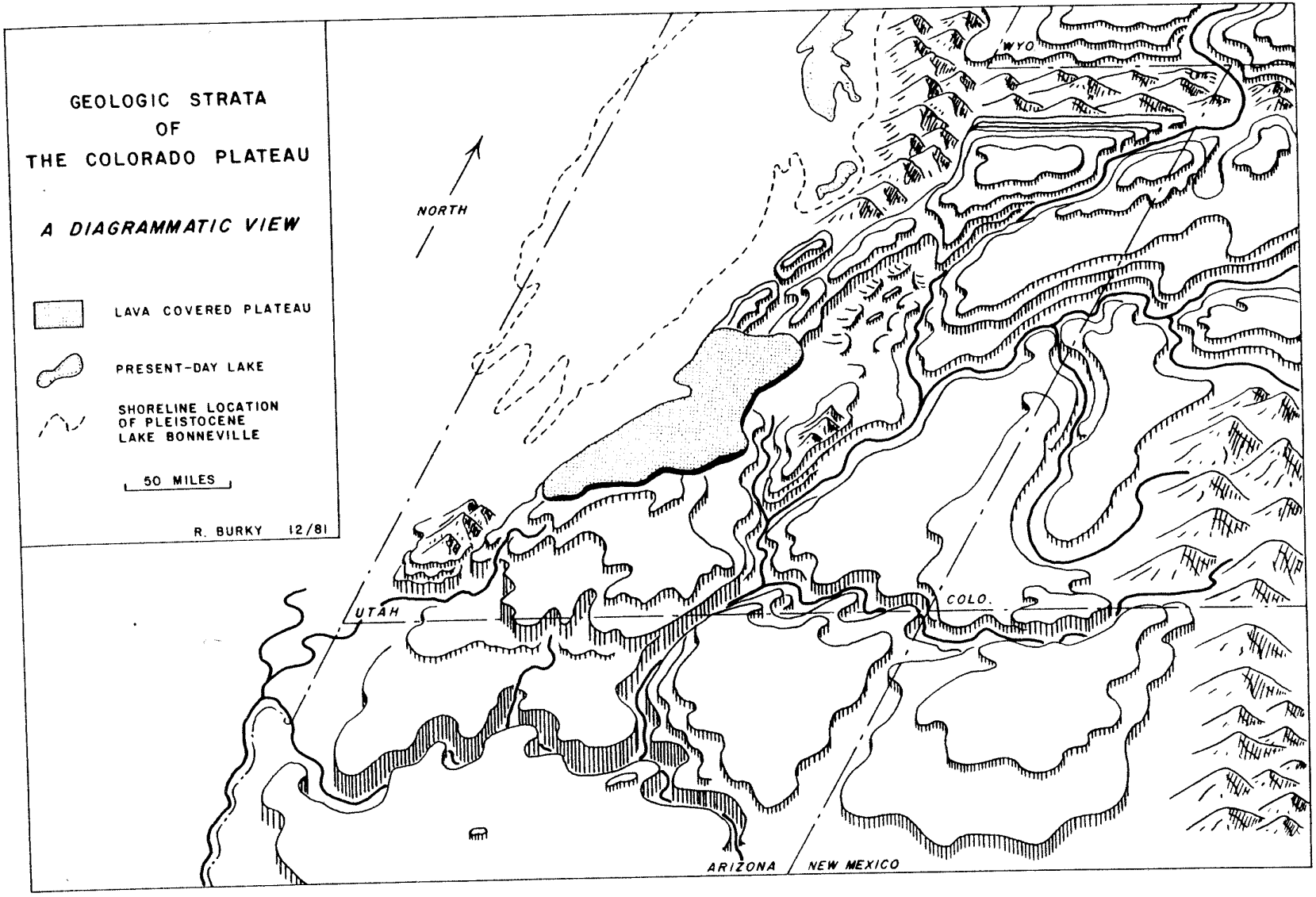
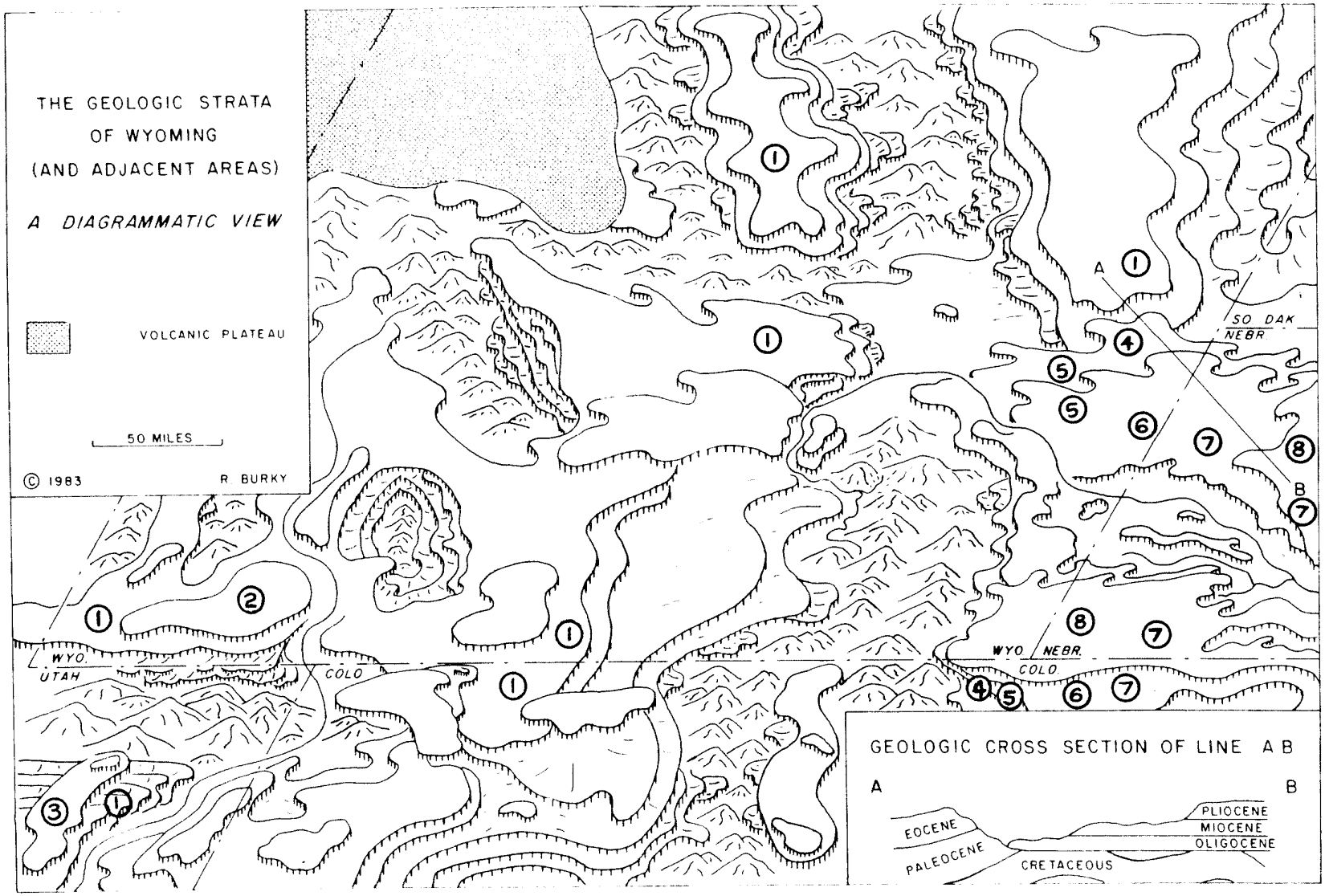

GEOLOGIC STRATA
OF
THE COLORADO PLATEAU
A DIAGRAMMATIC VIEW
LAVA COVERED PLATEAU
PRESENT-DAY LAKE
SHORELINE LOCATION
OF PLEISTOCENE
LAKE BONNEVILLE
50 MILES
R. BURKY 12/81
NORTH
WYO
UTAH
COLO.
ARIZONA
NEW MEXICO

APPENDIX A



Sequence of Horse Genera In The Cenozoic Strata of Wyoming and Adjacent Areas.

1 - "Eohippus" (Hyracotherium)
2 - Orohippus
3 - Epihippus
4 - Mesohippus
5 - Miohippus
6 - Parahippus
7 - Merychippus
8 - Pliohippus

(Equus is found only in surfacial deposits in relation to this chart.)

APPENDIX B