

THE THEORY OF DEVELOPMENT. . .
A VIABLE ALTERNATIVE TO EVOLUTION

Richard Burky, spring 1975

A viable theory of creation that will effectively counter the theory of evolution has long been overdue. The approach of too many religionists has been either to discredit the geologic record by considering it merely a rapidly deposited sequence of strata deposited by one or more cataclysmic floods within the past 6,000 years, or to capitulate totally to the evolutionist's claim and consider the early chapters of Genesis a myth, concluding that God merely created a primitive organism in the dim past and let it gradually evolve through totally "natural" processes into the kaleidoscopic variety of living organisms on earth today. Others simply ignore the problem. None of these approaches are acceptable if you are intellectually honest and consider the Bible an inspired source of knowledge.

The Bible merely alludes to a few events that took place prior to the creation of Adam. The chief source of information on this vast time period is from the geologic record. To organize the extensive data from such a broad source, a unifying theory is necessary. Evolutionary theory has been used by the academic world for this purpose, but evolution is obviously not acceptable to a creationist.

What is needed is a rational theoretical structure into which the creationist can fit the geologic evidence, the paleontological evidence, and the Genesis account of creation. Up to this time, such a theory has not been generally available.

The purpose of this paper is to formally introduce a theory that blends a literal interpretation of the early chapters of Genesis with the classical understanding of the geologic record. Both records are considered complementary. Neither is considered exclusive or contradictory to the other.

I do not consider the Theory of Development merely a philosophical idea but rather a rational structure or framework to explain observed physical evidence. One cannot deny, however, that it does carry with it a strong philosophical impact.

Craig White

The Physical Evidence

An accurate chart of the evolutionary family tree does not connect the branches to the main trunk. (Hardly a healthy condition for a living tree.) The reason for this being that there is not sufficient fossil evidence to show where to attach the branches to the trunk. Great gaps still occur in the fossil record, even after over 100 years of intensive search. But these are "gaps" only if you consider life as a single continuum. Were these forms merely not fossilized? Or did they never even exist? No one can tell for sure. Since solid evidence is lacking, only rational evaluations can be made that are based on existing evidence.

The concept that all life forms are part of one continuum is part of evolutionary theory, not provable fact. The observance that life comes only from pre-existing life of the same type is the only thing that man has ever experienced on a scientific basis. It is the only rational approach if you do not allow the possibility of the existence of supernatural forces. If you do allow for supernatural forces, then there are other rational explanations.

Fossil forms of organisms appear in the geologic record. By evolutionary theory, if they resemble earlier fossil forms, they are considered related through a direct lineage continuum to the earlier forms, either directly or through a yet earlier common ancestor. Also by evolutionary theory, all changes apparent in the later organism must have been caused by nothing more than natural processes working over a period of time. By developmental theory these changes may have been made by a supernatural being directly intervening and making changes to develop and refine the organism in question.

The fossils are real and are often in an environmental context that shows its existence for an extensive time period, but the differences between them and preceding forms are often so considerable it is irrational to conclude that the changes are merely the result of the natural processes of evolution.

The Theory of Development

The Theory of Development acknowledges vast geologic time periods, faunal succession and generally the classical geological record.

Stated briefly the concept of development is that a supernatural mind (or minds) guided and directed the development of living organisms throughout geologic time. This involved direct physical intervention in the physical makeup of organisms to institute changes as well as introduction of wholly new organisms at various times. The theory allows for the elimination of "non-useful" or undesired types by either natural or supernatural methods. This is in direct contrast to the theory of evolution which requires all changes, additions to, and eliminations of living organisms to be caused purely by natural processes operating over long periods of time.

Development is probably best explained by drawing an analogy with a process familiar to all of us. That process is the development of the modern automobile. The first automobile was put together toward the end of the last century. Though we would consider it very crude or primitive by modern standards, we probably would recognize it as an automobile. As time progressed, the automobile was developed and perfected by literally thousands of technological and esthetic improvements. These require millions of man-hours spent in design, development, testing, redesign, etc. Throughout the development period, automobiles were manufactured in quantity and were fulfilling useful purposes for man. Design, testing, changing, and improving were all part of the development process. Some changes were good and continued. Others proved faulty and had to be modified in later models.

Families of automobiles developed. . . Ford, Chrysler, General Motors, etc. These had basic similarities in mechanical design and physical appearance but also possessed prominent individual characteristics that differentiated them from each other. Some individual makes as well as whole families of automobiles didn't make it. We have our dead-end lines such as the Chord, Willys, Henry J., Crosley, etc.

In later years of development we find foreign forms introduced from different geographic areas. These are different in mechanical design and physical appearance because they had been developed through a different lineage. They too can be grouped into families on the basis of mechanical structure. . . Volkswagen, Volvo, Toyota, etc. After their introduction many U.S. automobiles take on similar designs as a result of the success of the introduced concepts and ideas.

All these phenomena are familiar to those found in the paleontological record. We know the development of the automobile was the

product of rational minds (or nearly rational minds) working over a long period of time. It is remarkable that we find similar patterns in the geological record.

At present there is a seeming infinite variety of makes, models, and types of motor vehicles. There are trucks, buses, tractors, motorcycles, etc. These can all be traced backward through developmental lines to earlier vehicles. This does not mean they came from these earlier forms, but that a pattern was continued in the minds of the men developing these particular vehicles. And though the earlier models looked like wagons or carriages, we cannot say they came from those vehicles. Yet, in another way we can say they are a logical continuation of these older vehicles. Living organisms are of course different than mechanical machines in that they can't reproduce themselves and do so with a latitude of variation. But the genetic mechanism does have bounds. It is the limit of these bounds that is one of the biggest questions for evolution.

The development has been totally the product of rational minds: planning, producing, changing, and developing over a long period of time. Development required a long period of time, yet, individual vehicles can be produced in incredibly short periods of time. For example the Ford Motor Company has taken years to develop the cumulative technical skill and capacity to produce the Pinto. Now that the development period is over, they can physically manufacture several hundreds of thousands of them in a single year. The development period required a great amount of time. The fabrication period is very short.

The geological record shows a general development of living forms over a very long period of time, but vast steps forward for individual organisms are not represented in fossil forms. Evolution would require myriad more forms (missing links) in the fossil record than what are actually there. If development ideas take place in a rational mind, a step-by-step progression of improvement may not show up in either a sequence of motor vehicles or in a sequence of fossil organisms. Jumps in development would take place without a physical representation of transitional types. Hence, an Edsel could show up in the record without an immediate predecessor. This situation occurs thousands of times in the paleontological record. In fact it is the rule, not the exception. Of course evolutionists can say that the transition stages are merely missing from the record. But this is conjecture based on missing evidence.

If we had a hypothetical stratified junkyard that had been gathering worn-out automobiles since the late 1800's, we could make a very close analogy between its contents and those of the faunal succession contained in the geological record. A similar developmental pattern would be shown.

The geologic record then, in terms of development theory, records the long time period in which God developed, or had developed, the patterns for all present living organisms on earth. It is not likely that this was the sole purpose accomplished during this time period, any more than the development of the automobile was the sole purpose accomplished during its development period. It may easily have been somewhat of a secondary or parallel goal or accomplishment.

The "creation" account of Genesis 1:2-31 is a late occurring (in geologic terms) manufacture or "creation" of living organisms that are directly ancestral to those living today. This account does not require that present day types of living forms had not lived before. Neither does it require that all previously living creatures were dead. Jeremiah 4:23 uses the same Hebrew words to describe the earth at a future time, during which there are many men still living on the earth, as Genesis 1:2 uses to describe the conditions that were extant at that time, prior to the creation account.

In the geologic record we find that animal forms were developed over a long period of time. Evidence from archaeology and geology makes it seem highly probable that man may have also been so developed. Forms such as the Australopithecines, Homo erectus types, the Neanderthals, and the Cromagnons may likely have been only working models of what was to come later.

It is the purpose of this paper to present merely the overview of the concept of development. It would require more than a book to present the major evidence upon which it is based. The analogy to the development of the automobile is not intended as evidence to substantiate the veracity of the concept. Its sole purpose is to help explain the concept. The real evidence resides in the fossil record of which few are fully conversant or knowledgeable, hence the use of the analogy.

The Approach Defended

The development theory has a built-in supernaturalistic bias. Many evolutionists would consider it a cop out or merely an appeal to the mythical to explain observed phenomenon. I contend that it is an intellectually defensible approach as long as one does not alter or deny factual evidence. Evolution is based on an anti-supernaturalistic bias. It leaves no room for even the possibility of the supernatural. Is this acceptable if truth and reality are really sought? What if the supernatural is a reality?

Neither evolution nor development is absolutely provable from the fossil record in a strict scientific sense. There will always be possible loopholes. The results of neither can be reproduced by man. Both are theoretical frameworks to explain observed facts.

An Important Mistake that Must be Avoided

The basis of the Theory of Development is that a Supernatural mind created living organisms on earth and then made changes and improvements on them from time to time. It does not deny that certain natural processes such as natural selection, mutation, genedrift, etc. were also at work then, just as they are today, changing the living organisms in various ways. Defining where purely natural processes stop and supernatural ones begin on fossil organism is probably impossible. We should be able to determine the extremes by thorough study of the fossil evidence of individual groups of similar organisms, but we probably cannot determine exact boundaries.

There is always the danger with this method of concluding that what we can't presently explain by natural processes was done by supernatural ones, only to find later that there are natural processes to explain the change. This does not mean the theory is not valid. It just means we should be cautious in its application.

I feel the great steps forward made by many of the fossil organisms in very short time periods were accomplished by supernatural intervention. I also feel natural processes have worked on organisms over a long time period to modify them in significant ways. This might be considered a type of "evolution." Care must be taken not to jump to

immediate conclusions about specific developments of specific organisms lest we find ourselves holding the wrong end of a half truth.

Suggestions for Additional Research

Following is a list of what I feel to be the areas that would be the most productive for additional research. These are listed in order of perceived importance.

1. Search out the physical and cultural evidences of the creation period described in Genesis 1:2-31.
2. Searching out the physical and cultural evidences of the flood described in Genesis 6-8.
3. Examining critically, and if possible, quantitatively, the limits of the natural processes responsible for "evolutionary" development.
4. Examining the fossil record for "evolutionary" advances that are outside the rational limits of natural processes.

THE PHYSICAL EVIDENCE FOR TIME AND FAUNAL SUCCESSION
IN THE GEOLOGIC RECORD

Richard Burky

For over 100 years the geologic record has been a source of conflict between science and many Judeo-Christian religious groups. Much of the conflict is caused by the evolutionary interpretation that has been placed on the data from the geologic record. Because of the evolutionary slant given to geologic data, many groups go to the extreme of either totally ignoring or totally rejecting the classical geologic record. They often interpret the total geologic record as the result of one or more supernaturally induced floods mentioned in the Scriptures. Those who do this are not aware of the details involved that make such an approach unrealistic. They make themselves and their religion a laughing stock of those who are familiar with geologic record. The end result is that old wounds are reopened and the wedge between science and religion is driven even deeper.

A more acceptable approach is to accept the factual data of the geologic record, strip it of its evolutionary interpretation, build an acceptable creative interpretation for it, and place the supernatural events of the Scriptures in their proper geologic perspective and context. Once this is done, a geologist or evolutionist may not agree with the interpretation, but he will have no factual basis upon which to deny or ridicule the concepts.

The purpose of this paper is to present, at a layman's level, evidence for extended time periods and faunal succession in the geological record. Another paper will fit this evidence into a viable, creative framework that explains the actual geologic and paleontologic evidence better than evolutionary theory, without appealing to vast quantities of missing physical evidence that is necessary with evolution.

It is my desire to present a simple, clear understanding of the geologic record by basing this explanation on an actual geographic area on the earth's surface. I feel by dealing with a specific area, and specific details from that area, a more concrete understanding of earth and life history can be gained by the non-professional, than could be gained by being exposed to generalized examples from a wide selection of locations.

Craig White

The Area

The area selected for this overview of the geologic record includes most of the state of Utah, the northern third of Arizona, and the western edge of Colorado. The primary reasons for selecting this area were its simple geologic structure and the completeness of the geologic record represented in this area.

The area's structure is essentially one of horizontally lying strata. Most of the sedimentary rocks are lying in undisturbed order of deposition. There are no major overthrust faults or chaotically confused and upside down strata that need to be sorted out. The alterations of structure that have occurred are those of simple faults, broad folds, or uplifts, and other simple changes in positional geometry. A layman can validate the superposition of the strata in the area. Many of the individual strata are so unique and uniform in appearance over extremely wide areas, that correlation is easy and sure.

Sediments in this area range from pre-Cambrian (very old rocks) to the latest Pleistocene and Recent sediments, with a very full and complete stratigraphic record in between.

The general area of the study is shown by the surface feature map of Plate I. This map shows only the more prominent surface features that are of interest to the study. The lines A-A' and B-B' show the surface location of the geologic cross sections illustrated in Plate II.

Definitions

A few terms are necessary to define in order to facilitate explanation. They follow:

FORMATION - This is a basic unit used for defining or naming geologic strata. Ideally it encompasses a single stratum or series of strata that have a unified appearance or composition that can be identified and mapped over a wide area. Formations are often given names based on the locations where they were first described but may be given names on the basis of many other logical or illogical reasons.

FAUNAL SUCCESSION - This term applies to the observed sequence in which the fossils of living organisms are found in the geologic record. This is generally that simple generalized organisms are found to exist in the earlier strata, followed by more "advanced" and specialized organisms occurring in later strata.

RADIOMETRIC TIME - This is a term used to denote "absolute" time based on measuring the amount of decay in various radioactive elements. (Since these are commonly held in question by many creationists, the time evidences given in this paper are based on other phenomena.)

GEOLOGIC DIVISIONS - These are worldwide stratigraphical divisions based on various geologic changes and on types of fossil organisms found within the strata. While their bounds are generally arbitrarily set, based on some notable geologic change in an area, once set they are uniformly applied by geologists as a whole. The classical geologic divisions are used throughout this paper.

LOCAL GEOLOGIC COLUMN - This is the actual vertical section of the geologic strata that occurs in a local area of study. This is in contrast to the generalized geologic column divisions developed for the earth as a whole. The local column rarely, and probably never, contains a complete record of geologic time. For this to occur an area would have had to be receiving sediments continually throughout geologic time. This is a highly unlikely situation.

Plate III: Geologic Time and Faunal Succession

Plate III summarizes and correlates a number of items in relative time sequence. It relates the general geologic divisions to the local geologic column in the study area and the general faunal succession to the faunal succession observed in the study area. Its primary function is to indicate location and type of depositional time indicators in the local geologic column. Radiometric time dates are added for consideration, but the evidences for extended geologic time periods given in this paper do not depend on these time figures in any way.

The column labeled "local geologic column" lists geologic formations in the study area that are in observable, direct vertical superposition to one another. The formations from the Pre-Cambrian Vishnu Schist through the Jurassic Navajo formation are selected from the southern portion of the study area, while the later strata identified in the column were selected from the northern portion of the study area. This was done because the completeness of the record in these areas varied accordingly.

Maximum thicknesses for each formation are given in the next column. These are the maximums given in the publications researched. The chance is very good that these maximums are exceeded in reality. They are listed to help illustrate the tremendous thicknesses of strata in the study area.

The "faunal succession" column indicates generally when new types of organisms show up in the geologic record and when particular groups of organisms were especially abundant. Where space permitted a few notations of fossil plant materials are made. This is merely to give a very general overview of faunal succession in relation to geologic time. What the chart can really not illustrate is the development that has occurred within the individual types of organisms, e. g. the first fossil fish are vastly different from those familiar to us today. This holds true for most types of organisms, but there are a few exceptions. Cenozoic mammals illustrate this same principle. One cannot really describe most of the early mammals in terms of the mammals we see around us today. As an analogy, it would be like trying to describe the first automobile in terms such as Ford, Chrysler, or Toyota. The best that can be hoped for is to describe it in terms such as car, truck, motorcycle, motorized carriage, etc. To show development within broad general types of organisms is beyond the scope of this paper.

Another column is devoted to the occurrence of fossils within the study area. Note that the fossils found are in total agreement to what should or rather could be found on the basis of the generalized faunal succession. More definitive and precise explanations would show that even the development level of types of organisms agree with the generalized faunal succession.

A very important item to notice in relation to proof against deposition by catastrophic floods is the clear demarcation in most formations between fossils of water and land-dwelling organisms. Fossils

contained in the formations are not a hapless jumble of both types. A few formations contain both marine and land-dwelling organisms. The ones that do also contain ample physical evidence that would indicate an environment of deposition compatible with their mutual incorporation. Examples of environments where both would be buried together would include costal swamps, delta areas, or river flood plains.

If space and time permitted, much could be discussed on the physical features of deposition and their relation to time and the overall understanding of the geologic record. Such discussion would include topics such as source of sediments, types of sediments, length of transport time prior to burial, areal extent of strata, areal variation of composition, etc. I feel the evidence presented is sufficient to prove the points made, but it is by no means considered an exhaustive presentation of the evidence available.

Density Sorting Concept

One concept that has infiltrated creationist thinking that needs to be quickly and quietly laid to rest is the concept that faunal succession results from density sorting in flood waters. Here are two major evidences against it; more could be given.

1. The faunal succession cannot be differentiated on the basis of density. Later occurring organisms are not necessarily less dense than earlier ones. Trilobites do occur in the lower strata, but pelecypods (clams) occur throughout the record. Few organisms are more dense than clams.
2. Boulders, gravel, sand, and silt show no evidence of density sorting vertically throughout the geologic column. Such vertical grading only occurs locally within individual formations.

Depositional Time Indicators

One of the most important columns in Plate III is the column headed "time indicators." This lists selected depositional time indicators that the non-professional can readily comprehend. This list is not considered exhaustive. It is merely a number of plain and simple

examples selected to prove the point. Many more could be presented. This list of factors will be systematically considered by starting at the bottom of the column and working upward.

The oldest rocks exposed in the Grand Canyon have been given the formation name, Vishnu Schist. This formation consists of sedimentary rocks that were later metamorphosed by the pressure of overlying sediments, folding, and compression. The rough surface that would have naturally occurred as a result was leveled to a plain of very low relief. On this surface was deposited the Bass Limestone. In this formation is found the first fossil evidence of living organisms in the local geologic column we are studying. This evidence consists of deposition of concentric layered carbonate very similar to that deposited by certain types of modern day algae.

The next formation, the Hakatai Shale, shows evidence of slow deposition. It is brightly colored by highly oxidized iron compounds, totally unlike formations above or below it. This gives evidence of long exposure to an oxidizing environment during deposition. Also the formation contains many layers of shrinkage or "mud" cracks. These definitely indicate slow deposition. Molds of salt (NaCl) crystals are also found. These indicate subaerial evaporation during deposition.

In the strata of the Chuar Group, a little higher up the column, are found more concentrically structured algal deposits. These are eight feet or more in thickness. This can definitely not be deposited rapidly. It takes algae a long time to build up these structures layer by layer.

After the deposition of the Chuar Group, intense block faulting occurred. After block faulting a period of leveling, erosion, and weathering occurred. Studies of the area have found a weathering profile 10-20 feet thick developed on the rocks underlying the Tapeats Sandstone. A tremendous amount of time is required for solid rock like the Vishnu Schist to weather that deeply.

The next formation to consider is the Redwall Limestone. Here is a dense, relatively pure deposit of limestone. Calcium Carbonate, which probably makes up at least 85 or 90 percent of the bulk of the formation is a chemical deposit which is very slowly concentrated and deposited. The fossils found in the Redwall are all marine organisms. There is no sign of major physical disruption during deposition. The

top of the Redwall contains solution cavities that eroded in it prior to the deposition of the Supai. This indicates a period of subaerial erosion after deposition.

The Supai, in direct contrast to the Redwall, is highly colored with highly oxidized iron compounds and contains tracks and trails. One would not expect to find tracks and trails preserved under catastrophic conditions. In the Hermit Shale immediately above the Supai there are numerous layered mud cracks, salt crystal molds, and animal tracks and trails. These two formations are so similar they are hard to separate on the basis of overall appearance.

The Coconino Sandstone is a very even grained sandstone made up of frosted grains of windblown sand. It contains some preserved footprints but little other fossil evidence. The depositional contact between it and the mudstones of the Hermit Shale below is sharp and clear, as would be expected if sand were blown on mud, solidified or not. This is in direct contrast to the contact between the Coconino and the overlying Toroweap. The Toroweap is a water deposited (marine) formation. The junction of the Toroweap and the Coconino is a mixed zone. The topmost sand of the Coconino is reworked and redeposited. This would be expected if water later covered a sand dune area.

The Moenkopi contains many of the evidences for extended deposition time that we have previously noted, such as, mud cracks, animal trails and highly oxidized iron compounds. In addition it contains gypsum beds, an additional factor not previously mentioned. Gypsum is a common constituent of sea water. When sea water is evaporated, common salt (NaCl) is first precipitated, then gypsum. Gypsum would be dispersed, not deposited, under flood conditions. Strata containing extensive gypsum beds show a very evaporative, depositional environment. Large quantities of sea water must be evaporated to get significant quantities of gypsum.

Petrified tree stumps standing in growth position and location are reported in the Chinle formation in northeastern Arizona. This shows a period of non-deposition within the Chinle for a number of years while the trees grew. It also shows that the Chinle and the formations immediately above and below it were not a rapidly deposited sequence of strata.

The Navajo formation is a windblown sand similar to the Coconino but on a much larger and grander scale. The tremendous cliffs of Zion National Park are composed of this formation. It extends from south of the study area to at least the extreme northern boundary of it. This was an extensive area of blowing sand. There were some areas where pools of water existed. At least one of these have dinosaur tracks preserved near it. The crossbedding and depositional patterns characteristic of windblown sand show throughout the formation. Again, this is not flood deposited material.

Above the Navajo lie the Carmel, Entrada, and Curtis formations. Within these formations are massive deposits of salt and gypsum. Again evidence for long periods of deposition under non-flood conditions.

In the Cretaceous strata of southern Utah, there are relatively pure beds of oyster shells up to ten or more feet thick which can be traced for nearly half a mile. It is hard to conceive of any catastrophic mechanism that would deposit them in such a manner without mixing in foreign materials. It would seem quite evident that they were buried where they lived and died. Tracks, trails, and coal beds occur in much of the Cretaceous strata in the study area.

In the Eocene Green River formation, there exist numerous beds of algal-deposited carbonate structures. In one section of less than 500 feet thickness in the upper part of the formation, there are thicknesses of algal structures that would require over six thousand years for algae to deposit at the rate observed in similar modern types of algae. The strata within the algal area physically resemble those below it. There is no reason to believe that lower strata were deposited any more rapidly than those in the algal area. We just do not find good time markers in them.

Summary

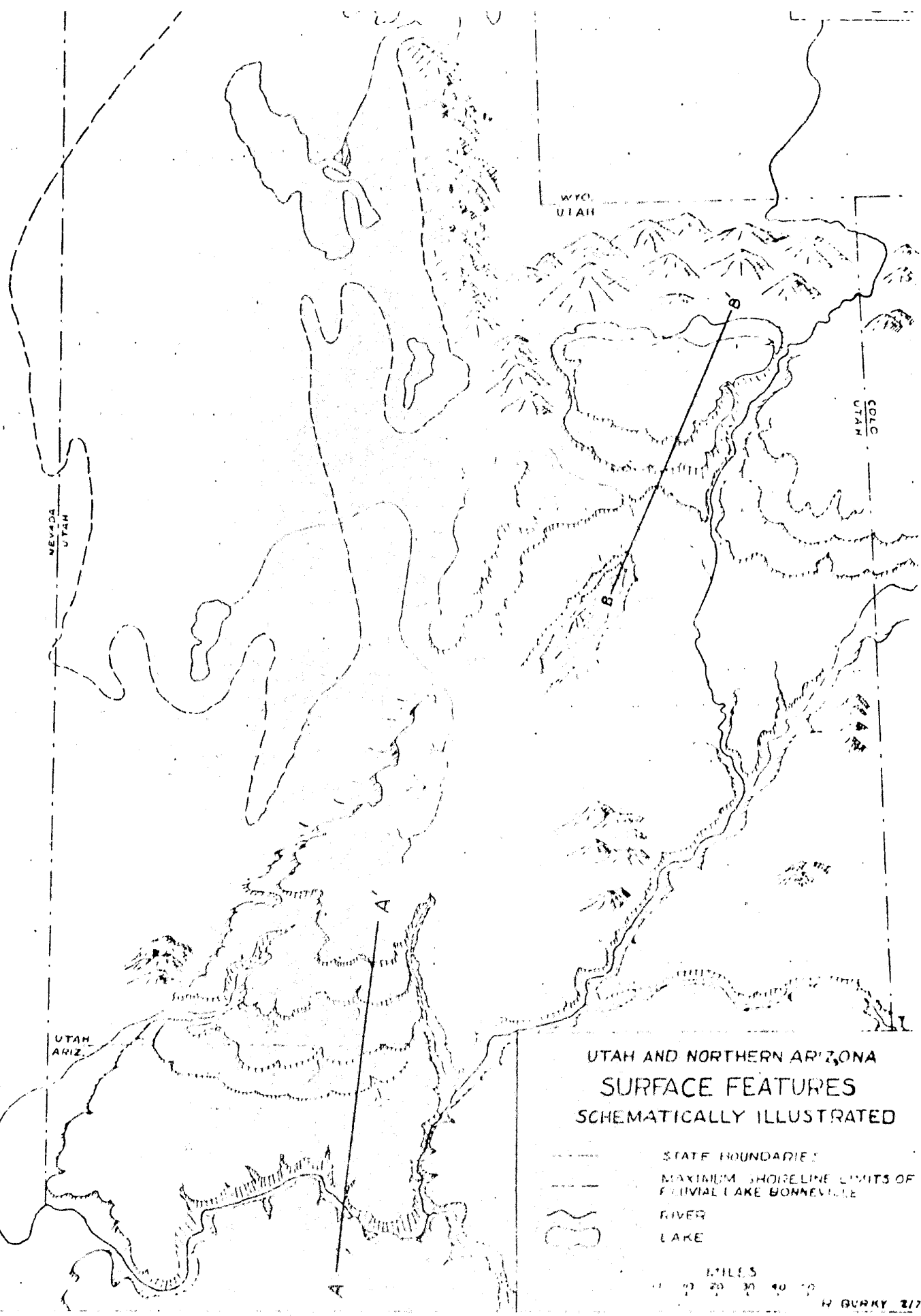
By examining such a complete section of geologic strata, it becomes clear that the geologic record is not merely the result of one or more catastrophic floods, but rather of involved geologic processes that have occurred over long time periods. This does not refute or deny the Scripture account of a flood. It merely means that many have wrongly attributed great sequences of geologic strata to flood deposition based on superficial examination of the evidence.

Exact determination of the time involved is difficult if radiometric dating techniques are not accepted. However, once one acknowledges that the earth is vastly older than 6,000 years and that most geologic strata are not the result of the flood mentioned in the Bible, the religious basis for objection to radiometric dating techniques should not be a problem.

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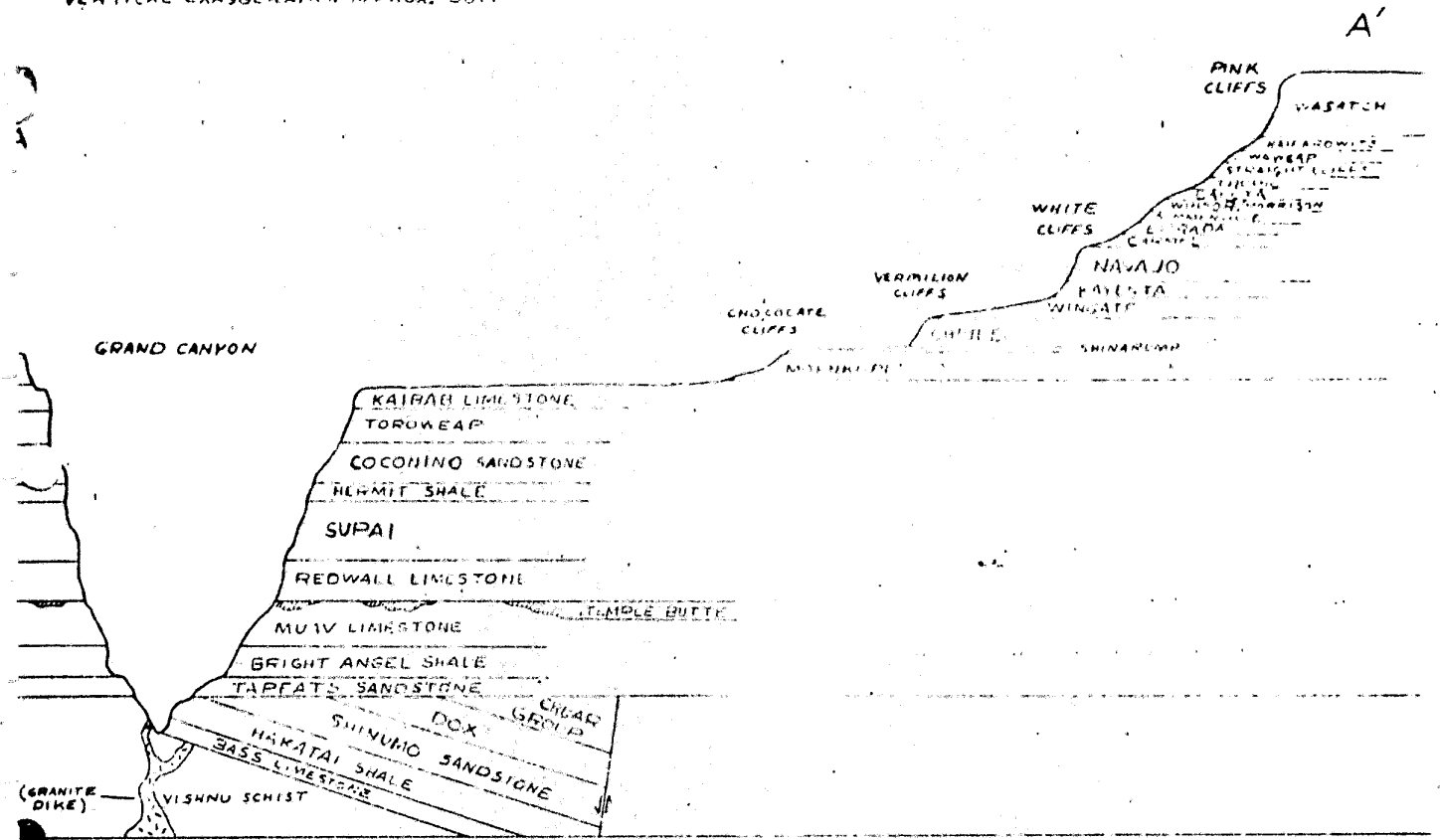
UTAH AND NORTHERN ARIZONA
 SURFACE FEATURES
 SCHEMATICALLY ILLUSTRATED

- STATE BOUNDARIES
- MAXIMUM SHORELINE LIMITS OF PLEISTOCENE LAKE BONNEVILLE
- ~~~~~ RIVER
- ⊖ LAKE

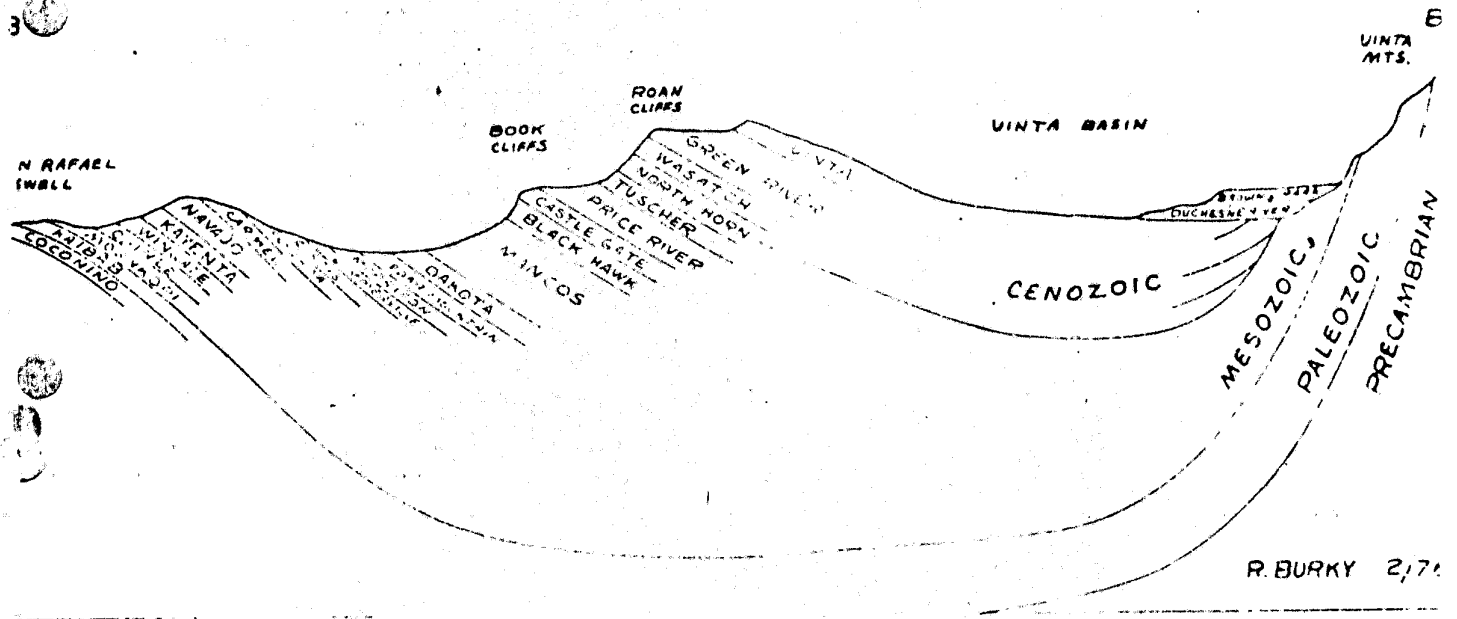
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 VERTICAL EXAGGERATION APPROX. 50:1



DIAGRAMMATIC
 CROSS SECTION B-B'
 VERTICAL EXAGGERATION APPROX. 25:1



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GEOLOGIC TIME AND FAUNAL SUCCESSION

RADIOMETRIC TIME (MILLION YEARS)	ERA	GEOLOGIC DIVISIONS	LOCAL GEOLOGIC COLUMN	MAXIMUM THICKNESS	TIME INDICATORS ⁽¹⁾	FAUNAL SUCCESSION ⁽²⁾	STUDY AREA FOSSILS ⁽³⁾
0.01	CENOZOIC	RECENT				THINGS INCLUDE: TREE, SNAIL, BIRD, BEETLE, FISH, MAMMAL, REPTILE, AMPHIBIAN	
3		PLEISTOCENE				NEOMAMMALS, INSECTS, AMPHIBIANS AND BIRDS TO MODERN MAMMALS, BIRDS, AMPHIBIANS, REPTILES, AMPHIBIANS, MAMMALS	
9		PLIOCENE				MODERN MAMMALS, BIRDS, AMPHIBIANS, REPTILES, AMPHIBIANS, MAMMALS	
25		MIOCENE	BROWN'S PARK	800'		MODERN MAMMALS, BIRDS, AMPHIBIANS, REPTILES, AMPHIBIANS, MAMMALS	
35		OLIGOCENE	LUCHLEDAF RIVER	1500'		MODERN MAMMALS, BIRDS, AMPHIBIANS, REPTILES, AMPHIBIANS, MAMMALS	
54		Eocene	GREEN RIVER	2600'		MODERN MAMMALS, BIRDS, AMPHIBIANS, REPTILES, AMPHIBIANS, MAMMALS	
63	PALEOCENE	WASATCH	4000'		FIRST SEQUENCES OF MAMMALS AND BIRDS (SOUTHERN UTAH) (SOUTH PACIFIC)	MODERN MAMMALS, BIRDS, AMPHIBIANS, REPTILES, AMPHIBIANS, MAMMALS	
128	MESOZOIC	CRETACEOUS	TUSCHEN			EXTINCTION OF GIANT LAND, MARINE, FLYING REPTILES, FOSSIL BIRDS, AMPHIBIANS, AMPHIBIANS	AMPHIBIANS
			TRICE PALER	1200'		MODERN INSECTS	
			CATTLE HATE			EXTINCTION OF ROUGHED AND PLACENTAL MAMMALS	SPERMATOPHYTES, GYMNOSPERM
			BLACK HAWK	1000'		EXPANSION OF FLOWERING PLANTS	WATERFLOWS
			MANCOS	5070'		GIANT DINOSAURS SUCH AS TYRANNOSAURUS AND TRICERATOPS	PLANT POLLEN, AMPHIBIANS
		DAKOTA	100'				
		CEDAR MOUNTAIN	41'				
		ADAMS	890'				
		JURASSIC	CURTIS	60'		FIRST: MAMMALS, BIRDS, FISH, TYPICAL CONIFERS	DINOSAURS ABUNDANT
			ENTRADA	250'		GIANT DINOSAURS (LARGE MARINE REPTILES)	CONIFERS, TYPICAL CONIFERS
	CARMEL		675'		GIANT DINOSAURS (LARGE MARINE REPTILES)	CONIFERS, TYPICAL CONIFERS	
185	TRIASSIC	NAVAJO	2000'		MAMMALS, BIRDS, AMPHIBIANS AND CONIFERS ABUNDANT PLANTS	CONIFERS, TYPICAL CONIFERS	
		KAYENTA	700'		MUD TRACKS	DINOSAUR TRACKS	
		MOENAVE	460'			DINOSAUR TRACKS	
225	PERMIAN	CHINLE	385'		STANDING TREE STUMPS	FIRST: DINOSAURS, TURTLES, AMPHIBIANS, BIRDS, LOBSTERS, AMPHIBIANS, REPTILES, CONIFERS	REPTILES, AMPHIBIANS
		SHINARUMP	185'		ABUNDANT AMPHIBIANS		
		MOENKOPF	2100'		MUDCRACKS, GYPSUM, TRACKS	DIVERSIFIED MAMMALS AND REPTILES	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
		KALEB	320'			FIRST: MAMMALS, BIRDS, REPTILES, TURTLE CONIFERS	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
280	PENNSYLVANIAN	TOROWEAR	300'		WIND BLOWN SANDSTONE TRACKS & TRAILS	EXTINCTION OF MANY KINDS OF MARINE INVERTEBRATES	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
		COCONINO	400'		LAYERED MUD CRACKS, SALT CRUSTAL MUDS, TRACKS & TRAILS	EXTINCTION OF MANY KINDS OF MARINE INVERTEBRATES	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
320	MISSISSIPPIAN	HERMIT SHALE	300'		TRACKS & TRAILS	FIRST: REPTILES, AMPHIBIANS, BIRDS, CONIFERS	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
		SUPAI	1000'			GIANT TREES, AMPHIBIANS, BIRDS, CONIFERS	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
		RED WALL LIMESTONE	500'		SOLUTION CAVITIES PRIOR TO DEPOSITION OF SUPAI	FIRST: REPTILES, AMPHIBIANS, BIRDS, CONIFERS	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
345	PALEOZOIC	DEVONIAN	TEMPLE BUTTE	100'		ABUNDANT AMPHIBIANS, REPTILES, AMPHIBIANS, BIRDS, CONIFERS	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
405			SILURIAN				ABUNDANT AMPHIBIANS, REPTILES, AMPHIBIANS, BIRDS, CONIFERS
458		ORDOVICIAN					ABUNDANT AMPHIBIANS, REPTILES, AMPHIBIANS, BIRDS, CONIFERS
515			CAMBRIAN	MUAV LIMESTONE			ABUNDANT AMPHIBIANS, REPTILES, AMPHIBIANS, BIRDS, CONIFERS
	BRIGHT ANGEL SHALE	400'			EMERSON SURFACE	REPTILES, AMPHIBIANS, BIRDS, CONIFERS	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
	TAPEATS SANDSTONE	200'				REPTILES, AMPHIBIANS, BIRDS, CONIFERS	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
600	PRE-CAMBRIAN	SHINUMIC SANDSTONE	1100'		GIANT PALEOZOIC POSITION	REPTILES, AMPHIBIANS, BIRDS, CONIFERS	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
		HAKATAI SHALE	200'		WIND BLOWN SANDSTONE	REPTILES, AMPHIBIANS, BIRDS, CONIFERS	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
		BASS LIMESTONE	200'		WIND BLOWN SANDSTONE	REPTILES, AMPHIBIANS, BIRDS, CONIFERS	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS
		VISHNU SCHIST			WIND BLOWN SANDSTONE	REPTILES, AMPHIBIANS, BIRDS, CONIFERS	REPTILES, AMPHIBIANS, BIRDS, CONIFERS, TYPICAL CONIFERS

(1) TIME INDICATORS LISTED ARE THOSE OF THE STRATIGRAPHIC COLUMN. THEY DO NOT NECESSARILY CORRELATE WITH THE MODERN CLASSIFICATION OF LITHOLOGIC UNITS. (2) FOSSILS ARE ALLY FOUND WITHIN THE INDICATED COLUMN. (3) FOSSILS ARE ALLY FOUND WITHIN THE INDICATED COLUMN.