

Creation Research Society Quarterly

Haec credimus

For in six days the Lord made heaven and earth, the sea, and
all that in them is, and rested on the seventh. — Exodus 20:11

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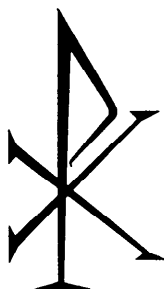
SEPTEMBER, 1979

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COVER ILLUSTRATION

On the front cover is shown a scene along the Paluxy River, near Glen Rose, Texas, drawn from a photograph provided by Mr. Fredrick P. Beierle.

The Paluxy is well known among Creationists, because of the fossil tracks found there. Mr. Beierle, elsewhere in this issue of the *Quarterly*, describes some evidence of another kind, found at the same place. This new evidence may be as useful as the tracks in showing that there were dinosaurs living no more than a few thousand years ago, and consequently that the uniformitarian ages assigned to them are grossly inflated.

CALL FOR ARTICLES

The special Theme for the Annual issue of the *Quarterly* in June 1980 will be the Creationist view of the domestication of plants and animals.

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The uniformitarian, evolutionary outlook causes many problems about domestication. For instance, what possible natural selection could have brought plants (especially) to a point at which it would appear worthwhile to domesticate them? If, on the other hand, some early breeder started from some extremely unpromising-looking wild plant, how did he know that it would be worthwhile to do so?

Other problems concern plants which have no wild forms, or which can continue to exist only with human care. Then there are such things as the cotton, clearly bred artificially, found on both sides of the Atlantic before Columbus' time. How did it get there?

A Creationist may consider that some plants, and maybe some animals, may originally have been domestic, in the Garden or soon after, never having had an original wild stage. Of course, some of them could have gone wild later; such a thing has happened likely in historical times.

Items intended for the Annual issue should reach the editor by 1 February, 1980.

A NEW KIND OF EVIDENCE FROM THE PALUXY[†]

FREDRICK P. BEIERLE*

Received 10 January 1979

The tracks, believed by many to have been made by human beings, found along with dinosaur tracks in and near the Paluxy River, Texas, are well known to Creationists, and have been discussed extensively. During a search for more or better tracks, in August 1978, a piece of evidence of another kind was found.

At the time mentioned, the river was almost dry; it was said to be the driest that it had been for years. In company with several others, I was hunting for tracks, both of dinosaurs and of men, in places where they are believed to exist.

We did indeed find a number of new tracks, as well as studying some old ones. Moreover, we discovered evidence of a new kind, which casts additional light on to the co-existence of man and dinosaur, as has been shown in for instance the film *Footprints in Stone*.¹

The Charred Branch

In the company with Prof. W. Fields, the Ozark Bible group, Mr. Rex Hess, and others, I was looking for more tracks around what is commonly called the number two crossing, a section of the river, adjacent to the Robert Mack farm, where there are many dinosaur tracks. In the same formation as the dinosaur tracks, about 200 meters downstream from them, we found a charred branch from a tree embedded in the Cretaceous rock. The branch was about 2 inches in diameter and 7 feet long. It had apparently fallen into the soft, mud-like material which later became limestone, and while the branch was burning. It had quickly been buried, but had continued to smolder for some time, thus being converted into charcoal, and had remained when the mud hardened into limestone. Figure 1 shows the discovery of the branch, and Figure 2 the branch itself.

Excerpt from Prof. W. Fields' Report on the Branch

"About 200 meters (666 feet) south of the ford by the Mack farm, we found a burned tree branch that had been buried in the stone river bed. The erosion of the past year had exposed most of its length.

The branch had seemingly fallen off a burning (lightning-struck?) tree to the east, and fallen into the mud that hardened into the limestone river bed. It had been completely encased in the stone. The fact that the wood was charcoal and not ash shows that it was burning when it fell, and cooled where it could not get air. The wood clearly showed the cracks often seen in half-burned wood. It lay east-west, at nearly a right angle to the direction of the river.



Figure 1. This shows the author, pointing out the exposed burned branch, as it was found encased in the limestone. This photograph is used by courtesy of Prof. W. Fields.

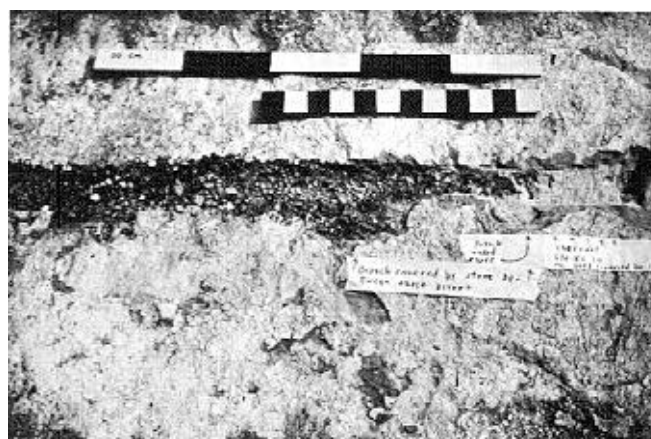


Figure 2. This shows the larger end of the branch, including the petrified section. The upper (as shown here) tag, seen by the branch, says: "Branch ended here" (i.e., at a place about the middle of the tag); and: "Charcoal flecks in this area (covered by shale)." (i.e., toward the right end of the tag). The lower tag says: "Branch covered by stone between these arrows", the arrows being about at the two ends of the tag. This photograph is used by courtesy of Prof. W. Fields.

A CALL FOR PAPERS

You are welcome to prepare a paper for possible delivery at the open meeting of The Creation Research Society, 1 P.M., April 18, 1980, Concordia College, Ann Arbor, Michigan. Papers should be of 20 minutes or less in duration and should center on aspects of scientific creationism as opposed to megaevolution ideology.

A one-page abstract if the paper should be mailed to the Research Committee Chairman, Dr. Emmett Williams, Jr., 5093 Williamsport Dr., Norcross, GA. 30071. These abstracts may be printed for circulation at the meeting. Write to Dr. Williams as soon as you are ready. See you in April!

George F. Howe, President, C.R.S.

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[†]This discovery is also reported by Beierle, Fred, 1979. Paluxy River Report. *Bible Science Newsletter* 17(4):4.

The branch was 2.26 m.. Its east tip was still concealed in the stone, and all of its length was imbedded. The thicker east end was about 5 cm. wide. It appeared that the branch was about 2.5 cm. deep (thick).

Both on top of the charcoal and around it were stone bubbles (globules or spheroids), averaging 3-4 mm. in diameter. There were lots of these, and we felt they had been produced by the heat in the burning branch upon the limey mud into which it fell. One of our crew that had worked at a foundry said that limestone is sometimes added to the coke and metals in a crucible as a means of raising the temperature in the crucible. Maybe the burning branch created a crucible for itself by falling into the limey mud.

In the cracks of the charcoal we saw numerous crystals (calcite??). Mr. Fred Pitts, a teacher of earth science, said that the presence of mineral crystals in the wood cracks was due to crystallization of mineral solutions that penetrated into the wood after it fell into the mud. They were therefore something like CAVE deposits. The crystals were not mineral replacement of the wood, but were distinct deposits of minerals that had penetrated into the cracks and crystallized."²

Description of the Branch

The way in which the branch was embedded in the rock is shown in Figure 3. At the right it was completely fossilized or petrified. Then, going to the left, there is a transitional part, and then the long charred section. Samples of the charred wood were taken from this part, to be tested for age by carbon 14. As shown, only the central part was then exposed.

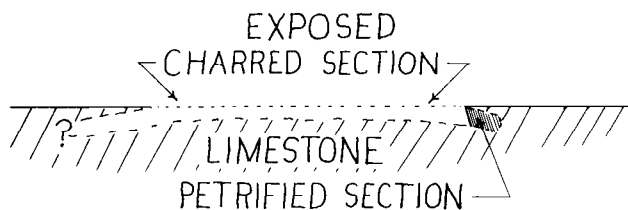


Figure 3. This shows how the branch was embedded in the rock when it was found. Only the center part was then exposed.

In Figure 4 is shown a closer view of the way in which the branch was embedded into the stone. Note especially the tiny bubbles which were around it. The bubbles must have been formed while the limestone was still soft mud. This seems to show that the branch was a branch, not a root which had grown into the rock long after it had been formed. Also, the wood section was located in the bed of the river, being embedded in the rock between successive layers of limestone, as shown in Figure 5. The formations all along the Paluxy River, it may be mentioned, are not always level; in some places they are tilted or bowed.

Other reasons for believing that the branch is not a root which grew into a crack in the stone after it had

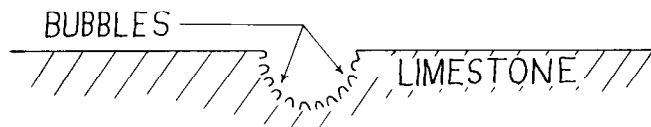


Figure 4. This shows a cross section of the branch, as it was embedded in the rock. The bubbles, which may have been caused by heating, are found along the whole length of the charred section.

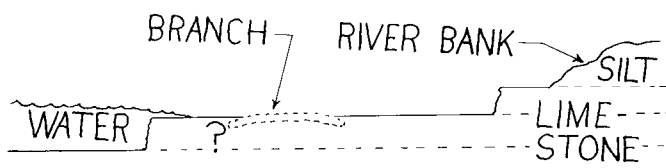


Figure 5. This shows how the rock, in which the branch was found, formed part of the bed of the river.

been formed are the following. First of all: how, if that were so, would it have become charred? It would have been under water most of the time.

In the second place, to judge from the rate at which the bed of the river is now eroding, a uniformitarian would have to believe that 12,000 years ago the layer of rock in which the branch was found would have been far underground. A root would never have gone so deep; nor would it have grown into the rock and left the kind of impression which exists today.

Discussion and Tests

I believe the charcoal from this wood to be from a branch that had been on fire and fell into the soft mud, or the material now observed to be hard limestone. This branch appeared to be burning its complete length prior to entering the mud where it was completely engulfed and continued to smolder until it lost the heat of combustion in a closed environment free of oxygen. Why the lower, or what appears to be the butt end fossilized and the rest did not I'm not sure unless it was not burning and entered the mud as wood which would then lend itself to the normal petrification processes.

There were three separate samples of the burned wood taken, one by Mr. Rex Hess, one by Prof. Wilbur Fields, and one by myself. Each of us agreed to have an independent Carbon-14 analysis performed on our respective samples and then to compare the results.

After obtaining my sample we searched for a reputable organization to analyze the burned wood, and Dr. Reisner Berg of UCLA was recommended to perform the analysis on my burned wood sample. The results of his analysis is that, according to carbon 14 dating, the burned wood is approximately 12,800 years old.

Conclusion

The test shows that the wood is about 12,800 years old. Now the mud must have hardened into rock after
(Continued on page 131)

AN ANALYSIS OF DARWIN'S NATURAL SELECTION—ARTIFICIAL SELECTION ANALOGY

RANDALL R. HEDTKE*

Received 19 March 1979, revised from 28 August 1978

It is pointed out that Darwin based his case very much on an alleged analogy between the facts that in nature some creatures have more offspring than others, and that a breeder arranges for creatures of the kind which he wants to have more offspring. In other words, he drew an analogy between the alleged natural selection, and selection as practiced by a breeder. However, the two cases are quite different in many respects, and there is no true analogy. Hence Darwin's arguments prove nothing.

Critique of Darwin's Methods

The following analysis of Darwin's natural selection-artificial selection analogy is an excerpt from a manuscript in which all eight of the basic hypotheses that make up evolution theory are analyzed. Also, in the manuscript—and it is essential to the analysis—I have gone to considerable lengths to establish the existence of several common misconceptions regarding evolution theory. One of them is the belief that Darwin was a scientist in the modern sense of the word. In reality, however, he was a natural philosopher (in the contrasting sense), not an exact or natural scientist. Because evolution theory was established according to natural philosophical guidelines rather than the more rigorous natural or exact science guidelines, the controversy centers *first and foremost* on natural philosophy versus natural science. The primary antagonists are not, as is popularly misconceived, theology versus natural science. John Dewey, one of the founders of the Progressive education movement, explained it this way: "The vivid and popular features of the anti-Darwinian row tended to leave the impression that the issue was between science on one side and theology on the other. Such was not the case—the issue lay primarily within science itself"¹

Darwin's *modus operandi* as an investigator was a throwback to the natural philosophical method of investigating the environment which had been common among seventeenth century naturalists and also prior to a reform of science instituted by René Descartes and Sir Francis Bacon, among others. Natural philosophy, if I may borrow a phrase from the evolutionists, was the "Primitive precursor" of exact science. It was characterized by: (1) an aversion to experimentation and observation because they lead to limited explanation and (2) a striving after unlimited explanation which results in (3) an overloading of the facts far beyond what they can stand for. Exact science attempts to formulate truth statements about the environment; whereas when natural philosophy (4) makes statements about the environment the main criterion is that they be philosophically or intuitively pleasing, hence there is inevitable bias. All of this adds up to pure speculation masquerading as science; and, because it is speculation in order to convince others, the approach must necessarily be one of (5) persuasion rather than proof.

Some of Darwin's Other Theories

That Darwin was a natural philosopher is obvious, not only in his evolution theory, but also in three of his other abortive attempts to establish himself within the scientific community as a reliable theorist. These attempts involved hypotheses to explain the formation of coral reefs and atolls; the cause of the so called "parallel roads" formations in the Scottish Highlands; and an explanation as to how traits are inherited, which he called pangenesis. All three of these hypotheses were upset or found inadequate by later investigators. What is so important about these hypotheses is that they establish his *modus operandi* as an investigator.

Basically, Darwin tended intuitively to develop an *a priori* hypothesis and then would, by variety of machinations, fit all facts into the hypothesis or monger-in subsidiary hypotheses to explain away conflicting facts. The technique, which is explained in detail in the manuscript, I have named, covert intimidation. His *a priori* hypothesis always had precedence over the facts, rather than the other way around, as it should be, according to exact science.

In regard to the "parallel roads" which he hypothesized were ancient sea beaches caused by subsidence, he wrote to Sir Charles Lyell, "I have fully convinced myself (after some doubting at first) that the shelves are sea beaches although I could not find a trace of a shell; and I think I can explain away most, if not all the difficulties."² One year after his paper was presented before the Royal Society in 1839, two geologists, Agassiz and Burckland, discovered a more plausible explanation in the hypothesis that glaciers had dammed back the water that shaped the terraces. Years later he wrote that his "parallel roads" hypothesis had been "one long gigantic blunder from beginning to end." And that, "my error has been a good lesson to me never to trust in science to the principle of exclusion."³ Excluding alternative hypotheses is not a principle, rather a corruption of science. Unfortunately, the lesson was not applied when he wrote the *Origin of Species*. Special creation, or any alternative hypothesis similar in effect to special creation in relation to the evidences, are systematically excluded from consideration in favor of his *a priori* belief that life had evolved.

In regard to pangenesis, Nordenskiöld reports that, "Darwin is here, as so often elsewhere, a speculative natural philosopher, not a natural scientist."⁴ Pangenesis was strictly armchair speculation, whereas, Gregor Mendel's laws of heredity were established on the basis of experimental evidences. As for coral forma-

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tions, they have since been discovered to be considerably more complex than Darwin had imagined. His hypothesis, based upon subsidence, rather than being a panacea explanation, has been relegated to perhaps being an occasional factor in coral growth. Darwin, by the way, formulated his hypothesis prior to ever laying eyes on a coral formation.

Because natural philosophers strove after total explanation when investigating natural phenomena, it was common for them to think abstractly in terms of analogies and metaphors and to ignore observation and experimentation. It is this aspect of natural philosophy that must be considered when analyzing Darwin's alleged evolutionary natural selection mechanism.

The Notion Suggested by Reading Malthus

At this point, we must review how the evolutionary natural selection hypothesis crystallized in the minds of both Darwin and another naturalist, Alfred R. Wallace. Wallace was a self-made naturalist whose limited formal schooling was compensated by unlimited interest and enthusiasm. He traveled widely and endured numerous hardships in his zeal to collect specimens which he studied and sold. Like so many others in his day, he too was preoccupied with the idea of discovering a materialistic explanation for the origin of life. In January 1858, on the small unexplored island of Ternate, while ill with a fever, the natural selection hypothesis suddenly occurred to him:

One day something brought to my recollection Malthus's *Principle of Population*. . . . I thought of his clear exposition of the "the positive check to increase"—disease, accident, war, and famine It then occurred to me that these causes or their equivalence were continually acting in the case of animals also It occurred to me to ask the question, "Why do some die and some live?" . . . the best fitted lived . . . this self-acting process would necessarily *improve the race* ⁵

As soon as the fever had left him, Wallace spent a few days developing the hypothesis in more detail and sent it off to Darwin. Much to his disappointment, Darwin read an hypothesis almost identical to the one that he had been working on for some 20 years and at first assumed that priority for it would go to Wallace. Darwin's priority, though, was established by an 1844 sketch that he had written. In 1859, about a year after receiving Wallace's paper, Darwin published the *Origin*; but A. R. Wallace's name had become inseparably linked with Darwin's.

What one finds so interesting is that both men arrived at an identical hypothesis in an identical manner. It was immediately after reading, or thinking about, Thomas Malthus's *Essay on the Principle of Population* that the idea of natural selection or survival of the fittest occurred to them. After reading Malthus's *Essay*, Darwin reports, "It at once struck me that favorable variations would tend to preserve, and unfavorable ones would be destroyed."⁶

Malthus was writing about the human population when he pointed out that populations tend to grow according to a geometric progression, e.g., double each generation, while food supply may be increased only to

a limited extent. Famine becomes inevitable unless other catastrophes such as war and disease hold populations in check. Darwin and Wallace realized that the same potential for plant and animal populations to grow geometrically must also exist. What is holding their populations in check? The survival of the fittest: those with useful variations such as length of neck, or wings or color, etc., survives the struggle and the others die out. The result is that populations are maintained at a level appropriate for the available food supplies, while an evolutionary change progresses.

But Does Selection Actually Occur in Nature?

Both theorists were confronted with the same problem—they could not prove that slight differences in a characteristic make a plant or animal more or less fit for survival. In other words, they could not report actually observing a variation being selected against and actually eliminated from a gene pool (the word, of course, is newer) of a species. Both theorists decided to use the same deceit. As a substitute for the unobserved natural selection, they made their hypothetical natural selection mechanism analogous to artificial selection.

Analogy Substituted for Observation

At this point, there is a parting of the ways in their thinking. The two theorists use their analogy differently. Artificial selection refers to the selection by man of domestic plants and animals in order to accentuate certain traits. Darwin's analogy goes something like this: If feeble man can make horses, for example, run faster by artificial selection, nature, being more powerful than man, could eventually change horses into new kinds of animals. He does not dwell on the fact that man only accentuates traits and does not create new kinds.

Wallace approaches the analogy this way: He concedes that man does not create new kinds by artificial selection. In fact, when domestic plants and animals are returned to their natural environment they will either become extinct or return to their original condition. Somehow this was supposed to prove that natural selection could change organisms into new kinds.⁷ In other words, plants and animals are immutable as far as artificial selection is concerned; seemingly illogical conclusions by both Darwin and Wallace.

What is the status of analogy among present day logicians?

. . . arguments from analogy may be fertile but they are all invalid:⁸

Metaphors, like analogy, are dangerous, since they are double-edged.⁹

It is unwise to stretch analogies too far. The result of our reasoning with analogy must be checked against reality to make sure that they hold.¹⁰

Although there is a legitimate tendency for people instinctively to think in terms of analogy, by relating the unknown to something familiar, it is being used in a false and misleading fashion when carried too far. Should we claim ignorance of the misleading potential of analogies for Darwin and excuse him on those grounds? No, the analogy is too skillfully and deliberately fashioned to have been written by someone

who was naive about their dangers. Darwin, I am convinced, knew the weakness of his argument when he wrote chapter IV in the *Origin*, where he introduced his alleged natural selection mechanism. For in the conclusion of the *Origin*, where he discusses whether life descended from four or five progenitors, or a single prototype, he makes this revealing comment: "But analogy may be a deceitful guide."¹¹

Imagine, if you will, the enormous problem that confronted Darwin while writing the *Origin*; how could he convince the public that his mechanism, evolutionary natural selection, was really functioning in the environment when he could not report observing it in action? How could he convince people that the fit were surviving the competition and the less fit were being eliminated? Or more specifically, how could he convince people that nature had the selective power to eliminate absolutely some variations and to perpetuate others? It would be necessary for him to create an appearance of a mechanism and to hand this out to readers.

Let us make ourselves familiar with Darwin's method for making artificial selection the mental stand-in for evolutionary natural selection. After discussing in the first 3 chapters, topics such as selective breeding, variations under nature, and a struggle for existence caused by the potential for populations to increase geometrically, he introduces the natural selection mechanism in chapter IV. In the first 3 sentences he boldly begins making artificial selection analogous to natural selection. Chapter IV is about 36 pages long and has approximately 37 references making natural selections and artificial selections analogous. Here is a sample:

Can it, then, be thought improbable, seeing that variations useful to man have undoubtedly occurred, that other variations useful in the same way to each being . . . should occur If such do occur, can we doubt . . . that individuals having any advantage . . . would have the best chance of surviving and procreating their kind.¹²

Frequent references to the artificial selection—natural selection analogy are made throughout the book. Here is one from chapter III: "I have called this principle, by which each slight variation, if useful, is preserved, by the term Natural Selection But the expression often used by Mr. Herbert Spencer of the Survival of the Fittest is more accurate . . . is a power incessantly ready for action, and is immeasurably superior to man's feeble efforts"¹³

Faced with this mental slight-of-hand technique, the less critical reader is apt to accept artificial selection as proof of natural selection and not demand the obvious proof, which Darwin could not deliver: observation of the mechanism in action, in the environment.

Critique of the Analogy

As usually happens when analogies are applied, similarities are emphasized while differences are ignored. There are two things wrong with the natural selection-artificial selection analogy. First, man does not create new kinds by artificial selection; and second, we observe limited variability, not unlimited variability. Consequently, the analogy shows, if anything, that a

change from one kind to another kind would be impossible. It is one of the great ironies of this controversy, and it also demonstrates an ambivalence common among all of the founders of evolution theory, that Thomas Henry Huxley, Darwin's "bulldog", should be the one to reject Darwin's analogy and explicitly use artificial selection as a test against natural selection. His test is exact science; it places the burden of proof where it belongs, on the theorist. The evolutionists are required to prove that the unlimited variability that we do not observe, but which the theory requires, does exist. Huxley's test reads as follows:

Mr. Darwin, in order to place his views beyond the reach of all possible assault, ought to be able to demonstrate the possibility of developing from a particular stock by selective breeding, two forms, which should either be unable to cross one with another, or whose cross-bred offspring should be infertile with one another . . . it has not been found possible to produce this complete physiological divergence by selective breeding . . . if it should be proved, not only that this *has* not been done, but that it cannot be done I hold that Mr. Darwin's hypothesis would be utterly shattered.¹⁴

Here we have a prime example of natural philosophical thoughts versus exact science supplied by the two leaders of the evolution movement. Darwin extrapolates as follows: If feeble man can make horses run faster by selective breeding, Nature, which is more powerful than man, can transform horses into new creatures. Huxley does not buy the analogy, the extrapolation, or the relative strength or weakness of man and Nature. He turns it against Darwin by proposing a test which is to say that, if man cannot create new kinds by artificial selection why should we think Nature can? Weird isn't it? Darwin, the author of the theory, uses artificial selection to prove natural selection; while Huxley, the grand promotor of the theory, turns it around and uses artificial selection to disprove natural selection.

Limitations to Artificial Selection

Considering the length of time that man has been selectively breeding plants and animals, not many people, even those favorably disposed toward evolution theory, will harbor the belief that new kinds can be created by artificial selection. The theory is disproved by the test. Huxley did not take this test lightly. He proposed it early in his career and later in his book of essays on evolution theory entitled, *Darwiniana*, he again makes special reference to it.

How did Darwin react to limited variability which would make evolution impossible? He simply ignored that conflicting fact: "That a limit to variation does exist in nature is assumed by most authors, though I am unable to discover a single fact on which this belief is grounded."¹⁵ Darwin, like everyone else, observed limited variability, but imaginatively concluded unlimited variability.

Do Evolutionary Natural Selectors Exist?

Huxley, and Asa Gray, the Harvard professor of botany, add a new dimension to the evolutionary

natural selection hypothesis by questioning the existence of *natural selectors*. In this case it is not unlimited variability that is being questioned, but Darwin's assumption that nature, given unlimited variability, can select like man. In this quote Huxley describes the mechanism in a true Darwinian fashion:

The Darwinian hypothesis . . . may be stated in a very few words; all species have been produced by the development of variety from common stock . . . by the process of natural selection, which process is essentially identical with that artificial selection by which man has originated the races of domestic animals . . .¹⁶

But then he becomes the skeptical scientist:

"Without the breeder there would be no selection, and without the selection no race . . . it must be proved that there is in Nature some power which takes the place of man, and performs a selection *sua sponte*."¹⁷

Man's efforts at selection are *consciously* directed. Can Nature *spontaneously* do likewise? He later reiterates his skepticism:

"The question is, whether in nature there are causes competent to produce races, just in the same way as man is able to produce by selection such races of animals as we have already noticed."¹⁸

Gray, in the following quote, seems to be thinking along the same lines as Huxley: challenging Darwin's assumption, based upon analogy, that there is anything in nature that can select like man:

The assertions are, no doubt, backed by alleged facts; but almost everyone of these "facts" gives occasion for controversy . . . the worth of these may be understood when we affirm, that Mr. Horner's Nile-Mud hypothesis is one of them. Besides, . . . the views brought out in this chapter . . . are all associated with the presence of man's intelligence. But . . . it is not within the range of our belief, that, even though you affirm a personality to "Nature", while you banish God from the scene, this to some all-potent, *she*, would equal to these results.¹⁹

This throws a different light on alleged evolutionary natural selection; grant the theory unlimited variability and useful-for-survival mutations, can nature select upon it? Can nature, like man, perpetuate some variations and eliminate others? If the reader will bear with me now, we can prove that evolutionary natural selection is naturally impossible, because there is nothing in the environment that can select like man.

Gray and Huxley seem to realize that artificial selection and the alleged evolutionary natural selection are two different entities, but to expose them as such is something they could not or would not do. The names themselves tell us that artificial selection cannot be analogous to natural selection; artificiality must, in fact, be the antithesis of naturalness.

What About Artificial Selection?

Artificial selection or selective breeding is really a technological endeavor. The dictionary gives this definition for technology—"the totality of the means employed to provide objects necessary for human

sustenance and comfort." Technology is an effort by man to exploit or somehow utilize nature for his particular needs or desires. Artificial selection is a form, perhaps one of the oldest forms, of technology whereby man exploits the genetic variability of some domestic plants and animals to satisfy his needs or desires. In that sense, then, all domestic plants and animals are products of a technological effort, and consequently may be considered not natural but technological forms. They exist only so long as man is present to maintain them as technological products; remove man from the scene and technological organisms will revert to an original type.

Technological animals and plants are maintained under artificial conditions; man's presence is required to feed and protect them and above all make certain that varieties of the same kind are always interbreeding. Golden retriever dogs, for example, only exist as long as man is present to make sure that they mate with their own kind; mongrels become a common variety when random mating is permitted.

Artificial selection, if the breeder is to acquire a degree of success, requires the rigid adherence to two basic rules. These rules are so simple and obvious that any breeder will instinctively apply them. Breeders do not need to be told what to do, although they may advise one another as to how best to accomplish their goals.

The Unwritten Rules for Artificial Selection

1. Prevent random mating of the selected individuals with individuals having undesirable traits. With animals, this usually requires some form of restraint such as pens or fences. With plants, the breeder may prevent undesirable cross-pollination by covering the pistil.

2. Prevent the random destruction of mature and immature individuals having the desirable traits.

The net result of the strict enforcement of these rules is to make man a persistent and consistent selector with the ability to make micro-changes in certain desirable directions. The failure to enforce these rules is to prevent any change and to preserve the status quo. Success requires a constant enforcement of the rules. A breeder cannot expect to make any progress if for several generations horses are bred up for speed and then for even one generation are allowed to mate indiscriminately. The persistence and consistence required by artificial selection may be illustrated by the British, who at one time had a law requiring the destruction of all horses under a certain size. This, of course, was to ensure an increase in horse size.

Darwin claims this for his mechanism: "It may metaphorically be said that natural selection is daily and hourly scrutinizing, throughout the world, the slightest variation; rejecting those that are bad, preserving and adding up all that are good; silently and insensibly working, *whenever and wherever opportunity offers*, at the improvement of each organic being in relation to its organic or inorganic conditions of life."²⁰

First Analogy, Now Metaphor

The reader will notice that Darwin claims that Nature is selecting only in a *metaphorical* sense. In other words, Nature is not literally selecting for some traits and eliminating others; natural selection is merely a figure of speech. Darwin elaborated on this when he wrote that: "In the literal sense of the word, no doubt, natural selection is a false term." He goes on to say that: "Everyone knows what is meant and is implied by such metaphorical expressions; and they are almost necessary for brevity . . . I mean by Nature only the aggregate action and product of many natural laws, and by laws the sequence of events as ascertained by us." He closes by assuring the reader that this is nothing to be concerned about: "With a little familiarity such superficial objections will be forgotten."²¹

In regard to natural selection as a metaphor, Macbeth notes the following: "If the reader is surprised to find natural selection disintegrating under scrutiny, I was no less so. But when we reflect upon the matter, is it so surprising? The biologists have innocently confessed that natural selection is a metaphor, and every experienced person knows that it is dangerous to work with metaphors. As the road to hell is paved with good intentions, so the road to confusion is paved with good metaphors. Perhaps the sober investigator should not have staked so much on a poetic device."²²

What does all of this mean: suddenly to learn that natural selection is merely a figure of speech, a poetic metaphor. In Darwin's definitions of natural selection, we obviously were led to believe that nature was in a literal sense preserving and eliminating variations. We were further led to believe this by a carefully calculated effort to make natural selection analogous to artificial selection. In a literal sense, there is artificial selection: man does preserve some variations and eliminate or at least suppress others with his constant vigilance.

What is the status of metaphors in scientific method? It is acknowledged that they are not applicable; they are as useless and dangerous as analogies, (which, of course, they resemble.) Metaphors have a literary value, but are useless in science. They are, in fact, a throwback to the natural philosopher's desire for total explanation:

Any theories based on metaphors are highly hypothetical.²³

Metaphors, like analogies are dangerous, since they are double-edged. While they have a legitimate heuristic use, and are also suggestive, the suggestions they make are often the source of errors which would otherwise have been avoided.

Metaphorical statements are not true or false, but merely apt or inapt, appropriate or inappropriate. Scientific statements make truth claims and therefore cannot be metaphorical.²⁴

Also, "to mistake the metaphorical for the fact is to be the victim of the metaphor, and this is perhaps only another way of saying that we must not accept the metaphor as true."²⁵ And, "an unresolved metaphor consists of a false ("nonsensical") identification or attribution."²⁶

So. It all comes down to this: Evolution theory, allegedly one of the greatest scientific theories of all

times, the foundation for many philosophies, religions, and political systems, is merely a metaphor "proved" by an analogy, an abomination of science. Those who believe it have been over-influenced by the clever persuasion tactics of a natural philosopher.

Analysis of the Natural Selector- Artificial Selector Analogy

It is within the capability of scientific analysis to prove the impossibility of evolutionary natural selection. Science, as we have learned, takes words in a literal sense; therefore in order to bring natural selection into the realm of science we must find a way to analyze it in a literal sense.

Whenever anyone uses the phrase natural selection or when we read in a book that this or that organ or organisms evolved by means of natural selection, the speaker or writer is really using a cliché to express his ignorance. Natural selection is supposed to be comprehended by analogically associating it with artificial selection. The writer or speaker understands literally, exactly and specifically how man, the selector, accomplishes his tasks, but cannot literally, exactly and specifically describe the factors or forces in nature that allegedly accomplishes its task. Natural selection is comprehended metaphorically and analogically, not literally. Let us prove now what Huxley and Gray suspected; that there is nothing in nature that can select as man can.

To do this, we must reduce both artificial selection and evolutionary natural selection to the same common denominator. Failure to do this has permitted this false analogy to live. When the phrase artificial selection is used, we immediately identify man as the *selector*. Man's success as a selector, although limited by limited variability, is a result of his being a persistent and consistent selector. A desultory, haphazard, random selector would merely preserve the status quo. And we know that man is a persistent and consistent selector because he has the intelligence to enforce the two basic rules of artificial selection, which is really a form of technology.

The problem comes when we use the phrase natural selection. We have permitted evolutionists to identify nature, or the environment, as the selector analogous to man. But nature is a connotation too vague and ephemeral for scientific use; it represents an "aggregate" of alleged selectors. In order to overcome this incorrect comparison, we must do with the phrase natural selection what we have done with the phrase artificial selection; namely, identify and specify the selector.

You may recall that the real test for evolutionary natural selection would be to observe it in the environment. As a substitute for observation, Darwin made the mechanism seem analogous to artificial selection by proposing imaginary examples. Direct observation however would make analogy and imagination unnecessary.

Imaginary Examples of Natural Selection

Let us analyze his imaginary examples and reveal how unrealistic they are. The first one is an example of

macroevolution, how Darwin thought bears could be transformed into whale-like animals: "In North America the black bear was seen by Hearne swimming for hours with widely opened mouths, thus catching, like a whale, insects in the water. Even in so extreme a case as this, if the supply of insects were constant, and if better adapted competitors did not already exist in the country, I can see no difficulty in a race of bears being rendered, by natural selection, more and more aquatic in their structure and habits, with larger and larger mouths, till a creature was produced as monstrous as a whale."²⁷

As explained earlier, whether the analogy is true or false can only be determined by identifying the selector in the environment. The selector in the example just described is the insects in the water. Man has only accomplished microevolution in his selection; but according to Darwin's analogy, the insects, functioning spontaneously, can transform bears into whale-like animals! The example may seem ridiculous, absurd, and fantastic in the highest degree, but according to evolution theory it would be a commonplace occurrence.

I maintain that the insects are not persistent and consistent selectors like man, and to entertain the idea that they are is unreal. Darwin admits, "in the case of methodical selection, a breeder selects for some definite object; and if the individuals be allowed freely to intercross, his work will completely fail."²⁸ There is no way that the insects can prevent random mating of ordinary bears in the territory with the bears that are supposed to evolve. Insects cannot enforce the first rule of artificial selection and consequently cannot make any changes in the natural status quo, which is a phenotype of bears some with slightly larger or smaller mouths and bears with ordinary paws and bears with incipient (very slightly) fin-like paws. The exceptionally large mouths and fins, even if we concede that such dramatic traits can occur, would have to begin as incipient forms and, because of random mating, could never develop into anything of any survival advantage. Man, as a persistent and consistent selector must be constantly vigilant; while the insects, according to the analogy, are supposed to accomplish more than man by simply being passively in existence in the water.

Macroevolution, the change from one kind to another, is what we are challenging. Macroevolution would require unlimited variability as well as a persistent and consistent selector. It is interesting to note that the bear to whale-like transformation was the only example of selection involving macroevolution that I could find. This example was in the first edition of the *Origin*; but Darwin was advised to remove it, probably because it put too much strain on the credibility of the theory. Yet, according to the theory, the example should be considered commonplace. In the remaining editions of the *Origin*, the example was revised to read as follows: "In North America the black bear was seen by Hearne swimming for hours with widely opened mouth, thus catching, almost like a whale, insects in the water."²⁹ As you can see, the second important sentence is omitted and the reader is left to imagine that the sentence that remains is some sort of evidence for evolution.

The remaining examples of selection that will be analyzed, some of which have actually been observed, apply to microevolution, a change within a kind, the possibility of which is not being questioned, when man is the selector. But even this seems to be more than any natural selector can accomplish. Artificial selection, to achieve microevolution, is a technological technique and seems to be more than a natural selector can duplicate. We are not challenging selection *per se*. Some sort of selection must be holding the populations in check; but it is not evolutionary natural selection, leading to macro changes.

Darwin imagined that giraffes acquired long necks because it was a survival advantage for food-getting. Critics of this imaginary example pointed out that, if long necks are of significant survival advantage, why do we not have a large number of quadrupeds with long necks? Darwin could only answer with vague conjecture.

The example of how giraffes are believed to have acquired a long neck is given in most of the high school textbooks. It is illustrated in a series of pictures to compare Darwin's theory with Lamarck's defunct theory. Lamarck, according to the pictures, would say that giraffes *needed* a long neck and, by stretching their necks to reach the vegetation, their offspring would somehow end up with longer necks.

According to Darwin's theory, the first picture shows several giraffes, some with long necks and some with shorter necks. The second picture shows long-necked giraffes feeding while on the ground lies a dead giraffe, presumably a starved short-necked one. The third and final picture shows several uniformly long-necked giraffes. The alleged example creates more questions than it answers. For example, it does not explain how all giraffes originally would have come to have necks long enough to make slight differences in lengths a survival factor.

When we analyze these pictures in class, I ask the students what the natural selector is and they tell me it is the vegetation. I ask them if they think the lack of vegetation can eliminate short-necked giraffes—they think not. They seem to think that the amount of available vegetation at lower levels would always be sufficient to sustain short-necked giraffes; therefore the status quo of the first picture would have been preserved. Vegetation is a random factor, the quantity and availability of which may vary from place to place and time to time. The randomness of the factor forbids it from ever being a persistent and consistent selector. It would ever and always permit mating of short-necked giraffes with long-necked giraffes.

On at least two occasions students have commented, and several authors have pointed this out also, that, if the lack of low vegetation could rigorously destroy adult short-necked giraffes, then the offspring from the long-necked giraffes would also be rigorously destroyed. We see immature giraffes surviving after being weaned and can assume then that short-necked adult giraffes could also. The example disintegrates under close analysis.

Sometimes a student will suggest in reply, that perhaps long-necked adult giraffes pull vegetation

down to within range of their offspring. The student has a perfect right to formulate that hypothesis; but should realize that he or she is simply mongering-in an hypothesis with no basis in fact, as a natural philosopher would do, to save the theory.

May I reiterate that besides limited variability, evolutionary natural selection is impossible because according to Darwin's own analogy, no natural selector can eliminate some traits and perpetuate others: Natural selectors can only preserve the genotypic status quo or temporarily alter it. This is exemplified in the following example from the *Origin*: "... of the best short-beaked tumbler-pigeons a greater number perished in the egg than are able to get out of it Now if nature had to make the beak of a full-grown pigeon very short for the bird's own advantage . . . there would be simultaneously the most rigorous selection of all the young birds within the egg, which had the most powerful and hardest beaks . . . or more delicate and more easily broken shells might be selected" ³⁰

This example of selection involving microevolution reveals Darwin's lack of mental rigor as a theorist. We see also how Darwin personified nature, giving it the capability to make decisions like man. In this example he suggests that nature can determine at the embryonic stage what kind of beak would be useful for birds as adults. The natural selector in this example is the hardness of the egg shell. Obviously egg shells cannot eliminate one kind of beak and perpetuate another kind. He plainly states that the thickness of the egg shells vary at random (not persistently and consistently) as do kinds of beaks. Well then, if the selector varies at random and the trait varies at random, the status quo will be preserved and no change will occur in any direction. We have here a perfect example of the randomness that seems to pervade nature. Nordenskiöld explains it this way: "The variations are certainly guided by laws . . . not, however, in any given direction but in all possible directions, and they are influenced, depending upon every chance, quite incalculably by natural selection. But if, then, natural selection were guided by chance it would exclude the possibility of any law-bound phenomenon in existence. Herein really lies the greatest weakness of the Darwinian Doctrine of selection." ³¹

This example of selection involving microevolution occurred about the turn of the century in England. A Professor Bumpus collected a sampling of sparrows of the species, *Passer domesticus*, which were killed during a February sleet and snow storm. Measurements were made of the weight, length of beaks and skulls, length of humerus, etc. The general conclusion from the study was, "that when nature selects, through the agency of winter storms of this particular severity, those sparrows which are short stand a better chance of surviving." ³²

The selector in this example is the February storm. Obviously it is not a persistent and consistent selector. In fact, the inconclusive results of this study could not be verified because of the infrequent occurrence of that kind of storm in a given area. Storms rarely occur in consecutive years in the same areas and of comparable severity. The storm may have temporarily altered the genotypic and phenotypic status quo in an isolated area, but random mating of the surviving sparrows

within that area and possibly the surrounding areas will prevent a micro-change to smaller sparrows.

The Much-Mentioned Peppered Moth

When I ask students to check the literature for examples of evolutionary natural selection, they frequently cite the example of the moths near Manchester, England. Evolutionists have gotten a great deal of mileage out of this study; and on the surface it appears to be a valid example. The actual results, however, prove what has been concluded from the other examples, that natural selectors cannot select persistently and consistently as man can. The selectors fail because they cannot eliminate one trait while preventing random mating.

This study was conducted in the 1950's by Dr. H. B. D. Kettlewell. Back in the 1800's it was noted that there was a dark pigment and a light pigment form of the Peppered Moth, *Biston betularia*. The phenotypic status quo in the vicinity of Manchester in 1848 was about 1% of the dark form to 99% of the light form. This ratio was believed to be the result of birds preying on the moths as they rested on the lichens growing on the bark of the trees in the woodland. The dark moths were more conspicuous against the light background of the lichens, so they were eaten most frequently.

As a consequence of industrial development, the natural habitat was altered by soot and chemical gases from the factories so that the bark of the trees in these areas was darkened. Conditions were now reversed: the light moths had the pigment that was most conspicuous. At the time Kettlewell conducted his study in the 1950's the dark moths had become the dominant phenotype.

The natural selectors in this example are the birds that prey upon the moths. In the unpolluted habitat the birds apparently were unable to eliminate the dark moths, probably because there were always enough dark areas on the tree bark where dark moths would tend to rest and become inconspicuous. In the polluted habitat where man actually, inadvertently but nevertheless, was co-selector with the birds, the light moths could not be eliminated. Probably the reason was the same as that given for the unpolluted habitat; also there would be a continual movement of light-colored moths into the area from adjacent unpolluted areas.

Recent environmental concern has brought about a reduction in the amount of soot and gases that formerly polluted the area. Predictably, the tree bark has returned to its natural color, and the ratio of dark to light moths is again being reversed. One thing is certain: the natural selectors were unable, in either the natural or the artificial habitat, permanently to alter the genotypes of moths in any one direction.

Now, if man were to eliminate one form of the Peppered Moths by artificial selection, he would have to isolate a portion of the population to prevent random mating with migrating moths and then systematically remove all off-spring over many generations having the undesirable color. Theoretically, the desired form would breed true as long as the artificial selection persisted.

In these analyses, we have made careful distinctions, in order to avoid gross assumptions. It is a blatant

deception for evolutionists to claim any kind of selection as evolutionary natural selection when it obviously falls short of what the theory requires.

Speculation vs. Fact About Wolves

The following quote from the *Origin* is another imaginary example of selection involving microevolution which explained to those who wanted to believe it, how wolves became swift and agile. The example also demonstrates the advantage scientific observation has over natural philosophical speculation. It is unique in that what Darwin imagined can be contrasted with actual observation:

Let us take the case of a wolf, which preys on various animals, securing some by craft, and some by strength, and some by fleetness; and let us suppose that the fleetest prey, a deer for instance, have from any change in the country increased in numbers Under such circumstances, the swiftest and slimmest wolves would have the best chance of surviving and so be preserved or selected I can see no more reason to doubt that this would be the result, than that man should be able to improve the fleetness of his greyhound by careful and methodical selection ³³

In this example Darwin, true to form, attempts to make it credible by analogically comparing it to man's selection of greyhound dogs. The selector in this example is the swiftness of the deer. Although wolves feed on other prey, the reader is left with the impression that the deer-wolf prey-predator relationship is of evolutionary importance. If one were to carry this example to its logical conclusion, the wolf would in turn be considered a selector to make deer faster by eliminating the slower ones. The wolves would not then be gaining an advantage from an increased speed, since, hypothetically, every slight increase in speed on the part of the wolves would be offset by an increase in the speed of the deer.

Now let us discover what is really happening in the great outdoors. In the late 1950's Farley Mowat, a trained biologist, was sent by the Canadian government into the Arctic region to determine the cause of a rapid depletion of the caribou herds. Mowat concluded that wolves, the prime suspects, were not the cause, but more likely over-zealous hunters were. He became intimately familiar with a wolf family, and was able to study their habits closely and even to learn how wolves hunt their prey. Contrary to what Darwin speculated, slight differences in speed among the caribou were not of any significance, since the slowest healthy caribou could easily outdistance a wolf. Wolves instead select their prey on the basis of vigor versus infirmity.

Mowat learned that a healthy adult caribou, and even a three-week old fawn, can easily outrun a wolf. Knowing it was a senseless waste of energy to attempt to run down a healthy caribou, the wolves would rather systematically test the state of health of the deer in order to find one that was not up to par. This was done by rushing each band and putting them to flight. If an inferior beast was not revealed, they would give up the chase and test another band.³⁴

When the testing finally revealed an inferior beast, "the attacking wolf would . . . go for its prey in a

glorious surge of speed and power . . . the deer would begin frantically zigzagging . . . this enables the wolf to take shortcuts and close the gap more quickly."

Mowat also reports that, "most of these carcasses showed evidence of disease or serious debility . . . on a number of occasions I reached a deer almost as soon as the wolves had killed it Several of these deer were so heavily infested with external and internal parasites that they were little better than walking menageries, doomed to die soon in any case."³⁵

From this observed example of selection we learn that it has no evolutionary significance. There is no way that deer can eliminate the genes for slowness in the gene pool of wolves. Randomness is the overriding factor in the deer-wolf prey-predator relationship. It is not a life or death struggle, as Darwin imagined, slight differences in speed determining the outcome. Besides, the slowest wolves can participate and share in a kill equally with any slightly faster wolves among the pack. The genotype of the pack is preserved. Apparently under the sun, the race is not to the swift nor the battle to the strong, but time and chance happen to them all.

The wolf predation actually benefits the caribou herd; it results in the maintenance of a high reproductive vigor among the caribou by eliminating the diseased and aged members who would consume food but probably would not reproduce.

A similar study was conducted of the moose-wolf prey-predator relationship on Isle Royale in Lake Superior. An analysis of the skeletal remains of wolf-killed moose revealed that in this instance also the wolves were taking individuals that were old and arthritic. Selection was based upon vigor versus infirmity, not upon variations in speed.

Any Selection in Nature is Commonly Random

Let us pass on to one final example of alleged evolutionary natural selection. This example deals with the common snail, *Cepaea nemoralis*, which is frequently preyed upon by thrushes. The shells of the snails are colored dark brown or pinkish or else yellow (greenish when the animal is within). To this colored surface up to five blackish bands may be added. A study of shell remains revealed that, "they destroy relatively few of the least conspicuous types; yellow (greenish) upon grass; brown upon leaf litter in woods; banded shells upon a diversified background, as mixed herbage; and unbanded in a relatively uniform environment." The author says that the thrushes do not select at random, but in the next paragraph states that, "Yet though the inappropriate colours and patterns are constantly being eliminated in nature, the populations do not become invariable."³⁶

Obviously, the selection was random to a degree that one or more colors or patterns could not be eliminated. The thrushes could not cause microevolution. How could they? The snails are constantly moving, the backgrounds are constantly changing, seasonally and from place to place; and the snails are randomly mating. A color or pattern that was favored at one time and in one area may not be so in another area at a different time. The author attributes the persistent variability of colors and patterns, not to the randomness of the thrushes as

selectors, but the genetic make-up of the snails—a super-gene that resists the elimination of a trait, which only adds to the numerous objections already confronting the alleged mechanism.

Summary of the Natural Selector-Artificial Selector Analogy

We have now completed an analysis of the alleged evolutionary natural selection mechanism. We have noted that it fails the test of observation, and have gone on to explain that natural selectors lack the persistence and consistence necessary to favor one variation to the exclusion of others. You may recall that Darwin's mechanism was developed as follows:

- (fact) 1. Variations exist—no two members of a species are exactly alike.
- (fact) 2. Populations *tend* to increase geometrically—2, 4, 8, 16, 32, 64, etc., e.g.

The salient question, then, is what is holding populations in check? Darwin's answer was the evolutionary natural selection mechanism. But because of limited variability, lack of useful-for-survival-mutations,³⁷ random selectors, and a failure to observe the mechanism in action, Darwin's guess as to what is holding the population in check must be incorrect. Conversely, because of limited variability, lack of useful-for-survival mutations, and successful observation of random natural selection in action, random natural selection, at least random to the degree that traits are not eliminated, must be what is holding populations in check. Therefore this alternative to Darwin's hypothesis should be included in the textbooks:

What is holding populations in check?

- 3. No selectors in nature can choose to eliminate some variations and perpetuate others.
- (observed) 4. Chance selection holds populations in check, resulting in no macro-evolution.

Now I know evolutionists will insist that both kinds of selection, random natural selection and evolutionary natural selection, are occurring in the environment. In fact, Darwin has already conceded random selection:

... there must be much fortuitous destruction, which can have little or no influence on the course of natural selection. For instance, a vast number of eggs or seeds are annually devoured, and these could be modified to natural selection only if they varied in some manner which protected them from their enemies. Yet many of these eggs or seeds would perhaps, if not destroyed, have yielded individuals better adapted to their condition of life than any of those which happened to survive... a vast number of... animals and plants, whether or not they be the best adapted to their conditions, must be annually destroyed by accidental causes...³⁸

The point is that we have no reason at all to believe that his alleged evolutionary natural selection plays a part in holding populations in check, and every reason to believe that fortuitous destruction or random natural selection is the only kind of selection that is functioning in the environment. In other words, a double standard

exists; the evolutionary natural selection mechanism is credible according to natural philosophy, but is disproved according to exact science.

What Difference Does Time Make?

In closing, it may be appropriate to consider the question of time available for evolution. Darwin confused the issue by relating infinite power for evolution to infinite time. Consequently, the concept of an extremely old earth is regarded, by less rigorous thinkers, as proof of evolution. Radiometric dating, which is supposed to indicate an old earth, is, however, a procedure open to question. If, for example, someone reports that a fossil or rock stratum is approximately one hundred thousand years old, one can only accept that date on the conviction that the test itself was conducted without error, and that the rate of radio-active decay has always been constant throughout time. There is no way to cross-check a date that old with the only logical test involving human witness—recorded history. An extremely old earth would not, indeed, in itself prove evolution. On the other hand, a young earth would be another factor disproving evolution theory. Other than that, the concept of time is not relevant to the theory. Besides several authors have pointed out that parts of an organism are correlated; therefore, organisms cannot change slowly, but would have to come into existence *en bloc* or not at all. So the gradual accumulation of variations, supposedly shrouded in the mists of time, is an impossibility even though eternity were granted. Also, the random relationship presently observed between natural selectors and variations could never have been a persistent and consistent relationship in the past, even an infinite past. A random relationship between selector and variations is the law-bound phenomenon in our environment. The concept of immense time is no defense of or evidence for an alleged mechanism which is obviously not functioning at the present time.

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CREATION, EVOLUTION, AND OBJECTIVITY

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Two contrasting world-views, Creationism and uniformitarianism, have long been opposed one to the other. More recently a third opinion, which might be called secular catastrophism, has gained many adherents. An attempt is made here to investigate how these three world-views differ, and in so doing to draw some distinctions which may be helpful in discussing the matter.

Preface

The difficulty of maintaining an objective concept of nature is compounded by the concepts of "natural" and "supernatural" (the latter being regarded by many as an illusion—entirely subjective). This is further complicated by the fact that even natural events are often viewed as the result of Divine Purpose. We might say that "natural" is that which happens regularly under the same circumstances; e.g., if one steps into water, he sinks. The ability to walk on water (without technological assistance) would clearly be supernatural. In contrast to this deterministic example, stochastic events confuse matters even more. How improbable must a natural event be to be impossible without supernatural intervention?

To try to assure a uniform frame of reference for what follows, we will preface our discussion with a couple of seemingly straight-forward definitions:

Subjective: Of, affected by, or produced by the mind or a particular state of mind.

Of, or resulting from the feelings or temperament of the subject or person thinking, rather than the attributes of the object thought of.

Objective: Independent of the mind; real, actual.

Determined by and emphasizing the features and characteristics of the object.

(From Webster's *New World Dictionary of the English Language*.)

Introduction

The creation-evolution *controversy* has raged for over a century: the *debate* is even older. Within the last century the two predominant camps (i.e., creationists and uniformitarians) have consistently viewed one another as objectionive and unscientific. In recent years another philosophy has rapidly gained adherents; that of secular catastrophism. From this camp the other two are derided—*both* accused of being unobjective and unscientific. In view of this accusation, perhaps some introspection and comparison are in order.

We can begin with a semidefinite tabulation, in Table 1, showing one area in which the three camps show a particularly marked difference: this being the kind of evidence they will accept. There are obviously gray areas between the different groups.

As would be expected, the philosophies embraced by these groups are reflected in their respective interpretations of varied scientific evidence.

World-View	Attitude Toward Evidence
Creationism	Acceptance of Biblical pronouncements—Consideration accorded to other records.
Uniformitarianism	Total rejection of Biblical pronouncements and other ancient records that contradict modern experience.
Secular Catastrophism	Evaluation of all ancient philological records. (Bible on approximately the same footing as others.)

Table 1. Attitude of the three world-views toward ancient literary evidence contrasted.

Evaluation of Testimonial Evidence

Since it is impossible for one individual to do with his own hands all the experiments that establish his science, he almost always accepts many reported results of scientific experimentation by others. This is in effect an act of faith (beyond one's own experience) even as the creationists' acceptance of the Biblical account of origins (and subsequent events, even though highly unusual). Thus, even the form of the literature has some bearing on its adjudged value.

Some subjectivity might well be admitted then by creationists because of this acceptance of Biblical revelation concerning origins, observation of which was naturally not possible by man. However, as we shall see, this is often not the full extent of the subjectivity.

Subjectivity is seen in uniformitarianism in its (frequently documented) rejection of even contemporary hard scientific evidence that contradicts its tenets.

Secular catastrophism tends to evaluate all observational evidence regardless of its literary context, but systematically disallows all elements that appear to be supernatural; which again is subjective editing.

Two points separating creationists from noncreationists are the problem of existence and the idea of progressive complexification (evolution of individuals and interrelationships between individuals). Existence is explained to the satisfaction of the creationist by the Bible. There is no scientific theory that can explain this to the satisfaction of the noncreationist, and secular catastrophists have had nothing original to offer in this respect. Complexification, a necessity for the noncreationist, is rejected by most creationists as contradictory to their interpretation of Biblical records.

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Evaluation of Static Evidence

Although the acts of creation were not observable by man, change is; e.g., in the fossil record. How is this record to be interpreted? In attempting an interpretation, all that can be said with certainty is that some biological forms of the past no longer exist, and some forms alive today do not appear as fossils. Some of the former have apparently become extinct. Others have possibly changed form to the extent that the extinct and the extant are not recognizable as part of the same line. (Even males and females of some living species bear little resemblance to one another.)

Given the imperfectly known possible range of variation within living species (such as dogs), it is impossible to say that one form complexified from another. This complexification is a forced conclusion of noncreationists by their rejection of a Creator (and/or a particular creation process). However, neither can it be said that any given living form not appearing in the fossil record would be like one that does to the point of being interfertile. This interfertility is a forced conclusion of creationists based on their interpretation of the Bible. Both conclusions reflect a degree of subjectivity.

Evaluation of Dynamic Evidence

A living biological interrelationship often cited as proof of creation is that of the Yucca Moth and the plant from which its name is derived; a highly specialized animal-plant relationship—each dependent on the other for its survival. The Yucca Moth and its host certainly refute any argument for gradualism in their development; else how would they ever have survived until culmination? More positively, as do so many other things and combinations of things, they bespeak intelligent design. What is often not recognized by creationists, however, is that this would seem to be a postdeluge arrival, as must be true of a large number of similar relationships. Given a universal destruction during the Flood, the relationship *must* have arisen (complexified) afterward, since there is no reason to suspect that the two components migrated in unison from the Old World to the New, surviving only in the latter. The alternative is something less than universal destruction by the Flood.

Whatever be the facts about the point here raised, two conclusions can be drawn from this relationship.

1. Uniformitarianism is refuted, as the “system” was necessarily complete at its inception.
2. Intelligent design is exhibited.

Nothing can be concluded so far about the time or method of its creation. In this regard, there are two possibilities:

1. Creation “in the beginning”—with the ramifications noted above.
2. Sudden (“catastrophic”) genetic change—reprogrammed behavior—after the Flood (clearly with purpose).

Any conclusion on this will also reflect a degree of subjectivity.

Creationists' Evaluation of Biblical Evidence

Insofar as we have to *interpret* any part of the Bible, to that extent any science so derived is subjective. Areas of the Bible that are less than explicit should be used only as *guides* in directing and understanding our *research*—lest they lead to erroneous interpretations that become unjustifiable tenets.

A case in point is the so-called predeluge “vapor canopy.” In an earlier issue of the *Quarterly* I pointed out that consideration of all relevant verses in Genesis I would lead to the untenable conclusion that the canopy would have encompassed the Greater and Lesser Lights; “waters above the firmament” therefore meaning something other than such a canopy.¹ One defensive response to this was “We *believe it is possible* for the word ‘firmament’ to have two meanings . . . In one instance firmament *may* refer to the lower atmosphere in which the fowl fly (1:20), while in 1:17 the reference *may* be to space where God placed the sun, moon, and stars.” (Emphasis added.) Does such interpretation not differ only in degree from that of individuals who interpret the Genesis use of the term “create” as an evolutionary process? How can one claim that the Bible is the basis of his belief when some cherished opinion formed on non-Biblical grounds becomes the basis of Biblical interpretation? We (author included) frequently cast stones at the uniformitarians—but even among creationists objectivity sometimes appears to be a will-o-the-wisp.

Natural vs. Supernatural

For many years creationists have discussed and debated the possible causes of the Great Deluge and have pondered over the source of the water. It seems to be agreed that while the Deluge is not denied to have been an instrument of God, there is some “natural” explanation for it. No one has suggested that the waters just materialized from nothing; few that they were created just for the occasion. Recourse is frequently made to the collapse of the aforementioned “vapor canopy.” The same canopy (its one-time existence and collapse) is invoked as an explanation for a variety of phenomena associated with both our planet and its inhabitants.

Creationists’ “natural explanations” for Biblical upheavals often reflect a rather subjective selectivity. To try to explain some phenomena as natural (i.e., violating no physical laws) frequently provokes an adverse emotional response. One sometimes wonders what is allowed to be natural and what must be supernatural.

By definition, the creationist accepts God’s miraculous creation of nature—life and intelligence are necessary to beget life and intelligence. Even though not restricted by the physical laws He established, who is to say by what means the Creator is to deal with His Creation? Can He not use one part of this Creation to effect His Will in another part? And is He not a God of order?

In the study of Biblical history, many curious things present themselves. In seeking to understand them, while the supernatural is not precluded, a natural explanation should be sought first—else whence the basis for any line of scientific inquiry?

Conclusion

Creationists admit that there have been changes in the life forms occupying this planet. On the basis of existing physical evidence, e.g., fossils, they cannot say that the changes have been less than any given degree, nor can evolutionists say that they have been greater than any given degree. Neither can say if any apparently new form represents a degeneration, "revision," or complexification relative to its predecessor.

The fossil record cannot be interpreted as evidence for the sudden initial appearance of fully developed life forms, since it resulted from destructive processes well after the proliferation of those forms. It may provide evidence *against* slow, continuous, gradual development. All life forms and extant biological interrelationships logically demand functionality at their outset, although this in itself says nothing about the *time* of their appearance.

The existing order of the universe, from microcosm to macrocosm, demands the recognition of a Creating Intelligence. It offers no evidence favoring particular means of creation or any subsequent *modus operandi* on the part of the Creator. Such things can be known only from records.

If there were no Book of Genesis, what would our creation philosophy be? (This is virtually the case in uniformitarian thought.) This question should make extremely clear the dependence our theories and hypotheses have upon Biblical pronouncements—and our interpretation of them. Regardless of the philosophy, some subjectivity is unavoidable—but we should take great care to minimize it.

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WHAT CAN MUTATION AND SELECTION ACCOMPLISH?

WILLIAM J. TINKLE*

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The author of this article had a mental shock when he was a college student, while reading *Plant-Breeding* by L. H. Bailey of Cornell University. I had been confident that the more one selects seed for planting, the more he improves his garden in future years. A common attitude was that the more you throw away the more you improve the quality of what is left. What a shock it was to learn about a gardener who selected big beans, also little beans (all by weight), and harvested the same average crop from each.

This careful investigator, Wilhelm Johannsen, was proving something that I, until I read about it, had never heard of, namely the limit of effective selection. Could it be that the method on which Darwin depended did not always produce results?

In explanation it should be said that in the beginning of Johannsen's work, the expected result did occur: big beans did produce big beans. But weighing the progeny of each stalk and planting them in separate plots, he found that *from the same plant*, little beans produced plants giving the same average weights as the big beans. For instance, taking an example from line A, one bean at planting weighed 40 centigrams and bore beans averaging 57.2 cg.; another bean weighed 70 cg. and produced beans averaging 55.5 cg., not far from the same.¹ In plants like beans, which normally pollinate themselves, it takes but one generation to produce uniformity in the genes of the progeny; and among things that are alike, of course there is no point in selecting. Any difference among the plants is caused by the environment and this, it is agreed, is not inherited. By the way, it was Johannsen who gave us the word *gene*, which is now used very widely.

You will recall that such results, although confirmed by various careful geneticists,² were at variance with

Darwin, who assumed that all genes change slightly and in all directions at each reproduction. It was unpleasant to have disharmony in the family of scientists and it led to hard words. We will let Byron Nelson relate to us the facts of the story.

From the beginning a pronounced dislike for Mendel's laws was apparent on the part of evolutionists. Alfred Russell Wallace, Darwin's close friend and co-worker, said, "On the general relation of Mendelism to evolution, I have come to a very definite conclusion. That is that it is really antagonistic to evolution." . . . Professor Scott of Princeton, another evolutionist, has said, "Interesting and profoundly important as are the results of Mendelian investigation, it must be admitted that they have rendered but little assistance in making the evolution process more intelligent, but instead of removing difficulties have rather increased them." Bateson revealed the situation when he said, "I notice that certain writers, who conceive themselves to be doing a service to Darwinism, take occasion to say that they expected as much (of Mendelism) and that from the first *they disliked the whole thing*." (Emphasis in the original)³

Although Nelson's degree was in theology he observed carefully and widely and wrote several books which have been read widely. In his book he gives the references to the above quotations very exactly.

To react to the situation the evolutionists took a characteristic step: instead of doubting evolution they would explain their beloved obsession by mutation and keep selection.

Perhaps you know that creationists recognize mutation just as much as evolutionists do. Usually a mutant (a change caused by mutation) has been caused by a change in a gene; but an unusual number of chromosomes, a break in a chromosome, or one turned end for

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end will cause a change in morphology which may not be distinguished from a mutation which is a change in a gene. The extensive studies of the gene in the last 30 years have made difficulty for the acceptance of origin by chance and development by struggle. The present model of a gene is that of a code made up of clumps of atoms⁴ just as a word is made up of letters. Just as a word is made up of letters and the meaning of the word depends upon the *order* of the letters, so the order of the parts of a gene is very important and this order is repeated at each reproduction, normally. A change in that order is a mutation. All students of the subject agree that mutations arise in nature at unexpected times, and the change does not increase through a series of years but is inherited like other traits. It is superfluous to point out that such a change is nearly always harmful; for this has been observed and stated many times.

When a mutation which is not too large occurs in a plant or animal in the laboratory, a scientist usually keeps the mutant alive and reproducing, for in this way we may learn genetic facts. But it is easy to assume from the number of mutants we have seen in laboratories, that mutation is a frequent occurrence; passing by the fact that if left to themselves these unfit creatures would have been eliminated by the struggle for existence.

H. Nilsson, a famous geneticist of Sweden, evaluates mutants as follows:

This is the fundamental question. The mutations may be as numerous as the stars in the sky, they may originate in this manner or in that, but if they are not able to compete with their mother variety in a natural population they are without any value in the process of speciation—and then no evolution can occur.⁵

Later the same author adds:

A review of known facts about their (*Drosophila* mutations) ability to survive has led to no other conclusion than that they are always constitutionally weaker than their parent form or species, and in a population with free competition they are eliminated. Therefore, they are never found in nature, e.g. not a single one of the several hundreds of *Drosophila* mutations, and therefore they are able to appear only in the favorable environment of the experiment field or laboratory—and there they seem to be new.⁶

These results, based upon much more observation than mine, give proof of the same conclusion.⁷

Bauer worked with *Antirrhinum majus* (snapdragon) and found a number of mutations; then he went to the

natural home of the species in southern Europe and could find not one of the mutations growing wild in nature. His conclusion was the same as that of Nilsson.

Selection at best would only make plants and animals more strong, not more beautiful; in fact a beautiful plant is more likely to be devoured by a grazing animal than a plain one. Some say that beautiful flowers attract insects for pollination; but plants such as beans and peas which pollinate themselves have pretty flowers. Evolutionists make glib mention of *favorable mutations*; let them point out some and tell in what respect they are of advantage. Why don't they do this? The list would be very short.

The usual type of change which results in permanent (if maintained by breeding,) improvement of note is found in plants or animals in which there is a group of genes for a character instead of a single pair; examples are size and productivity. More often than not this selection is carried on by persons rather than nature, resulting in the production of more meat, milk, or sugar for examples. The result is not a new species, not evolution, but a new variety which depends upon continued selection to maintain its record; and is it better from the standpoint of science, better in ability to care for itself? No, it is less able to care for itself than ones in a state of nature.⁷ Yet such examples are the ones upon which Darwin based much of his belief in evolution.

Conclusion

What then, are the facts? Mutation does not give us the characteristics which would elevate Amoeba to Homo; rather it gives characteristics which would lead to extinction. Selection narrows the possible choice of organisms and eliminates the unfit ones, but it does not cause any new characteristics. Neither process, nor both together, could cause a gradual change from amoeba to man.

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CORRECTION

Dr. J. Dillow has informed us that he has found an error of fact in his article *The Catastrophic Deep-Freeze of the Beresovka Mammoth*, which was published in the *Quarterly* for June 1977.

It was stated there that petals of buttercups had remained undigested in the animal's stomach. However, a closer examination of the Russian original, which had

not been available previously, shows that the presence of buttercups was deduced, not from petals, but rather from seeds. The difference is apparent, for the seeds are likely to have been more rugged.

However, petals of another flower, *Alopecurus alpinus*, were found. It is true that the action of stomach acids on them has not yet been tested; but it seems likely that they, too, can furnish good evidence that the carcass must have cooled very quickly.

RADIOMETRIC GEOCHRONOLOGY REAPPRAISED

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The use of radiometric dating in Geology involves a very selective acceptance of data. Discrepant dates, attributed to open systems, may instead be evidence against the validity of radiometric dating.

A systematic and critical review of dating applications is presented; emphasis being placed on the geologic column. Over 300 serious discrepancies are tabulated. It is, however, demonstrated that most discrepant results are not published. Discrepant dates capriciously relate to petrography and regional geology.

Neither internal consistencies, mineral-pair concordances, nor agreements between different dating methods necessarily validate radiometric dating.

The large spread of values for igneous and metamorphic rocks (especially of the Precambrian) may indicate artificial imposition of time-values upon these rocks.

Plan of this Article

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- I. Phanerozoic Geochronology: Selection Amidst Contradictions.
 - A. Introduction to Phanerozoic Geochronology
 - B. The Selective Publication of Dating Results
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 - D. Open-System Rationalizations for Discrepant Igneous Dates As Deduced from Petrography and Regional Geology
 - E. Radiometric Dating of Biostratigraphically-Bracketed Igneous Rocks
 1. Effusives (Tuffs and Bentonites) and Extrusives (Lava Flows)
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- II. Highlights of Precambrian and Non-Biostratigraphic geochronology.
 - A. Consistency and Concordances Among Radiometric Dates
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 - C. Age Values for Igneous and Metamorphic Terranes

Introduction

Radiometric dating is supposed to confirm and quantify the evolutionary-uniformitarian claims of geologic ages with biological evolution. All speculations of a legendary Flood, a local Flood, or a tranquil Flood placed aside, both evolutionist-uniformitarians and Creationist-Diluvialists will agree that there is no evidence of a truly global Flood if uniformitarian time scales are accepted in any way. Once divested of all the time claims imposed upon it, the fossiliferous rock testifies to the Noachian Deluge, and all life (fossil and extant) is then mutually contemporaneous as is demanded by a literal six (24 hr.) day Creation. Therefore acceptance of radiometric dating abrogates not merely a young earth, but also the six-day Creation and the Universal Deluge.

Creationist-Diluvialists have uncovered dozens of powerful evidences for an Earth age of only several thousand years, and these scientific evidences are summarized by Morris.²¹² Reasons for questioning the validity of radiometric dating are presented in the major works by Whitcomb and Morris,²¹³ Cook,²¹⁴ Slusher,²¹⁵ and Wilkerson.²¹⁶ These works center on the many unproven assumptions behind radiometric dating. This work, by contrast, seeks critically to evaluate the claims of radiometric dating via a geological approach; the author believing that dating is best understood in its geologic context.

The intended theme of this work is best portrayed by the following statements by Goldich:²¹⁷ "Fifteen years ago, radiometric age determinations on minerals and rocks were so startling that 'absolute age' became a password. Intensive research with successive improvements in the K-Ar, Rb-Sr, and U-Pb methods, however, revealed that geologic processes influence isotopic systems and that the age measurements are analytical values that commonly require geological interpretation." Thus open systems caused by geologic events ("geological interpretation") is claimed as a cause of spurious dates, but a less self-congratulatory view would be that only a *select* number of dates are accepted as indicating the true age of the rock; others explained away as having become open systems.

Owing to the breadth of the topic of radiometric dating, this work will not consider any extraterrestrial dating, nor marine dating, and little Pleistocene dating. Attention will be focused upon the dating of biostratigraphically-defined materials in the Phanerozoic. The dating of the fossil record is thus emphasized over the Pre-Cambrian because it is the Phanerozoic which is a pivotal point in both the evolutionist-uniformitarian and Creationist-Diluvialist paradigms, and because that is where radiometric dating can be compared with fossil dating.

I. Phanerozoic Geochronology: Selection Amidst Contradictions

A. Introduction to Phanerozoic Geochronology

The values given for geologic periods in terms of the time come from dated material that is biostratigraphically defined. It will become obvious that actually grossly contradictory results are obtained from materials of the same geologic periods and that some values are accepted as true, while others are explained away.

It can not be said that discrepancies are primarily caused by the poorer analytical equipment available in the late 1950's/early 1960's as contrasted with that of the late 1970's. Recently, Waterhouse²¹⁸ said: "Improved laboratory techniques and improved constants have not reduced the scatter in recent years. Instead the uncertainty grows as more and more data is accumulated . . ."

Table 1 is a compilation of over 300 different sets of dates that are in gross conflict with one another and with expected values for their indicated paleontological positions. How unwanted and discrepant dates are ra-

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Table 1. The phanerozoic time scale: major inconsistencies. This is a compilation of over 350 different radiometric dates that are very anomalous with respect to accepted values for their biostratigraphic positions. At left are the values for geological periods (and subdivisions of them) in millions of years, taken from radiodates that are considered to be correct. The numerical values for the subdivisions of the time scale are those of Braziiunas.²¹¹ To the right of them are given the discrepant results. How these dates are explained away is extensively discussed in the text.

The asterisk (*) denotes a date from a biostratigraphically-bracketed igneous body; non-asterisk items are direct dates on sedimentary rock. Dates for sedimentary rocks are obtained from separated authigenic minerals: g-glaucinite; il-illite. Directly dating fossils (ca-calcite) is not considered to be reliable (only 2 examples are given) and is hardly ever done. Dates from igneous rocks are obtained from entire samples (wr- whole-rock; wri-whole rock isochron) or from mineral separates (mi-mineral isochron; b-biotite; s-sanidine; l-lepidolite; m-muscovite; p-phlogopite; h-hornblende; arf-arfvedsonite; z-zircon; mo-monzanite; ch-chevkinite; hu-hutchettolite; gl-undevitrified volcanic glass (1 example only given); pl-plagioclase feldspar). Information not given is denoted: ng.

<i>Age Expected</i>	<i>Age Obtained</i>	<i>Method & Material</i>	<i>Common or Formational Name/Locality</i>	<i>Reference</i>
TERTIARY				
1	81	K-Ar g	sandstone/Yenisei, USSR	1
5	1-10.6	K-Ar s, b	*Bailey Ash/California, USA	2
9.5	13-31	K-Ar s	*tuff/Nevada, USA	322
10	95	K-Ar wr	*basalt/Nigeria	3
10	153 ± 10	K-Ar h	*Nogales Fm. (tuff)/Arizona, USA	4
11	6.4-7.6	K-Ar ng	*Mount Capanne granodiorite/Elba Island, Italy	5
	7.2	Rb-Sr mi		
12	30-36	K-Ar g	ng/ng	6
23	3.4	K-Ar wr	*Suta Volcanics/Solomon Islands	391
<25	30-40	Rb-Sr wri	*volcanics/Saudi Arabia	7
27	31-43	K-Ar wr	*Velolnyk suite (volcanics)/Kamchatka, USSR	392
30	21.6	K-Ar s	*tuff/Oregon, USA	8
38	21-2	K-Ar g	sediments/New Zealand	9
42	18-36	K-Ar g	sediment/California, USA	10
42	31	K-Ar g	sediment/Hordhorn, W. Germany	11
47	24-153	K-Ar b	*tuffs/Wyoming, USA	12
52	39	K-Ar g	Winona sand/Gulf Coast, USA	13
55	200-280	Pb ²⁰⁷ /Pb ²⁰⁶	ores/Wyoming, USA	393
60	38	K-Ar g	ng/Gulf Coast, USA	13
60	35-110	Pb ²⁰⁶ /U ²³⁸	Front Range ores/Colorado, USA	14
	42-113	Pb ²⁰⁷ /U ²³⁵		
	114-430	Pb ²⁰⁷ /Pb ²⁰⁶		
<65	49-271	K-Ar wr	*Mafic Dykes/Mull, Scotland	323
65	46	K-Ar b	*Ruby Star Granodiorite/Arizona, USA	15
65	46	K-Ar g	sediment/California, USA	16
65	260 ± 54	Rb-Sr wri	*Loch Uisg Granophyre/Scotland	324
>65	42-48	K-Ar wri	*andesite/British Columbia, Canada	17
<70	500	Rb-Sr wri	*basalts/Patagonia, Argentina	394
<70	494 ± 20	Pb ²⁰⁶ /U ²³⁸ z	*granites/Utah, USA	18
	756 ± 80	Pb ²⁰⁷ /U ²³⁵ z		
	794 ± 50	Pb ²⁰⁸ /Th ²³² z		
<70	2750	Rb-Sr wri	*volcanics/Inner Hebrides, Scotland	18
	300	Pb ²⁰⁷ -Pb ²⁰⁶		
<70	90-1330	Rb-Sr wri	*basalts/western USA	20
<70	290, 400	Rb-Sr wri	*andesite/Peru	20

CRETACEOUS

70	103	K-Ar ng	*Brazeau FM. (bentonite)/Alberta, Canada	21
> 70	9-31	Rb-Sr b	*Mandi granite/Manikaran, India	395
72	12-21 20	K-Ar ng Rb-Sr wri	*Pamir-Shugnan granites/India	22
74	104 ± 8	K-Ar g	Tinton Sands/New Jersey, USA	23
> 74	47	K-Ar h	*Ginger Ridge granodiorite/Jamaica	24
< 75	490-770	Pb ²⁰⁷ /Pb ²⁰⁶	ore/Nigeria	325
< 75	120, 481	K-Ar h	*diorite/Colorado, USA	60
75	142	K-Ar p	*kimberlite/Orange Free State	25
77	105 ± 3	K-Ar g	Woodbury Fm./New Jersey, USA	23
> 82	45, 55	K-Ar wr	*Mifune Group (tuffs)/Kyushu, Japan	326
~ 90	~ 250	Rb-Sr wri-il	Pierre Shale/South Dakota, USA	26
96	44, 76-8	K-Ar g	sediment/Brezina, Czechoslovakia	27
96	66-116	K-Ar g	sandstone/Georgia, USSR	28
99	42 59-82	K-Ar il K-Ar g	*Viking Fm. (bentonite)/Alberta, Canada	29
100	142 ± 10	K-Ar g	ng/ng	6
100	68-73	U ²³⁸ /Pb ²⁰⁶	*Mbeya Carbonatite/Tanganyika	30
100	170-8	K-Ar il	clays/Texas, USA	31
100	22-1343	K-Ar b, h, wr	*lamprophyre dikes/New Zealand	396
101	75-115	K-Ar g	Clearwater Fm./Alberta, Canada	32
101	70	K-Ar g	sediment/north Caucasus, USSR	27
> 102	72-143	K-Ar b	*Eagle Granodiorite/British Columbia, Canada	33
105	70-80	K-Ar b	Santa Lucia Plutons/California, USA	327
> 105	61	K-Ar b	*Tres Guanos Quartz Monzonite/Cuba	34
> 112	58-143	K-Ar b, h	*Peninsular Ranges Batholith/California, USA-Mexico	35
115	31	K-Ar g	sediment/Salzgitter, W. Germany	36
118	88	K-Ar g	sediment/Esciagnelles, France	37
~ 120	60-68, 129-150	K-Ar wr	*trachybasaltic dikes/Cordoba, Argentina	328
< 120	241	K-Ar wr	*diabase dyke/Franklin, Canada	38
> 122	71-149	K-Ar wr	*Isfjorden diabases/Advantdalen, Norway	329
< 130	235-382	Pb ²⁰⁷ /Pb ²⁰⁶ z	*granites/Japan	39
< 130	500	Rb-Sr wri	*volcanics/James Ross Island, Antarctica	40
~ 130	70 70	K-Ar wr Rb-Sr wri	*volcanics/Chile	330

JURASSIC

± 130	74 ± 5	Rb-Sr wri	*Serie Tobifera volcanics/Chile	331
> 130	74	K-Ar wr	*Rock Hill Basalt/Nevada, USA	41
> 130	95, 120	K-Ar wr	*La Teta Lava/Colombia	332
< 140	163, 186	K-Ar ng	*Coast Range Batholith/Alaska, USA	42
140	275 ± 20	K-Ar h	*Pearse Peak Diorite/Oregon, USA	43
~ 140	435-780	Rb-Sr il	Shale/Great Basin, Australia	333

140	105-171	K-Ar b, h	*Nelson Batholith/British Columbia, Canada	44,
	104-150	Rb-Sr wri		397
140	95-160	K-Ar b, h	*Wallowa Batholith/Oregon, USA	45
140	50	K-Ar wr	*basalt/Caucasus Mts., USSR	398
> 140	3-23	Rb-Sr m, b	*Mt. Bukulia Granite/Yugoslavia	334
145	106, 117	K-Ar g	sediment/Milne Land, Greenland	32
145	77-180	K-Ar ca	Malm Limestones/Bavaria, W. Germany	46
148	86-118	K-Ar g	Fernie Fm./Alberta, Canada	47
> 150	114-78	K-Ar wr	*Apoteri volcanics/Guyana-Brazil	48
152	26	K-Ar g	sediment/Braunschweig, W. Germany	49
> 153	67-240	K-Ar b, h, m	*granites/West Malaysia	50
> 153	110	Rb-Sr mi	*pegmatite/New Zealand	399
~ 155	61 ± 2	K-Ar h	*Novatak Glacier pluton/Alaska, USA	335
~ 155	1020 ± 320	Rb-Sr wri	*volcanics/Dronning Maud Land, Antarctica	51
157	92-145	K-Ar wr	*volcanics/Zuidwal, Netherlands	336
160	140-165	K-Ar b	*Carmel Fm. (bentonite)/Utah, USA	52
	85-163	Rb-Sr b		
160	70-109	K-Ar wr	*Rajmahal Traps (lavas)/India	400
~ 160	78	K-Ar b	*Chocolate Fm. (volcanic breccia)/Peru	337
165	106 ± 6	K-Ar b	*granodiorite/British Columbia, Canada	53
165	21	K-Ar g	sediment/Coston Del Vette, Italy	54
165	63, 138-178	K-Ar b	*Topley intrusions/British Columbia, Canada	55
165	176, 228	Rb-Sr wri-il.	Bedford Canyon Fm. (shale)/California, USA	425
165	109-165	K-Ar wr	*Volcanics/North Sea, England	426
< 170	7-250	K-Ar wr	*Basalts/Victoria Land, Antarctica	427
< 170	223	K-Ar b	*granodiorite/Yukon, Canada	56
170	78-90	K-Ar b, h	*Chigmit Mountains Batholith/Alaska, USA	57
~ 175	265	Rb-Sr wri	*rhyodacite/California, USA	338
178	134-76	K-Ar wr	*Kirkpatrick Basalt/Victoria Land, Antarctica	58
< 180	296-302	K-Ar wr	*dolerite/Midlands, England	59
< 180	2661	Pb ²⁰⁶ /U ²³⁸ z	*Independence dikes/California, USA	401
	2774	Pb ²⁰⁷ /U ²³⁵ z		
	2860	Pb ²⁰⁷ /Pb ²⁰⁶ z		
~ 180	70, 120-250	K-Ar b	*granite porphyry, pegmatite/Caucasus Mts., USSR	61

TRIASSIC

~ 180	120-25	K-Ar wr	*Serra Geral Fm. (lavas, diabase)/Brazil	339
180	105-175	K-Ar b	*granite/Billiton, Indonesia	62
180	170-265	K-Ar b, h	*Guichon Creek Batholith/British Columbia, Canada	63
< 185	244 ± 15	K-Ar wr	*mafic dike/Idaho, USA	64
185	291	K-Ar ng	micaceous sandstone/Nilgiri, India	65
185	137-219	K-Ar wr	*Karoo volcanics/Lesotho	66
~ 185	186-1230	K-Ar pl, wr	*diabase dikes/Liberia	402
< 190	286	K-Ar h	*Tulameen ultramafic complex/British Columbia, Canada	67
~ 190	79, 140	K-Ar wr	*Watchung Basalt/New Jersey, USA	68

~ 190	151-201	K-Ar wr	*lavas/Connecticut, USA	69
~ 190	178-217, 328 ± 24	K-Ar wr	*North Mountain Basalt/Nova Scotia, Canada	70
~ 190	80	K-Ar b	*Mt. St. Elias pluton/Alaska, USA	340
~ 190	139-217	K-Ar b	*Hotailuh Batholith/British Columbia, Canada	71
~ 190	89-199 104, 144	K-Ar b, h Rb-Sr wri	*Klotassin Batholith/Yukon, Canada	72
< 195	152-235	K-Ar wr	*Foum Zguid dolerite, lavas/Morocco	73
195	126	K-Ar gl	*tuff/Alaska, USA	74
< 200	246 ± 10	K-Ar p	*kimberlite/Siberia, USSR	428
<	170, 259	Pb ²⁰⁶ /U ²³⁸ z	*diorite/California, USA	429
< 200	212-278	K-Ar wr	*gabbroids/Tien Shan, USSR	430
~ 200	102-110	K-Ar wr	*diabase dikes/Arctic Canada	431
~ 200	100-220	K-ar ng	intrusives/New Zealand	432
200	118 ± 10	K-Ar m	*pegmatite/Neyriz, Iran	433
~ 200	61-181	K-Ar wr	*volcanics/Othris, Greece	434
~ 200	98-107	K-Ar b	*granites, quartz monzonites/British Columbia, Canada	75
200	43-188	K-Ar ca	bone/Nordwurttemberg, W. Germany	46
200	20-218 295 ± 20	Pb ²⁰⁷ /U ²³⁵	Pitchblende, Chinle Fm./Arizona, USA	76
< 204	270 ± 45 360	Rb-Sr wri	*Ferrar Dolerite/Victoria Land, Antarctica	77
< 205	363 ± 15	Rb-Sr wri	*Inas Granite/Malaysia	78
~ 210	114-214	K-Ar ng	shale/Nilgiri, India	65
~ 210	175-237	Rb-Sr wri	*Predazzo granite/Dolomites, Italy	79
~ 220	131 ± 5	K-Ar wr	*rhyolite/Peru	341
> 225	188-270	K-Ar wr	*Korvunchana Series (basalts, tuffs, ejecta)/Tunguska, USSR	80
230	231-280	K-Ar wr	*Semeitau lavas/Kazakhstan, USSR	81

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230	241-75	K-Ar h	*Yakuno gabbros/Japan	342
> 230	71-118	Pb ²⁰⁷ /Pb ²⁰⁶	ore/Lenterios, Portugal	82
> 230	97 111	Pb ²⁰⁷ /U ²³⁵ Pb ²⁰⁶ /U ²³⁸	ore/Wittichen, W. Germany	82
> 230	146-57	Pb ²⁰⁷ /Pb ²⁰⁶	ore/La Crouzille, France	82
> 230	87	K-Ar b	*granite/Kocaeli, Turkey	83
240	165	K-Ar g	limestone/Sokolka, USSR	84
240	173-243	Rb-Sr wri-il	Estrada Nova Fm. (shale)/Brazil	343
~ 240	175	K-Ar g	sediment/Kirovsk, USSR	85
240	310 ± 70	Pb ²⁰⁷ /Pb ²⁰⁶	ore/Thickley, Scotland	86
< 250	346	K-Ar ng	*granite/Peru	87
~ 250	182	K-Ar wr	*trachyandesite lava/Caucasus Mts., USSR	85
~ 250	337 ± 61	Pb ²⁰⁷ /Pb ²⁰⁶	Jachymov Pitchblende/Bohemia, Czechoslovakia	88
250	165-263	K-Ar wr	*rhyolite, tuff/Zechstein, E. Germany	344

250	136-245	Rb-Sr b	*volcanics/New Zealand	89
~ 250	96 ± 6	K-Ar b	*lavas/Oman, Iran	435
~ 250	1380	Rb-Sr wri	*Croydon Volcanics/Queensland, Australia	436
> 250	130-182	K-Ar wr	*volcanics/Auk Field, England	437
> 255	209	K-Ar b	*Mitaki Granite/Japan	90
< 260	330-380	K-Ar p	*Stockdale kimberlite pipes/Kansas, USA	91
< 260	294-351	Rb-Sr wri	*Nychum volcanics/Queensland, Australia	345
~ 260	165	K-Ar g	sediment/Vestspitsbergen, Norway	92
260	259-315 216	K-Ar b Th ²³² /Pb ²⁰⁸	*Oslo Series (subvolcanics)/Norway	93
260	219-280	Rb-Sr wri	*Barhalde Granite/Schwarzewald, W. Germany	94
~ 265	363	Rb-Sr il	Stearns Shale/Kansas, USA	95
265	193 ± 7 230 ± 11	K-Ar wr K-Ar b	*Filipowice Tuff/Krakow, Poland	96
265	252-374 164-595	K-Ar il Rb-Sr il	Eskridge, Stearns Shale/Kansas, USA	97
265	229-74	K-Ar wr	*Lizzie Creek Volcanics/Queensland, Australia	98
~ 265	245 ± 220	Rb-Sr mi	*Donnersberg Rhyolite/Saar, W. Germany	99
< 270	2700	U-Pb z	*Diorite dike/California, USA	100
< 270	368 ± 18	K-Ar b	*peridotite/Pennsylvania, USA	101
< 270	1180 ± 60	Rb-Sr wri	*Rose Dome Granite/Kansas, USA	102
< 270	831	K-Ar h	*Tortilla Quartz Diorite/Arizona, USA	346
~ 270	280-300, 390	Rb-Sr wri	*Pine Mountain Granite/British Honduras	103
270	155	K-Ar g	sediment/ng	149

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> 270	150-280	K-Ar b	*granites/northern Italy	104
> 270	120-280	K-Ar b	*granites/Zabaikal, Mongolia	105
> 270	157, 194 162, 220	Pb ²⁰⁶ /U ²³⁸ z Pb ²⁰⁷ /U ²³⁵ z	*granite/Switzerland	403
280	255, 859	Rb-Sr wri-il	Madera Fm. (shale)/New Mexico, USA	404
280	330-441	Rb-Sr il	underclays/Illinois, USA	405
280	190	K-Ar wr	*basalt, gabbro/Franklin, Canada	406
280	385	Pb ²⁰⁷ /Pb ²⁰⁶ z	*Monti Orfano granite/Italy	407
< 285	305-475	Pb ²⁰⁷ /Pb ²⁰⁶	ores/Limburg, Netherlands	106
290	220 ± 25	Rb-Sr wri	*Wamsutta Fm. (rhyolite)/Massachusetts, USA	107
290	70-140 85	Pb ²⁰⁷ /Pb ²⁰⁶ K-Ar wr	*Mrzyglod diabase/Krakow, Poland	108
< 300	390	U-Pb z	*porphyritic intrusions/British Columbia, Canada	109
300	139-315	K-Ar wr	*Whin Sill (diabase)/Northumberland, England	110
300	233	K-Ar il	shale/Missouri, USA	111
300	114-385	K-Ar il	shale/Iowa, USA	111
~ 300	85	K-Ar wr	*tuffs/Andscollo, Argentina	112
300	318-456 338-511	K-Ar il Rb-Sr il	underclays/Pennsylvania-Ohio, USA	113

300	230-55	K-Ar g	Veraya Tier sediments/Kuibyshev, USSR	114
> 300	220-354	K-Ar ng	*Old Crow Batholith/Yukon, Canada	115
> 300	20-350	K-Ar m, b	*granites/Caucasus Mts., USSR	116
~ 310	185-315	K-Ar wr	*Toadstone Lava/Derbyshire, England	117
310	162-262	K-Ar wr	*volcanics/Silesia, Poland	408
310	145	K-Ar b	*granite/Caucasus Mts., USSR	347
310	282-367	K-Ar wr	*basalt/Quebec, Canada	118
310	238	K-Ar wr	*felsite lava/Primorye, USSR	85
320	266	K-Ar wr	*porphyritic lava/Kara Mazar, USSR	85
> 320	245-330	K-Ar arf., s	*Han Bogdo Batholith/Mongolia	119
330	267-312	K-Ar wr	*Waterswallows Sill/Derbyshire, England	120
> 330	265 ± 7 263 ± 7 244 ± 20	Pb ²⁰⁶ /U ²³⁸ z Pb ²⁰⁷ /U ²³⁵ z Pb ²⁰⁷ /Pb ²⁰⁶ z	*Sicker volcanics/British Columbia, Canada	121
> 330	225	K-Ar b	*Vallorcine Granite/Aiguilles Rouges, Switzerland	122
334	250-78	K-Ar g	shale/Texas, USA	123
< 335	420	Rb-Sr wri	*granites/Montagne Noire, France	124
~ 340	126 ± 30	K-Ar wr	*pumice tuff/Nottinghamshire, England	117
< 340	440 ± 60	Pb ²⁰⁷ /Pb ²⁰⁶	*Vosges granites/Col de Grosse Pierre, France	125
< 340	780 2500	Pb ²⁰⁷ /U ²³⁸ z Pb ²⁰⁷ /Pb ²⁰⁶ z	*granite/Saxony, E. Germany	126
< 340	347-500	K-Ar b	*granodiorites/Balkhash, USSR	409
340	247	K-Ar w	*dacitic lava/Aral, USSR	410
340	240-330	K-Ar ng	*granites/east Ural Mts., USSR	127
> 342	268-373	Rb-Sr wri	*Nictaux granites/Nova Scotia, Canada	128
343	288, 307	K-Ar b	*Kuttung lavas/New South Wales, Australia	348
~ 345	154	K-Ar il	Rocky Mountain Fm./Alberta, Canada	47
> 345	165	K-Ar ng	arkosic sandstone/Alexander I Land, Antarctica	129
< 350	240-1630	K-Ar wr	*diabases/Georgia, USA	356
< 350	400-453	K-Ar wr	*kimberlites/Siberia, USSR	411
350	222-284	K-Ar s	*Exshaw Fm. (bentonite)/Alberta, Canada	130
350	315 ± 7	Rb-Sr wri	*tuffs/Aljustrel, Portugal	349

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~ 350	240-330	K-Ar b	*granites/Aral, USSR	131
> 350	242 ± 10 218 ± 11	K-Ar b Rb-Sr wri	*granite/Langkawi Island, Malaysia	50
> 350	275 ± 11	K-Ar b	*granite/Alaska, USA	132
360	290-330 286	K-Ar b Rb-Sr wri	*granite/Queensland, Australia	133
~ 360	248-375	K-Ar b	*biotite granite/Maine, USA	134
~ 360	249-93	K-Ar b	*binary granite/Maine, USA	134
~ 360	247 ± 8	K-Ar b	*garnetiferous granite/Maine, USA	134
> 360	239-306	K-Ar m	*Andover Granite/Massachusetts, USA	134
> 360	221-241	K-Ar m, b	*Fitchburg Pluton/Massachusetts, USA	134
> 360	260 ± 8	K-Ar b	*Peabody Granite/Massachusetts, USA	134

> 360	230 ± 8	K-Ar b	*Esmond Granite/Rhode Island, USA	135
~ 370	173 ± 16	Rb-Sr wri-il	Ponta Grossa Fm. (shale)/Brazil	350
370	308	K-Ar wr	*Lovozero Suite (basalt)/Kola, USSR	136
> 370	307	K-Ar b	*granite/Bungonia, Australia	137
372	300-333	K-Ar wr	*Hoy Lavas (basalts)/Scotland	138
< 375	440	Rb-Sr wri	*Webhannet, Lyman plutons/Maine, USA	139
375	285	K-Ar g	sediment/Saskatchewan, Canada	85
~ 375	246-306	K-Ar b	*granites/New Hampshire, USA	140
	241-335	Rb-Sr b		
375	350-450	Pb ²⁰⁶ /U ²³⁸	Chattanooga Shale/Tennessee, USA	141
< 377	439 ± 22	K-Ar b	*peridotite/New York, USA	101
380	310	Rb-Sr wri	*Tioga Bentonite/Virginia, USA	142
	305	Rb-Sr g-mi		
380	266	K-Ar wr	*porphyritic lava/Kara Mazar, USSR	85
380	278-83	K-Ar wr	*nepheline syenite, tuff/USSR	85
~ 380	500-900	Pb ²⁰⁷ /Pb ²⁰⁶	galena/Kazakhstan, USSR	143
390	475 ± 80	Rb-Sr wri	*Irizar Granite/Victoria Land, Antarctica	351
390	303 ± 18	Rb-Sr g	Carlisle Center Fm./New York, USA	144
390	295 ± 9	K-Ar m	*Kinsman Quartz Monzonite/New Hampshire, USA	134
	605 ± 83	Rb-Sr wri		140
395	238	K-Ar wr	*porphyritic lava, tuff/USSR	145
400	364-510	K-Ar b	*Shap adamellite/Westmorland, England	146,7
400	212, 360	K-Ar b	*Gocup Granite/New South Wales, Australia	352
400	321	Rb-Sr g	sediment/ng	148
400	240	K-Ar g	sediment/ng	149
400	401, 484	K-Ar h	*granite/Newfoundland, Canada	353

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400	290 ± 15	K-Ar wr	*basalts/Aral, USSR	412
~ 400	114-190	K-Ar b	*Hikami granite/Japan	150
	315, 354	K-Ar h		
	339 ± 12	Rb-Sr wri		
400	173 ± 4	K-Ar wr	*rhyolite tuff/Florida, USA	438
400	264-380	K-Ar ng	*Mount Peyton Batholith/Newfoundland, Canada	439
> 400	339 ± 5	K-Ar m	*granite/Peru	440
> 400	189 ± 4	K-Ar b	*migmatite/Columbia	441
> 400	250-400	Pb ²⁰⁷ /Pb ²⁰⁶	galena/Kazakhstan, USSR	151
> 400	330	Pb ²⁰⁶ /U ²³⁸ z	*Cape Granite/Republic of South Africa	152
	238 ± 30	Pb ²⁰⁸ /Th ²³² z		
~ 405	247	K-Ar g	Binnewater Sandstone/New York, USA	153
~ 410	230, 550	Pb ²⁰⁷ /Pb ²⁰⁶	galena/Perthshire, England	154
> 410	245-88	K-Ar wr	*Vent Rhyolite/Wales	155
< 420	1243	Rb-Sr wri	*Ornakam-Moldhesten granite/Norway	354
< 420	411-493	Rb-Sr wri	*Murrumbidgee Batholith/New South Wales, Australia	413, 414
420	344-39	Rb-Sr il	Marblehead illite/Wisconsin, USA	405
420	326	K-Ar il	Bertie Fm./New York, USA	156

420	332	K-Ar il	Camillus Fm./New York, USA	157
420	345	Rb-Sr wri	*Newbury volcanics/Massachusetts, USA	355
420	369-519	K-Ar il	Colonus Shale/Skane, Sweden	158
> 420	25-180, 410	K-Ar ng	*migmatites/Bulgaria	357
< 430	635-94	K-Ar p	*kimberlite/east Siberia, USSR	159
430	363	K-Ar il	Rochester Shale/New York, USA	157
430	349	K-Ar b	*granite/Terskei Alatau, USSR	145
~ 430	314 ± 9	K-Ar wr	*diabase/Wales	358
430	289	K-Ar il	State Circle Shale/Canberra, Australia	160
430	111-235	Rb-Sr wri-il	Trombetas Fm. (shale)/Brazil	359
> 430	310-630	K-Ar wr	*Natkusiak Fm. (basalt lavas)/Franklin, Canada	161, 2
435	357	K-Ar il	Williamson Shale/New York, USA	163
435	367	K-Ar il	Sodus Fm./New York, USA	163
435	113-26	Rb-Sr b	*granites/Ax-les-Thermes, France	164
	275 ± 11	Rb-Sr m		
	300-70	Rb-Sr wri		
< 440	409, 563	Pb ²⁰⁶ /U ²³⁸ z	*Dale City Quartz Monzonite/Maryland, USA	165, 6
	432, 556	Pb ²⁰⁷ /U ²³⁵ z		
	535-47	Pb ²⁰⁷ /U ²³⁵ z		
	444, 555	Pb ²⁰⁸ /Th ²³² z		
< 440	400-1300	K-Ar h, b	*Furuland Granite/Sulitjelma, Norway	360
440	267-84	K-Ar il	Chimney Hill Limestone/USA	167

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~ 440	510 ± 10	Pb ²⁰⁷ /Pb ²⁰⁶ z	*Deadman's Bay Granite/Newfoundland, Canada	168
> 440	306 ± 10	Rb-Sr wri	*Oporto Granite/Portugal	415
> 440	168	K-Ar b	*granite/Caucasus Mts., USSR	416
447	445, 337	K-Ar b	*Bail Hill Volcanics/Dumfriesshire, Scotland	169
447	294, 416	K-Ar wr	*Alcaparrosa Fm. (lavas)/San Juan, Argentina	361
< 450	540 ± 50	Rb-Sr wri	*Oughterard Granite/Ireland	170
< 450	564 ± 24	Rb-Sr wri	*Ben Vuirich Granite/Scotland	171
< 450	580 ± 20	K-Ar h	*Rosetown Pluton/New York, USA	172
< 450	542-62	K-Ar b	*granite/Idaho, USA	173
	1310-1490	Rb-Sr wri		
< 450	425-540	K-Ar b	*diorites/Kazakhstan, USSR	409
450	350-540	K-Ar il	Sylvan Shale/USA	232
450	272 ± 13	K-Ar wr	*Vent Rhyolite/Wales	155
~ 450	308, 420	Rb-Sr wri-il	Anse du Veryach Series (shale)/France	362
450	402 ± 25	K-Ar b	Utica shales/Quebec, Canada	174
	566 ± 75	Rb-Sr b		
~ 450	329 ± 10	K-Ar b	*Waits River Fm./New Hampshire, USA	134
~ 450	273-340	K-Ar b	*Albee Fm./New Hampshire, USA	134
> 450	372 ± 6	K-Ar m	*Main Donegal Granite/Ireland	175
> 450	315	K-Ar b	*Ellicott City granodiorite/Maryland, USA	176
	300	K-Ar h		
~ 460	360	K-Ar ng	*granite porphyry/Caucasus Mts., USSR	363
~ 460	375-471	Rb-Sr g	sediment/ng	148

470	379	K-Ar s	*Mystery Cave bentonite/Minnesota, USA	364
470	350, 423	Rb-Sr il	claystones/Kentucky, USA	405
470	362, 371	K-Ar h, wr	*gabbro/Cockermouth, England	417
> 470	300-420	Rb-Sr wri	*granites/Newfoundland, Canada	418
475	493-584	K-Ar b, h	*granite/eastern Canada	177
475	390 ± 19	K-Ar m	*Walloomsac Fm./Connecticut, USA	135
~ 475	376, 450	K-Ar wr	*diorite, gabbro/Quebec, Canada	365
475	362	K-Ar g	sediment/Georgia, USSR	145
475	44	Rb-Sr b	*bentonite/Tennessee, USA	366
475	300, 400-900	Rb-Sr il-mi	Lowville Limestone/New York, USA	113, 178
475	297	K-Ar g	*bentonite/Ostergotland, Sweden	179
< 480	590	Rb-Sr wri	*Cooma Granite/New South Wales, Australia	180
~ 480	247-487	K-Ar ng	*Tangriseau microgranite/Wales	367
480	305 ± 10	K-Ar wr	*Warboys diorite/Huntington, England	181
< 480	458-548	K-Ar h	*Ophiolite (mafic-ultramafic complex)/Newfoundland, Canada	368
495	355 ± 20	Rb-Sr g	sediment/Falkoping, Sweden	144
495	495, 362	Rb-Sr wri-il	shales/New Zealand	419
~ 500	407-11	K-Ar wr	*olivine diabase dike/Ontario, Canada	182
500	380 ± 35	Rb-Sr g	sediment/Stenbrottet, Sweden	183

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~ 500	345	K-Ar wr	*trachyandesites/Normandy, France	369
> 500	392-584	Rb-Sr g	sediment/ng	148
~ 510	412 ± 60	K-Ar g	Murray Shale/Tennessee, USA	184
510	411-50	K-Ar g	Franconia Fm./Wisconsin-Minnesota, USA	185
	413-33	Rb-Sr g		
> 510	396-569	Rb-Sr wri	*Tioueiine granite/Ahaggar, Algeria	186
~ 520	225-400	Pb ²⁰⁶ /U ²³⁸	kolm (alum shale)/Gullhogen, Sweden	187
	330-430	Pb ²⁰⁷ /U ²³⁵		
	720-920	Pb ²⁰⁷ /Pb ²⁰⁶		
~ 520	373-500	Rb-Sr wri-il	Erguy Kerity Fm. (shales)/France	362
~ 530	391-4	K-Ar b	*Windyhills' Granite/Aberdeen, Scotland	188
540	340	K-Ar g	sediment/ng	149
< 550	635-694	K-Ar -	*kimberlite/Siberia, USSR	428
550	404	K-Ar il	sediment/Bohemia, Czechoslovakia	442
~ 550	?-460	K-Ar wr	*felsic volcanics/Georgia, USA	443
~ 550	282-1097	K-Ar il	Conasauga Shale/Virginia, USA	189
~ 550	300-413	K-Ar g	sediment/Alberta, Canada	371
550	393	K-Ar il	Riley Fm./Texas, USA	190
~ 550	830-1160	Rb-Sr wri	*norites/Scotland	191
> 550	284 ± 5	K-Ar wr	*Sledgers Fm. (lava)/Victoria Land, Antarctica	420
< 560	764	Pb ²⁰⁷ /U ²³⁸ ch	*granite/North Baikal, USSR	192
565	346-390	Rb-Sr g	sediment (Mt. Whyte Fm.)/USA	183
~ 565	760	K-Ar g	sediment/Northern Territory, Australia	193
	790	Rb-Sr g		

565	411-891 394	K-Ar wr K-Ar wri	*Bourinot group (volcanics)/Nova Scotia, Canada	372
> 565	400 ± 40	Pb ²⁰⁸ -Th ²³² z	*Carlton rhyolite/Oklahoma, USA	373
> 565	460	K-Ar b	*granite/Oklahoma, USA	194
568	447	K-Ar il	sediment/Shropshire, England	11
570	406	K-Ar g	sediment/Wyoming, USA	16
570	1145 ± 98	Rb-Sr wri	*andesite/Suldal, Norway	374
570	645, 708	K-Ar g	Gros Ventre Shale/Wyoming, USA	195
570	399	K-Ar g	sediment/Narke, Sweden	179
570	395-511	K-Ar wr	*Antrim Plateau Volcanics/Victoria River, Australia	196
570	400-542	Rb-Sr g	Flathead Sandstone/Montana, USA	197
~ 570	490 ± 15	ng ng	*Palmer Granite/Adelaide, Australia	375
570	385	K-Ar g	sediment/Byelorussia, USSR	198
575	395-413	K-Ar g	Cavell Fm./Alberta, Canada	47
575	413	K-Ar g	sediment/Gotland, Sweden	54
~ 580	894 ± 58	Rb-Sr wri	*granite/Massachusetts, USA	199
580	457	K-Ar il	sediment/England	11
580	439	K-Ar g	Chilhowee Group/Tennessee, USA	190
580	334	K-Ar wr	*Lighthouse Cove Fm. (basalts)/Newfoundland, Canada	200
590	393-442	K-Ar il	Rome Fm./Virginia, USA	201
590	436	K-Ar g	sediment/Oland, Sweden	195
~ 600	486 ± 22	K-Ar b	*granite/Pechora, USSR	202
600	479 ± 20	K-Ar b	*Fairville Granite/New Brunswick, Canada	203
600	452-529	Rb-Sr wri-il	shales/Shropshire, England	421

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> 600	350-420	K-Ar g	sediment/Kazakhstan, USSR	371
> 600	320-380	K-Ar b	*granite/Danmarkshaven, Greenland	376
> 600	500 ± 17	Rb-Sr wri	*Hoppin Hill Granite/Massachusetts, USA	204
> 600	100-550	K-Ar wr	*Akitkan Fm. (volcanics)/Baikal, USSR	377
> 600	489 ± 10	K-Ar b	*Athis granite/Normandy, France	205
> 600	350-440	K-Ar b	*Carnsore Granodiorite/Ireland	378
> 600	480 ± 10	K-Ar m	*pegmatite/Wadi Hawashia, Egypt	206
> 600	373-8	K-Ar b	*granite/Kviteseid, Norway	379
> 600	480 320	Pb ²⁰⁸ -Th ²³² mo Pb ²⁰⁶ -U ²³⁸ mo	*granite/Gebel Dara, Egypt	206
> 600	450 ± 120 370 ± 25	Pb ²⁰⁸ -Th ²³² z Pb ²⁰⁶ -U ²³⁸ z	*riebeckite granite/Gebel Gharib, Egypt	206
> 600	420 410 370	Pb ²⁰⁸ -Th ²³² hu Pb ²⁰⁷ -U ²³⁵ hu Pb ²⁰⁶ -U ²³⁸ hu	*granite/east Siberia, USSR	126
> 600	34	K-Ar m	*granite porphyry/New Mexico, USA	380
> 600	470 ± 18	K-Ar il	sediment/Algeria	207
> 600	485-570	K-Ar h	*diorites/Worcestershire, England	381
> 600	460	Rb-Sr wri	*Wooltana Volcanics (basalt)/Australia	208

> 600	340-412	K-Ar b	*granites/Norway	382
> 600	482 ± 30	Rb-Sr wri	*Bull Arm Volcanics/Newfoundland, Canada	209
> 600	401 ± 16	K-Ar wr	*mafic dykes/South West Africa	383
> 600	370 ± 38	Rb-Sr wri	*Coldbrook group (volcanics)/New Brunswick, Canada	210
> 600	461-540	K-Ar b	*Mancellian granites/Chausey Islands, France	384
> 600	300 ± 5	Rb-Sr wri	*volcanics/Morocco	385
> 600	440	K-Ar h	*charnockite/India	386
> 600	510	Rb-Sr wri	*granite/Montagne Noire, France	422
> 600	350-400	Rb-Sr wri	*granites/Alaska, USA	444
> 600	368-1200	K-Ar m, b	*Forsyth Batholith/Queensland Australia	445

tionalized away is the topic for subsequent sections in this work.

Many other dates could have been listed, but Table 1 is limited to dates which approach 20% discrepancy: being either 20% "too young" or "too old" for their biostratigraphical positions. Many are over 30% discrepant. A 20% discrepancy means that an indicated date is off by at least one geologic period in the lower Mesozoic and off by two geologic periods in the early Paleozoic. From Table 1, it is evident that a 330 million year date is obtained for Carboniferous rock, but that the same value is often obtained for rocks as old as Cambrian. Viewed another way, Devonian rocks give "true" values near 375 million years, but also values of 220 ("properly" Triassic) and 450 ("properly" Ordovician).

The arbitrariness of the practice of selecting some values as being true and disregarding others which conflict with them was recently admitted by Waterhouse,³¹⁵ who commented: "It is, of course, all too facile to 'correct' various values by explanations of leakage, or initially high concentrates of strontium or argon. These explanations may be correct, but they must first be related to a time line or 'cline of values' itself subject to similar adjustments and corrections on a nonstatistical, nonexperimental basis."

Table 1 does not include the many anomalous dates from those minerals that have grown in disrepute with respect to radiometric dating. K-feldspars usually give K-Ar ages that are "too young," and this is attributed to argon loss associated with exsolution and perthitic growth. Only sanidine is considered reliable. Because of their K-feldspars, whole-rock dating of acidic intrusive igneous rocks is avoided, and mica or amphibole separates are used instead. Minerals such as beryl, cordierite, and zeolite often give erratic K-Ar ages attributable to isotope fractionation. With few exceptions, Table 1 is confined to datings on material that is considered to be reliable.

Very many igneous bodies which have been dated yield a wide spread of discordant dates, but they could not be entered into Table 1 because they have little or no biostratigraphic definition of their relative ages and thus escape violating any biostratigraphy. Others were entered into Table 1 as "greater than," "less than," or "approximately equal to" some biostratigraphic limit:

dates being so anomalous that they violated even their liberal biostratigraphic limits. The heavy attention given to K-Ar dating in Table 1 reflects the overwhelmingly preponderant use of this method over all others combined; and it also serves to balance the heavy emphasis placed on U-Th-Pb dating by other Creationist scholars.

The uniformitarians may contend that there are many more dates in agreement with accepted values than there are anomalies such as all of Table 1. Even if this were true, it would not appear to be an overwhelming majority, and a significant minority of discrepant dates would probably be sufficient to discredit all of radiometric dating. Since most igneous bodies have wide biostratigraphic limits,²¹⁹ it is difficult to tell that a date is not anomalous because it could take on many different values and not be anomalous.

As a matter of fact, the number of determinations actually used to define "correct" values for the geologic column are fewer than the anomalies comprising Table 1, except for the Cenozoic and Cretaceous. Armstrong³¹⁶ compiled a listing of dates that are considered to be reliable time-points for the Phanerozoic; the list presumably up to date as of 1976-1977. There are 260 pre-Cenozoic dates compiled, but 98 of the 260 are Cretaceous, and many determinations have only partial biostratigraphic brackets.

Some estimates would make dates in agreement with accepted values a minority among all dates obtained in the Phanerozoic. That direct sediment dates (on glauconite) agree within plus or minus 10% of accepted values approximately half the time is estimated by Obradovich and Peterman.²¹⁸ Afanass'yev²¹⁹ considers dates from biostratigraphically bracketed intrusives to be less reliable than glauconite dates, while Armstrong and Besancon²²⁰ point out that most dates on basaltic lavas are discordant. Combining these estimates, it may be that somewhat less than half of all dates agree within 10% of accepted values for their respective biostratigraphic positions.

B. The Selective Publication of Dating Results

An objective comparison between the number of fitting vs. the number of anomalous dates in the Phanerozoic is hindered (if not prevented) by the fact that anomalous dates frequently (or usually) are not reported in scientific journals.

Many researchers directly or indirectly imply that they are not reporting discrepant dates that they have obtained. An implication of there being unreported K-Ar ages that are "too young" and attributed to argon loss is made by Mitchell and Reen,²²¹ who write: "Alternatively, if the *reported* ages can be argued to be free of argon loss . . ." (emphasis added here and elsewhere unless otherwise indicated). A contrast between proper/published and anomalous/unpublished dates is evident in the following statements by Twiss and DeFord:²²² "... some of the ages do not correspond with stratigraphic position. The *reported* ages in millions of years are . . ." Armstrong²²³ writes: "The dates *reported* are all consistent with observed geologic relationships." Plevaya *et al.*²²⁴ write: "The *published* results attest to the possibility of obtaining rather reliable ages for glauconites by the argon method."

In a recollection of how anomalous dates re-occurred, Curtis *et al.*²²⁵ said: "As a result I suggest that it would be important to report all anomalous results." This is not done. Most sobering of all is the following recent statement by Mauger:¹² "In general, dates in the 'correct ball park' are assumed to be correct and are published, *but those in disagreement with other data are seldom published nor are discrepancies fully explained.*"

There is a tendency to leave unpublished the results which conflict with those of other investigators or which disagree with accepted values. Thus, a certain reluctance to provide a non-fitting date seems to be the case in this report by Forman:²²⁶ "The remarkably congruent date obtained for the Tiburon Peninsula eclogite with that . . . for the Cazadero tectonic blocks is very pleasing (147 m.y. *versus* 135 to 150 m.y.). Thus it is a little untidy to report 106 m.y. for the age of the amphibolite on Catalina Island."

C. Direct Radiometric Dating of Sedimentary Rocks

Sedimentary rock samples are not indiscriminately dated because the constituent detrital particles would ostensibly give the age of the source region(s), and not the time since sedimentation. Alternatively, some value between that of provenance and of sedimentary rock formation might be obtained. Dating of fossil material and limestone samples has been abandoned because in nearly every case (as ref. 46; Jurassic and Triassic, Table 1) the K-Ar ages are far too low, and this is attributed to the low argon-retentive properties of calcite.

Sedimentary rocks are dated by the K-Ar and Rb-Sr methods utilizing the authigenic minerals glauconite and illite. In dating glauconites, Rubinstein²²⁷ commented: "... we often get anomalously high figures." This is supposedly caused by minute amounts of allo-genic contaminant incorporated within the glauconite. Usually, however, glauconite K-Ar and Rb-Sr values are "too young" for their biostratigraphic position. Many such anomalously young dates are entered into Table 1.

Rationalizations for these discrepant dates have centered upon claims that glauconite is vulnerable to becoming an open system via spontaneous recrystallization, leaching, or slight heating. Although some correlation of anomalous dates with permeability of host rock and depth of burial were found by Morton and Long,²²⁸

they otherwise stated: "Several factors were studied which could correlate with open-system behavior: grain morphology, extent of weathering, percent expandable layers, recrystallization caused by former deep burial, and permeability of the host rock None of these factors, singly or in combination, was infallibly useful to predict which of the Llano glauconites will have behaved as an open or closed chemical system . . ." Owens and Sohl²²⁹ found similar crystallinity and compositions between glauconites yielding expected, and anomalous, dates.

Depth of burial is supposed to produce diametrically opposed effects on glauconite dates. Evernden *et al.*²³⁰ considered deeply-buried glauconites to be less reliable than shallow-buried ones, on the grounds that the former are more likely to be exposed to heating. Holmes²³¹, by total contrast, contended that shallow-buried glauconites would tend to be less reliable because deeply-buried ones are better shielded from weathering.

Most any discrepant date can be excused on the basis of some presumed system-opening situation. The wide variety of factors which presumably cause open systems and plasticity in attributing anomalous dates to these factors suggest that these are just rationalizations. An alternative view would be that dates are discrepant not because of "open systems" and geologic causes but because radiometric dating is invalid.

K-Ar and Rb-Sr dates on the clay mineral illite produce far greater discrepancies than dates on glauconite. Table 1 includes dates on illite so anomalous that they are several times the "true age" of the rock, or a small fraction of the "true age." For instance, the Conasauga Shale (Cambrian, ref. 189, Table 1) gives us spread of ages ranging from Upper Carboniferous to twice the time since the Cambrian.

"Correct"-age illites are assumed to be authigenic. Those fractions which yield ages "too old" are explained away as being detrital in origin. Finally, those that give ages "too young" for their biostratigraphic positions are claimed to either be the result of argon loss from the authigenic illite, or from the illite being diagenetic and not authigenic in origin. Agreement with accepted values for the biostratigraphic positions may be coincidental. One such K-Ar dating on a shale was described by Hower *et al.*²³² "The whole-rock age is quite good for the Upper Ordovician. However, an examination of the K-Ar ages and mineralogy of the various particle sizes shows 'good' age must be at least partly fortuitous."

Rb-Sr mineral dates, like the K-Ar dates, are subject to the same interpretations when the dates turn out discrepant (for example Permian, ref. 95, Table 1). The Lowville Limestone (Ordovician, ref. 113, 178, Table 1) is one of several examples in Table 1 of situations where Rb-Sr illite isochrons are constructed but not accepted as the age of the rock because of their very discrepant values. The ages that were "too old" were supposed to indicate that the Sr isotopes had homogenized in the source region and not in the shale at the time of its deposition. At the same time, "too young" Rb-Sr isochrons were considered to be indicators of diagenetic Sr isotope homogenizations long after deposition of the

shale. Still other Rb-Sr isochrons were not even considered to have any geological meaning.

U-Th-Pb methods have been used in dating uranium-bearing shales. They are now not considered to remain closed systems throughout alleged geologic time. The classic Swedish kolm (Cambrian, ref. 187, Table 1) is an outstanding example of erratic dates being attributed to its inability to remain a closed system.

D. Open-System Rationalizations for Discrepant Igneous Dates As Deduced from Petrography and Regional Geology

Radiometric dating finds its greatest utility in the dating of igneous rocks. The section after this one will consider radiometric dating of biostratigraphically-bracketed igneous bodies. This section will review some principles by which discrepant dates are attributed to some processes that would cause open systems. Microscopic studies of rock thin-sections helps determine if the rock has suffered weathering, deuteric alteration, or low grade metamorphism. The author is not denying that a heating, leaching, or weathering event on a rock could cause an open system and thereby make discrepant dates, but wishes to point out that a very plastic and capricious situation exists between the state of the rock and whether the dates from it are "good," or if they are anomalous.

Very many K-Ar dates from altered rocks are "good." For granites, Miller and Mohr²³³ said: "But again there is microscopical evidence for appreciable alteration, at least of the feldspar, which must be reconciled with an apparently complete retention of radiogenic argon." Zartman²³⁴ reported that: "... much greater discordances occur in fresh rather than obviously weathered rock." Armstrong²³⁵ stated that: "In two cases altered and fresh samples of the same granite body were analyzed and in both excellent agreement was obtained." No correlation between degree of alteration of quartz monzonite and its ages was found by Bassett *et al.*²³⁶ Bell²³⁷ warned: "In interpreting the isotopic ages, it should be remembered that isotopic diffusion does not necessarily imply recrystallization. The danger in confidently correlating certain petrofabric and isotopic events is apparent."

Basalts and other mafic rocks are believed to be especially vulnerable to becoming open systems because of the ease of their alteration. But in dating basalts, Dasch *et al.*²³⁸ wrote: "... by analyzing samples of strongly altered (59) and relatively fresh (C20) rock from the same dike; within analytical uncertainty the two samples have identical K-Ar dates." Evans *et al.*²³⁹ reported: "Some of the present highly altered rocks gave discrepantly low ages, others, equally altered, did not appear to have suffered extensive argon loss. In addition, low ages were obtained from some apparently very fresh rocks. In fact, no direct quantitative correlation between the presence or amount of the fine-grained secondary minerals of reputed poor retentivity and the apparent age discrepancy observed could be established."

The fact that very many anomalous results by K-Ar dating come from unaltered material is frankly admitted by Durant *et al.*²⁴⁰ "Although it is obviously better to work with fresh material, the fact that a rock is petro-

graphically fresh is no guarantee that ^{40}Ar loss or excess ^{40}Ar phenomena are absent."

Rb-Sr dating is generally believed to be more resistant to heating than is K-Ar, but more vulnerable to leaching caused by weathering or hydrothermal fluids. Zartman²⁴¹ deliberately dated some weathered granite by Rb-Sr, and found: "That these minerals give such a consistent age pattern, indicating a closed system even upon exposure to rather severe weathering, is rather remarkable."

Many discrepant Rb-Sr dates have no alteration on the rock sample dated. Zartman *et al.*²⁴² reported: "An anomalously low Rb-Sr age . . . was found for the biotite. Although no effects of metamorphism or alteration are visible in the syenite, some such process undoubtedly disturbed this . . . radiometric system." In speaking of all Rb-Sr dating, Faure and Powell²⁴³ generalize: "First of all, there may be no mineralogical or textural evidence to warn the geochronologist that an igneous rock or any of its minerals he is analyzing for an age determination has been altered." In fact, Hamilton²⁴⁴ wrote: "It is *quite common* for a metamorphic event detected by Rb-Sr dating to leave no obvious imprint on the hand specimen or in thin section."

The implications of all these findings are enormous. Any discrepant date can be explained away, and a heating or weathering event can be invented whenever necessary for this purpose. No evidence need be found because its absence can be attributed to it being strong enough to make the unwanted date discrepant, but too weak to show up in thin section. An illogical situation arises because at one time it is claimed that radiometric dates have withstood obvious alteration of the rock, while at other times they supposedly were so sensitive that they were made discrepant by an event too weak to alter the rock itself. A skeptical view of radiometric dating looks at all these lacks of correlation of alteration and discrepancy of dates as evidence that they are just rationalizations, and that discrepant dates are not primarily caused by alteration but by the fundamental invalidity of radiometric dating.

Rationalizations for discrepant dates are also formed on the basis of the regional geologic context of the rock sample being dated. The reasoning involved is best described by Evernden and Richards:²⁴⁵ "Thus, if one believes that the derived ages in particular instances are in gross disagreement with established facts of field geology, he must conjure up geological processes that could cause anomalous or altered argon contents of the minerals."

It is interesting to note cases where the regional geology of the dated sample would indicate the likelihood of a date being discrepant, but it isn't; or else some dates are supposedly disturbed while others strangely are not. In his dating, Zartman²⁴⁶ wrote: "It is difficult to postulate a mechanism responsible for the low Rb-Sr and K-Ar ages in the pegmatite biotite while the adjacent granitic biotite has not suffered a similar effect." Pankhurst²⁴⁷ commented: "The writer thinks it unlikely that this biotite alone can have escaped the event so consistently recorded by the remainder, especially since it comes close to a contact with a younger intrusion. It seems that this result is anomalous . . ."

On the basis of regional geology, a strong expectation of dates having been made discrepant via a later orogenic event near them was supposed by Eastin and Faure,²⁴⁸ who found: "A remarkable feature of these volcanic rocks is that they appear *not* to have lost radiogenic Ar⁴⁰ during the Ross Orogeny . . ." (emphasis theirs). Similarly, Haller²⁴⁹ reported: "The biotite of a polygenic migmatite was found to yield a K-Ar age of 490 ± 12 m.y. The surprising thing about this result is that the isotopic age is not about 400 m.y. since the Caledonian effects appear to be so strong."

Burchart²⁵⁰ stated: "Numerous cases have been reported in which Sr isotopic ratios have been found extremely sensitive to geologic events . . . which may have been indistinguishable by classic geologic or petrologic methods. The case of the Tatra Mountains serves as an example of just the opposite situation . . . a major event according to petrological record does not always leave its mark on isotopic dates." It is obvious that once again there is a very plastic relationship between anomalous dates, and their regional geology. That discrepant dates very frequently are not related to regional geology and can be explained away without resorting to it is evident in the following statement by Kratts:²⁵¹ ". . . an understanding of the true causes of discrepant values in concrete cases reveals geologic and geochemical events not discernible by the usual geologic methods."

Any discrepant date can be explained away by claiming that some event has opened the system, while at the same time claiming that the alleged event is not recorded in regional geology if the discrepancy cannot be conveniently fitted in to the geologic history of the region as envisioned by uniformitarians.

Not surprisingly, dates must agree with their biostratigraphic position in order to be considered valid indicators of age. In their datings, Wanless *et al.*²⁵² commented: "No stratigraphic evidence is available to confirm or deny this age." Elsewhere, Williams *et al.*²⁵³ wrote: "The internal consistency demonstrated above is not a sufficient test of the accuracy of the age determinations; they must also be consistent within any age constraints placed on intrusion by fossils in the country rocks."

The investigators dating a Triassic basalt (ref. 70, Table 1) said: "The Mississippian age for sample NS-45 cannot be correct because it is grossly inconsistent with the stratigraphic position of the lavas. No clues as to apparent preferential loss of potassium or gain of excess Ar⁴⁰ from this sample are in evidence from thin section examination." In dating the Ferrar Dolerite (ref. 77, Table 1), the authors wrote: "Rb-Sr analyses of an initial group of hypersthene tholeiites were well aligned on the isochron diagram. They appeared to define an isochron of 270 ± 45 million years. This result is incorrect, since it contradicts a firm stratigraphic control of the age . . ."

Recently, Hayatsu⁴²³ wrote: "In conventional interpretations of K-Ar age data, it is common to discard ages which are substantially too high or too low compared with the rest of the group or with other available data, such as the geological time scale. The discrepancies between the rejected and the accepted are arbitrarily attributed to excess or loss of argon." In invoking

"excess argon" because of biostratigraphically and paleomagnetically discrepant K-Ar results from Pleistocene lavas, Armstrong⁴²⁴ said: "This is an inherent uncertainty in dating young volcanic rocks; anomalies may be detected only by stratigraphic consistency tests, independent dating techniques, and comparison with the known time scale of geomagnetic reversals during the last 5 m.y. (Cox 1969)."

E. Radiometric Dating of Biostratigraphically-Bracketed Igneous Rocks

1. Effusives (Tuffs and Bentonites) and Extrusives (Lava Flows)

Since extrusives and effusives are depositionally accumulated, the Law of Superposition applies to them. The biostratigraphic bracket is imposed by the fact that they must be younger than what they overlie but older than whatever overlies them.

Volcanogenic ash very frequently yields "too old" K-Ar dates. It is claimed that this is from "excess radiogenic Ar" whereby the parent magma is contaminated with argon heated out of the wall rock (vent) that it is coming through, and that the minerals which crystallize do so too rapidly to degas this contaminant argon. Scarborough²⁵⁴ writes: "Age information is interpreted carefully because of a distinct tendency for certain ash layers to contain a variable amount of excess argon." Eocene tuffs (ref. 12, Table 1) are one of several such examples.

Other anomalously old K-Ar dates are explained away by claiming contamination of the tuffs by detrital minerals. Christiansen *et al.*²⁵⁵ said: "Preliminary K-Ar data from alkali feldspars of the second and third ash-flow sequences yield dates apparently too great, suggesting contamination by Precambrian feldspars." These alleged contaminants cannot readily be distinguished, according to Curtis *et al.*,²⁵⁶ and they suggest that: ". . . the thing to do is get a sequence of dates and throw out those that are vastly anomalous."

K-Ar dates from undevitrified volcanic glass (one example in Table 1-ref. 74) are not considered to be reliable. Other igneous materials, when "too young", are claimed to have undergone argon loss (for example, the Filipowice Tuff, Ref. 96). The ejecta of the Korvunchana Series (ref. 80) turned out "too young", and this was ascribed to supposed potassium additions. Unaltered mineral separates from bentonites which are "too young" likewise are attributed to open systems. The Carmel Formation bentonite (ref. 52) gave anomalously young K-Ar and Rb-Sr ages, and this was attributed to hydrothermal effects, even though there is no evidence for it. The Tioga Bentonite (ref. 142), though weathered, amazingly yielded a good Rb-Sr isochron for 15 of 22 samples, although the isochron defined an anomalously young date.

Rationalizations for discrepant dates from lava flows are similar to those for tuffs. "Too old" K-Ar dates from lavas (for instance, basalt, ref. 118) are attributed to "excess argon." K-Ar dates from lavas are commonly discrepantly young, and these results are explained away by claiming some thermally-induced argon loss (as from deuteric alteration or low grade metamorphism) although (as the previous section demonstrated)

no evidence for such an alleged event need be found.

Some of the many discrepantly young K-Ar dates from lavas included in Table 1 are: Karroo volcanics (ref. 66), Toadstone Lavas (ref. 117), Hoy Lavas (ref. 138), Antrim Plateau volcanics (ref. 196), etc. That contradictory dates from lavas occur as a rule is stated by Armstrong and Besancon:²²⁰ "Detailed dating studies using pre-Tertiary whole rock basalt and dolerite specimens have been made . . . and limited optimism for the method appears justified. In spite of collection of unweathered samples and precautions taken to discard samples with evident alteration, it is *usual* to obtain a spectrum of discordant dates and to select the concentration of highest values as the correct 'age'." Even this is accommodating because, as Stewart *et al.*²⁵⁷ pointed out, a maximum in an age-value spread need not be accepted as any specific event.

Rb-Sr whole-rock isochron dating of lavas has produced its share of surprises. Some lavas have given Rb-Sr dates very much greater than the maximum permissible biostratigraphic age. Examples of this in Table 1 include the Ferrar Dolerite (ref. 77), refs. 19, 20, 40, and 191. It is claimed that these isochrons are not defining the time since the Sr isotope homogenization when the lava crystallized, but are defining some Sr isotope homogenization in the mantle. In supporting this, Pankhurst²⁵⁸ remarked: "This is nothing short of a revolution in the fundamental principles of Sr-isotope geology."

Rb-Sr isochron dates which are "too young" are explained away by claiming that the isochrons are not the Sr isotope homogenization when the rock formed, but a re-homogenization caused by some later thermal event on that rock. Some examples of this from Table 1 include the Woollana volcanics (ref. 208) and the Coldbrook Group (ref. 210).

2. Intrusives (Hypabyssal and Plutonic Rocks)

The law of Cross-Cutting Relationships serves to set biostratigraphic brackets for intrusive rocks. An intrusive rock must be younger than any country rock that it intrudes, but older than any rock unconformably overlying it or containing clasts eroded off that intrusive.

Many discrepant results from intrusives are rationalized away immediately by accepting the dates but reinterpreting the biostratigraphic bracket. For instance, the Rose Dome Granite (ref. 102) was believed to contain Pennsylvanian (Upper Carboniferous)-aged inclusions, but this was dropped when the granite yielded a preCambrian Rb-Sr isochron age. A granite (ref. 173) intrudes a quartzite which was believed to be part of an Ordovician quartzite lithostratigraphic unit. This quartzite is now considered to be preCambrian and not part of the Ordovician quartzite because of PreCambrian dates from the granite.

A granite (ref. 199) gave an Rb-Sr date much greater than the biostratigraphic age of the rock intruded. This discrepancy was explained by claiming that the granite is "thrust in" tectonically, not intrusive. But against this, Gates *et al.*²⁵⁹ noted that it is: ". . . not marked by a major fault or an unconformity. Rather . . . seem to be interlayered and concordant throughout the mapped area."

The most common manipulations performed to resolve discrepancies involve the claim of composite plutons. A discrepant date can be explained away by claiming the sample dated is from an earlier or a later phase of the biostratigraphically-bracketed pluton. For instance, the anomalously old date from the Pine Mountain Granite (ref. 103) was explained away by regarding the Rb-Sr date as giving the age of an earlier phase of the Granite. Pertaining to an Ordovician granite (ref. 177), the authors wrote: "1) The Granitic bodies may be composite with an earlier, partly updated phase of latest PreCambrian or Early Cambrian age and a later phase in Middle or Late Ordovician, and 2) The granitic bodies were indeed emplaced during Middle Ordovician time but biotite and hornblende during (Devonian) alteration and/or slight recrystallization have absorbed freed radiogenic argon. *These explanations are not altogether satisfying.*"

The upper biostratigraphic limit on granites imposed by clast-bearing sedimentary strata was disregarded in the case of the granites entered in Table 1 under refs. 150, 203, and (Devonian) ref. 50, when radiometric dates conflicted with it. It was simply claimed that the clasts resulted from erosion of some hidden early or late granites, and not from the main granitic body being dated.

An amazing series of rationalizations were proposed for discrepant U-Th-Pb zircon dates from the Dale City Quartz Monzonite (ref. 165, 166). Seiders¹⁶⁵ accepted the intrusion of this body into a slate, but denied the Ordovician age of the slate claiming that the fossils from it were inconclusive. Higgins¹⁶⁶ accepted the biostratigraphic age-designation of the slate, but claimed that the Monzonite is not intrusive into it, but unconformable. Alternatively, he accepted the intrusive nature of the Monzonite into the slate but suggested that the anomalously old zircon U-Th-Pb dates are caused by inherited (contaminant) lead.

Dates from plutons that turn out discrepant are subject to the same open-system rationalizations as are those from lavas. An examination of Table 1 notes many plutons (for example, refs. 44, 104, 105, and many others) yielding a spread of mutually-contradictory K-Ar dates, some of which spread over several geologic ages.

K-Ar dates that are "too old" for their biostratigraphic positions are attributed to "excess argon" contamination or to an allegedly protracted two-stage magmatic history where the early phase (xenoliths, xenocrysts, or phenocrysts) is supposedly hundreds of millions of years before the later phase (groundmass).

Kimberlites and peridotites often show anomalously old K-Ar dates. Pertaining to the Stockdale kimberlite pipes, the authors wrote (ref. 91): "These ages are indicative of a xenocrystic origin of the micas." Hence the constituent minerals were assumed to have originated deep within the earth hundreds of millions of years before the intrusion. Elsewhere (ref. 101), the constituent biotites were flaky, suggesting an earlier origin, but some did not give anomalously old K-Ar dates. It was claimed that they had been degassed of their previously-accumulated radiogenic argon.

Of especial significance are some Siberian kimberlites (ref. 159), because not only the xenocrysts but also the groundmass gave "too old" K-Ar dates. The ease of explaining away any discrepant date was portrayed when it was claimed that the groundmass got anomalously old by K-Ar when the xenocrysts allegedly shed some of their argon into the magma just as it was crystallizing to form the groundmass.

Anomalously old K-Ar dates are not confined to ultramafic and mafic rocks. Hornblende from the Pearse Peak Diorite (ref. 43) was much "too old" by K-Ar, and this was attributed to its alleged occlusion of "excess argon." Much the same situation occurred in the case of the Rosetown Pluton (ref. 172); among others in Table 1.

K-Ar dates from intrusives often turn out far "too young" for their biostratigraphic positions. This is explained away by claiming that the K-Ar dates from 30 million to 350 million years from certain granites (ref. 116), the 30 million-year dates are supposed to be completely degassed by the heating of the Alpine orogeny, the 350 million-year dates are considered to have survived all the heating events, and the many dates in between are supposed to have no geologic meaning; being supposedly "hybrid ages" of partial argon loss during the Alpine heating event of 30 million years ago.

Thus, discrepantly young K-Ar dates can be claimed to have been completely "reset" if the anomalously young K-Ar date can be matched up with some inferred process (as orogeny) of regional geology, or it can be claimed to be geologically meaningless and giving a value in between the "true" age of the rock and the "true" age of a thermal event if the date does not correspond to either. The Vallorcine Granite (ref. 122) is one example of a "geologically meaningless" K-Ar date. Refs. 34, 127, 104, and 120 are just a few of the many hypabyssal and plutonic rocks of varying compositions that are entered into Table 1, and which give "too young" K-Ar dates. The Klotassin Batholith (ref. 72) is especially significant because the alleged heating event on it which made its K-Ar dates "too young" was supposedly intense enough to have also "rejuvenated" its Rb-Sr isochron date.

Another line of rationalizations for discrepantly young K-Ar dates for intrusives is the claim that they were deeply buried tens or hundreds of millions of years after their crystallization, making them too hot to hold their accumulating radiogenic argon for that amount of time. Some Devonian granites (refs. 134, 135) provide the classic example. It is supposed that they give K-Ar dates accepted for Permian because they were deeply buried from Devonian to Permian time. Zartman *et al.*²⁶⁰ admitted the difficulty of belief in such a prolonged post-crystallization burial of the granites, but accepted it because they found tectonism and regional metamorphism inferred for Permian time to be too localized to account for such a wide area yielding "too young" K-Ar dates from granites. Elsewhere, the batholith under ref. 35 is a similar example of alleged protracted burial.

A variation of the K-Ar method known as the Ar^{40}/Ar^{39} Spectral method has been used on plutons in recent years. It supposedly can distinguish between "excess

argon," "rejuvenated," and "true" K-Ar dates because a true K-Ar date will shed its argon uniformly at different temperature fractions, giving rise to a flat spectrum. The disturbed rock or one with "excess argon" will give off very different amounts of argon in different temperature-fractions and give rise to a "stepped" and "saddle" spectrum, respectively.

That this method can invariably distinguish between "excess" and "disturbed" argon contents was questioned by one study.²⁶¹ Dallmeyer²⁶² found that "too young" K-Ar dates yielded undisturbed spectra, so he claimed that the Ar^{40}/Ar^{39} technique is incapable of distinguishing between a true date and a date of very prolonged burial. The claim that a flat spectrum indicates a true date comes to beg the question, because any flat spectrum from a "too young" conventional date can be claimed to be from protracted burial, and thus the whole method ends up avoiding the question that it is purported to answer.

The Ar^{40}/Ar^{39} method of K-Ar dating failed dramatically by giving flat spectra for samples that would virtually certainly be considered to have been disturbed, and for samples containing "excess argon." Biotites were taken from a gneiss in a contact metamorphic zone within a few hundred meters of an igneous intrusion. Conventional K-Ar dates were dramatically younger nearer the intrusion than further. In summarizing the results of the Ar^{40}/Ar^{39} method applied on the biotites, Ashkinadze *et al.*²⁶³ wrote: "The spectrum shows no features that would indicate any natural disturbance in the K-Ar system. The plateau levels could be erroneously taken as representing the true age of the specimens if the conclusions . . . were followed." In another experiment, Ashkinadze *et al.*²⁶⁴ performed the Ar^{40}/Ar^{39} method on biotites that had given absurdly old K-Ar dates. It gave a flat spectrum, failing to indicate any "excess argon."

The Rb-Sr whole-rock method is frequently used on intrusives. There is some subjectivity in isochron construction that enables samples to be chosen so that they define an isochron age in agreement with accepted values for the biostratigraphic position of the intrusives. Two quite different isochrons obtained from the Barhalde Granite (ref. 94) attest to this. An outright case of fudging the Rb-Sr isochron is evident in the following description of the Kinsman pluton (ref. 140) by authors Lyons and Livingston: "The Kinsman Quartz Monzonite for all six isochron points also yields an unsatisfactory isochron of 605 ± 83 m.y. The isochron shown . . . however, has been drawn by eliminating sample MK 37-73 . . . the resulting isochron of 411 ± 19 . . . embraces what we consider to be an accurate determination of the age of emplacement of the Kinsman."

Any discrepant Rb-Sr isochron can be explained away by claiming that some points on it don't "belong" on that isochron because they allegedly came from different crustal sources and had different initial Sr^{87}/Sr^{86} ratios. In the case of the Ben Vuirich Granite (ref. 171) the anomalously old Rb-Sr isochron was dismissed as "a spurious result" and attributed to source Sr isotopes not homogenizing.

Other anomalous Rb-Sr isochrons are rationalized away by claiming that they become open systems after

the rock formed. In the case of the Cooma Granite (ref. 180), an alleged open system was the cause for the "too old" Rb-Sr isochron. By contrast, "incipient weathering" was the cause of the "too young" Rb-Sr isochron from the Hoppin Hill Granite (ref. 204). Either weathering or deuteric alteration was the alleged cause for the anomalously young isochrons from the Tioueiine granite (ref. 186), and hardly any alteration was visible in petrographic thin sections.

U-Th-Pb methods on intrusives are performed either on separated accessory minerals or on ore bodies that formed during late-magmatic or post-magmatic processes around intrusives. U-Th-Pb dates from pitchblende and galenas are usually discordant and in conflict with biostratigraphic positions. Some European ores (ref. 82) gave "too young" U-Th-Pb dates because they allegedly were subject to later re-mineralizations. Others (for instance, refs. 106, 143, and 151) are much "too old" for the biostratigraphic positions of their host rocks, and are explained away by claiming that they became contaminated with ancient, "remobilized" lead during their mineralizations.

Zircons are the most common accessory mineral used for U-Th-Pb dating of intrusives. Like ore deposits, discrepant dates from them are attributed to various supposed open-system and contaminating conditions. The Deadman's Bay Granite (ref. 168) is one example of this, as is the Cape Granite (ref. 152). Zartman²⁶⁵ pointed out that: "... the morphology of the zircon crystal does not always reflect the presence of inherited old radiogenic lead." Thus any anomalous zircon date can be explained away just because it is discrepant.

Some anomalously old U-Th-Pb dates from zircons are supposed to indicate that the zircons themselves are "xenocrystic," or inherited from the country rock through which the magma intruded. Zircons from plutons entered under refs. 18 and 100 are examples of this explanation.

In considering all the dating methods, it should not be supposed that dates which fit accepted values for Phanerozoic systems are the only ones that are consistent. That discrepant dates also are consistent is pointed out by Polyakov *et al.*²⁶⁶ "Still more important is the fact that 'rejuvenated' dates are nonrandom and recur on a regional or even a global scale." The significance of dates that are internally consistent from different samples of the same outcrop or the same igneous body; and dates which are in agreement by different dating methods will all be discussed in the next section (considering both Phanerozoic and Precambrian consistencies).

II. Highlights of Precambrian and Non-Biostratigraphic Geochronology

A. Consistency and Concordances Among Radiometric Dates

It is often claimed that reliable K-Ar dates can be objectively distinguished from apparent dates because the former will show internal consistency from widely separated samples, while the latter will scatter because an altering event does not affect all regions of the sampling area equally.

In practice, the analytic data is subordinate to geologic "fit" of the dates obtained. Marvin *et al.*²⁶⁷

write: "Many geologists commonly evaluate age determinations only in the light of geologic evidence and do not adequately consider the importance of the analytical data. Admittedly, an analytically valid age may occasionally prove to be geologically spurious because it conflicts with incontrovertible geologic field relations."

There are many instances of dates with good internal consistency being rejected as not giving the correct age of a rock because they conflict with accepted values. In a Precambrian situation, K-Ar dates were much younger than the (presumed correct) Rb-Sr dates, and about the K-Ar dates McKee and Noble²⁶⁸ commented: "Continuous partial argon loss may have occurred. If this is the case, the consistency of these apparent ages is fortuitous."

Cases of modern lavas giving anomalously old K-Ar dates are so well known to Creationists that they are not repeated here. In one case, authors McDougall *et al.*²⁶⁹ warned against accepting consistent K-Ar dates as necessarily valid, because they found that: "With few exceptions, anomalously old but often internally consistent K-Ar dates were found for the lavas."

The fact that anomalously young K-Ar dates can be internally consistent was pointed out by Wetherill.¹⁷⁶ A different argument from consistency involves the supposition that samples of widely differing K⁴⁰ concentrations which yield consistent K-Ar dates are valid because a suite of samples would not have gained or lost Ar⁴⁰ in just the right amounts to be identically proportional to their respective K⁴⁰ concentrations. But a series of anomalously old but correlative K⁴⁰/Ar⁴⁰ situations was described by Kaneoka and Aoki,³¹⁹ who wrote: A Greenland dolerite has also shown an anomalous old age in spite of good correlation in the ⁴⁰Ar/³⁶Ar vs. ³⁹Ar/³⁶Ar isochron diagram. These evidences suggest that the excess Ar⁴⁰ is sometimes located in K or K-similar sites." Consistency of K-Ar dates is therefore no proof for their validity.

In Rb-Sr whole-rock dating, it is commonly believed that if the points plotted to define an isochron show good collinearity, then the rock remained a closed system and the date will be valid. But against this view, Goldich²¹⁷ wrote: "Linearity of points defining a whole-rock Rb-Sr isochron is not a sufficient criterion of the isochron age being the time of igneous emplacement or crystallization." Elsewhere, Matsuda²⁷⁰ made a very similar statement.

A profound regional internal consistency for "too young" Rb-Sr isochrons was attributed to orogenic reheating. Fairbain *et al.*²⁷¹ wrote: "If this is the actual explanation, it is remarkable that it has operated to about the same degree on three volcanic series hundreds of miles apart."

It is widely held that when K-Ar dates on biotite and hornblende are in agreement, the date is valid. Numerous authors approximate the energy of activation for thermally-induced argon loss to be reached at minimum temperatures of 250 °C for biotite and 450 °C for hornblende. Had a pluton cooled so slowly that it yielded spurious K-Ar dates, the hornblende date would be older than the biotite date because the former is cool enough to retain its accumulating radiogenic argon sooner than the latter. Alternatively, had there been a

later heating event on the rock, K-Ar biotite/hornblende would be discordant because the biotite alone would be degassed, or (if hot enough to degas both) the hornblende would still be older because again it would be cool enough to retain its argon sooner than the biotite.

That is the theory. In fact, there are many cases of consistent K-Ar dates from these mineral separates that are "too young." The Chigmit Mountains Batholith (ref. 57) is one example. Elsewhere, McDougall and Leggo²⁷² wrote: "... hornblende and biotite K-Ar ages agree in a few cases where the measured ages are too young Hence, arguments based on consistency of results must be used with caution." Webb and McDougall²⁷³ studied 51 discordant biotite/hornblende pairs and found no statistically significant preference for one to be older than the other. They concluded: "The concordance of biotite and hornblende K-Ar ages could lead to the erroneous conclusion that the date is the time of emplacement or strong metamorphism."

In K-Ar dating of the Peninsular Ranges Batholith (ref. 35), concordant but anomalously young biotite/hornblende pairs were found. The claim made was that the Batholith was deeply emplaced for tens of millions of years after intrusion, making it too hot for either mineral to retain argon. Then it is supposed that it got uplifted so rapidly that it cooled from above 450 °C to below 250 °C so quickly that no difference is shown between biotite and hornblende despite the fact that they are "too young". A similar train of thought was utilized by Wetherill *et. al.*²⁷⁴ for a similar find.

The most powerful argument claimed for the validity of radiometric dates is the agreement of results from different dating methods. K-Ar/Rb-Sr whole-rock and U-Th-Pb/Rb-Sr whole-rock agreements appear to be more common than K-Ar/U-Th-Pb and non-concordia U-Th-Pb concordances. It is thus significant that the Rb-Sr isochron can be fudged.

Just as the Rb-Sr isochron can be fudged to get it to fit biostratigraphic evidence (as in the previously-discussed Barhalde Granite (ref. 94) and Kinsman Quartz Monzonite (ref. 140)) so it can be fudged to get it to agree with K-Ar or U-Th-Pb. An indication of some subjectivity in Rb-Sr isochrons was shown when several granites yielded isochrons ranging from 418 to 479 m.y., and when the data were pooled together, a 413 ± 7 m.y. isochron resulted.²⁷⁵

A U-Pb zircon date of 2560 m.y. was in disagreement with an Rb-Sr isochron of 1840 m.y. until the latter was subject to the following initial-ratio fudge: "An age of 2510 is obtained by calculating an average rock total and by using a more normal r_i ."²⁷⁸

The numbers of cases of concordances are no doubt exaggerated by the selective publication of dating results. In a discordancy, the results of the method most considered correct will be published, and the results of another method ignored. In one granite (ref. 133) K-Ar and Rb-Sr isochron dates are in agreement, but "too young" for the biostratigraphic position. Just as the agreement was minimized by noting the change in Rb-Sr value by a change in initial Sr^{87}/Sr^{86} ratio (changeable from allegedly poor radiogenic Sr^{87} enrichment), so other agreements may be caused by adjusting the initial ratio.

Certain concordances are dissolved after further studies. In one situation described by Higgins,²⁷⁶ U-Pb and Rb-Sr isochron dates agreed at 425 m.y. for three igneous bodies. One of the igneous bodies was reinterpreted as being much later and its 425 m.y. Rb-Sr mineral isochron dissolved and considered a meaningless result.

Allsopp *et. al.*²⁷⁷ wrote: "... measurements on one pegmatite sample . . . indicated an apparent Rb-Sr age of 3.4 b.y.; this age was then interpreted as support for the 3.4 b.y. lead-model age Although analytically correct, the high apparent age . . . is considered anomalous in the light of new measurements"

Geologic interpretations are frequently changed in order to avoid situations where there would otherwise be a gross conflict between biostratigraphy and results in agreement by two or more radiometric dating methods. Clasts from the Hikami Granite (ref. 150) and an unnamed Devonian granite (ref. 50) were reinterpreted as being derived from a supposedly hidden later granite in order to avoid an anomalously young situation for the agreeing K-Ar/Rb-Sr whole-rock isochron dates. The biostratigraphic age of conglomerate containing clasts of the Pamir-Shugnan Granites (ref. 22) was changed for the very same reason. When K-Ar/Rb-Sr dates on glauconite (ref. 193) were much "too old" for the biostratigraphy but in agreement with each other, the glauconite was claimed to be reworked. Yet it was considered enigmatic because the nearest appropriate source area was much too distant for a soft glauconite pellet to be transported.

At least 2 of the 4 U-Th-Pb dating methods would be simultaneously in agreement with each other and "too old" (for example, ref. 18) if the claim of the "xenocrystic" origin was not accepted.

Concordant results by two or more methods, as the results from only one method, can be rejected as giving the age of the rock and instead considered to have other geologic meaning. Anomalously young but concordant K-Ar/U-Th-Pb dates from the Mrzyglod diabase (ref. 108) are supposed to indicate that the alleged heating event which had completely "rejuvenated" the K-Ar date also was related to a uranium mineralization. Discrepantly young but concordant K-Ar/Rb-Sr isochron from the Klotassin Batholith (ref. 72) are supposed to reflect a later heating event having "rejuvenated" both dates.

Still other agreements between different dating methods are considered to have no meaning whatsoever. In commenting on a K-Ar/Rb-Sr agreement on biotite, Wasserburg and Lanphere²⁷⁹ said that it "... is a case of accidental concordance. That is, the time calculated does not have any meaning in terms of an event." In fact, anomalous agreements of K-Ar/Rb-Sr on biotite are so common that equal daughter-product loss is invoked, as by Webb and McDougall:²⁸⁰ "... the frequent correspondence between Rb-Sr and K-Ar ages on this mineral from all environments suggests that Sr diffuses at similar rates and at the same temperatures as does Ar." K-Ar/Rb-Sr agreements on glauconite that are "too young" are also common (for example ref. 185, the Franconia Formation), and Hurley²⁸¹ proposed a similar explanation.

Miller and Kulp²⁸² described a case of what they considered to be a series of fortuitous agreements between Pb^{206}/U^{238} and Pb^{207}/U^{235} caused by a mixing-in of contaminant lead. Stuckless *et. al.*²⁸³ found a Rb-Sr isochron in agreement with K-Ar but considered the possibility that the isochron: "... may be fortuitous." A granite yielded concordant K-Ar/Rb-Sr isochron values which fell into a time span considered to be a period of tectonomagmatic quiescence. For that reason, Armstrong²⁸⁴ suggested that the mutually-corroborating results are neither the age of the granite nor a "rejuvenating" event but an in-between value: "... by coincidence, nearly concordant but meaningless K-Ar and Rb-Sr dates."

A fortuitous U-Th-Pb/Rb-Sr isochron agreement is supported by Dietrich *et. al.*,²⁸⁵ who write: "the 1320 ± 100 m.y. date defined by a whole rock isochron is not known to correlate with any well-recognized sedimentary or tectonic event (It is similar to the discordant 'age' of about 1300 m.y. reported from two probably detrital zircon samples ... any agreement with these 1300 m.y. 'ages' would appear to be little more than a coincidence.)."

The fact that there are many anomalous dates which agree by two methods and are explained away as mutually rejuvenated or totally fortuitous suggests that concordant dates need not be accepted as an unassailable proof for the validity of radiometric dating. The fact that agreements considered to be fortuitous occur on a routine basis in some cases (Rb-Sr/K-Ar agreements on glauconite and igneous biotite) further encourages belief that all concordances may have a geochemical explanation that has nothing to do with the true ages of the rocks dated.

Of course, it is important to note that comparisons between results of different dating methods are commonly (if not usually) discordant, and are promptly dismissed as open systems. York and Farquhar³⁸⁷ said: Where the results of comparisons of this sort disagree, it is clear that some sort of transfer of materials into or out of the rock or mineral has taken place. It has also become apparent from the number of published discordant ages that disturbances of this nature are far more common than was formerly realized."

In speaking of the U-Th-Pb methods, Davidson³⁸⁸ wrote: "Ideally, the isotopic ratios ... should all give results in good agreement ... In practice, very few uranium and thorium minerals have been found to exhibit this concordant pattern of ages, and the much more common discordances between the three or four values have been facilely explained away, as each investigator thought best fitted to local circumstances ..."

Hurley and Rand³⁸⁹ did a comparison of K-Ar and Rb-Sr results from the Precambrian continental crust, using published and some unpublished sources from nearly every continental region on earth. The best-fit line on the Rb-Sr vs. K-Ar graph was $K-Ar = .75Rb-Sr$, indicating a systematic tendency of K-Ar/Rb-Sr discordance. One fourth of the points were indicative of such discordance that they plotted at or near the line $K-Ar = .5Rb-Sr$.

In writing of results of datings in Phanerozoic orogenic belts, Brown and Miller³⁹⁰ said: "In general, strong discordances can be expected among ages deduced by different methods." Since most dates obtained by the simultaneous application of more than one method come from orogenic belts, it may follow that the majority of comparative datings from the Phanerozoic, as in the Precambrian, are discordant.

B. Radiometric Violations of Superpositional and Cross-Cutting Relationships

Radiometric dates routinely violate common-sense relationships of field geology. It is almost self-evident that in a depositional situation the topmost beds must be at least slightly younger than those below them, and in an intrusive relationship it is the intruding body which must be younger than the body it cuts.

In writing about tuffs (obvious depositional accumulation), Curtis *et. al.*²⁸⁶ write: "These beds may appear to be pure ... yet gave different ages from top to bottom; *the younger age being on the bottom.*" The rationalization invoked for this absurd situation was that the first-deposited were uncontaminated while the upper beds were subject to influx of contaminating detrital minerals.

A tuff yielding a K-Ar date of 40-41 m.y. was found intruded by a dike and sill yielding K-Ar dates of 49-50 m.y.²⁸⁷ A diorite whose biotite yielded a 157 m.y. K-Ar date is intruded by a quartz diorite yielding a 204 m.y. K-Ar biotite date.⁸⁷ Violations of cross-cutting relationships are not exceptional. Hopson²⁸⁸ states: "This curious relationship, in which the pegmatites give mineral ages older than those from the host rocks, is now known to be common ... " These gross anomalies are explained away by claiming that the pegmatite gives older K-r ages than the intruded country rock because the country rock is composed of fine-grained minerals that are more vulnerable to thermally-induced argon loss. This is accommodating, because many coarse-grained pegmatites properly give younger K-Ar and Rb-Sr mineral dates than the fine-grained country rock. Furthermore, Leach *et. al.*²⁸⁹ found coarse-grained schists giving ages near 72 m.y. whereas fine-grained varieties gave dates near 123 m.y., and they appealed to "... some other process ..." to explain this.

A different set of violations involves Rb-Sr whole-rock isochrons. The Stony Creek Granite of 610 ± 50 m.y. Rb-Sr isochron age cuts the Monson Gneiss of 444 ± 15 m.y. Rb-Sr isochron age.²⁹⁰ Remobilization of Sr isotopes during metamorphism was the supposed cause of this.

Violations are especially prominent in Precambrian rocks. A pegmatite yielding Rb-Sr isochrons of 1.7 to 2.7 b.y. cuts the country rock which yields 2.0-2.2 b.y. Rb-Sr isochrons.²⁹¹ In the Baltic Shield, metamorphic rocks of the Kola series give Rb-Sr dates of 2.4-2.7 b.y. and maximum K-Ar dates of 2.7-2.8 b.y. They are intruded by basic and ultrabasic rocks comprising the Nonchegorsk Massif, and yield U-Pb dates of 2.9 b.y. and K-Ar dates of 3-3.5 b.y. Elsewhere, granites cutting the Kola Series have given K-Ar dates from 2.8 to 3.6 b.y. and U-Pb dates of 2.8 b.y.²⁹² In the Guyana Shield, the basement rock yields a 1.8. b.y. Rb-Sr isochron date, while a gabbroic-doleritic mass intruding it gives K-Ar

dates up to 3.06 b.y. "Excess argon" in the basic rocks is the rationalization invoked.²⁹³ Space limitations prevent the listing of countless other violations.

Rank absurdities arise from radiometric dating which are explained away in terms of metamorphic processes. For instance, Varadarajan³¹⁷ found that the Amritpur Granite of India yields K-Ar dates of 1.3-1.9 b.y. and intrudes metavolcanics of 228 m.y. He rejected others' suggestions that the contact is not intrusive, and proposed that the ages are correct but that the Granite was partially remelted after 228 m.y. ago, and thereby emplaced intrusively into the much younger metavolcanics. In another case,³¹⁸ the Kochatev granite massif of 450 m.y. was unconformably overlain by the Zherinsk Series of 1.2-1.5 b.y. The rationalization invoked for this absurdity was that the granite had been remelted while the overlying formation was unaffected.

Probably the greatest violations of all are radiometric dates many times greater than the accepted 4.5 b.y. age of the earth. They may be a type of *reductio ad absurdum* of accepting billions-of-years ages for rocks. A plagioclase crystal gives an unexplicable age of 4.9 b.y. while everything else around gives Rb-Sr ages of 1.3-1.5 b.y.²⁹⁴ Mark *et al.*²⁹⁵ found a probably Tertiary basalt yielding an isochron of 10 b.y. The Pharump diabase²⁹⁶ from the Precambrian of California yielded an Rb-Sr isochron of no less than 34 b.y., which is not only over 7 times the age of the earth but also greater than some uniformitarian estimates of the age of the universe. This super-anomaly was explained away by claiming some strange metamorphic effect on the Sr.

K-Ar ages much greater than inferred earth age are also common. Gerling *et al.*²⁹⁷ called attention to some chlorites yielding K-Ar dates of 7 to 15 b.y. It had been noted that some minerals which yield such dates (as beryl, cordierite, etc.) can be claimed to have trapped excess argon in their channel structures or to have fractionated the Ar isotopes, but none of this can apply to the simple mica-like structure of chlorite. They also pointed out that for the anomalies to be accounted for by excess argon, unreasonably high partial pressures of Ar during crystallization would have to be required. They concluded by suggesting some unknown nuclear process which no longer operates to have generated the Ar. Elsewhere, Galimov²⁹⁸ suggested that ⁴⁰K captures an external electron via K-capture. The possibility of K decaying to Ar some other way should be interesting to those Creationist physicists studying the question of how invariant decay rates are.

C. Age Values for Igneous and Metamorphic Terranes

It is most interesting to note many cases where radiometric dating imposes time partitions which appear to be unsupported or contradicted by lithostratigraphic evidence. In dating layers of lava flows, Williams and Curtis²⁹⁹ wrote: "According to potassium-argon determinations, the exposed volcanic rocks range in age from about 2.5 m.y. to 1.4 m.y. We admit, however, that some age-determinations are difficult to reconcile with observations made in the field. The absence of signs of deep erosion and soil-horizons suggests that accumulation of the Rampart beds was essentially a continuous process, without long periods of volcanic quiet."

Precambrian terranes composed of igneous and metamorphic rock contain unconformities which are supposed to be erosional surfaces generated during orogenic cycles each of which is hundreds of millions of years in duration. Several cycles are supposed to have occurred during the Aphebian (dates as 1.7 to 2.5 b.y.) and Archean (over 2.5 b.y.). Stockwell³⁰⁰ notes many cases where Aphebian rocks grade directly into Archean, and attributes this to the destruction of the alleged unconformities during gneissification. An alternate view would be that the unconformities never existed, that the hundreds of millions of years never elapsed, and that radiometric dating has artificially segmented continuous strata into fallacious time partitions.

At the same time, Archean rock is unconformably overlain by igneous and metamorphic rock sometimes billions of years younger. Yet Hurley *et al.*³⁰¹ observe that commonly the radiometric ages are the same on both sides of the unconformity; that Archean basement tends to be as radiometrically young as the overlying material. This is attributed to rejuvenation of Archean as the overlying rocks are formed, but an alternative view is that rocks supposedly billions of years apart in time are uniformly young because radiometric dating is invalid and so are the artificially-erected time designations, and various contrivances are necessary to harmonize lithostratigraphy with radiometric dating and uniformitarian concepts.

In generalizing on all Precambrian geochronology, Peterman *et al.*³⁰² wrote: "... correlations based on lithologic and successional similarities and 'layer cake' stratigraphy generally result in an oversimplification and serious errors." This is supposedly caused by the geologic complexity of Precambrian terranes, but another view is that radiometric dates routinely violate not only lithostratigraphy, but result in a completely artificial imposition of time partitions which have no basis in reality and naturally result in confusion.

Dott and Dalziel³⁰³ wrote: "Lithic correlation of the Baraboo metasedimentary sequence with Animikie rocks in northern Michigan and northern Wisconsin has seemed compelling, for each succession has pure quartzite overlain by a carbonate and iron-bearing interval, which is in turn succeeded by thick slates." The Baraboo rocks have yielded a "meaningless" date near 750 m.y. and a spread of K-Ar and Rb-Sr dates from 1.1 to 1.6 b.y. By contrast, Animikie rocks have given U-Pb and Rb-Sr dates from 1.9 to 2.1 b.y., with an even older correlative of 2.1-2.4 b.y. dates. Are rocks of such similar composition and lithostratigraphy really separated by hundreds of millions of years of time, or is radiometric dating a delusion?

Unnatural time-imposition by radiometric dating may be evident even in rocks that approach 4.0 b.y.—the oldest dates accepted for terrestrial material. In comparing greenstone-granite formations from Greenland that have yielded dates near 3.8 b.y. with other greenstone-granites that give only 2.7-3.3 b.y. dates, Moorbath *et al.*³⁰⁴ commented: "The major volcanic and sedimentary features are essentially indistinguishable from those of younger greenstone belts in North America and southern Africa . . ."

An extremely plastic acceptance of radiometric dates is admitted for the Precambrian. Sabine and Watson³⁰⁵ cite: "... the rather subjective task of separating 'true' from 'apparent' ages." Wasserburg and Lanphere³⁰⁶ appealed to complex Precambrian histories to explain discrepant dates, and commented: "... geochronologic studies commonly lead to a confusing array of data, in which many of the determinations ... are not the age of primary metamorphism or intrusions." Barton³⁰⁷ said: "As in the case with radiometric ages determined from almost any rock unit, it is impossible to establish unequivocally that the ages reported here reflect the time of original crystallization or emplacement of the bodies from which they are derived."

Just as dates in the Phanerozoic must fit accepted values for their biostratigraphic positions in order to be accepted as valid, so also radiometric dates are selectively accepted depending upon the geologic relationships of Precambrian rock. The subordinate nature of radiometric dates even in the Precambrian is evident in the following statement by Pulvertaft:³⁰⁸ "... poor exposures and low relief have forced geologists to rely too much on isotopic age determinations."

A very prominent feature of Precambrian geochronology is the fact that radiometric dates from the igneous and metamorphic complexes spread over hundreds of millions (or even billions) of years. Odom and Fullagar³⁰⁹ found the Cranberry Gneiss yielding Rb-Sr isochrons from 670 m.y. to 1.3 b.y. and commented: "... the so-called Cranberry Gneiss might represent a time span equivalent to that of the entire Phanerozoic."

This is not exceptional. Sabine and Watson³¹⁰ point out that: "... one outcome of isotopic age-studies had been the demonstration that some metamorphic complexes had been built up by repeated activity over periods of several hundred million years." A skeptical view of radiometric dating would question the incredible lengths of time indicated for these rocks and suggest that there is actually a very self-contradictory spectrum of dates and that this spectrum is not caused by repeated petrogenetical activity but that it actually illustrates the meaningless and invalidity of radiometric dating.

Very self-contradictory age-spreads in the Precambrian are so common that it is claimed there was repeated tectonomagmatic activity going on for billions of years in given regions. Pulvertaft³¹¹ writes: "Reactivation is recognized by most geologists as a common feature of Pre-Cambrian basement areas. What is not always realized is the scale on which it may have taken place."

The Sao Francisco Craton of Brazil shows a K-Ar spread of 1.1 to 1.9 b.y.³¹² Elsewhere, Peterman and Hedge³¹³ found both K-Ar and Rb-Sr mineral dates in a huge mutually-contradictory spread of 80 m.y. to 1.8 b.y. Gerling *et al.*²⁹² reported K-Ar dates from the Baltic Shield spreading from a high of 3.5 b.y. to a low near 1.2 b.y. In the Saamo-Karelian Zone alone, a spread of 1.7 to 2.8 b.y. was encountered.³¹⁴

When stripped of all the claims of reactivation, it is obvious that rocks yield ages which spread over significant fractions of the entire earth's alleged 4.5 b.y. history. Such absurdly contradictory results may be further evidence against the validity of radiometric dating.

Creationists and Diluvialists are not alone in their disbelief of radiometric dating. The fact that radiometric dating lacks credibility even in some uniformitarian circles is evident in the following statement by Houtermans:³²⁰ "Sometimes the dates given by radioactive methods are accepted enthusiastically by the classical geologists, sometimes if these dates do not fit their previously formed hypotheses they come to the conclusion to deny the usefulness of radioactive methods altogether." Similarly, Brown and Miller³²¹ commented: "Much still remains to be learned of the interpretation of isotopic ages and the realization that the isotopic age is not necessarily the geologic age of a rock has led to an over-skeptical attitude by some field geologists." Whether the skepticism has been excessive or whether it has been insufficient is, of course, a matter of opinion.

Every paradigm has explanations for data that won't fit it. The paradigm crumbles when the explanations are not accepted and considered to be only excusing rationalizations that cover-up the basic failure of the paradigm. Likewise, all of the various open-system explanations for discrepant results may be accepted at face value, or they may be seen as excusing rationalizations that cover up the invalidity of radiometric dating and all the eons of time that it purportedly demonstrates and measures.

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- AG — American Association of Petroleum Geologists Bulletin
- AJ — American Journal of Science
- AN — Antarctic Journal of the United States
- BV — Bulletin volcanologique
- CE — Canadian Journal of Earth Sciences
- CG — Geological Survey of Canada Paper
- CH — Chemical Geology
- CO — Proceedings of the International Geological Congress
- CT — Contributions to the Geologic Time Scale (American Association of Petroleum Geologists Studies in Geology No. 6)
- DE — Doklady: Earth Science Sections (translation from Russian)
- EG — Economic Geology
- EP — Earth and Planetary Science Letters
- GA — Geological Society of America Abstracts with Programs
- GB — Geological Society of America Bulletin
- GC — Geochimica et Cosmochimica Acta
- GE — Geology
- GG — BMR Journal of Australian Geology and Geophysics
- GH — Eclogae Geologicae Helveticae
- GI — Geochemistry International
- GJ — Geochemical Journal (of Japan)
- GL — Quarterly Journal of the Geological Society of London
- GM — Geological Society of America Memoir
- GN — Norges Geologiske Undersøkelse Bulletin
- GP — Geological Society of America Special Paper
- GR — Journal of Geophysical Research
- GU — Journal of the Geological Society of Australia
- IG — International Geology Review
- IN — Journal of the Geological Society of India
- IS — Isochron/West: A Bulletin for Isotope Geochronology
- JG — Journal of Geology
- JR — Journal of Research of the United States Geological Survey
- KG — Kwartalnik Geologiczny
- LG — Liverpool Manchester Geological Journal
- MI — Geologie en Mijnbouw
- MP — Contributions to Mineralogy and Petrology
- NA — Nature
- NP — Norsk Polarinstitutt Skrifter

NY —New York Academy of Sciences Transactions

OG —Overseas Geology and Mineral Resources

PE —Journal of Petrology

RE —Precambrian Research

RU —Geologische Rundschau

SC —Science

SG —Scottish Journal of Geology (Transactions of the Edinburgh Geological Society prior to 1964)

SP —Journal of Sedimentary Petrology

SR —Colloques Internationaux du Centre National de la Recherche Scientifique

SV —Springer Verlag Publishing Co. Berlin, Heidelberg, New York

TI —Norsk Geologisk Tidsskrift

TS —The Phanerozoic Time Scale (Geological Society of London Special Publication 120s)

UG —United States Geological Survey Professional Paper

UN —Transactions American Geophysical Union

YG —Proceedings of the Yorkshire Geological Society

ZG —New Zealand Journal of Geology and Geophysics

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ATLANTIS AND THE FLOOD

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It is suggested that the story of Atlantis, about which there has been so much speculation, may have originated in a tradition of the Flood which still existed in Egypt in Plato's time.

The tradition of the lost continent of Atlantis has often been recounted by those interested in traditions of by-gone days. Perhaps our generation would never have heard the story of Atlantis, had it not been for that famous Greek philosopher, Plato.¹ If there is any validity to the Atlantis story, perhaps Plato would have been more apt to have heard about it than modern historians, because Plato lived nearly two and a half millennia ago, closer to the time when that mythological sub-continent of some estimated 150,000 square miles, larger than Arizona and half of New Mexico combined, disappeared.

According to Plato, this sub-continent of Atlantis had a population estimated at some 20 million, and the people were the dominant race in that part of the world. Its influence reached as far east as Egypt, and it had a Mediterranean Empire. The inhabitants created a civilization where brotherhood and morality were dominant motives. But eventually selfishness and greed for material gain became obsessions, as happened to the other antediluvians. Perhaps this spelled their eventual doom, which doom was shared by the rest of the world in the days of Noah, who build an immense ark to ride out the destructive storm, brought on by the Almighty, Who created Heaven and earth.

The inhabitants evidently built canals to carry water for their crops. Hot Springs were believed to have abounded. Elephants and other African life were thought to have lived in the forests.

Also according to Plato, the Atlanteans were a religious people, believing that their gods dwelt in isolation atop the tallest mountains. It is typical of most non-Christian faiths, that their gods are hard to reach. Recall how the priests of Baal in Elijah's time waited all day trying to contact their god, but no luck. In the midst of the capital city of Atlantis, was the temple of Poseidon, encircled by a great wall coated with bronze, while their temples were decorated with gold and silver.

Plato placed Atlantis beyond the Pillars of Hercules, which is the Strait of Gibraltar. This is the present location of the Azores, a cluster of islands some 750 miles west of Europe in the midst of the Atlantic ocean.^{2,3} If this be the former location of Atlantis then we have a clue. We now know from submarine study of the Atlantic, that the Azores are that portion of the Mid-Atlantic ridge that shows above the surface of the ocean. Most of the mid-Atlantic ridge is submerged; but it constitutes the longest mountain range on earth, with its northern anchor point in Iceland, a recent volcanic island, with geysers and vulcanism.⁴ In fact we recall the birth of a very recent island off the shore of Iceland: Surtsey; which the present writer was twice scheduled to visit.

This submerged mountain system cuts the Atlantic Ocean roughly in half, and extends to the southern tips of Africa and South America. But what caused the sub-continent of Atlantis to sink? That will be a study in itself.

It has been speculated that Atlantis was blessed with a balmy climate. This could well be, since the whole earth is believed to have had a balmy climate before the world-wide Flood as described in Genesis. Most of the Flood waters probably came from "the waters above the firmament" that Moses described, at the time of Creation. This vapor blanket, many believe, could have produced a more equable climate than the present one.⁵

We have good evidence for this mild climate; flocks of mammoths and mastodons found ample food even above the Arctic Circle, where at present they would starve to death. One has but to watch the million tons of crude oil daily flowing south through the Alaska pipeline from Prudhoe Bay, on the Arctic Ocean, south 800 miles to Valdez, where it is loaded onto tankers. This alone attests to a former verdant vegetation in an area now too cold for much life.

Again, we look to the great Antarctic ice sheet, where on land have been found great deposits of coal.

Genesis records that turbulent rains kept coming down on the earth for forty days, until the tops of the highest mountains were covered. Naturally Atlantis would have been among the many areas of civilization that were drowned completely. Whether the mid-Atlantic range of mountains was above water before the Flood we don't know; but since the present Azores are now above water, likely before the great Flood, much more accompanying land was also above water. Thus we are safe in attributing the disappearance of Atlantis to the Flood.

The Mid-Atlantic Ridge widens to about 250 miles at the Azores, and this great platform, now submerged is some 678 miles in length, north and south. Before the Great Flood, this platform, then above water, could well have been the sub-continent of Atlantis. "In a single dreadful day and a single dreadful night", as Plato wrote, Atlantis disappeared. Plato evidently was not much of a uniformitarian, for such scientists would no doubt have stretched out this catastrophe to cover some millions of years. Even catastrophists would have stretched out Plato's "single dreadful day and night" to take some 40 days to drown Atlantis.

A recent writer, Muck, takes note of the discovery that some of the giant mammoths in the far north were frozen so suddenly that they had no time to swallow the grass in their mouths. At the circus I have seen elephants hold human heads in their mouths without swallowing them, but in this case I felt no atmospheric chill. But with the frozen mammoths scientists say that it would require a sudden drop in temperature to minus 150 degrees.⁶

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This very evening, as I write this we have watched unprecedented rains and floods in Central Texas that caused great loss of life and property, after some 20 inches of rain, or more. Many Creationist scientists view the Genesis Flood as the sort of flood we are now watching in Texas, where rivers are swollen far above their flood water banks, but many times greater. If scientists would recognize the Biblical Flood for what Scripture describes it to have been, they would not have to call on the supposed impact of some asteroid to explain the undoubted signs of former catastrophic events.

The new science of plate tectonics has been proposed to explain assumed major movements of the continents of the earth. It has been contended that at one time all of the continents were joined into one supercontinent. India was believed to have traveled from the Antarctic area to its present position attached to the southern part of Asia. A newer development subdivides the continents into a number of plates, like the armadillo.

While some scientists, including some Creationists, accept this new science,⁷ some have doubts. Paul Wesson of the University of Cambridge, for instance, has shown some 74 arguments against this whole notion.⁸ One objection to this theory is that according to it the western shore-line of Africa has apparently moved eastward, while the eastern shoreline has moved westward!

Would a better explanation be that the shore-lines of continents were moved by the Flood of Noah? Manifestly before the great Flood the ocean level was perhaps thousands of feet lower than at present. This in itself would have greatly enlarged the surface areas of the continents, leaving the western shoreline of Africa much further west, and the eastern shoreline farther east. That is in my opinion the only explanation possible. Continental travel would not match the evidence nearly so well.

Coal beds, formed at or near sea-level, have been found in the Indian ocean at about 6,000 feet below the

surface, attesting to the tremendous volume of water that covered the earth at the time of Noah. Flood geology answers a host of earth problems much better than any explanation contrived by mere human reason.

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- ¹The story of Atlantis is told in the dialogues *Timaeus* and *Critias*, which may be found in any edition of Plato's works.
- ²It has been suggested that documents, maybe in the form of tablets, may have been handed down by the patriarchs, and that Moses may have used them in editing *Genesis*. See Wiseman, P. J., 1946. New discoveries in Babylonia about *Genesis*. Marchall, Morgan, and Scott, London. If so, is it possible that such documents may even have included maps of the antediluvian world? Jacob might have taken such things, which were in his keeping, to Egypt; and while Moses evidently had many of them, or copies, others, or, again, copies, might have remained in Egypt even until Plato's time.
- ³For a critical discussion of the notion that Atlantis was really the island Thera, see Isaacson, Israel M., 1975. Some preliminary remarks about Thera and Atlantis. *Kronos* 1(2):93-97.
- ⁴For some similar thoughts along this line see Heyerdahl, Thor, 1979. Early man and the ocean. Doubleday and Co., Inc., Garden City, New York. Pp. 359-361.
- ⁵Dillow, Joseph C., 1978. Mechanics and thermodynamics of the pre-Flood vapor canopy. *Creation Research Society Quarterly* 15(3): 148-159.
- ⁶Dillow, Jody, 1977. The catastrophic deep-freeze of the Beresovka mammoth. *Creation Research Society Quarterly* 14(1):5-13.
- ⁷Tippett, Mark W., 1979. Pangea shattered. *Creation Research Society Quarterly* 16(1):7-15 and 83.
- ⁸Wesson, Paul S., 1972. Objections to continental drift and plate tectonics. *Journal of Geology* 80(2):185-197.
- (Editor's note.) As this item was being prepared for the press a further report about Atlantis appeared. A story on page 1 of the *Kingston Whig-Standard*, 3 April, 1979, states that Prof. A. A. Aksyenov, a Russian oceanographer, reports finding, in the Atlantic off Gibraltar, a submerged group of flat-topped mountains, which, he believes, may once have been an archipelago. Moreover, there were what appear to be ruins of man-made structures.
- Dr. Burdick informs me that he has seen a similar account, originating in Moscow, and quoting Alexander A. Nesterenko, director of the Soviet Institute of Oceanography, and Andrei Akensov, an authority on underwater exploration.

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- ¹The well known film, *Footprints in Stone*, is distributed by the Films for Christ Association, North Eden Road, Elmwood, Illinois 61529.
- ²Fields, W., L. Hemby, and R. Mehrens, 1978. Paluxy River explorations. Published by Wilbur Fields, 2313 E. 20th St., Joplin, Missouri 64801.

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- ¹⁸*Ibid.*, p. 433.
- ¹⁹Gray, A. 1860. The origin of species. *The North British Review*, Vol. 32:465.
- ²⁰Darwin, C. *Op. cit.*, p. 66.
- ²¹*Ibid.*, p. 64.
- ²²Macbeth, N. 1971. Darwin retried. Gambit, Inc., Boston, p. 50.
- ²³Leatherdale, W. H., *Op. cit.*, p. 206.
- ²⁴*Ibid.*, p. 181.
- ²⁵*Ibid.*, p. 149.

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A New Kind of Evidence

(Continued from page 88)

the branch fell into it. But the tracks in the rock must have been made in the mud only a very short time before it hardened, or else they would never have remained. So the tracks in the rock must be no more than about 12,000 years old.

Nobody, as far as I know, has disputed that the dinosaur tracks found at the river are genuine. Thus, there must have been dinosaurs living about 12,000 years ago. This conclusion, it will be noted, follows whether or not the human tracks which many have found are genuine. On the other hand, when the dinosaur tracks have been shown to be comparatively recent, there is no reason to doubt that human tracks might be found in the same place.

EVOLUTION AND FLUCTUATIONS—A CREATIONIST EVALUATION

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Fluctuations are examined as a possible mechanism for molecules-to-man evolution. Dissipative structures offer promise as good models for certain existing nonequilibrium systems, but fail as proper models for origins. Often they are used as tools to avoid, in theory, the consequences of degeneration processes. The major problem with the evolutionary hypothesis is the lack of an explanation of how the universe moved out of the initial equilibrium condition. The use of fluctuations to accomplish the task appears unrealistic. Creation of the original order is a sensible alternative.

Introduction

Recently the hypothesis of molecules-to-man evolution received a needed boost. The introduction of the concept of fluctuations has been heralded as the possible driving force for evolution.¹

As stated by Prigogine, Nicolis, and Babloyantz,

For reasons to be explained later, we shall refer to this principle as *order through fluctuations*.²

Obviously the scientific world considered the work to be of such importance that Ilya Prigogine was awarded a Nobel Prize in 1977 for his efforts.

The entire subject falls within the domain of irreversible thermodynamics and the arguments must be evaluated thermodynamically. An interested reader may find a comprehensive development of the thermodynamics of structure and fluctuations in reference 3. For a creationist interpretation of irreversible thermodynamics, see reference 4.

Unrealistic Starting Conditions

It is well-known that all entities in the inorganic world proceed toward a state of equilibrium fairly rapidly. The attainment of equilibrium is much slower in living systems⁵ but is still evident.

Thus to model his systems as close to "the desires of nature" as possible, an evolutionist should start the molecules-to-man process at an equilibrium state and work "upward." However upon investigation of many evolutionary schemes from astronomy to biology, it is found that the usual initial state is one of *nonequilibrium*. Evolutionists need preexisting order to provide any hope of success in their hypothesized process since the equilibrium state is one of maximum disorder.⁶

As for the first law of thermodynamics, order can bring forth more order.⁷ For example, living systems can replicate themselves. Therefore a nonequilibrium state is no proper place to start any molecules-to-man scheme; since the biggest problem has been avoided, getting the system out of the equilibrium state, while all known natural "forces" want to maintain that condition. Nonequilibrium states are entirely unrealistic as starting points for molecules-to-man evolution. This very assumption completely *voids* the idea as a sensible theory of origins.

The work of Prigogine *et al.* deals totally with nonequilibrium states.

The main idea is the possibility that a prebiological system may evolve through a whole succession of

transitions leading to a hierarchy of more and more complex and organized states. Such transitions can only arise in nonlinear systems that are maintained far from equilibrium; that is, beyond a certain critical threshold the steady-state regime becomes unstable and the system evolves to a new configuration.⁸

The subject of origins is beyond the scope of the concept and this is admitted by the authors.

This picture of selection through "survival of the fittest" already implies the existence of self-maintaining and self-reproducing systems. Strictly speaking therefore, it is not a theory of the origin of life.⁹

When the work is carefully investigated it is found that it is not a proper basis for evolution.

Dissipative Structures

To maintain the artificial nonequilibrium state, even in theory, a number of imaginary structures must be invented.

As might be expected, the stability of thermodynamic equilibrium implies the stability of states *near* equilibrium. This is the reason why all non-trivial stability problems cannot be approached by linear thermodynamics of irreversible processes. The possibility of new types of organization of matter past an instability point under the influence of non-equilibrium conditions, occurs only when the system is sufficiently far from equilibrium. The study of such a new organization, the so-called *dissipative structure*, arising from the exchange of matter and energy with the outside world, appears as one of the most fascinating subjects of macroscopic physics.¹⁰

The equilibrium state can be defined away if one invents a dissipative structure which has as its sole purpose the ability to reject entropy faster than it can produce or receive it! Then order can be maintained and useful information can be transferred between structures.

Such a construct has definite advantages.

It is therefore possible, *a priori*, to have a number of new effects, for instance: the system may not decay monotonically to the steady state belonging to the thermodynamic branch, once it is perturbed from it; in the limit it may even never return to this state but evolve to a time-dependent regime: under similar conditions it may finally deviate and evolve to a new stationary regime corresponding to a branch different from the thermodynamic one. This transi-

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tion will manifest itself abruptly as an *instability*, i.e. as a fundamentally discontinuous process.¹¹

Since the entropy of an isolated system is a monotonically increasing function of time,¹² dissipative structures are a very neat way of avoiding the degenerating influences in nature. In the marriage of kinetics with thermodynamics to form the science of irreversible thermodynamics, the tail (kinetics) has begun to wag the dog (thermodynamics). This writer warned about such a possibility in 1971.¹³ The system under study is conveniently kept away from equilibrium by theoretical dissipative structures.

It is therefore very tempting to associate biological structures with chemical instabilities leading to a spontaneous self-organization.¹⁴

Once the imagined system gets far enough away from equilibrium, life spontaneously generates!

Summarizing, we may say that instabilities in the thermodynamic branch of solutions can lead to time or space organization and to a change in functional behavior in open systems undergoing chemical reactions.¹⁵

The creation of order by virtue of instabilities is an example of imagined ever-onward-upward evolution.

It would be thus very tempting to think that dissipative instabilities act as a kind of phase transition leading to a *new state of matter*.¹⁶

This new state of matter is one in which the second law of thermodynamics has been overcome. At last the evolutionist has triumphed over observable phenomena.

It is exciting to realize that the analogy between dissipative and biological structures may lead to the idea that life and absence of life are just two states of matter separated by a chemical instability.¹⁷

Thus a totally atheistic, mechanistic, and naturalistic picture of life has evolved from the consideration of dissipative structures. Such structures may be excellent models for studying the maintenance of existing non-equilibrium living systems, but they cannot explain how these systems originated.

Order Through Fluctuations

The general path supposedly taken by fluctuations and dissipative structures is that to higher and higher order. Such a process can be visualized in Figure 1.

A nonequilibrium state (a) exists and is made stable by conservation processes. Suddenly a system fluctuation at time t_1 drives it to a more highly-ordered state (b). This state is stabilized for a while by conservation processes until another fluctuation occurs at time t_2 driving the system to an even more highly ordered state (c). This state is made stable by conservation processes, and the net system order has increased by such imagined processes.

It should be noted that when fluctuations of the right kind are needed, they occur. When conservation processes are needed, they operate. When thermodynamic considerations (conservation) need to be overcome, kinetics (fluctuations) can do the job. You systematically allow for what you want to happen. It is unfortunate that nature is not that cooperative with evolutionary necessity. Yet fluctuations and conservation processes

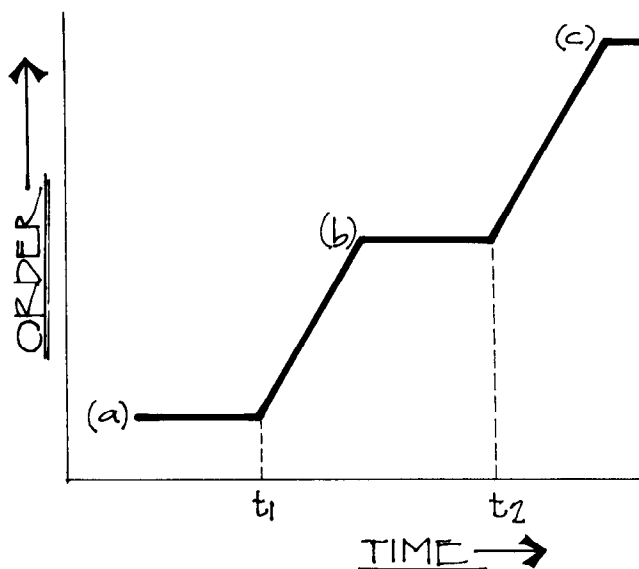


Figure 1. Schematic diagram of an increase in order by fluctuations and stabilization of the order by conservation processes.

seem never to interfere with each other and degeneration processes seem reluctant to act! Evolution by "blessed events"¹⁸ can operate.

The seemingly perfect working-together of fluctuations and conservation processes are totally unnatural. These changes exist only in the minds of evolutionary scientists. Men can intelligently plan and cause changes that apparently lower the entropy of a system. Constant maintenance of the system at a low entropy state by energy inflow and outflow is necessary to hold back the degenerating effects. Yet eventually even the preservation processes of the ordered open system coupled to its surroundings cannot stop the degeneration.¹⁹ It appears that God has created into the living organisms certain conservation processes that slow down the inevitable, yet the state of maximum entropy or disorder is eventually reached.^{20,21}

If thermodynamic principles were left free to perform in the naturally-expected manner, the net result of the fluctuation process might be as follows.

The original created order state (a) is stabilized by conservation processes. A fluctuation occurs at time t_1 driving the system to a new metastable state (b) of lower order. Conservation processes maintain state (b) until another fluctuation occurs at time t_2 driving the system to state (c) of even lowered order. This type of behavior would be expected with the interaction of conservation and degeneration processes.²²

At best the level of ordering expected in the interaction of conservation and degeneration processes²³ is shown in Figure 3. The original created order is shown as state (a).

The same fluctuation-conservation-degeneration pattern is seen at states (b) and (c) and at times t_1 and t_2 as shown in Figure 2. However at time t_3 a fluctuation causes the system to change to state (d) which is more ordered than states (b) or (c). Such an ordering process can be imagined as long as it results in a state with less order than (a). No change or fluctuation can generate

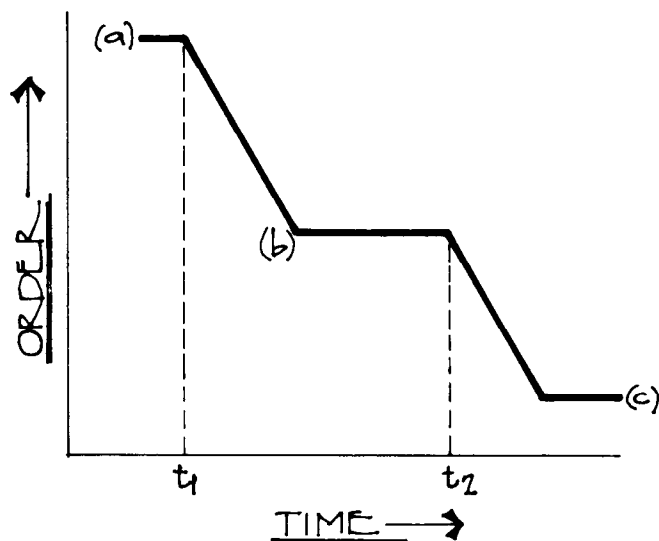


Figure 2. Schematic diagram of a decrease in order by fluctuations and stabilization of the order by conservation processes.

more order than the original state (in this case the created order). Possibly such a change is a model of what occurs in genetic recombination. A further change noted in Figure 3 fluxes the system at time t_4 from state (d) to a state (e) of lower order.

It would seem that the postulated changes illustrated in Figure 2 and 3 provide a more realistic model for natural situations. Order can bring forth other order (conservation processes) but order can never arise spontaneously out of disorder (equilibrium state).

Do fluctuations honestly lead to states of higher order? This question was asked of Prigogine.²⁴

J. Keck: I would like to comment on Professor Prigogine's remarks about generation of order from disorder.

What you have described to us was the decay of a metastable state into a more ordered state. In the same sense, an explosion would be an example in which a degree of order is created out of disorder by releasing energy.

I wonder if you would make a distinction between your example and mine. I don't really think these are examples of the creation of order out of disorder. The systems were metastable to begin with.

I. Prigogine: The order to which I referred corresponds to situations which are sufficiently far from thermodynamic equilibrium, and which permits to transform the flow of energy into structure. We go then from our branch of the solution of the conservation equation to another branch.

The above exchange lays bare the inadequacy of the evolutionary scheme. Order is not created out of disorder. If an explosion in a print factory can generate Webster's *Unabridged Dictionary*, then molecules-to-man evolution can occur by the proposed fluctuation mechanism.

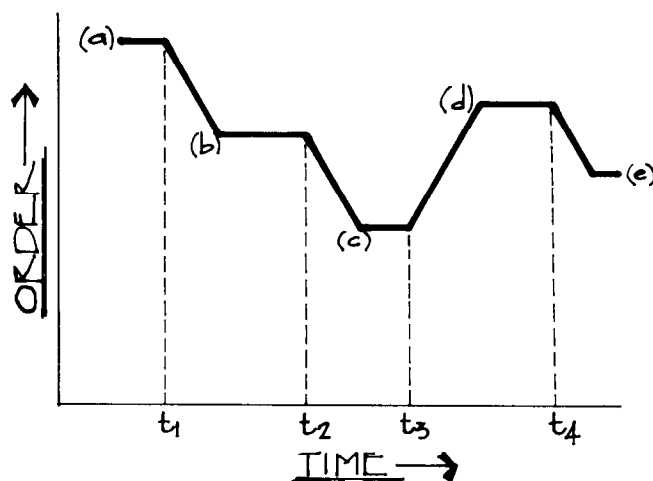


Figure 3. Interaction of fluctuations, conservation and degeneration processes to produce temporary order.

Fluctuations at Equilibrium

Essentially for fluctuations to be of importance in the evolutionary hypothesis of *origins*, they must be able to bring a system out of equilibrium state into a stable nonequilibrium state. This concept will be developed using fluctuations in entropy of an ideal monatomic gas system at equilibrium for simplicity. An ideal gas at known temperature, pressure, and volume is considered a macrostate. The actual arrangement of the atoms at this state cannot be observed; however statistical considerations can be introduced as a model for what is happening on the atomic level.

The atoms of gas are in constant motion in a state of disorder. Yet if it were possible to take a photograph each instant, the positions of the atoms in one photograph would be different from their positions in other photographs. Yet each would be of a disordered arrangement. These would represent various microstates of the system, that make up all of the possible arrangements of the equilibrium macrostate designed by W_e . Suppose a fluctuation causes the atoms in the gas to assume a slightly ordered arrangement. This new macrostate is represented by W_{ne} since it is a nonequilibrium condition.

The entropy change in going from one macrostate to another can be calculated using the Boltzmann formula as follows.²⁵

$$dS = k \ln \frac{W_{ne}}{W_e} \quad (1)$$

where $dS = S_{ne} - S_e$, S_{ne} = entropy of the nonequilibrium state, S_e = entropy of the equilibrium state, and k is Boltzmann's constant.

Starting with the first law of thermodynamics for an ideal gas

$$dU = dQ + dW \quad (2)$$

where dU = internal energy gained or lost by the system, dQ = heat gained or lost by system, dW = work done on or by system, $dW = -PdV$ (mechanical work only), P =

pressure of gas, and V = volume of gas.

Thus (2) becomes

$$dU = dQ - PdV \quad (3)$$

From the classical definition of the change in entropy, $dS = dQ/T$. T is the absolute temperature; (3) becomes $dU = TdS - PdV$, or

$$dS = \frac{dU}{T} + \frac{PdV}{T} \quad (4)$$

The internal energy of an ideal gas is a function of temperature only so that $dU = C_v dT$. Also $C_v = 3R/2$. Here R is the ideal gas constant.

Therefore (4) after substitution can be written as

$$dS = \frac{3}{2} R \frac{dT}{T} + \frac{P}{T} dV \quad (4')$$

By the ideal gas law $PV = nRT$, or $P/T = nR/V$, where n = number of moles of gas, then

$$dS = \frac{3}{2} R \frac{dT}{T} + \frac{nRdV}{V} \quad (5)$$

Indefinite integration of (5) yields

$$S = \frac{3}{2} R \ln T + nR \ln V + S_0 \quad (6)$$

where S_0 is the integration constant.

If $n = 1$, then $nR = Nk$. Here N is Avogadro's number; and (6) becomes²⁶

$$S = Nk(\ln VT^{3/2} + \frac{S_0}{R}) \quad (7)$$

This equation represents the entropy of one mole of an ideal monatomic gas at temperature T and volume V .

$$S = NkC$$

$$C = (\ln VT^{3/2} + \frac{S_0}{R}) \quad (8)$$

Return to equation (1). When the fluctuation occurs the entropy decreases since $W_e > W_{ne}$ and dS is negative.²⁷

Equation (8) can be written as

$$dS = NkCx \quad (9)$$

where x is the fractional decrease in entropy due to the fluctuation.

Equate (1) and (9):

$$\frac{W_{ne}}{W_e} = e^{-NkCx}$$

If the gas is assumed to be helium at 273°K and 1 atm.,²⁸ $C = 14.96 \approx 15$, and $W_{ne}/W_e = e^{-15Nx}$.

Suppose an entropy decrease of one part in a million occurs as a result of the fluctuations, or $x = 10^{-6}$, then $N = 6.02 \times 10^{23}$; and $15Nx \approx 10^{19}$, or $W_{ne}/W_e = e^{-10^{19}} \approx (2.7)^{-10^{19}}$.

Thus the chance of an infinitesimally small entropy decrease is about 10 raised to the -10^{19} power.²⁹ The

odds against any sizeable entropy decrease would be astronomical. Fluctuations offer no hope to the evolutionist to drive a system out of an equilibrium state.

Even if minute ordering fluctuations do occur somewhere in the system, immediately upon another fluctuation the short-range order would be destroyed. Another area of order may appear simultaneously in some other part of the system. Yet it will be dissipated by the next fluctuation.

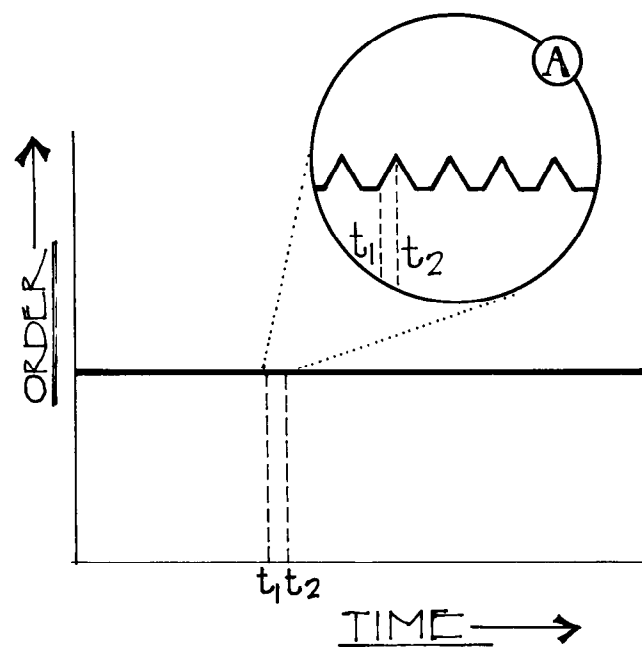


Figure 4. The production of short-range order in a gaseous system subject to fluctuations at equilibrium. The inset A represents a small section of the curve greatly magnified; it shows how the curve of order vs. time may be "bumpy" due to microscopic fluctuations.

The process can be schematically represented in Figure 4. The macroscopic entropy of the system does not change. However during system fluctuations, short-range order can develop, dissipate, develop elsewhere, dissipate, etc. A fluctuation occurs at t_1 causing the appearance of short-range order. Another fluctuation at time t_2 causes the order to dissipate in that area. No lasting order can be built up by such a process. Molecules-to-man evolution needs ordering fluctuations of monumental magnitude and unnatural locking mechanics to stabilize any generated order as degenerative forces attempt to drive the system back to equilibrium. Such schemes can be created on paper, but the operation of them in nature is doubtful.

Such a hopeless procedure appears to be doomed to failure. The primary need of any evolutionary hypothesis—to move the system away from equilibrium—is highly improbable. Actually fluctuations tend to disorder a system,³⁰ and if the improbable does happen on one fluctuation, the probable will occur in succeeding fluctuations destroying any temporary order.

Conclusions

Although there are fluctuations in natural systems such as shock waves and other catastrophic events, it is unreasonable to assume that they can be used as a driving force for molecules-to-man evolution. Nonuniform conditions can exist briefly as illustrated by the Zhabotinski reaction.³¹ However, like all real systems, it is driven toward equilibrium and does not proceed to higher states of order.

Dissipative structures offer considerable promise as good models for living systems and certain temporary nonequilibrium states found in nature. However they cannot be used as models for the origin of such systems.

The major problem that must be faced by evolutionists is how their imagined universe moved out of the preferred natural state of equilibrium. Natural means seem fruitless. This writer prefers to believe

In the beginning God created the heaven and the earth
as the origin of natural order.

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The Zhabotinski reaction goes as follows. A solution of $\text{Ce}_2(\text{SO}_4)_3$, KBrO_3 , $\text{CH}_3(\text{COOH})_2$, H_2SO_4 and a few drops of Ferroline (redox indicator) are mixed and stirred by magnetic agitation. The solution changes color periodically from red (excess of Ce^{+3}) to blue (excess of Ce^{+4}) and back, etc. Depending upon concentration, temperature, and mixing conditions the entire solution will change at once or in "bands". The system reaches equilibrium, staying a single color, usually in less than thirty minutes.

THE SPECIES CONCEPT IN LYELL'S PRINCIPLES OF GEOLOGY

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Lyell's book had also something to say about biology; and his views on that subject are investigated here. It turns out that he was not so much of a Darwinian as is often supposed; in fact, his doctrine was more like the one now commonly called Progressive Creation. Creationists who have not read the work may be surprised to find that some of his arguments and illustrations may still be useful to them.

This article will summarize the concept of biological species in Sir Charles Lyell's *Principles of Geology*. The book was first issued in 1830 (vol. I), 1832 (vol. II), and 1833 (vol. III), and its original full title was *Principles*

of Geology, Being an Attempt to Explain the Former Changes of the Earth's Surface, By Reference to Causes now in Operation. After the 5th edition (1837), the contents were split into the *Principles* (6th and later editions), dealing mainly with processes now seen in operation on the earth's surface, and *The Elements of Geology* and *Manual of Elementary Geology* which dealt with "geology proper". This article is based on the 9th edition (1853) of the *Principles*, whose full title is *Principles of Geology; or, the Modern Changes of the Earth and its Inhabitants Considered as Illustrative of Geology*, and which was published by John Murray of

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London. It is illustrated with some charming wood engravings.

Books I and II deal respectively with the history of geology and modern geological processes. Of present concern is book III (pp. 566-799), which is largely on biology. Chapters XXXIII-XXXVI are on the species concept; XXXVII-XXXIX, on geographical distribution of species; XL-XLIII, on the origin and extinction of species; and XLIV-L, on the influence of organisms in geography (coral reefs, for instance) and the formation of fossils. Also on fossils was the much earlier chapter IX, in which Lyell was still arguing, at this late date, that the fossil record did not show progression. Henceforth, we shall be concentrating on the material in chapters XXXIII-XXXVI and XL-XLIII, as well as "Concluding Remarks" on pp. 798-9. Page numbers refer to the 1853 printing, and readers who have access to earlier editions, or the facsimile reprint (New York, 1970) of the first edition, may be interested to compare the treatments.

Early in chapter XXXIII, Lyell introduces four problems to which he addresses himself in the book. First, do species have a "real and permanent existence in nature"?—or are they "capable, as some naturalists pretend, of being indefinitely modified in the course of a long series of generations?" Second, if species have a real existence, is each derived from a single stock or from several? Third, how far is the duration of each species limited by changing conditions in the animate or inanimate world? Finally, are there proofs of the successive extinction of species and the creation of others to take their place? (pp. 566-7) The rest of the chapter is occupied with the first problem, and consists of ten pages of an apparently fair presentation of "Lamarck's arguments in favour of the transmutation of species" (pp. 567-77). It is largely based on Lamarck's *Philosophie Zoologique*, and need not be summarized here. One remark is worth making, however; it is curious how transmutation theories achieved wide circulation before 1859 through the works of antitransmutationists. William Paley introduced Erasmus Darwin's theory of appetencies to many who would not otherwise have learnt about it, Lyell broadcast Lamarckian theory effectively, and Hugh Miller did the same for de Maillet, Lamarck, and the *Vestiges*.

In the next three chapters, Lyell opposes Lamarck's theory with a presentation of his own concept of species. The last page of chapter XXXVI gives a summary of his answer to the first problem stated above. It contains six points. (1) "... there is a capacity in all species to accommodate themselves, to a certain extent, to a change of external circumstances, this extent varying greatly, according to the species". (2) A large change in situation is usually followed by modifications, "but the mutations thus superinduced are governed by constant laws, and the capability of so varying, forms part of the permanent specific character". (3) "Some acquired peculiarities, of form, structure, and instinct, are transmissible to the offspring..." (4) "The entire variation from the original type... may usually be effected in a brief period of time...; indefinite divergence, either in the way of improvement or deterioration, being prevented, and the least possible

excess beyond the defined limits being fatal to the existence of the individual". (5) "The intermixture of distinct species is guarded against by the aversion of the individuals composing them to sexual union, or by the sterility of the mule offspring". (6) "From the above considerations, it appears that species have a real existence in nature; and that each was endowed, at the time of its creation, with the attributes and organization by which it is now distinguished". (p. 611)

It is worth presenting Lyell's views somewhat more fully on several of these conclusions. On variation, for instance, he readily admits that some species "may be found to differ less widely from one another than do the mere varieties or races of certain species". But this "would by no means overthrow our confidence in the reality of species" (p. 581). In explaining this, final causes are introduced. "We must suppose that when the Author of Nature creates an animal or plant, all the possible circumstances in which its descendants are destined to live are foreseen, and that an organization is conferred upon it which will enable the species to perpetuate itself and survive under all the varying circumstances to which it must be inevitably exposed" (p. 582). Species destined to survive under a wide range of environments, such as horses or dogs, may therefore be able to produce varieties, the differences between which exceed the interspecific variation in other genera.

The remainder of chapter XXXIV gives illustrations of the variability of species, to support the principle that variability is merely one of the fixed characters of a species. Dogs are instanced as showing extreme variability (pp. 584-5), but to show that this variability is limited or "definite", the French researches on mummies acquired during the occupation of Egypt are mentioned. "Instead of wasting their whole time exclusively in collecting human mummies, M. Geoffroy and his associates examined diligently, and sent home great numbers of embalmed bodies of consecrated animals, such as the bull, the dog, the cat, the ape, the ichneumon, the crocodile, and the ibis" (p. 585). The authors of the report on these specimens were MM. Cuvier, Lacépède, and Lamarck, and they agreed that they could find no differences between the mummified specimens and their modern equivalents to suggest transmutation (pp. 585-7). Lyell continues by considering seeds from Egyptian tombs, modern cabbages, primroses, and changes induced by soil and horticulture. But in cases where considerable changes can be induced, "we soon reach certain limits, beyond which we are unable to cause the individuals descending from the same stock to vary..." (p. 588).

Chapter XXXV re-emphasizes that any change which a variable species can undergo will generally be effected within a few generations; "the quantity of divergence diminishes after a few generations in a very rapid ratio" (p. 592). Some examples are then given of the inherited peculiarities of some varieties of a species—usually the dog. Not all characters of this type are inherited, however. "A pig has been trained to hunt and point game with great activity and steadiness; and other learned individuals, of the same species, have been taught to spell; but such fortuitous acquirements never become hereditary, for they have no relation whatever

to the exigencies of the animal in a wild state, and cannot, therefore, be developments of any instinctive propensities" (p. 595).

The rest of the chapter is concerned with domestic races, once more, and the point Lyell particularly makes is that the use to man of domestic animals was foreseen by God, who provided them with the requisite variability and other specific characters; "... the power bestowed on the horse, the dog, the ox, the sheep, the cat, and many species of domestic fowls, of supporting almost every climate, was given expressly to enable them to follow man throughout all parts of the globe, in order that we might obtain their services, and they our protection". And in case the elephant appears to be an exception, its restriction to the warmest latitudes is still a providential arrangement because "the quantity of vegetable food required by this quadruped would render its maintenance in the temperate zones too costly, and in the arctic impossible" (p. 597). A piece of evidence in favor of this general interpretation of domestic animals is seen in the horse; the obedience of an individual horse to a succession of human owners is a propensity of no obvious use to horses in the wild state (p. 596).

The problem of hybrids dominates chapter XXXVI, and it is a problem because some naturalists consider hybrids "as affording the strongest of all proofs in favour of the reality of species; others, on the contrary, appealing to them as countenancing the opposite doctrine . . ." (p. 600) Lyell regards hybrids as supplying evidence for fixity of species on various counts: hybrids generally cannot sustain themselves in the wild state; very closely related species are often found to have non-overlapping geographical ranges; a hybrid of two well adapted species would itself be unlikely to be well adapted to that environment; and if most species arose as hybrids from original types, where are the original types? It is in the context of the low chance of survival of hybrids in the wild state that Lyell introduces natural selection theory; "even of the seeds which are well ripened, a great part are either eaten by insects, birds, and other animals, or decay for want of room and opportunity to germinate. Unhealthy plants are the first which are cut off by causes prejudicial to the species, being usually stifled by more vigorous individuals of their own kind In the universal struggle for existence, the right of the strongest eventually prevails; and the strength and durability of a race depends mainly on its prolificness, in which hybrids are acknowledged to be deficient" (pp. 604-5). At times, the history of natural selection theory has run a course independent of the history of evolutionism, and there are a considerable number of variants of the theory. In this case, Lyell is adhering to a common form in the period before 1859, one in which natural selection is seen as weeding out defective individuals and hence stabilizing a variety or species—not changing it.

The question of origin and extinction of species is turned to in chapters XL to XLIII. In contrast with Linnaeus' theory that all original species were created in the same restricted locality—namely, the first habitable part of the world to emerge, on the subsidence of the primeval oceans (p. 665)—Lyell proposes that "Each

species may have had its origin in a single pair, or individual, where an individual was sufficient, and species may have been created in succession at such times and in such places as to enable them to multiply and endure for an appointed period, and occupy an appointed space on the globe" (p. 666). Admitting the existence of barriers to the spread of species, such as seas, mountain chains and climatic belts in the case of land organisms, land, shoals, abysses and currents in the case of marine organisms, and winds in the case of species dispersing in the air, then we have an explanation of the restriction of many species to particular regions of the world.

Lyell's views are somewhat more original when he comes to time and duration. He does not adhere to a literal reading of Genesis, but first quotes the theory of the Italian, Brocchi, to the effect that "The death . . . of a species might depend, like that of individuals, on certain peculiarities of constitution conferred upon them at their birth; and as the longevity of the one depends on a certain force of vitality, which, after a period, grows weaker and weaker, so the duration of the other may be governed by the quantity of prolific power bestowed upon the species . . ." (pp. 668-9)

Brocchi's theory is not entirely acceptable to Lyell, though they agree on the "gradual extinction of species one after another" (p. 669), and the limited duration of species. Lyell believes, against Brocchi however, that the "prolific powers" of species are unimpaired at their extinction, and that they die out for other reasons—these being the main substance of chapters XL to XLIII. There are many interesting ecological observations in this part of the book, which suggests that Lyell was no mean naturalist. In particular he emphasizes the concept of the "station" of each species, which is "all the circumstances, whether relating to the animate or inanimate world, which determine whether a given plant or animal can exist in a given place" (p. 669). He instances the restriction of some species to particular soils, such as *Carex arenaria* and *Elymus arenarius* (p. 670). Competition between species is mentioned, and also co-operation, as in the case of young oaks protected by holly from deer and swine in the New Forest of Hampshire, England (p. 671). Insects give some striking examples. "Entomologists enumerate many . . . cases where insects, appropriated to certain plants, are kept down by other insects, and these again by parasites expressly appointed to prey on them" (p. 672). The use of final causes is again evident. Lyell compares the efficiency of insects with the steam engine, which has the advantage over many hundreds of horses, of equivalent power, in that it does not require to be fed when not in use. Similarly, among insects, "A scanty number of minute individuals, to be detected only by careful research, are ready in a few days, weeks, or months, to give birth to myriads, which may repress any degree of monopoly in another species, or remove nuisances, such as dead carcasses, which might taint the air. But no sooner has the destroying commission been executed than the gigantic power becomes dormant" (p. 673) and the population drops to its usual level. This idea is used to explain Linnaeus' assertion that three flies, of the

species *Musca vomitoria*, "could devour a dead horse as quickly as a lion" (p. 673).

The intention in discussing all this ecology is to establish that species "depend on a great complication of circumstances" (p. 677), and that "if it be shown that stations can become essentially modified by the influence of known causes, it will follow that species, as well as individuals, are mortal" (pp. 669-70). As to be expected, chapters XLI and XLII proceed to demonstrate how familiar causes can so alter the stations of species that "the successive destruction of species must now be part of the regular and constant order of nature" (p. 678). Considerable evidence is presented for the drastic effects on species when a different species is introduced into the environment, and this includes an interesting account of the effects of "the Greenland bears, when they are drifted to the shores of Iceland in considerable numbers on the ice" (p. 679). In general, Lyell wishes to demonstrate "that when any region is stocked with so great a variety of animals and plants as the productive powers of that region will enable it to support, the addition of any new species, or the *permanent* numerical increase of one previously established, must always be attended either by the local extermination or the numerical decrease of some other species" (p. 678). Inorganic changes may also have the same effect, either by altering the barriers limiting dispersal of species, or by affecting conditions of the environment such as climate. As an example, Lyell considers the multiplicity of changes in climate, and barriers to migration of land and marine species, if the isthmus of Panama were to subside below sea level (pp. 691-2). Altogether, "amidst the vicissitudes of the earth's surface, species cannot be immortal, but must perish, one after the other There is no possibility of escaping from this conclusion, without resorting to some hypothesis as violent as that of Lamarck. . . ." (p. 696).

Lyell finally comes to a four-page section on the "Introduction of New Species". He allows that some naturalists, such as Humboldt, regarded the topic "as among the mysteries which natural science cannot reach"; but Lyell thinks that "To geology . . . these topics do strictly appertain . . ." (p. 704), and he proceeds to consider "what kind of evidence we ought to expect . . . of the first appearance of new animals or plants, if we could imagine the successive creation of species to constitute, like their gradual extinction, a regular part of the economy of nature" (p. 704). The problem is that, with knowledge of species still at an elementary stage, the sudden appearance of a new species, in a locality already well investigated, legitimately prompts the inference "that the beings in question had previously eluded our research; or had at least existed elsewhere, and only migrated at a recent period into the territories where we now find them" (p. 704).

Attention is then directed to the probable rate of extinction and creation of species. After reviewing estimates of the number of species, and arriving at a very approximate number of "between one and two millions of species now inhabiting the terraqueous globe", excluding microscopic species, Lyell thinks it reasonable to assume "that if only one of these were to become ex-

tinct annually, and one new one were to be every year called into being, much more than a million of years might be required to bring about a complete revolution in organic life" (p. 706). If, for the sake of the argument, this be accepted, then it would seem that an area the size of Europe (about a twentieth of the world's surface) would experience an extinction and a creation once in twenty years on average—and much less frequently if we think only of terrestrial and well known groups of species in which the events in question might be detected for what they were. Since the chances of gaining useful knowledge on the replacement of species among the extant fauna and flora are so small, Lyell considers that the study of the first appearance of living species in the fossil record gives a much better opportunity of establishing or disproving his theory of the continual replacement of species.

At the very end of the *Principles*, there are two pages of "Concluding Remarks". They are concerned with the age of the earth—or, rather, whether it had an origin. Two opinions are contrasted. One school of thought wishes "to discover in the ancient rocks the signs of an epoch when the planet was uninhabited, and when its surface was in a chaotic condition and uninhabitable". But "The opposite opinion, . . . that the oldest of the rocks now visible may be the last monuments of an antecedent era in which living beings may already have peopled the land and water, has been declared to be equivalent to the assumption that there never was a beginning to the present order of things" (p. 798). Lyell seems to be saying, in the succeeding paragraphs, that geological evidence is indeed quite compatible with a steady state theory, postulating no origin. However "if, in tracing back the earth's history, we arrive at the monuments of events which may have happened millions of ages before our times, and if we still find no decided evidence of a commencement, yet the arguments from analogy in support of the probability of a beginning remain unshaken . . ." (p. 798). "To assume that the evidence of the beginning or end of so vast a scheme lies within the reach of our philosophical inquiries, or even of our speculations, appears to be inconsistent with a just estimate of the relations which subsist between the finite powers of man and the attributes of an Infinite and Eternal Being". ". . . in whatever direction we pursue our researches, whether in time or space, we discover everywhere the clear proofs of a Creative Intelligence, and of His foresight, wisdom, and power" (p. 799). Thus, we have good evidence for the existence and attributes of God in geology, but no evidence for an origin of the earth. Belief in that must rest on other evidence.

In summary, we have in Lyell's *Principles of Geology* a fairly conventional view of the nature of species—conventional for the period, that is. Species were created with fixed attributes, but nevertheless able to undergo limited modification to the extent that distinct races may be produced. Final causes are admissible in explaining some characteristics of species, such as unusual variability. Just as the organs are carefully adjusted to each other so that no "indefinite" modification is compatible with viability in the animal or plant, so each
(Continued on page 141)

REPORT OF 1979 BOARD OF DIRECTORS MEETING

The annual meeting of the Board of Directors of the Creation Research Society was held 20, 21 April at Concordia College, Ann Arbor, Michigan. The meeting was opened Friday, 20 April, at 1800 hours by President Howe; there was a short period of silent prayer. Members present: G. Howe, E. Williams, H. Armstrong, W. Frair, R. Korthals, W. Rusch, T. Barnes, D. Boylan, C. Burdick, D. Gish, J. Klotz, J. Meyer, J. Moore, H. Morris, G. Mulfinger, H. Slusher, E. Smith. Absent: W. Tinkle, because of health. Friday evening there were about 20 visitors, mostly from the Detroit Creation-Science Association whose members graciously provided refreshments during the break. The 1978 minutes were read and approved.

Membership Secretary Rusch indicated there were 657 voting members, 1221 sustaining members, 417 student members, 119 subscribers, 201 library, 27 school and 7 church subscriptions, giving a total of 2649. For the first time in its history the organization has passed the 2500 mark. Rusch said that the C.R.S. must pay \$3. to \$5. extra for each foreign check it receives. No such charge is levied if payment is in American funds drawn on an American bank; so we should encourage that payments from foreign countries be made in this way.

Secretary Frair presented election results indicating that 249 ballots had been cast and the following were elected for a three-year term: Klotz, Korthals, Morris, Rusch, Slusher, Smith. The financial report was given by Treasurer Korthals; and it shows total cash assets of \$53,676.49. There was a \$4000. increase in income over last year and also a \$2600. advance royalty from Mott on the new textbook. Income included \$7,008.23 from Zondervan for royalties on the current text.

Rusch indicated that the contract for the new text has been signed and that individuals have been selected for most sections of the new book. When all the sections have come in, the Publications Committee will act on these.

Editor Armstrong reported that Volume 15 of the *Quarterly* has been completed and Volume 16 is under way, material coming in very well. Meyer, Chairman of the Membership Promotion Committee, reported that advertisements had been placed in each of *Science*, *BioScience*, *American Scientist* and *Nature*, with a total circulation of approximately 350,000. Four hundred brochures were mailed out; 5000 posters were printed; and it is hoped that these posters can be placed on college and university bulletin boards all over our country. Meyer expressed concern for retaining our present members and subscribers who do not renew each year.

Slusher reported that the student chapter at the University of Texas at El Paso has a large number of graduate students in physics and math and that they have been meeting every two weeks. Word has come from the University of Prince Edward Island (Charlottetown, Prince Edward Island, Canada C1A 4P3) regarding starting a chapter. Possibly also Christian Heritage College may start a chapter.

Barnes reported on his statement on "Openness as a Principle in Science", indicating that there have been about 740 signatures of scientists.

Mulfinger reported his activities in moving ahead with facsimile reprints the first of which is expected to be *The Case Against Evolution*, by G. B. O'Toole, 1925. A new monograph is being prepared on the subject of thermodynamics, to be edited by Williams.

Williams, Chairman of the Research Committee, reported on research being done by the Genesis Laboratory on sediment mechanisms including wave profiles. The investigating committee has indicated that seven publications will be prepared for the C.R.S. *Quarterly*. Williams also reported on his own continuing experiments showing that stalactites and stalagmites can be produced quite rapidly.

Lammerts discussed his experiments dealing with bristlecone pine in which he is varying environmental factors to see if more than a single ring can be produced in one year.

Howe presented research on chamise (grease wood), showing that after a fire, it regrows primarily from seedlings, contrary to what is often stated.

Frair presented research on the biochemical taxonomy of sideneck turtles found in Africa, South America and Australasia, suggesting that possibly ocean currents were important in distributing the present groups.

Smith detailed experiments involving layering of fresh water on top of heavier salt water in a physical model demonstrating how some fresh-water as well as marine organisms could have survived the Flood.

Gish reported on his debating activities including those in England with Professor Alexander (Leeds University), Dr. Halsted (Reading University) and Professor Maynard Smith (Sussex University). Generally there has been a good response to his presentations.

Moore recounted how, having been an evolutionist, he became a Creationist. He is studying the subject of Creation from the standpoint of history as a teacher. He pointed out that the founders of science were Christians (theists) and that science now is too often being presented by reactionaries who have moved away from their roots in science. He urged that we use the terms "megaevolution" or "microevolution" when referring to change and that we refer to similarity rather than to relationship.

Williams discussed books in science for Christian schools. He pointed out that those issued by Bob Jones University Press contained considerable Biblical material and specifically were written for the Christian school market.

Armstrong read a letter suggesting that a prize (possibly somewhat resembling the Nobel prize) be established for outstanding work in Creationism. It was the consensus that we are not in a position to proceed with this unless considerable funds are available; and that the idea is meritorious but outside our province at this time.

The following motions were carried:

1. that up to \$150. could be spent for C.R.S. display purposes at the Bible-Science convention in Anaheim, California, in August 1979;

2. that this year we publish two one-third-page advertisements in *Nature* and one one-third-page advertisement in *Moody Monthly*;
3. that one questionnaire be sent to voting members and another to sustaining members who do not renew membership;
4. that we ask Mott Media to handle the reprinting of the whole O'Toole book;
5. that the C.R.S. pay all expenses of board members incurred in attending the annual meeting including the meals;
6. that the theme of the June 1980 *Annual* be "Domestication of Plants and Animals" (including the origin of these forms);
7. that we proceed to develop a clearing house for employment;
8. that five of the incumbents of the Board of Directors whose terms would expire be renominated (Tinkle had written indicating that he did not wish to be renominated). Other nominations were made. (Elsewhere in this issue the complete slate is listed.);
9. that the present officers of the board be re-elected;

10. that the C.R.S. establish facilities to act as distributor for our books, reprints and monographs, which would be sold from a central location;
11. that consideration be given to reprinting *Scientific Studies in Creationism*;
12. that Williams be empowered to spend up to \$2000. for C.R.S. books from Craig Press (in partial carrying out of 10);
13. that C.R.S., while not wishing to contribute financially toward a convention booth for the Missouri Association for Creation commend the organization for its activities;
14. that ex-board members who are Fellows be permitted to attend meetings, but not to vote;
15. that the 1980 meeting of the Board of Directors be held 18, 19 April at Ann Arbor, Michigan, the business session to start at 1800 hours (members should be encouraged to come earlier). (See the announcement, elsewhere in this issue, about an open meeting).

Wayne Frair, Secretary

SPECIAL NOTICE

The following candidates have been nominated to the Board of Directors to serve for a three-year term beginning in 1980.

Harold L. Armstrong
 Thomas G. Barnes
 D. R. Boylan
 Duane T. Gish
 Erich von Fange
 Emmett L. Williams
 Paul A. Zimmerman

Six members are to be elected to the board. It should be remembered that elections are staggered, one third of the members of the Board being elected annually. Thus, if a certain member of the Board is not listed here, it does not necessarily mean that he is leaving the Board.

The date of the annual election is 1 March 1980. Biographical information on each nominee will be distributed with the ballots.

EXCERPTS FROM THE BYLAWS

Article III - Election of Directors

Section 1. The date for the annual election of directors shall be set by the secretary, but in no case shall it be later than March 1.

Section 2. The Board of Directors shall annually nominate at least one candidate for each vacancy on the Board of Directors, said candidate to have agreed to serve on the Board of Directors. The secretary shall report the names of those nominated by the Board of Directors together with the date of the election to all voting members not less than 120 days prior to the election.

Section 3. Any voting member may nominate one candidate for election to the Board of Directors by presenting a petition signed by not less than 25 voting members of the Society, said petition to list the name and address of the candidate, indicate the qualifications of the candidate in not more than 50 words, list the name of the individual nominating him, bear the certification of the nominator as to the authenticity of the signatures on the petition, and contain a statement by the nominator that the individual nominated is willing to serve on the Board of Directors. This petition must be mailed to the secretary and must be postmarked not less than 60 days prior to the election. On receipt of the petition, the secretary shall ascertain that at least 25 of the signers of the petition are voting members in good standing.

The Species Concept in Lyell's Principles (Continued from page 139)

species is carefully adjusted to other species and its environment in a complex, harmoniously balanced ecosystem. The rather more unusual features in Lyell's concept of species are his denial of general progression and his theory of the regular creation of new species (in opposition to the mass creation of new species following geological catastrophes).

This article has been written with a view to encouraging special creationists to read widely in the biological and geological literature of the first half of the 19th cen-

tury and earlier. There is a surprising amount of sound theory to be encountered, more of which could well be taken seriously today.

PANORAMA OF SCIENCE

A Variable Constant

The latest report of a changing nuclear decay rate involves cobalt-60.¹ The fascinating part is that the experiment was done in an undergraduate science lab! The environment of the Co-60 nuclei was altered by placing the source within the poles of a permanent magnet (10^3 gauss). The author repeatedly found that the magnet increased the count rate by 2%. This is certainly a *macroscopic* change in view of the 5.24 year half-life of Co-60. Of course, the results *may* have been due to scattering, or magnetic effects on the detector, or mere coincidence. On the other hand, perhaps the nuclear decay rate really was altered. Students may wish to perform this experiment with a radioactive calibration source, a geiger counter, and a horseshoe magnet. It is increasingly clear that nuclear half-lives, and thus radiometric dates, are variables which depend on the nuclear surroundings. How interesting that radioactive decay is being tested by students, whose science texts *continue* to state that such decay is absolutely constant!

—Contributed by Don B. DeYoung

God's Design

The inspiration for the following poem came from two articles in *Scientific American* regarding the compound eye. Neither author gave God credit for what obviously could not have come about by evolutionary chance but which must have been a perfect design; for if not perfect they would have been of no use to the organism in which they are found.

The eyes of most have lenses,
Which are the orb's refractors,
Some others have light senses,
With quarter-wave reflectors.²

Could this be by evolution,
As every part is perfected?
Selection is no solution,
To a minute layer reflected.³

The compound eye radius varies,⁴
The perfection is for His glory,
This might be seen 'ever it tarries,
The pseudopupil tells the story.⁵

The insect eye hexagonal,
Is of use to all almost,
But find the square quadrangular,⁶
In shrimp and crayfish as host.⁷

The Creator from zero,⁸
Somehow designed the wonders,
Science is mankind's hero,
He discovers God's splendors.

Evolution is suspect,
Nature is design, you see,
Only God can make perfect,
The Cosmos, the Earth and me.⁹

Contributed by
Mr. Mark W. Tippetts

The Thermostat of Vertebrates.

Just why do you get goose pimples and shiver the moment you step into a refrigeration room? Research described recently is begining to find the answers.¹⁰ First in the study of vertebrate metabolism was the rather inaccurate classification of them into ectotherms or "cold blooded" animals and endotherms or "warm blooded" ones. The body temperature of ectotherms such as fishes, frogs, and reptiles is more or less dependent on the heat from their environment. They do regulate their body temperature by selecting a suitable "microclimate." Some such as the chuckwallah lizard and box turtle also use panting when they are too hot. When they can no longer find places warm enough to maintain a high body temperature, ectotherms become inactive, their body temperature following that of the environment.

The first clue as to how some vetebrates so exactly regulate their body temperature, as for example human beings at 98.6°, came when Charles Richet in France and Isaac Ott in the U.S. noticed that partial destruction of the hypothalamus at the base of the brain in dogs resulted in elevated temperature. The region responsible is just over the place where the optic nerves of the two eyes converge. Just how does it operate? First it must have accurate information about actual body temperature by means of a feedback circuit. Second it must "know" the optimal body temperature, i.e. be programmed to some kind of reference point, and third, be able to compare actual body temperature with the optimal one and trigger the proper behavioral and thermoregulatory mechanisms. Such responses include shivering, erection of fur, or formation of "goose pimples" in human beings when too cold, or panting and sweating when too hot.

As to whether the hypothalamus temperature provides all the needed feedback information, simple observations show the story is much more complex. Thus if you enter a cold room, shivering begins almost instantaneously, and vice versa sweating begins as soon as you enter a sauna, certainly before any rise in the hypothalamus temperature. It seems that peripheral sensors at the surface of the body provide the control thermostat with information about rapid environmental changes almost instantaneously. Experiments have confirmed that the concept is correct and the thermoregulatory output is varied without causing a change in the hypothalamic temperature. However, the start of a fever begins an increase in regulated body temperature and the onset of sleep a decrease.

As the size of an animal increases, so does the gain or loss of body heat required before being detected in the deep body core.

Hibernating animals do not abandon thermoregulators and become ectothermic as once thought, but instead adopt a precisely regulated lowering of the control thermostat in order to conserve energy. This is shown by many facts such as the arousal from hibernation if the surrounding temperature falls to a dangerously low level. This is an operation "Fail-safe" to prevent the animal from freezing to death. Also animals arouse from their torpor from time to time.

Most interesting is the correlation between effective arousal technique, and an animal's way of hibernating. Thus the garden dormouse can be aroused from torpor by cooling its feet, and it lies on its back with its feet sticking up when hibernating.

When an animal is going into hibernation, the decline in its body temperature is not smooth, as there are occasional bursts of metabolic activity resulting in extra heat production and shivering. It is most interesting that birds which are presumed to have descended from reptiles have endothermy parallel to that of mammals, though differing somewhat in details.

The authors then state that on the basis of what is now understood about the characteristics of the vertebrate thermostat, "it is possible to speculate on its neural design." Two populations of neurons have been discovered, one set reacting to warming, the other to cooling of the hypothalamus, by increasing the frequency of their impulse discharges and thus causing responses. It is furthermore thought that heat-sensitive nerve endings in the skin increase their firing rates as the temperature rises, and thus excite the heat sensitive neurons in the hypothalamus. Similarly the cold sensitive nerve endings could stimulate the central cold sensitive neurons.

In addition the hypothalamus receives many other inputs such as those from abdominal viscera, tension receptors in the muscle signaling the level of physical exercise, and inputs from the reticular portion of the brain.

The authors conclude that comparative studies of a wide range of vertebrate species with different thermal problems will enable us "to propose, test, and refine hypothetical models so that they will better reflect how the thermostat is really *designed*." Now the word design as a verb means to conceive, invent, or contrive, and in-

volves the concept of *some one* to do so. And as a noun design means the invention and disposition of the forms, parts, or details of something according to a *plan*. Surely something as intricate as the neuron populations could not have evolved so as to function successfully, since the reciprocal reactions must work perfectly. In other words it must be a going concern from the start.

Studies of hibernation may give us a clearer picture of just how the many species of animals survived for a whole year in the Ark during the world-wide flood. For undoubtedly most of the animals hibernated during the entire period of time. And though as far as I know birds do not hibernate, it is surprising how quickly they become silent when the sun goes down! They may then have been affected by the environment, such as lack of sunlight in such a way as to simulate hibernation. Swifts, swallows, and owls of course are night action birds, so some other factor than lack of sunlight must have quieted them down.

—Contributed by Dr. Walter E. Lammerts

References

- ¹Sykes, N. J. G., 1978. A simple investigation into the thesis of isotope decay constancy. *S.I.S. Review* III (2):43-45. The *S.I.S. Review*, the Journal of the Society for Interdisciplinary Studies, corresponds in Britain approximately to *Kronos* or *Pensee*.
- ²Land, Michael F., 1978. Animal eyes with mirror optics. *Scientific American* 239 (6):126-134.
- ³*Ibid.*
- ⁴Horridge, G. Adrian, 1977. The compound eye of insects. *Scientific American* 237 (1):108-120. See especially p. 109.
- ⁵*Ibid.*, p. 108.
- ⁶Reference 18, p. 134.
- ⁷*Ibid.*
- ⁸Genesis 1:1.
- ⁹Genesis 1.
- ¹⁰Heller, H. Craig, Larry I. Cranshaw, and Harold T. Hammel, 1978. *Scientific American* 239 (2):102-113.

BOOK REVIEWS

Synergetics—An Introduction: Nonequilibrium Phase Transitions and Self-Organization in Physics, Chemistry, and Biology by Hermann Haken 1977. Springer-Verlag, New York. 325 pp. Price \$31.70.

Reviewed by Emmett L. Williams.*

The title of the book suggests a study of nonequilibrium thermodynamics (kinetics plus thermodynamics). However synergetics is a relatively new discipline resulting from the marriage of kinetics and statistical physics. It appears that one of the major thrusts of synergetics is to provide a theoretical and mathematical foundation for improbable events.

One of the mathematical methods used to achieve this purpose is to introduce terms called order parameters into certain second order differential equations of mathematical physics. Using these order parameters

and the superposition principle, the stable solutions or modes are damped out allowing the unstable or highly improbable modes to become "more probable".

The author states that order can arise out of chaos (pp. VII, v, 15). However this reviewer feels that the examples offered to reinforce this view do not demonstrate the proposal. The operation of a laser, ferromagnetism, flow patterns such as the Benard instability and the Taylor instability, cloud streets, the Zhabotinsky reaction,[†] and the growth of slime mold in radial patterns offered as examples of ordered states that develop naturally (self-organization) from less ordered states. If one considers that any system in which the parts are not in a random arrangement is ordered, the reviewer can suggest the dendritic growth of metal grains in a casting, the vibrational modes seen on

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[†]For a brief description of this reaction, see reference 31 in Williams' article elsewhere in this issue of the *Quarterly*.

Chladni plates,¹ and the wave pattern that results when a rock is thrown into a pond of water as examples of self-organization.

Many wave phenomena or quantum effects can be classified as examples of self-organization using such reasoning. Anything in a nonequilibrium state can be imagined to possess some degree of order since the equilibrium state is one of maximum disorder. If order originally exists in a system, it can change form (conservation processes). New order can be introduced into the system if it is open. Order is not actually created, there simply is a rearrangement of existing order. Possibly some interesting models on the rearrangement of order may develop in the science of synergetics. It must be remembered that as yet no one has shown how a system can go *naturally* from an equilibrium to a nonequilibrium state.²

One may wonder if any degeneration effects are considered in "self-organization processes".

We do not ask *how* can one *prove quite generally* that entropy ever increases but rather, *how* and *how fast* does the entropy increase in a given system? Furthermore it will transpire that while the entropy concept and related concepts are extremely useful tools in thermostatics and in so-called irreversible thermodynamics, it is far too rough an instrument to cope with self-organizing structures (p. 12)

In other words, the second law of thermodynamics is defined away. In face of this principle of disorganization it is surprising that there is any order at all in the universe. Such order is the evidence of design to the creationist.

Fluctuations are treated as a mechanism for evolution.

It may be that nature supports evolution by changing external parameters so that the just-described switching process becomes effective in developing new species. (p. 201)

The switching processes (fluctuations) happen at the proper time in the right place in the necessary magnitude to drive the system ever-onward-upward according to evolutionary desire (the increase in order by "blessed events").

One of the most interesting proposals in the book is one suggestion of how self-organization can occur. Besides admitting probability and chance as acceptable mechanisms, information and necessity are also introduced! Intelligent design, and purpose (other words for information and necessity) must now be considered when natural ordering is discussed. This has been a creationist tenet for many years.

This well-written book makes interesting reading even though there are evolutionary overtones. Creationists should stay abreast of the field of synergetics to glean out any useful information and be prepared to counter any evolutionary dogma.

References

- ¹Taylor, C. A., 1965. The physics of musical sounds. American Elsevier Publishing Company, New York pp. 9, 10, 13.
²Williams, E. L., 1979. Evolution and fluctuations—a Creationist evaluation. *Creation Research Society Quarterly* 16(2): pp. 132-136.

The Moon—Its Creation, Form and Significance by John C. Whitcomb and Donald B. DeYoung, 1978. BMH Books, P.O. Box 544, Winona Lake, Indiana. 180 pages. \$7.95.

Reviewed by Emmett L. Williams.

This book is the first in a projected series of creationist studies on various astronomical subjects. The book is well-done and replete with interesting illustrations. There are considerable footnotes, and the documentation comes from both creationist and evolutionary sources. Since creationist studies must be based on the Bible, all contributors to this volume defend the verbal inspiration of the Scripture (p. 14).

Chapter 1 Lunar Exploration—A capsule history of the exciting lunar expeditions.

Chapter 2 Naturalistic Theories of the Moon's Origin—It is shown that no naturalistic theory of the origin of the moon conforms to the established laws of celestial mechanics (p. 35). The weaknesses of fission from the earth, capture by the earth, and condensation of gas theories of lunar origin are pointed out.

Chapter 3 The Genesis Record of the Moon's Creation—A meticulous defense of the Genesis account of creation is given. The concept of a young earth-moon system is defended, and the excellent work of Dr. Tom Barnes on the decay of the magnetic field of the earth is offered as primary evidence (p. 59).

The phase, disintegration of energy systems (p. 64), is used in the discussion of degeneration processes in nature. The reviewer suggests that depletion of useable energy sources is a more proper terminology. Of course this is a matter of scientific taste. The idea of brute fact vs. God-oriented facts is discussed (p. 69). Instantaneous creation of the moon is defended (p. 73).

This chapter would be an excellent source of basic facts to use against such popular antiscriptural compromises as theistic evolution and the day-age theory. A person with little Bible-science background as well as those well-versed in such matters could benefit from reading this section.

Chapter 4 Lunar Geology—This chapter is a veritable storehouse of interesting scientific facts about the moon. It contains a discussion of the chemical composition of lunar soil and rocks. The virtual nonexistence of water on the moon is mentioned. (p. 85). Temperature-induced expansions and contractions of the lunar surface are discussed. (p. 86).

A refutation of the supposed ancient age of the moon is presented. The weaknesses of the currently popular radioactive dating methods and their lack of agreement when used on lunar rocks and soil are discussed. Evidences offered for a young moon are depth of the surface dust and geologic instability.

Chapter 5 Transient Lunar Phenomena—This chapter is written by Professor George Mulfinger of the Physics Department of Bob Jones University. His purpose is to show that the moon is not a cold, dead body as often claimed in evolutionary literature and standard textbooks. Underlying this concept is the assumption that if the moon is "cold and dead", it is very old. A "live" moon indicates a young age and this may be why these effects are often ignored by the scientific community.

The phenomena mentioned are localized color changes, spots or streaks of light, clouds, hazes, and veils. Volcanic activity (p. 113) on the moon is offered as a possible mechanism for the transient observations as well as outgassing, fluorescent effects, and electrostatic glow discharge. The case for a young, active moon is well-presented.

Chapter 6 Lunar Distinctives—Many physical properties of the moon such as brightness and shape are presented. Lunar effects such as solar eclipses and ocean tides are discussed.

If one read these six chapters, he would have obtained much scientific and biblical information on the moon. As a "bonus", the authors offer three appendices connected to a creationist study of the moon.

Appendix I The Dependability and Destiny of the Moon—One of the most important points made in the entire book is that God's dependability in nature (p. 147) (the doctrine of God's providence) can be used as a reinforcement for His dependability in spiritual matters. In the latter half of the twentieth century it appears that many preachers and theologians cannot cope with the real world ("the nasty now and now"), and a great deal of their writing and preaching deals unduly with the spiritual world. Thus God's creation is left to be interpreted by naturalistic, mechanistic, atheistic evolutionists. One only needs to realize how much the Lord Jesus Christ used nature in His discourses to see how few in comparison are used by His servants today. This point could have been expanded to the benefit of any reader.

The God-ordained purposes of the moon are considered to be an illuminator, regulator, and sign (p. 150).

Appendix II Moon Worship—A Spiritual Disaster—This is a timely discourse considering modern man's infatuation with near-eastern religions, pantheism, and ecomania. The conclusion of this section is that the Creator is infinitely superior to any created object such as the moon (p. 154). Therefore He, not the moon, should be worshiped. Also this reviewer feels that there are certain aspects of solar worship in the popular solar energy craze. One of the grave short-comings of man is that he often chooses to worship a created object more than the Creator (Romans 1:25).

Appendix III The Bible and Science—An excellent bibliography for any student who wishes to do further literature review.

When the Greek letter ρ (Rho) is used for density, it appears as a "badly-evolved" integration sign (pp. 42, 131, 137, 138). It would aid in the general appearance of the book if this were "upgraded" in future printings. The reviewer hopes that there will be a future paperback edition; it might receive a deserved broader distribution because of the reduction in price.

It is a pleasure to recommend this unique book. It should be on the shelf on every Christian school library.

What About Origins? by Dr. A. J. Monty White. Dunestone Printers Ltd., 43 Gestrige Road, Kingseign-ton, Newton Abbot, Devon, England, TQ12 3EZ. 1978. 170 pages. Price: £1.80, about \$4.00.

Reviewed by Douglas E. Cox.*

The Biblical doctrine of creation, and the theory of evolution are examined in this book about origins. The premise, the Bible is the only source of truth about origins, is stated at the outset. The author contends that "a Christian cannot be an evolutionist, he can only be a creationist."

Creation, taught throughout the Bible, must be understood by faith; the evolutionist likewise believes in evolution by faith: "... it is not by observation, nor by experimentation, nor by scientific method, nor because of modern discoveries of science, (which disprove evolution), but it is by faith—faith in extrapolation, natural processes operating over vast periods of time, speculation and missing links."

Two approaches to the idea of theistic evolution are examined: firstly, the one which considers the Genesis account mythical; secondly, the one which accepts the Genesis account as historically true, but maintains that there is no conflict with evolution.

New Testament references to the events of the early chapters of Genesis show the account cannot be mythical. Many contradictions between the evolutionary account of origins, and the order of appearance of things created in creation week, discredit the second theistic evolutionist position. White concludes "There is in fact no harmony between creation and evolution; indeed theistic evolution is built on the false premise that the Genesis account of origins occurs in the same order as that found by evolutionists."

A discussion of astronomical evidence against evolution provides a vivid description of the complexity of the universe, and of the problems involved in formulating a naturalistic theory of its origin. The age of the universe is discussed; it is suggested that estimates of the distances of the stars are built on unproven assumptions. Several arguments for a relatively young universe and solar system are given.

A problem in the creationist model of a young universe, that of the length of time required for light to reach the earth from the extremities of the universe, is discussed.

In a section on the origin of life, probability calculations on the chance formation of a protein molecule show this to be virtually impossible. Sections on the origin of species and the origin of man consider the fossil record and anthropological evidence tending to refute evolution. The tautological nature of evolution is discussed, and its status as a scientific "theory" challenged.

The final chapter deals with dating methods. A pre-flood vapor canopy and an age of about 10,000 years for the earth are supported.

The book is packed with quotes from Scripture and from scientific sources. It is a thoroughly researched and well reasoned account of creationism.

*Mr. Douglas E. Cox's address is P.O. Box 18, Petersburg, Ontario, Canada.

Delayed Acknowledgement

Panorama of Science, in the Quarterly for June, 1979, was contributed by Mr. Mark W. Tippetts.

NOTICES OF BOOKS

The Establishment of the Religion of Secular Humanism and its First Amendment Implications, by John Whitehead and John Conlan, 1978. Available from the Texas Tech Law Review, Texas Tech School of Law, Lubbock, Texas 79409. Price not known, probably about \$2.00.

This work appeared as an article in the *Texas Tech Law Review*, vol. 10, no. 1, 1978. It exposes the way in which certain recent actions by courts have had the effect of establishing secular humanism as a state religion, contrary to the First Amendment; and should be of interest and use to anyone opposed to such trends.

C.S. Lewis: Images of his World, by Douglas Gilbert and Clyde S. Kilby. 1973. Published by Hodder and Stoughton, London. £4.50, about \$10.00. Many readers of the *Quarterly* are no doubt familiar with C.S. Lewis' writings. This book is, as the title says, about Lewis' world; it is made up of photographs of places where he lived or which he visited, and of people among whom he lived. Accompanying the pictures are short descriptions, or apt quotations from the works. The book is not particularly creationistic; but one may remember that Lewis always saw the world as God's world.

It may be added, as a point of interest, that Kilby is Curator of The Marion E. Wade Collection at Wheaton College, Wheaton, Illinois. That collection consists of correspondence by Lewis and by a few other Christian authors of about the same time.

Man, Dinosaurs and History, by Fredrick P. Beierle. Available from the author at P.O. Box 748, Lyons, Kansas 67554. 67 pages. This work is primarily an account of some of the searching for, and finding of, dinosaur, man, and other tracks in the rocks in and around the Paluxy River, Texas. There is also something about similar tracks found elsewhere, and about the Creationist interpretation of such tracks. Thus to some extent the book covers the same ground as the well known film *Footprints in Stone*. There are many photographs, which help in showing the nature of the footprints and other traces found.

CORRECTION

It has been brought to our attention that there were errors in the review of *The Creation-Evolution Controversy*, by Wysong, on page 171 of the *Quarterly* for December 1978. The address of the publisher is 4925 Jefferson Avenue, Midland, Michigan 48640; and the price is \$7.95 with kivar, or \$15.00 for a hard cover.

BOOKS PUBLISHED BY THE C.R.S.

Textbooks

Biology: a Search for Order in Complexity. (Revised Edition, 1974.) A textbook for high school presenting creation AND evolution. 595 pp., 436 illustrations, \$9.95.

Teacher's Guide to Accompany Biology: a Search for Order in Complexity. Paperback, \$1.95.

Investigations into Biology: Student's Laboratory Manual. Paperback, \$1.95.

Investigations into Biology: Teacher's Laboratory Manual. Paperback, \$1.95.

The books listed above are all available from Zondervan Publishing House, Grand Rapids, Michigan.

Anthologies

Watch subsequent issues of the *Quarterly* for information about where to obtain anthologies, composed of articles selected from past issues of the *Quarterly*.

Reprints

A Decade of Creationist Research, by Dr. Duane T. Gish. Reprinted from the *Quarterly* for June, 1975. 16 pp., 75 cents postpaid, 50 cents each for orders of 100. Order from the College Bookstore of Concordia College, 4090 Geddes Road, Ann Arbor, Michigan 48105.

TAPE REVIEW

Dinosaurs and Men, Series of three tapes by John C. Whitcomb, Grace Theological Seminary, Winona Lake, IN 46590. Price \$14.00

Reviewed by John D. Morris*

In keeping with his long-standing tradition of excellence in the field of Scientific Creationism, Dr. John Whitcomb has prepared a series of tapes that will prove to be a powerful tool in the hands of creationists. Whitcomb's unique combination of theology and science allow insights which promise to aid the listener not only in scientific understanding but also in his personal relationship to his Creator.

These tapes are oriented to the interested layman. Care was taken to cite only references to which the layman would have ready access, usually *National Geographic*. Already the tapes have been put to use in the lives of two of my acquaintances: one, a once dedicated Christian creationist who, as a senior in geology, has decided that the Bible could not be true and has renounced his faith in favor of evolutionary agnosticism; and two, a friend whose nine-year-old son comes home from school asking questions which show an evolutionary and specifically anti-biblical bent to his instruction. In the latter case, my friend now has useful information to discuss with his son, and in the former, the geology student has re-examined his evolutionary presuppositions in the light of these tapes, but prayer is requested for both him and me as I meet with him.

Tape 1, entitled "Dinosaurs and the Book of Job," examines the now well-known passage in Job 40:15-41:34. After establishing the date of the writing of the book of Job to be rather soon after the Genesis flood, Whitcomb shows that the Behemoth and Leviathan could not

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possibly have been a hippopotamus and crocodile but were certainly huge reptilian creatures, one a plant-eating giant, probably "supersaurus," and the other a fearsome marine dragon. Furthermore, Genesis chapter one shows that all sea monsters and creeping things were created by God during creation week and, therefore, contemporaneous with man.

The conclusion of tape one, certainly one of the most important sections in the series, delineates the contradictions between evolutionary scientism and Scripture and the tension that this dilemma causes for the Bible-believing Christian. The Scriptural answer presented suggests relying on the God-given resources of believing prayer (James 1:5-8 and Romans 8:26-27) and Biblical revelation (Acts 17:11; 1 Cor. 2:14; 2 Tim. 2:15; John 3:12) to resolve the conflicts before confronting the unbelieving mind.

Tape 2, "Dinosaurs and the Book of Genesis," further establishes the fact that dinosaurs were created during creation week. Since dinosaurs certainly existed, and the Genesis record claims that all animals including reptiles were created at that time, no option is left for the Bible-believer. To cover all possibilities, Whitcomb presents a short but informative critique of the Gap Theory, complete with fresh insights on the "problem" passages in Scripture that can best come from an Old Testament scholar. A thought-provoking section follows which suggests that God reprogrammed the genetic codes of certain plants and animals at the time of the curse to yield "thorns and thistles" and flesh-eating beasts, and that the violence mentioned in Genesis 6:11 include the hostile plant and animal worlds. These effects were possibly partially lifted after the flood, Whitcomb suggests, as indicated in Genesis 9:2. Other objections to the Flood story, such as the gathering and care

of the animals, capacity of the Ark and possibility of dinosaurian cargo, extinction of the dinosaurs in the post-flood world, etc., are dealt with much as they are in several books on the subject, most notably *The Genesis Flood*.

Tape 3, "Dinosaurs and Modern Discovery," deals almost entirely with scientific and historical evidence that man and dinosaur lived together, but first an exposé of the subtle circular reasoning in dating fossils sets the stage. Recently discovered evidence that man and dinosaur lived in the same world abounds and provides the listener with powerful ammunition. Examples are the Paluxy River tracks, the Komodo Dragon lizard, marine iguana lizards, alligators, crocodiles, and the enigmatic two-ton reptilian corpse dredged up near Japan. Some astounding facts about these and other "dinosaurs" are presented. Universal legends of interaction between dragons and men constitute another line of evidence.

Whitcomb closes his series by pointing out that man lives, not in an evolving world, but in a dying world. In the light of II Corinthians 4:16-18, he suggests that we as Christians focus our attention on eternal things, the "things which are not seen," enduring any "light affliction" which might come our way because of our stand. Concerning our dealings with unbelievers, Whitcomb states at the end of Tape 1, "Once we have learned to talk to God and to ask Him for wisdom, and then have asked Him for help in searching His Word, the easiest thing of all is to confront the unbeliever, the evolutionist, the uniformitarian, and to demand evidence and proof for the objectivity and scientific validity of his basic assumptions as he faces the questions of earth history and gives his interpretations."

Radiometric Geochronology Reappraised

(Continued from page 129)

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(Continued on inside back cover)

CREATION RESEARCH SOCIETY

History The Creation Research Society was first organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a real need for an association devoted to research and publication in the field of scientific creationism, with a current membership of about 500 voting members (with graduate degrees in science) and over 1600 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is recognized as probably the outstanding publication in the field.

Activities The Society is solely a research and publication society. It does not hold meetings or engage in other promotional activities, and has no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund is maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible.

Membership Voting membership is limited to scientists having at least an earned graduate degree in a natural or applied science. Dues are \$10.00 (Foreign, \$11.00 U.S.) per year and may be sent to Wilbert H. Rusch, Sr., Membership Secretary, 2717 Cranbrook Road, Ann Arbor, Michigan 48104. Sustaining membership for those who do not meet the criteria for voting membership, and yet who subscribe to the statement of belief, is available at \$10.00 (Foreign, \$11.00 U.S.) per year and includes subscription to the Annual Issue and Quarterlies. All others interested in receiving copies of all these publications may do so at the rate of the subscription price for all issues for one year: \$13.00 (Foreign, \$14.00 U.S.).

Statement of Belief Members of the Creation Research Society, which include research scientists representing various fields of successful scientific accomplishment, are committed to full belief in the Biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution), both of the universe and the earth with its complexity of living forms.

We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. In 1970 the Society published a textbook, *Biology: A Search for Order in Complexity*, through Zondervan Publishing House, Grand Rapids, Michigan 49506. Subsequently a Revised Edition (1974), a Teachers' Guide and both Teachers' and Students' Laboratory Manuals have been published by Zondervan Publishing House. All members of the Society subscribe to the following statement of belief:

1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.

2. All basic types of living things, including man, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.

3. The great Flood described in Genesis, commonly referred to as the Noachian Flood, was an historic event worldwide in its extent and effect.

4. We are an organization of Christian men of science who accept Jesus Christ as our Lord and Saviour. The account of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Saviour for all mankind. Therefore, salvation can come only through accepting Jesus Christ as our Saviour.

Board of Directors *Biochemistry*: Duane T. Gish, Ph.D., Institute for Creation Research, 2716 Madison Avenue, San Diego, CA 92116. *Biological Sciences*: Wayne Frair, Ph.D., Secretary, The King's College, Briarcliff Manor, NY 10510; George F. Howe, Ph.D., President, Los Angeles Baptist College, Newhall, CA 91321; John R. Meyer, Ph.D., University of Louisville, KY 40208; Wilbert H. Rusch, Sr., M.S., LL.D., Membership Secretary, Academic Dean, Concordia College, Ann Arbor, MI 48105. *Engineering*: D.R. Boylan, Dean, College of Engineering, Iowa State University, Ames, Iowa 50011; *Genetics*: John W. Klotz, Ph.D., Academic Dean, Concordia Seminary, St. Louis, MO 63105; Walter E. Lammerts, Ph.D., Freedom, CA 95019; William J. Tinkle, Ph.D., Timbercrest Home, North Manchester, IN 46962. *Geology*: Clifford L. Burdick, M.S., D.Sc., 924 N. 6th Avenue, Tucson, AZ 85705. *Geophysics*: Harold Shusher, M.S., D.Sc., University of Texas at El Paso, TX 79902. *Physical Sciences*: Harold Armstrong, M.S., Publications Editor, Queens University, Kingston, Ontario, Canada; Thomas G. Barnes, D.Sc., University of Texas at El Paso and Consultant to Globe Universal Sciences, Inc., El Paso, TX 79902; Richard C. Korthals, M.S., Treasurer, Dean, Concordia Teachers College, River Forest, IL 60305; Henry M. Morris, Ph.D., Institute for Creation Research, 2716 Madison Avenue, San Diego, CA 92116; George Mullinger, M.S., Bob Jones University, Greenville, SC 29614; Emmett L. Williams, Jr., Ph.D., Vice-President, Continental Telephone Laboratories, Norcross, Georgia. *Science Education*: John N. Moore, M.S., Ed.D., 136 Brody Hall, Michigan State University, East Lansing, MI 48824.

Radiometric Geochronology Reappraised (Continued from page 147)

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An Analysis of Darwin (Continued from page 131)

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