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EARTH'S HISTORY

In the beginning God created the heaven and the earth.

Three articles in this issue of SPECTRUM deal in one way or another with time and the history of our planet. That the earth has had a history and that some very remarkable changes have taken place during that history no one questions. Theories about the duration of earth's history have been many, and they have changed frequently and radically even within the scientific community during the last few centuries. In this past one hundred years, however, almost complete unanimity about the age of our earth has gradually developed among scientists, so that at present it is believed that earth's history extends over some four and a half billion years.

Practically without exception the various Christian churches have opposed these increasing estimates of the duration of terrestrial history. The reason for this is that most churches had adopted, either officially or by common usage, a chronology of our planet's past based on the one suggested by James Ussher, the Irish archbishop, in 1654, or at least one similar to that. With the passage of time, conflicts arose in most of these churches with both scientists outside the church and scholars within, and serious tensions resulted. Sometimes the differences led to a complete schism in a church, but usually they resulted in a gradual acceptance of the greater ages of our earth. The older and larger churches were involved first in this controversy, as might be expected, and the younger and smaller ones later. An exception was the Catholic church, which, in spite of its official adherence to the traditional teaching about the duration of earth's history, tolerated considerable deviation of scholarly opinion within the church. At present the large majority of Catholic scientists, and probably most Catholic theologians, seem to have accepted the age of the earth as being very great.

Except for a few scattered individuals in the older churches, most of the scholars who now defend a short history of the earth similar to that of James Ussher are found in the smaller denominations, and in practically all of them there is continual reappraisal of the scientific evidence and the theological arguments bearing on the question. Within this group of small denominations is the Seventh-day Adventist church. That this church never had an official position or doctrine on the age

of the earth is illustrated by the fact that various authors and editors during the history of the Seventh-day Adventists were permitted to argue either for or against a long history of the earth. As a matter of fact, however, most Adventists have followed the generally held view of the conservative evangelical churches of their time, namely, that the age of the earth is only about six thousand years.

In the early part of the twentieth century George McCready Price became an energetic and capable defender of this view, and his numerous books and articles became popular in many denominations. His work formed the basis of a number of apologetic works that were produced during the next fifty years by well-known authors in other churches. Within the Adventist church the so-called Deluge, or Flood, geology of Price became an almost unquestioned part of the earth history views held by the members. In this connection it is interesting to note that Price wrote in his later years that he believed the body of the earth had existed long before Creation week, and that he based this view on scientific evidence.

Harold W. Clark, Frank L. Marsh, Harold G. Coffin, and others within the Adventist church have continued to emphasize the belief in a young earth and the adequacy of the Noachian Flood to explain the major part of the geological changes that can be seen in the earth's crust. With the passage of time and the accumulation of scientific evidence, their views also have undergone considerable change, as their recent publications show. At the same time, other Adventist students in various disciplines were confronted with observations that seemed difficult to square with the view of an earth which was only six thousand years old, and considerable discussion has taken place among them during the past twenty-five years.

So in this issue we have three unsolicited articles, each one having some bearing on the problem of the age and history of our earth. Some readers may feel threatened by discussions on the subject. This, I believe, should not be. Our relation to God should not be affected by views on the age of our planet, be it young or old. That which is truly important is our recognition and worship of God as our Creator and Redeemer, One who is entirely trustworthy and dependable, and who in his great love tries to reveal himself to us and involve us in fellowship with him. What God reveals to us in his word, through his created works in nature, and through what he communicates to us by his Spirit will be found ultimately to be in complete harmony.

MOLLEURUS COUPERUS

Poem

ALAN P. DAVIES

With the morning's sun
hanging limp in the sky
like some kind of solar christ
after some kind of epic journey

With clouds like white stones
on an otherwise blue hill
put there to be a metaphor
for twentieth-century American poets

With the landscape lounging
over and around scattered rocks
to find its way on padded feet
to the valley that sleeps beyond

And with answers to several questions
on the tip of his only tongue
he heaves his arms sunward
and prepares to die for man

Traditional Adventist Creationism

ITS ORIGIN, DEVELOPMENT, AND CURRENT PROBLEMS

7

HAROLD W. CLARK

From time to time I encounter questions about the traditional views of Seventh-day Adventists on creationism: what these views really are, how they have arisen, and how they are related to modern research in scientific fields, especially geology. In an attempt to answer some of these questions, and possibly to clarify some misapprehensions, I will review the situation as I have seen it develop, particularly during the past fifty years.

I

Seventh-day Adventists' views on creationism may be divided into two phases: the theological phase from 1850 to 1900, and the scientific phase from 1900 to the present. The issue today is whether science has had any influence on the theological aspects of creationism, and if so, what influence.

The first number of the *Review and Herald* has the following in an unsigned editorial: "The blessing and sanctifying of the seventh day is mentioned in connection with the first seventh day in the order of time. . . . The Sabbath was enjoined immediately after the close of the work of creation."[1]

Again, four years later, came this comment: "He who observes . . . Jehovah's Rest-day . . . is in a special manner led to contemplate his six days' work of creation. And as he views the heavens above, and the earth beneath, and surveys the Creator's handy-works his mind is led upward to the living God."[2] So we see that the relation between Creation and the seventh-day Sabbath has always been a major point in Seventh-day Adventist theology.

The first statement I can find on the question of the origin of the species

came the year after the publication of Darwin's *Origin of Species*. G. W. Amadon wrote: "It is not necessary to suppose that each species now known was represented, for naturalists are generally of the opinion that their number has greatly increased from the influence of climate, food, intermixture of races, etc."[3]

About the same time, the question of geological interpretation was given attention: "Geology . . . is the great instrument which unbelievers are endeavoring to wield against the authority of the Scripture. . . . Certain formations . . . must have been ages on ages in reaching their present state; therefore the Mosaic record is not true. . . . The Bible is set aside, and infidelity triumphs."[4]

The question of when the *substance* of the earth was created (at the beginning of Creation week or long before) arose early. Note this remark: "Nor is there anything in revelation which forbids us to believe that the substance of the earth was formed long before it received its present organization. The first verse of Genesis may relate to a period millions of ages prior to the events noticed in the rest of the chapter."[5]

Although it was admitted that the substance of the earth may have existed long before Creation week, no recognition was given to the theory that living creatures had been on the earth for long ages of time. In 1864 Ellen G. White wrote: "The first week, in which God performed the work of creation in six days and rested on the seventh day, was just like every other week."[6] In a later work she expanded this point and made it still clearer: "When the Lord declares that He made the world in six days and rested on the seventh day, He means the day of twenty-four hours, which He has marked off by the rising and setting of the sun."[7]

An attempt to harmonize what some regard as a discrepancy in views was made in a long editorial in the *Review and Herald* in 1887. To quote word for word would be too extensive, but here are the main arguments: The Bible does not say that God *created* the heavens and the earth in six days. "*In the beginning* God created," but "in six days the Lord *made* the heavens and the earth." Here a separation is made between the creation of the substance and its organization in six days.[8]

In the *Signs of the Times* (1898), while Milton C. Wilcox was editor, these words appeared in an unsigned editorial: "When did God create, or bring into existence, the heavens and the earth? 'In the beginning.' . . . When this 'beginning' was, how long a period it covered, it is idle to conjecture; for it is not revealed. . . . On referring to the work in the beginning it is said, 'In the beginning God created'; but in referring to the six days'

work we read, 'In six days the Lord made.' Surely this is not accidental. Verse 1 refers to the *matter* of the earth; the six days' work to its formation."[9]

These statements seem to make a distinction between the time of creation of matter and the time of its formation, but those who believe that matter was brought into existence during the first moments of the six-day week find some support in statements by Ellen White: "In the formation of our world, God was not indebted to pre-existing matter."[10] If, as we have seen in some of the foregoing statements, the formation was the six-day process, then we would infer from this quotation that matter had not been in existence previously. Another statement reads: "The Sabbath institution, which originated in Eden, is as old as the world itself."[11]

Some have suggested that perhaps the word *world* refers only to the inhabitants. On the other hand, in another place Ellen White speaks of the "sophistry in regard to the world's being created in an indefinite period of time,"[12] clearly a reference to the material substance, not to the population. A further problem arises in that she says in the reference cited earlier that the *formation* was not dependent on preexisting matter, whereas in another place she says that "in the creation of the earth, God was not dependent on preexisting matter." No distinction between the time of creation and the time of formation shows up in these two statements. Thus, it is difficult to build any positive argument on them.

The question of when the substance of the earth was brought into existence, however, is not the vital issue in traditional Adventist creationism. The real problem lies much deeper than that, as we shall see.

Ellen White rejected all ideas that the days of creation were anything but literal twenty-four-hour days. Adventists therefore refused to accept the "day-age theory" that was once popular in many churches. Mrs. White stated over and over again that there is no scriptural foundation for the theory of evolution, and her influence was a mighty factor in keeping the Seventh-day Adventist church in line with the literal creation record of Genesis. I need not quote extensively on these points, because they are familiar to every Adventist, and to attempt to include her many statements in this study would take too much space.

If these questions have not been of serious concern to Adventists (for all seem to have accepted the major principles with little or no difficulty), there was one phase of the theological period that has since become a rather perplexing one — although it did not seem to be much of a problem at the time. That is the question of the *time* of the six-day Creation week of the

first chapter of Genesis. Time has become an issue because certain age-dating methods and geological studies appear to indicate the necessity of allowing more time than the genealogies of Genesis five and eleven will allow.

In 1864, only five years after the appearance of Darwin's *Origin of Species* and while Darwinism was rapidly capturing the imagination of the scientific world, Ellen White wrote: "Creation week was only seven literal days, and . . . the world is now only about six thousand years old."[13] This statement was followed in the next thirty-four years by thirty-six statements of like nature, or an average of one a year.[14] Of these, eighteen speak of six thousand years, about six thousand, or nearly six thousand; fourteen speak of about four thousand years between Creation and Christ; and the others are miscellaneous references implying the same time lapse.

The question naturally arises: What was Ellen White shown? Was she shown the *figure* 6,000, or was she simply shown the sequence of events from Creation onward, and left to make her own conclusions regarding the time? Inasmuch as Ussher's chronology was printed in the Bible at the time she wrote, it is natural to assume that Mrs. White accepted it. But what is the truth on this point? Probably we shall never know. Conservative Adventists argue that she would not have repeated these figures so many times if they were not correct. Of course, they admit, six thousand is a round number that allows a certain degree of flexibility. Yet, in four places[15] she uses the expression "nearly six thousand." This phrase does not allow for much extension beyond Ussher's dates, and it does not accommodate itself very well to the Septuagint — which, if the ages of the patriarchs are accepted as listed, would throw Creation back seventy-five hundred years.

The whole problem seems to revolve around three questions: (1) Is radioactive age-dating valid? (2) Were there geological changes of as comprehensive a magnitude between the Flood and the dawn of recorded history as the field evidence seems to demand? (3) Is it possible that ancient nations were developed during that time? These are questions that we shall not take the space to discuss now; I merely point them out as problems that must be faced and solved, if possible. The only alternative is to accept the Genesis time scale by faith, and leave the historical and geological problems open for further study.

II

Let us now turn to the scientific phase of Seventh-day Adventist creationism, for it is in this field that most of the perplexing problems lie. In

surveying this aspect of the subject, I will cite principal writings, past and present, and give brief analyses of their contributions to the current standing of the matter.

In 1902 George McCready Price published his first book.[16] In it he challenged three theories that were being accepted by Christian churches: Lyell's uniformitarian theory of geology, Darwin's theory of organic evolution, and theistic evolution. Price called for a return to the "primitive principles," which he characterized as direct creation and no long ages of life succession.

Believing that geology was the key to the evolutionary problem, in 1906 he published another book, which he called *Illogical Geology.* In the preface he made the following statement about the book: "It is, so far as I know, the only work published . . . which does not treat the science of geology as more or less a cosmogony."[17]

This small book challenged the theory of the succession of life, and asserted that if it were not really true, Darwinism would collapse. He was amazed, Price said, to see how the hypothesis of the succession of life was so continually assumed as a basis for evolutionary geology. To challenge this interpretation became the central theme of his writings for the next sixty years.

Price dominated the field of Seventh-day Adventist scientific philosophy for nearly a quarter of a century. His *Back to the Bible,*[18] *Q.E.D.,*[19] and *New Geology*[20] discussed all phases of modern science in relation to the problems of Creation, the Flood, and various aspects of scientific philosophy. Before he closed his long career of writing, lecturing, and teaching, he had published twenty-five books and scores of journal articles on creationism. One critic considered him "the last and greatest of the anti-evolutionists." His influence has been said to be "staggering," not only among Adventists, but in the Protestant world in general. By most Adventists he was regarded as almost inspired, and for years hardly anything was said in opposition to his published ideas.

My first direct contact with Price was in 1920, when he was teaching at Pacific Union College, where I was enrolled in his geology class. We had many profitable discussions, and it was he who inspired me to make geology a major line of study. He left the next year, and when I had finished my college course in 1922 I took over the biology department, where I remained until my retirement in 1956. I taught the geology course for twenty-five years, and assumed responsibility for the Home Study Institute correspondence course in geology in 1936 (I am still involved in this work). Since 1936 the course has been revised and brought up to date three times,

maintaining the principles laid down by Price while keeping the subject matter in line with the latest studies in the field.

As a teacher of geology I realized that I was under obligation to myself and my students to check critically every principle presented in the courses. In time I found, both by reading and by field observation, that certain assumptions made in *New Geology* needed revision; therefore, in 1946 I published *The New Diluvialism*.[21] While some revisions in the interpretation of certain geological phenomena were made, the basic principles were in no way challenged. I upheld Price's contention that uniformitarianism is "unproved and unprovable," that there is no proof for the succession of life through long ages of time, and that the major geological features of the earth are the result of the Flood described in Genesis.

What I did find was that in three areas a somewhat different interpretation is necessary, as evidenced by plain facts in the field. These are the sequence of the fossils, tectonics, and glaciation. Whereas Price believed that there is no valid order to the fossils, I became convinced that there is, and that an explanation for this order can be found in the concept of ecological zonation. And although Price had not admitted the validity of overthrusts, I was convinced that the concept is valid. He had interpreted so-called glacial evidences in terms of water action, but I gathered data to show that mountain glaciation had had a much greater extension, and that the presence of ice sheets on the plains of the northern hemisphere is a valid concept. These interpretations are now generally accepted by Adventist scientists.

We have had to meet difficult questions in the field of biology also (organic evolution versus direct creation, for example). In a number of his books, Price argued that the "major type forms" were created, and that the present array of species had arisen from these types. The use of the word *species* by Price, Marsh, and myself has not always been made clear, but it appears to me that in Price's mind Linnaean *species* and the *type forms* were more or less synonymous. I have generally used the word *species* in the modern context. In some of Marsh's writings the word is enclosed in quotes to indicate a difference between his modern usage and the usage of Price and Ellen White.

Price was unable to develop his ideas about species as fully as might be desired. In *Q.E.D.,* published in 1917, he held to rather rigid views about changes in species, but in *Phantom of Organic Evolution*[22] in 1924 he began to veer away from the idea of fixity of species. At this time the whole field of biology was in a state of flux: new knowledge of genetics was growing

rapidly, but the problem of speciation was still uncertain, because there had not yet been time to evaluate the consequences of the new knowledge.

Between 1935 and 1940 I made an extensive study of genetics and attempted to orient it to literal creation in *Genes and Genesis*.[23] As one might expect in a trial of this kind, criticism came from readers. The more conservative Adventists who were not familiar with the recent advances in biology thought the treatise was almost heretical, whereas colleagues in the field of biology, while offering suggestions and constructive criticism, were sympathetic. I studied these reactions and was ready to undertake a revision, when Frank L. Marsh published a study that was so close to what I would have written that I felt a revision of my book was unwarranted.

Marsh's book, *Evolution, Creation, and Science*,[24] discussed organic evolution versus creation so thoroughly that it has remained (as revised) one of the volumes in the Home Library series of the Review and Herald Publishing Association. It might be noted that in 1957 he published another work, *Life, Man and Time*,[25] now available in a 1967 revised edition, which I regard as one of the best treatises on literal creationism in print. This book and my book, *Genesis and Science*,[26] which was written for the layman rather than for the scientist, present the current thinking of conservative creationism in line with Adventist theology. To help science teachers in Adventist academies answer questions from students, the General Conference Department of Education published *Meaning of Nature*[27] in 1966. The author was Richard M. Ritland, director of the Geoscience Research Institute, Berrien Springs, Michigan.

In addition to these works, *Creation — Accident or Design?*,[28] by another Geoscience Research Institute staff member, Harold G. Coffin (assisted by Ernest S. Booth, Robert H. Brown, Ariel A. Roth, Edward E. White, and myself), gives a well-rounded picture of Adventist scientific interpretation of biological and geological problems from a conservative viewpoint. This book was designed as a college text, and it has also sold well to laymen.

During the past decade, the Geoscience Research Institute, which was set up by the General Conference, has promoted interest in the more puzzling aspects of geology and its relationship to the Genesis Flood. In 1960 a three-week tour of areas from Yellowstone National Park to the Grand Canyon, designed particularly for college science and religion teachers, helped many to understand actual conditions in the field. In 1965 and 1968 other tours included Adventist administrators in addition to scientists. These studies have resulted in a few changes of interpretation and have raised many questions that have not yet been answered.

It has been stated that Price's geological theory attributed practically all major geological features to the Flood. More recent studies have made it necessary to modify this viewpoint somewhat. Investigations on the lower Paleozoic rocks have led a number of us to believe that some of these deposits may have been formed before the Flood. It seems evident that the great reef formations found imbedded in strata as high as the Permian must already have been in existence when the great catastrophe occurred, at which time they were incorporated into the stratified rocks.

Some have wondered if before Creation week and the Flood there might have been long "ages" in which much of the geologic column could have been deposited. Such a view would leave the Flood as a comparatively minor occurrence, possibly taking place after the Cretaceous rocks had been deposited. Such suggestions meet with firm opposition from more conservative scholars, for they would introduce problems in what has generally been considered the orthodox interpretation of the Genesis record, both of Creation and the Flood. If the rocks below the Cretaceous stratum were deposited over long periods of time, the sequence of life in them must be interpreted in terms of such profound changes that no interpretation other than evolution could be possible, and traditional Adventist creationism would be in jeopardy.

A similar problem lies in the interpretation of the Tertiary rocks. In recent years a few of us who have been giving special attention to this problem (Booth, Coffin, Ritland, and I) have come to recognize the fact that some of the Tertiary geological phenomena must have occurred after the Flood. The question then arises: When did the Flood conclude? I can speak only for myself (but I am sure the others concur in general with my views) when I say that the closing paroxysms of the Flood are recorded in the rocks from Cretaceous up possibly as far as Oligocene strata. Part, perhaps much, of the Miocene stratum would be postdiluvial, and certainly Pliocene and Pleistocene strata must represent postflood phenomena.

This interpretation introduces some problems. It is evident from observation in the field that tremendous tectonic movements were involved in the production of many of the Miocene and Pliocene rocks, and that some profound changes took place while Pleistocene deposits were being laid down. How much time, then, would have been necessary to produce these changes? To some it seems impossible to account for such enormous changes in the time allowed by a short chronology based on Genesis five and eleven. What then, shall we do — push the time of the Flood back twelve thousand years as some creationists have done? Or shall we attempt to show how these

geological features could have been produced in a short time by sufficiently violent earth movements? This is one of the unsolved problems now facing Adventist scientists.

As I have been teaching the Home Study Institute geology course since 1936, I have found it necessary to keep informed on these problems in order to maintain the instruction on a sound scientific basis, but still in harmony with conservative views. One of the most difficult phases of this work has been the harmonizing of historical geology with Adventist theology. In order to make the study easier for my students I wrote *Fossils, Flood, and Fire,*[29] which discusses in detail the correlation between geological data and the traditional, conservative exegesis of the Genesis record of the Flood. A brief synopsis follows.

A comparatively pristine state persisted between Creation and the Flood. The violence of the Flood begins to show in the Ordovician and Silurian strata, as these rocks do show volcanic materials. Violence on a large scale, however, is not evident until the Pennsylvanian sedimentation. From here to the beginning of the Tertiary period we have remnants of the ancient life zones as they were destroyed successively and buried in sediments of sand and mud, forming great masses of stratified rocks. After the close of the Flood in the late Mesozoic or early Tertiary period came a short but violent postflood period in which Miocene, Pliocene, and Pleistocene deposits were laid down. The Pleistocene deposit includes glacial debris, which, it is argued, might have been produced in a much shorter time than is generally supposed.

III

Where are we now in our survey of traditional Adventist creationism? We have seen that Adventists, from the very first, held rigidly to a literal interpretation of the Genesis account of Creation in six days and a universal Flood. The question of the time of the creation of the substance of the earth was never settled, but statements by Ellen White caused Adventists (before the scientific developments of the past few years) to hold to the idea that the earth is about six thousand years old.

The scientific phase of Adventist creationism began with George McCready Price at the beginning of the century. His major points were in harmony with a strict interpretation: major geological features attributed to the Flood; no long periods of evolutionary geology; no changes in major types of life; present species of plants and animals result from changes *within* the created type forms.

On the question of the origin of the present species, other Adventist writers have followed the same line as Price, with illustrations and evidence brought from recent studies that Price was unable to have included in his studies. That the Flood was the cause of principal earth changes has also been regarded by later writers as a fundamental principle. Certain details were revised by Clark in 1946 and 1968, and by Coffin in 1969, but these do not discredit the premises that have been followed by Adventist writers.[30]

In this study I have tried to present objectively the progress of creationist philosophy as it may be found in the publications of Seventh-day Adventist publishing houses.[31] Some may feel that there are problems these books do not answer. That may be true, and if new evidence is discovered and studied, and, if it stands the scrutiny of qualified scientists and theologians, revisions may need to be made in some phases of our scientific philosophy. Until that can be done, we must remain committed to the viewpoints expressed in the literature that has been approved.

All who work on these momentous questions realize there are many points we do not yet understand, but we have tried to keep published materials in line with the principles that have been recognized throughout the history of the Seventh-day Adventist church. Certain truths will never change, and any acceptable interpretation must be in harmony with these truths. Developing solutions to such weighty problems is a long, slow process, and we must be careful not to allow false philosophies to influence our thinking.

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The Age of Meteorites

AND THEIR RADIOISOTOPE CHARACTERISTICS

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ROBERT H. BROWN

Meteorites are of particular interest to the person who is concerned with developing a satisfactory cosmology based on the specifications in the Bible. The isotopic characteristics of a meteorite may be interpreted to give the time of its fall to Earth, the variation of cosmic radiation intensity with respect to both time and position in the solar system, the duration of exposure to cosmic radiation, the length of time the meteorite has been in existence as a solid object, and a rough estimate of its thermal history. This information has significant implications for the creation of the primordial matter in the solar system.

SOURCE OF METEORITES

Meteorites were once regarded superstitiously as "stones from heaven." Classical Greeks supposed them to be objects that had fallen to Earth as a result of becoming loosened from their fastening on the celestial sphere. Approximately five hundred of these interesting objects fall on our planet in a typical year. About seventy percent of the falls are lost in the ocean. Of those meteorites that strike land, only about four out of one hundred fifty are recovered [1].

Data obtained from photographs of meteor trajectories establish that meteoroids, before striking Earth, orbit the sun in ellipses that usually range between Earth and Jupiter. The evidence strongly suggests that they originate from the asteroid belt between Mars and Jupiter. Some may be composed of material that was ejected from the moon when large craters were formed there [2].

COSMIC RAY EXPOSURE

Before entering Earth's atmosphere, meteoroids are subject to cosmic radiation. The high energy atomic nuclei that constitute the primary cosmic radiation break up some of the atoms in the outer portion of meteoroids. The formation of chlorine-36, tritium, nonradioactive isotopes of helium and hydrogen, and four free neutrons (by the impact of a cosmic ray proton with an iron-56 nucleus) is typical of these reactions:

$$H^1 + Fe^{56} \rightarrow Cl^{36} + H^3 + 2He^4 + He^3 + 3H^1 + 4n.$$

The neutrons released in this way react in turn with other atoms in the meteoroid to produce nuclear transmutations similar to those that take place in a nuclear reactor. The atoms formed as a result of cosmic radiation are classified by the term *cosmogenic nuclides.*

Thirteen cosmogenic nuclides ranging from H^3 to Co^{60} were identified in a fragment of Sputnik IV which had orbited 843 days. The United States Discoverer satellites, after a few days in orbit [3], have been found to contain detectable cosmogenic nuclides ranging from H^3 to Bi^{205}. Some cosmogenic nuclides are stable; others are radioactive. The half-lives of the principal radioactive cosmogenic nuclides found in meteorites are given in TABLE 1.

TABLE 1. Radioactive Cosmogenic Nuclides

NUCLIDE	HALF-LIFE	NUCLIDE	HALF-LIFE
V^{48}	16.1 days	H^3	12.5 years
Cr^{51}	27.8 days	Ar^{39}	269 years
Ar^{37}	35 days	Ti^{44}	~1000 years
Co^{58}	72 days	C^{14}	5730 years
Co^{56}	77 days	Ni^{59}	80 thousand years
Sc^{46}	85 days	Cl^{36}	400 thousand years
Co^{57}	270 days	Al^{26}	740 thousand years
Mn^{54}	313 days	Mn^{53}	2 million years
V^{49}	330 days	Be^{10}	2.7 million years
Na^{22}	2.58 years	K^{40}	1.31 billion years
Co^{60}	5.25 years		

TERRESTRIAL AGE

Radioactive cosmogenic nuclides permit a determination of the time since a meteorite fell. After the fall, it is shielded by Earth's atmosphere from further interaction with primary cosmic radiation, and there is a steady decrease in the radioactive levels that were built up as a result of cosmic radiation. Comparing the amount of radioactivity of a short half-lived cosmo-

genic nuclide with the radioactivity of a long half-lived nuclide in an old meteorite, and comparing this ratio with the corresponding ratio in a fresh meteorite, make possible an estimate of the length of time the old meteorite has been isolated from cosmic radiation. The period of time determined in this manner is known as the *terrestrial age.*

The nuclide pairs most commonly used for meteorite terrestrial age determinations are Ar^{39}/C^{14} and Ar^{39}/Cl^{36}. As can be seen from the data in TABLE 1, the ratio of Ar^{39} activity to Cl^{36} activity decreases by a factor of two for each 269 years since the date of fall. (The Ar^{39}/C^{14} *ratio* decreases about three percent less rapidly because the rate of C^{14} decay is greater than the rate of Cl^{36} decay.)

Terrestrial ages that have been determined for iron meteorites extend to about 3,000 years but are usually below 2,000 years. Only rough estimates of terrestrial age can be made for stony meteorites, because small quantities of appropriate activities are involved. Nearly all the determinations that have been made range between 3,000 and 5,000 years and are uncertain, with $\pm$ 2,000 years. A few stony meteorite terrestrial ages in excess of 20,000 years have been reported [4]. Stony meteorites may not be significantly different from iron meteorites with respect to terrestrial age.

The paucity of terrestrial ages greater than 3,000 to 5,000 years has been taken to indicate that reworking of our planet's surface has made earlier meteorite falls unavailable. It is unlikely that meteorite "finds" would include any cosmic objects that may have struck Earth before the Noachian Flood.

COSMIC RAY EXPOSURE AGE

The rate at which cosmogenic nuclides are produced in meteoroids can be estimated from measurements of the cosmic ray intensity in artificial satellites, from the number of cosmogenic nuclides that have developed during flight time in artificial satellites, and from the relative concentration of radioactive cosmogenic nuclides in meteorites at the time of fall. The last method, the most direct, has important cosmological considerations.

The rate at which a radioactive cosmogenic nuclide is formed in a meteoroid depends on the intensity and energy characteristics of the cosmic radiation to which it is exposed. The rate at which this nuclide disappears depends only on the half-life and the amount present. (If the amount is doubled, the number of atoms that disintegrate in a given time also doubles.) The concentration of each cosmogenic radioactive nuclide tends to a level at which the number of atoms disintegrating in a given time equals

the number formed within the same time and period. When this condition is established, the nuclide is said to be in radioactive equilibrium. Equilibrium cannot be attained (and has no practical meaning) if the cosmic ray intensity does not remain essentially constant over several half-lives [5].

The time required to reach equilibrium for the nuclides listed in TABLE 1 ranges from 60 days to 5 billion years. In the meteorites that have been analyzed, these nuclides are found to be in approximate equilibrium consistent with one another to an extent indicating that the cosmic ray flux varies by less than a factor of two throughout the meteoroid orbit and that its long-term average has not changed more than fifty percent over the past several million years [6].

As I explained above, if a cosmogenic radioactive nuclide is in equilibrium, its rate of decay is equal to the rate at which it has been formed by cosmic radiation. On the other hand, the concentration of a nonradioactive cosmogenic nuclide is the total number of such atoms that have been formed during cosmic ray exposure. Comparison of a pair composed of a stable member and a radioactive member, each of which has the same formation probability (or a known formation probability ratio), makes possible the estimation of the length of time a meteorite has been exposed to cosmic radiation. The concentration of the radioactive member indicates the rate at which the pair has been produced. The concentration of the nonradioactive member indicates the total exposure. The exposure age, or length of time the process has been going on, is then readily determined, but subject to the assumption that the cosmic radiation has remained essentially invariant during this time.

Stable radioactive pairs that have been used for exposure age determination are He^3/H^3, Ar^{36}/Cl^{36}, Ar^{38}/Ar^{39}, and Ne^{21}/Cl^{36}. Since K^{41} and 1.31 billion years K^{40} are cosmogenic in meteoroids, the pair K^{41}/K^{40} has also been used, although there are uncertainties concerning the equilibrium of cosmogenic K^{40} and contamination with primordial K^{40}. Determinations based on the pairs Ar^{36}/Cl^{36}, Ar^{38}/Ar^{39}, and Ne^{21}/Cl^{36} agree on exposure age of 0.53 ± 0.01 billion years for the meteorite Aroos, whereas the He^3/H^3 pair has yielded 0.8 billion years [7]. Most cosmic ray exposure age determinations for stony meteorites are made with helium-3 (He^3) [8].

Exposure ages for stony meteorites cluster at 5, 7, 20, and 22 million years, whereas those for iron meteorites cluster at 270, 550, and 700 million years [9]. The difference between the exposure ages of these two groups of meteorites may be taken to indicate uncertainties in the interpretation of the data from which exposure ages are determined. It may also be taken

to indicate marked differences in the cosmic or creative processes by which these two classes of meteorites have been formed.

The formation of cosmogenic nuclides is limited to a depth within approximately one meter, because of absorption of cosmic radiation by the meteoroid mass. The pre-atmospheric size and shape of a meteorite body can be determined from contours for equal concentration of a cosmogenic nuclide [10]. Since the formation of cosmogenic nuclides is a surface phenomenon for objects greater than a two-meter effective diameter, the range over which exposure ages are distributed has been taken to suggest that meteoroids are fragments of larger bodies that were broken up at various times during the history of the solar system. Accordingly, the cosmic ray exposure age is often referred to as the parent body break-up age.

SOLIDIFICATION AGE

Meteorites contain the same primordial radioactive elements that are found in Earth minerals and can be analyzed by the procedures that have been developed for determining radioisotope ages of terrestrial material. Considerations involved in the interpretation of these radioisotope ages have been treated elsewhere and need not be reviewed here [11]. If the necessary simplifying assumptions of decay rate constancy and chemical isolation during the time involved are satisfied, a daughter/mother radioisotope age for a meteorite will represent the time that has elapsed since the mother and daughter elements were chemically fractionated — i.e., the time the meteorite has been in its present solid state and the accumulating daughter products have been maintained at local sites in association with their parents. Both stony and iron meteorites give evidence of having been in a molten state at some time previous to their encounter with Earth. The radioisotope ages indicated by the daughter products, which appear to have accumulated in various mineral grains of these meteorites, are therefore described as solidification ages.

Crystallization out of a given molten mass may be expected to extend over a period of time that depends on the cooling rate. Accordingly, solidification ages for portions and mineral components derived from a unit of molten material may extend over a range of cooling time. If this range is less than the precision of solidification age determinations, it will not be discernible.

Rubidium-strontium solidification age determinations for stony meteorites may be determined within a precision of $\pm$ 0.2 billion years. The best values that have been obtained range between 4.46 and 4.70 billion years.

Rhenium-osmium ages for "stones" average 4.0 ± 0.8 billion years. The Pb^{207}/Pb^{206} technique yields ages ranging from 4.02 to 4.65 billion years. The Pb^{207}/Pb^{206} ages present an unsolved problem, because most stony meteorites do not contain enough uranium to account for their radiogenic lead. The average of Pb^{207}/Pb^{206} ages for those that do contain adequate supporting uranium is 4.6 billion years [12].

Pb^{207}/Pb^{206} age determinations on iron meteorites cluster around 4.60 billion years [13].

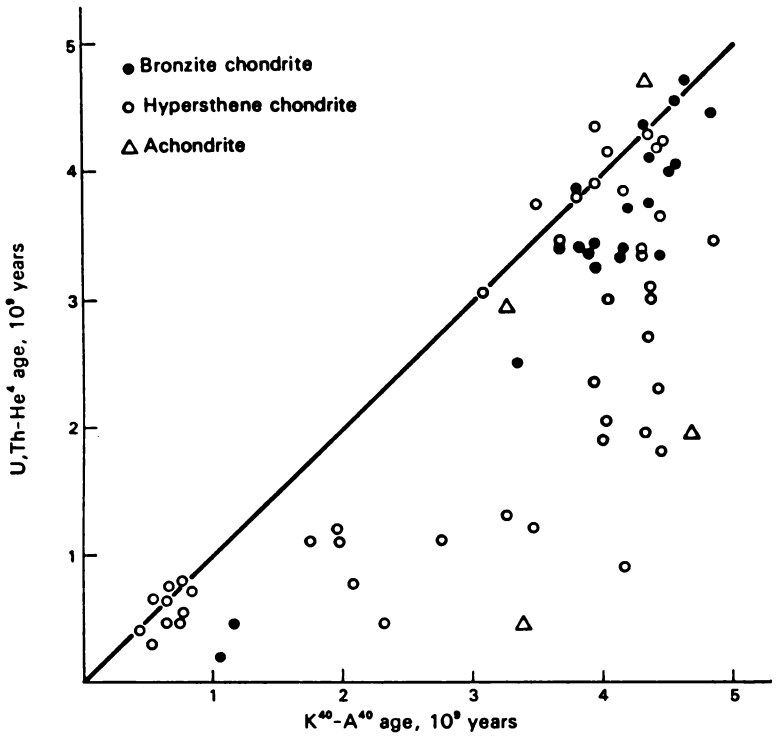
The weighted average of the Pb^{207}/Pb^{206} meteorite solidification age determinations that are considered to be most reliable is 4.550 ± 0.030 billion years [14]. This value is often referred to as "the age of meteorites."

GAS RETENTION AGE

Radioisotope ages given by the ratio of radiogenic Ar^{40} to parent potassium or radiogenic He^4 to parents uranium and thorium could also indicate the time of solidification if the material were subsequently maintained at a temperature low enough to prevent diffusion loss of gas. Heating that is due to impact, close approach to the sun, or descent through Earth's atmosphere — and also slow cooling after solidification — may be expected to reduce K-Ar and U-Th-He ages below the corresponding Rb-Sr, Re-Os, U-Pb, Th-Pb, and Pb^{207}/Pb^{206} ages. Since helium diffuses more readily than argon, K-Ar ages should be reduced less than U-Th-He ages, unless there has been sufficient heating to produce complete degassing. Because of the foregoing considerations, meteorite age determinations based on Ar^{40} and He^4 are classified as gas retention ages.

Gas retention age determinations have been limited to stony meteorites and range between approximately 0.5 billion years and the 4.5 billion year "age of meteorites" (FIGURE 1). For about half the meteorites on which data are available, the U-Th-He age is less than the K-Ar age, and in no case is it significantly greater [15]. The gas retention ages plotted in FIGURE 1 provide opportunity for emphasizing that a basic radioisotope age is merely a convenient means of expressing the ratio of a daughter/mother pair of nuclides. Considerations independent of the daughter/mother ratio measurement are required to determine whether or not a correlation exists between radioisotope age and real time. FIGURE 1 shows that in some cases Ar^{40}/K^{40} ages correlate with He^4/U or He^4/Th ages. When such correlation exists, there is a firmer basis for suspecting that these radioisotope ages might provide some indication of the real time lapse since an event in the history of the mineral involved.

FIGURE 1. Gas-retention ages of 69 stony meteorites: a comparison of results obtained by the U,Th-He^4 and K^{40}-Ar^{40} method. (Courtesy John A. Wood, *Meteorites and the Origin of Planets,* p. 62, McGraw-Hill Book Company 1968.)



EXTINCT RADIOACTIVITY

Iodine-bearing minerals in meteorites are found to contain xenon, which has an abnormally high ratio of Xe^{129}. The excess Xe^{129} appears to be the daughter product of extinct 16-million year half-life iodine-129 (I^{129}) [16].

A study of fission-product components of xenon in one meteorite has given evidence for fission products at least fifteen times greater than can be accounted for by the uranium content. The only likely source for these fission products is extinct 76-million year half-life plutonium-244 (Pu^{244}) [17]. Additional evidence for extinct Pu^{244} has been provided by the crystal structure damage produced by fission products in meteorites. The atoms produced by a fission reaction have sufficient kinetic energy and mass to dislocate the crystal structure over a considerable distance from their point of origin. With proper etching techniques, these dislocation paths become

visible under a microscope and are described as fission tracks. Data have been reported on two meteorites that contain fossil fission-track densities much too high to be accounted for by the uranium present. Spontaneous fission products from Pu^{244} appear to be the only reasonable cause of these excess fission tracks [18].

A meteorite that contains fission tracks from now undetectable Pu^{244} has most likely been in existence at a temperature below approximately 800° C for a time at least in the order of ten Pu^{244} half-lives — 760 million years. Higher temperatures would destroy the tracks; a shorter time would leave a detectable amount of Pu^{244}. For similar reasons, the evidence for the prior existence of I^{129} implies a history of meteoroid bodies in solid form extending over more than 160 million years.

CONCLUSION

The foregoing meteorite observations must be satisfactorily accommodated by a successful cosmogony. Cosmogonies based on the testimony given by Moses have either included meteorites in a general creation of matter at the beginning of the Genesis Creation week, placed their origin on the fourth day of Earth's history along with the moon, sun, and other stars, or presumed them to have originated from a creative episode which took place at a remote time before the events of Creation week.

A cosmogony that limits the existence of the matter which makes up meteorites to a duration period of only several thousand years should offer plausible reasons for the creation of meteorites with the radioisotope features that characterize them. On the other hand, a cosmogony that allows the most obvious interpretations of meteorite radioisotope data should be supported by biblical evidence that the creative activity which took place during the Genesis Creation week was principally confined to planet Earth.

Since God is the author of both nature and revelation, we should expect to develop a cosmogony that accounts in a manner intellectually acceptable for the observations on meteorites as well as for the specifications of revelation.

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Resurrection II

BRENDA J. BUTKA

Shout, O Son of Man!

Hurl holy hallelujahs heaven-high!

Alive in the kingdom of the living standing, gates of joy ajar,
fling your carpenter's arms about blunt fishermen,
loving around your tiny world lost curl them.

Chained darkness of damp worlds cramped below conquered into nothingness,
prisoners of shadow blink in bursting Light unbarred
and tremble at the possibility of Innocence at war and victor.

Braid the breaths of gladness flowing toward your robes of glory
(soft Mary-smiles, homely sparrow-clutter, mute signature of stone)
into shining cords and cables reaching endless to the sky.

Return to your kingdom on carpets of exulting song!

Shout, O Son of God!

Time — and Earth's History

ROSS O. BARNES

29

Since the time of Charles Lyell and Charles Darwin in the past century, the study of geology has been dominated by the concepts of uniformitarianism in nature and evolution of living forms [1]. These two concepts are incompatible with a literal interpretation of the first part of Genesis. Consequently, conservative Christians, including Seventh-day Adventists, have refused to accept them as commonly applicable to Earth's history.

Physical geology (that part of geology dealing with the inorganic materials of the earth) is becoming a more exact science in the sense of dealing quantitatively with experimental data by the application of relatively simple and well understood physical and chemical principles to the study of the earth. No adequate presentation of these aspects of geology and their religious significance exists in Adventist literature. In this paper, therefore, I attempt to present in as objective a manner as possible some of the critical evidence that bears on the question of the duration of Earth's history on the basis of quantitative physical and chemical principles.

Although the subject matter is technical, the significance of the conclusions warrants as technical and precise a presentation as is possible to a general audience. I have tried to make the presentation understandable, therefore, to a reader with at least a general acquaintance with basic scientific concepts. Some allusions not basic to the central argument have been left unexplained in the interest of brevity and unity of thought, but the important mathematical equations are presented in graphic form for those not familiar with algebra and calculus.

I

The actual meaning of *uniformitarianism* has remained a source of discussion and controversy among geologists. Some have attempted to limit

rates and magnitudes of geological processes in former times to those rates and processes we observe today. But evidence has steadily accumulated that many parts of the geological record were formed under conditions that do not exist on the earth today. The great successive floods of lava up to 10,000 feet in accumulated thickness and 200,000 square miles in extent in India, northwestern United States, and other areas; the extensive continental glaciers that covered high-latitude land areas; and the shallow sea deposits that underlie large areas of central United States are just a few examples of former conditions with no modern counterpart. Consequently, to many geologists uniformitarianism means that the physical and chemical "laws" that scientists demonstrate as operating in our present environment simply explain the evidence about the history of the earth that we find in the rocks beneath our feet [2].

This concept arose from an attempt to explain certain geological data and therefore has a degree of support from geological evidence. In fact, some degree of uniformity is necessary to investigate the history of the earth in any consistent manner. How can one say that a fossil represents the remains of former life or that a particular sediment was laid down by running water unless one assumes the basic historical continuity of biological processes or the same interactions of water with suspended sediment that we observe today? The traditional argument between conventional "uniformitarian" geologists and defenders of the Genesis story has been over (*a*) the rates and magnitudes of former geological processes and (*b*) the possible intervention by God in the normal operation of nature to produce non-normal results (i.e., the Genesis Flood).

Most of the large-scale processes that act on our environment and that are discerned in the geological record give no indication of the absolute time period involved, although some give an idea of the approximate time (for example, fossil mudcracks imply fairly rapid sedimentation). Rates of many geological processes — such as erosion, transportation, and deposition of sediments by water and wind, and eruption of volcanic materials from the earth's crust — depend on the amount of energy and material available. Therefore the question of time can be answered only after the rate at which energy and material were supplied has been determined. In many processes like those mentioned above, these rates are difficult and sometimes impossible to determine from the evidence available.

The increasing application of physics and chemistry to the study of geology has introduced the possibility of measuring time in an absolute, quantitative manner. Most basic physical and chemical processes — like planetary

motions, radioactive decay, and vibration of molecules — are quantitatively time-dependent. For example, a certain molecule will always vibrate the same number of times during a given time interval if other physical conditions are constant. Therefore, if certain geological data can be related to these basic processes, elapsed physical time can be determined theoretically.

There are certain questions that involve the validity of any such attempt: (*a*) Do we understand sufficiently all of the processes involved, or are we neglecting some important factor? (*b*) Is the available evidence sufficient to formulate definite conclusions? (*c*) Did the same processes operate in previous times as operate today, and at the same rates? The first two questions must be answered for each case investigated. But the third question is of a more general nature and concerns the success or failure of the attempt to use known physical and chemical processes to explain earth history.

The approach to this last question has been essentially the common working hypothesis of responsible science, namely, that theories and ideas are dropped or modified as evidence accumulates that they cannot explain. As it applies to geology this concept can be stated as follows: If physical processes have changed, or if observed geological evidence is the result of laws not at present understood or of direct divine intervention, then our attempt to explain geological history by current scientific knowledge should fail. (I am using the word *science* here and elsewhere in this article as "a rational and systematic approach" to understanding our universe (*a*) that is based on experimental evidence, (*b*) that uses as few a priori assumptions as possible, and (*c*) that is willing to accept its own reasonable conclusions.)

This is the position that any geologist, be he uniformitarian or Flood geologist, should start from. Neither the Bible nor the writings of Ellen G. White give a scientific account of Creation and the Flood in any modern sense of the word, and the most obvious characteristics of the geological record indicate continuity with present physical processes. Therefore the uniformitarian hypothesis should be the starting point for our investigation of geology, even if it only serves to delimit its own range of validity and point to the existence of other processes or of an incomprehensible divine intervention in earth history.

Modern science provides strong evidence that physical processes as we know them have remained essentially the same in space and time accessible to our observation. Astronomy has shown that the physical processes observable to us that operate elsewhere in the universe conform to the same physical "laws" as do those of the earth and the solar system. Recently discovered quasi-stellar objects (QSOs) seem to indicate the existence of

physical conditions in the universe very different from those in our tiny speck of space; but they present no more compelling evidence for new basic "laws" or processes, especially ones that are inherently foreign to better understood parts of the universe, than does any new area of knowledge. The light from the most distant observable galaxies appears to have taken about 4 billion years to reach us, yet indicates that the physical processes involving electromagnetic radiation at the time and place of its origin were the same processes operating here today.

The highly complex processes of biological life are intimately and directly related to very specific physical and chemical properties of matter and its interaction with energy. A minor change in the properties of any number of elements on which the life process depends would result in extinction of life in its present form [3]. Since the specific properties of elements are directly related to the fundamental "laws" of matter and energy (whether we clearly understand these laws or not), these laws could not have changed significantly since life has existed on earth, without a corresponding change of fundamental biological processes. But no evidence for such change exists in the geological record. Consequently we should be careful about postulating the existence of processes in the past that cannot be observed today unless the evidence suggests that this is so.

II

I will now examine some of the critical scientific evidence derived from the geological record concerning the time involved in the history of the earth. Of major importance is the phenomenon of radioactive decay. A comprehensive description here of the methods involved and the data accumulated on the subject of radiometric dating is impossible. Only the briefest account of methods is given. The conclusions and interpretations then presented are the result of a sincere attempt to understand and evaluate the existing evidence. The reader is encouraged to consult the references given, and others, to see if these things be so.

Perhaps a brief comment should be made about the accuracy of the data on which the following section is based. In general, the analytical methods and instruments used have been developed in the sciences of physics and chemistry. Slipshod analytical results or unwarranted interpretations in the geological literature are usually evident to a careful reader or are shown up by later publications. I have tried to keep these factors in mind and to deal with data that are well substantiated, or else to indicate the present state of certainty.

Certain atomic nuclei that are unstable disintegrate spontaneously to other nuclei with the emission of matter and energy. The types of disintegration of geological interest are (*a*) the emission of an alpha particle (helium nucleus, (*b*) the emission of a beta particle (positive or negative electron), (*c*) orbital electron capture by the decaying nucleus (same final result as positive beta emission), (*d*) nuclear fission (splitting of a nucleus into two smaller nuclei).

The decay of an individual nucleus cannot be accurately predicted; only the probability of its decay within a certain period of time can be determined. But the average behavior of a large number of such nuclei can be accurately predicted. The following equation represents the behavior of such a large number of like nuclei.

$$-dN/dt = \lambda N$$

This equation means that the number of nuclei decaying in a short period of time (-dN/dt) is proportional to the number of nuclei (N) existing at that time. The disintegration constant (λ) indicates the rate at which a given nuclear type decays.

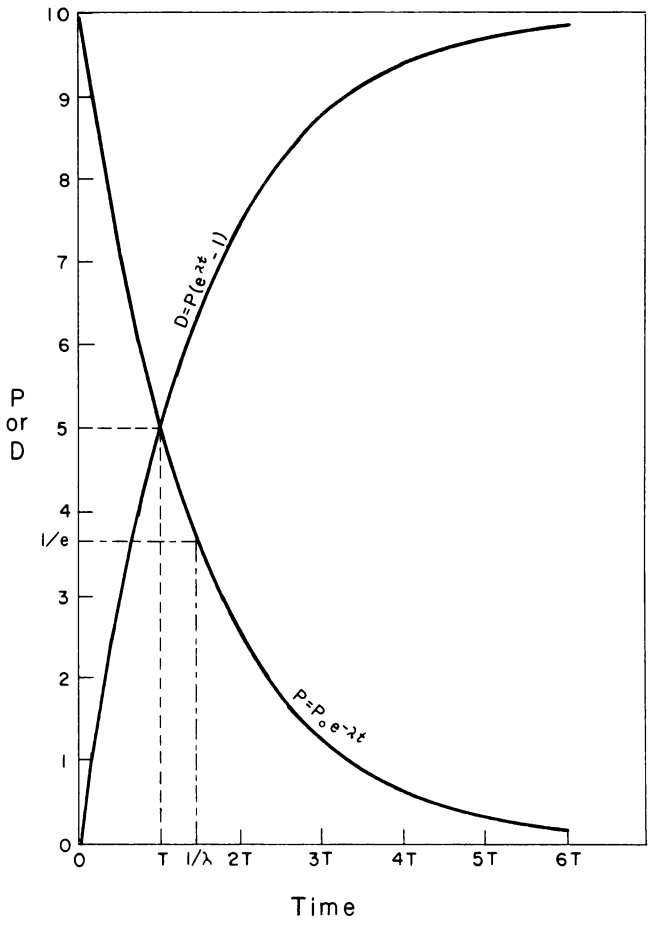
Another expression indicating decay rate is the *half-life.* This expression denotes that time during which one-half of the nuclei initially present will decay. The rate at which a given nucleus decays is a consequence of the basic forces on which the existence and behavior of matter depend. Therefore, in the absence of evidence to the contrary, it is logical to consider the decay rate to be constant.

There is no known way to alter significantly the rate of decay of a naturally unstable nucleus by changing its physical or chemical environment except in the case of electron capture [4]. This decay rate has been changed slightly in light elements with few electrons surrounding the nucleus, but such effects are not significant in any of the elements used in radiometric dating [5]. Mathematical manipulation of the foregoing equation leads to the following:

$$N = N_0 \, e^{-\lambda t}$$

N is the number of nuclei at any time t, and N_0 is the number present at time $t = 0$ (before any of the nuclei under consideration have decayed). N decreases exponentially with time (FIGURE 1). This equation can be used to indicate elapsed geological time if N and N_0 can be related to observable properties of rocks and minerals containing radioactive elements. In gen-

FIGURE 1. The decay of the parent (P) and the growth of the daughter (D) nuclei as a function of time in units of the half-life (T) of the parent.



eral, this involves measuring the abundance of a radioactive nucleus present (P, parent) and the abundance of its decay product (D, daughter). Then in the above equation $N = P$ and $N_0 = D + P$ or

$$P = (P + D)\ e^{-\lambda t}$$

Rearranging leads to

$$D = P\ (e^{\lambda t} - 1) \qquad \text{(Eq. 1)}$$

This is the basic equation used in radiometric dating (FIGURE 1).

There are three main assumptions involved in using equation 1. (*a*) Either there has been no gain or loss of parent or daughter from the material

investigated during the time involved, or such changes can be determined and corrected for. (*b*) Either no daughter was present at time t = 0, or the amount can be determined and used to correct D for the initial daughter present. (*c*) The decay rate has remained constant during the time involved.

The four main dating techniques that have been used, and their results, are discussed separately in the following sections.

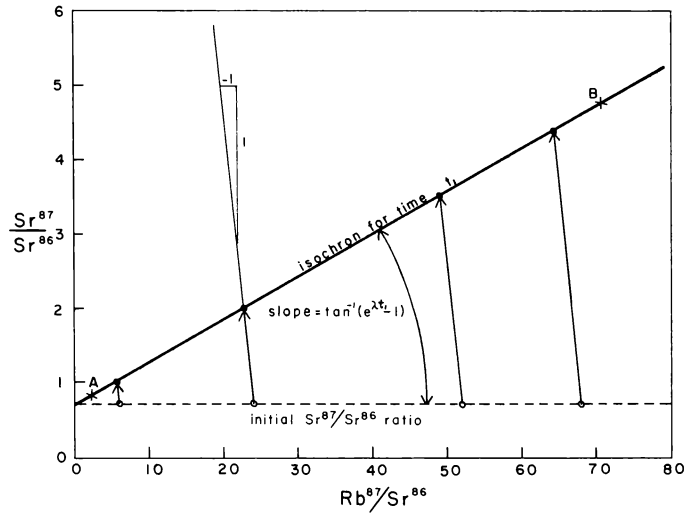
1. RUBIDIUM-STRONTIUM SYSTEM [6]

The isotope rubidium-87 (Rb^{87}) decays by negative beta emission to strontium-87 (Sr^{87}) with a half-life of about 47 billion years. (Isotopes are chemically similar atoms with different nuclear structure). Since the average abundance of strontium in the rocks usually dated by this method is similar to that of rubidium, the assumption of no initial Sr^{87} would be clearly invalid. Consequently a method must be found to determine the initial Sr^{87} present when the radiogenic time clock started. This can be done by measuring isotope ratios. Equation 1 is divided by the abundance of Sr^{86}, another isotope of strontium that is not involved in a decay process and therefore should have constant abundance with time, and a term is added to represent the initial isotope ratio.

$$Sr^{87}/Sr^{86} = (Sr^{87}/Sr^{86})_0 + (Rb^{87}/Sr^{86})\ (e^{\lambda t} - 1)$$

This equation is in the form y = b + mx, which is the equation of a straight line. If rocks and minerals formed at the same time and place, but with different Rb^{87}/Sr^{87}

FIGURE 2. A Rb/Sr isochron diagram showing the undisturbed growth of four minerals with different Rb/Sr ratios, but with the same initial Sr^{87}/Sr^{86} ratio. At any time t, the composition of the four minerals plots on a straight isochron line. The isochron could also be generated by mixing two compositions A and B in varying amounts.



ratios, can be analyzed and the measured ratios are the result of radioactive decay, the values when plotted on a graph of Sr^{87}/Sr^{86} versus Rb^{87}/Sr^{86} should form a straight line whose slope is related to the age of the samples and whose y intercept represents the initially common Sr^{87}/Sr^{86} ratio of the analyzed samples (FIGURE 2).

An alternative explanation of such a straight line would be that the plotted points represent different amounts of mixing between two different magma compositions, say A and B in FIGURE 2. If the plotted points represent different rock samples that are separated by a large enough distance to represent parts of a nonhomogenous liquid, this explanation could be geologically valid. But if minerals from the same small rock sample form such a line, then the decay explanation is the only possible one, since the liquid magma in a small area will be homogenous in Sr^{87}/Sr^{86} ratio because of mixing [7].

If the analytical values do not form a straight line but scatter, the assumptions underlying the use of the above equation are not valid in that particular case. Many studies have shown that the mixture hypothesis is rarely valid and that different rock samples that originated in the same geological event usually plot on a straight line, indicating homogenous initial Sr^{87}/Sr^{86} ratios sometimes over many square miles. In rocks that have been altered by heat or pressure after initial formation, the individual mineral samples often do not fall on a straight line, whereas the whole individual rock samples do. This indicates redistribution of isotopes over small areas (usually fractions of inches) [8].

All available evidence that I am aware of appears to support the validity of the method as a geochronological tool when proper and careful use is made of it.

2. POTASSIUM-ARGON SYSTEM [9]

A natural isotope of potassium (K^{40}) disintegrates by negative beta emission to calcium-40 (Ca^{40}) and by electron capture to argon-40 (Ar^{40}) with a total half-life of 1.26 billion years. The ratio of the two types of decay is constant; so only one decay product needs to be measured to determine radiometric time. Calcium-40 is very abundant in nature, whereas K^{40} is a rare isotope (0.02 percent of naturally occurring potassium); therefore, trying to measure any radiogenic calcium would be difficult, if not impossible in most cases.

On the other hand, Ar^{40} is a chemically inert gas whose only significant source in the rocks of the earth is the decay of K^{40}. Since it is chemically inert, it tends to be excluded from the orderly lattice structure of crystallizing minerals; but after the mineral has formed and cooled, the subsequently produced K^{40} will be trapped in the tight crystal structure. The assumption of no initial Ar^{40} is therefore a geochemically reasonable first approximation that can be modified as data accumulate. Other isotopes of potassium are measured to determine and correct for the presence of Ar^{40} not due to radioactive decay.

Experiments have shown that some rock materials are more suitable for potassium-argon dating than others. The best minerals have high potassium contents, high resistance to diffusive loss of argon, and low initial excess Ar^{40} relative to that produced by decay during the dated time interval. When minerals with these properties are se-

lected, good agreement with other dating methods, especially Rb-Sr and recently fission-track dating, has been obtained [10].

Of course violations of the dating assumptions have also been found. In rocks that have been subjected to rapid cooling (determined by independent evidence) [11] or that crystallized far below the earth's surface, where magmatic Ar^{40} may have attained relatively high pressures [12], excess Ar^{40} has been found. These effects are not usually significant for carefully selected samples, and the general agreement with other dating methods which are not subject to the same difficulties shows the general validity of the potassium-argon method. Recently developed analytical techniques may permit the use of the method even in less than ideal situations [13].

3. URANIUM-THORIUM-LEAD SYSTEM [14]

The three natural heavy isotopes — uranium-238 and -235 and thorium-232 (U^{238}, U^{235}, Th^{232}) — decay by alpha emission with half-lives of 4.5, 0.71, and 13.9 billion years respectively through a series of intermediate unstable isotopes to the stable end products, lead-206, -207, and -208 (Pb^{206}, etc.). These chemically and geologically associated nuclei allow four different age calculations to be made on suitable minerals. The mineral zircon is usually used because of its widespread availability, though low abundance, and relatively high uranium and thorium content. Equations similar to the Rb-Sr equation can be used for each parent-daughter pair, such as:

$$Pb^{206}/Pb^{204} = (Pb^{206}/Pb^{204})_0 + (U^{238}/Pb^{204})\ (e^{\lambda t} - 1)$$

where Pb^{204} is another naturally occurring lead isotope. In addition to the parent-daughter relationships, the ratio Pb^{206}/Pb^{207} can be used for dating, since this ratio varies with time, because of the different decay rates of U^{238} and U^{235}. The initial abundance of lead in zircons is usually so low that the $(Pb^{206}/Pb^{204})_0$ correction term is relatively minor [15].

Zircon is a very resistant mineral and often physically survives when other minerals in rock are altered because of physical or chemical changes in the environment. In such cases the U-Th-Pb system is usually affected by diffusion of these elements in the zircons, and ages calculated from the four different methods are not the same. Techniques have been developed to analyze these discordant ages. But since an adequate description is too involved for this article, the reader should consult the references given for details. The resistance of zircon and the availability of four independent age equations sometimes makes this system the only method available for dating the original time of formation of rocks where alteration subsequent to the original formation has invalidated other radiometric dating systems.

4. FISSION-TRACK DATING [16]

Although most U^{238} decays by alpha emission, about one in every two million atoms decays instead by spontaneous fission. This slow rate is fast enough to use the method for dating if the record of fission decay can be observed. The daughter nuclei recoil from the decay site and leave a damage trail in the surrounding crystal before they are stopped. These minute imperfections in the crystal can be chemically etched, observed, and counted under a microscope.

If the amount of parent uranium and the number of fission tracks present are known, a radiometric age can be calculated. This age does not depend on assumptions concerning initial daughter present, because there will be no fission tracks when the mineral first forms. Any age calculated is most likely to be less than the real radiometric age, because of track healing in the crystal with time.

Comparison of fission-track dating methods with the previously discussed systems shows good agreement to about 1 billion radiometric years, with a tendency for older materials to show a slightly lower age, probably because of track healing.

The great abundance of data available on the above dating methods has shown that, when suitable materials are analyzed, the different methods give concordant results within reasonable limits of geological and physical accuracy. Furthermore, discrepancies can be explained by known natural geochemical and geophysical processes (like alteration by heat or pressure) that act on the materials of the earth. It appears that radioactive decay is the only possible known mechanism that can account for the observed results.

Some apologists have used the "gap" theory of Genesis (chapter one, verse one) to reconcile radiometric dating with the seven-day creation record, but this explanation clearly does not fit the evidence of the geological record. The foregoing dating procedures do not measure the time that matter has been in existence, but the time since it has been in its present state in particular rocks and minerals (since solidification of a liquid magma or major alteration).

There are many of these once molten (igneous) rocks that have intruded fossiliferous sedimentary strata from below or have spilled out as lavas above them, in both cases clearly showing a genetically younger age than the associated fossils. In addition there are minerals such as glauconite that form by chemical precipitation from solution within the actual fossiliferous sediments that can be dated [17]. These are without doubt younger than the associated fossils. What appear to be the remains of bacteria and algae are associated with some of the oldest radiometrically dated rocks on earth, over 3 billion radiometric years [18]. Much effort has been made to date these rocks that can be related to fossils. The relative time scale of geological events that had previously been developed, on the assumption that the sequence of life forms has changed through time, has been substantiated in major details by the radiometric dating methods [19]. In fact, the extension of both radiometric dating and fossil correlation procedures often leads to very good agreement with the radiometric time scale developed in other areas of the world [20].

There still remains to be answered the question of the constancy of the decay rate. This cannot be determined in an absolute manner, although there exists evidence from which an inductive answer can be derived. Previous mention has been made of the firm basis of a constant decay rate in basic physical theory, but experimental evidence can also be investigated.

The isotope ratios of most important elements on earth have been investigated. Some of these ratios have also been determined for meteorites that strike the earth and recently for the lunar samples. The ratios of stable isotopes that are not affected by decay processes or nuclear reactions have been shown to be the same in these three sources (some of the elements involved are potassium, strontium, silver, carbon, nitrogen, and sulphur) — strongly suggesting that the material in these bodies had a common origin and that at the time of formation the radioactive isotopes also had similar abundances.

If this is true and if the decay rate has been the same on earth, meteorites, and the moon, the present ratios of the radioactive isotopes in relation to the stable isotopes of the same elements should be the same in the three sources. U^{238}/U^{235} should also be the same, since this ratio changes with time because of the different decay rates of the two isotopes. The uranium ratio is identical within experimental error in these three sources, and potassium and rubidium ratios are the same on earth and meteorites. (I am not aware of these ratios having been determined on lunar samples yet.) This would strongly suggest that the decay rate has been the same in all materials available for our study [21].

Another phenomenon that has been investigated in relation to the constancy of the decay rate is the pleochroic halo. The alpha particle emitted by a particular radioactive isotope has a definite kinetic energy and the variation in range (distance traveled before being stopped because of collisions) of mono-energetic alpha particles is small. The range is related to the energy of the particle. In addition, the energy of an emitted alpha-particle is related to the stability of the parent nucleus and to the decay rate — the less stable the nucleus, the faster the decay rate and the more energetic the emitted alpha particle. Physicists have developed equations that can approximately predict these quantities from basic nuclear properties of elements [22].

Quite often minute grains of highly radioactive minerals such as zircon are included in larger crystals of more common rock-forming minerals. As the alpha particles from the decay of radioactive nuclei in the inclusion are

emitted in all directions into the surrounding crystal, spherical halos of radiation damage are formed that can be detected as a discoloration of the crystal after a certain threshold track density has been reached. These halos have definite radii. Once the relation between alpha-particle range and energy in the host crystal is established, then the energy of the alpha particles that created the halo can be determined. The parent nucleus can be identified from a knowledge of radioactive isotopes and their corresponding decay energies. Multiple ring halos with radii corresponding to the decay products of the uranium and thorium series have been identified in rocks [23].

The foregoing relationship of decay rate and alpha-particle range can lead one to conclude that if a change has occurred in the stability and decay rate of alpha emitting isotopes, then this change would be reflected in variations of alpha-particle range and consequently of halo radii with time. Pleochroic halos produced by uranium and thorium in rocks of various ages have been investigated, and no significant change has been found. A slight change in the halo radius because of the parent uranium decay was reported [24], but this effect was explained later by the change in U^{238}/U^{235} ratio with time and corresponding decrease in intensity of the U^{235} halo, which is only slightly larger than the U^{238} halo. Strictly speaking, this just indicates that the apparent range-energy relationships of alpha particles have remained constant, but neither is there any physical evidence to say that the decay rate has not remained constant during the time involved.

In addition to the uranium and thorium series halos, other "anomalous" halos have been described, some of which can be identified with separately occurring short-lived uranium and thorium series isotopes [25]; others have not been identified with certainty and may belong to short-lived, now extinct, isotopes [26]. Some observers have suggested that these anomalous halos may be evidence of a short time elapsing between the creation of matter and its existence in its present form in rocks, because any separately occurring, unsupported, short half-life isotopes would have decayed if a long time had elapsed between these two events. The anomalous halos associated with the uranium and thorium decay series show geological and physical characteristics that suggest they originated by the chemical separation of the different elements in the series from chemically active solutions migrating through the enclosing rocks [27].

Such an explanation is geologically and geochemically plausible. The geological and geochemical conditions which are important to an understanding of the origin of the recently investigated anomalous halos have not been

reported. Until these important details about the origin of pleochroic halos are more thoroughly investigated and understood, conclusions about the nature of geological time based on them are very tenuous. In other words, this is an active area of investigation in which premature judgments are unwarranted, inasmuch as there is a basic lack of understanding of what phenomena are involved. Some details of the available evidence indicate that physical and chemical phenomena in addition to radioactive decay, such as alteration of minerals and diffusion of radioactive nuclei, may be involved in the genesis of these anomalous halos.

COOLING RATE DATING

Other aspects of physical geology also have a bearing on the duration of time. One of these is heat conduction. The small size of objects that we see heating and cooling every day does not readily bring to mind the long periods of time required for large objects to cool. Large bodies of rock the size of those we see in the cores of mountains today may require thousands of years to cool from their initially molten state.

I have made a calculation based on a simplified physical model [28]. A laterally extensive sheet of solid rock 6,500 feet in thickness with the upper surface kept at 0° C would require 100,000 years to cool from an initial uniform temperature of 700° C to a final maximum temperature of 70° C. Some areas of the world, especially areas of former mountain building, give evidence of many such large intrusions of hot magma related to each other in a time sequence. The large size of mineral crystals found in these rocks, which depends on slow rates of diffusion of chemical elements in liquid magmas, supports the long cooling periods determined by thermal conduction theory.

CARBON-14 AND THE ATMOSPHERE

I have left the discussion of carbon-14 dating until now, because it must be considered in relation to former conditions in the earth's atmosphere. Carbon-14 is produced mostly in the stratosphere (upper atmosphere) by nuclear reactions between neutrons generated by cosmic rays and nitrogen-14, the main constituent of the atmosphere. This C^{14} is incorporated into atmospheric carbon dioxide and mixed with the stable isotopes (C^{12}, C^{13}) of carbon in the systems that exchange carbon dioxide with the atmosphere (organic life and terrestrial waters).

When an organism dies, it stops exchanging carbon with its environment and either decays or is preserved. The C^{14} present in the dead material disintegrates with a characteristic half-life of 5,730 years. The remains of a

dead organism can theoretically be dated by measuring the present C^{14}/C^{12} ratio in the remains. The original C^{14}/C^{12} ratio is assumed to have been similar to the ratio found in modern organisms in a similar environment. This consideration of environment is important, since the C^{14}/C^{12} ratio varies in modern carbon exchange reservoirs. This dating method is normally useful for ages up to several half-lives of C^{14}, although techniques of isotope enrichment can theoretically extend the time limit considerably if problems of contamination with modern carbon can be reduced. For details, complications, and discussion of results, the reader is referred to other sources [29].

It has been postulated that the nature of the preflood atmosphere prevented the formation of appreciable C^{14} at that time. Therefore, apparently old C^{14} dates just indicate preflood, flood, or early postflood conditions. Two possible mechanisms proposed for this shielding effect are (*a*) a stronger geomagnetic field which effectively deflected most cosmic rays from the earth and (*b*) a water vapor canopy existing above most of the present atmosphere that absorbed cosmic rays and shielded the atmospheric nitrogen.

The possible nature of a preflood atmosphere could be the subject of another paper. Any postulated effects on the C^{14} system can be tested independently of hypothetical atmospheric conditions by comparison of C^{14} dates with some other dating system that does not depend on atmospheric conditions. The half-lives of the radioactive parents previously discussed are very much greater than those of C^{14}; so a direct comparison in the short time period useful in C^{14} dating is difficult. With considerable technical and geological difficulties, K-Ar dating has been extended to such short time periods. In cases where these difficulties appear to be overcome, there is good agreement between the two methods [30].

Under certain circumstances, chemical separation of the different elements in the uranium and thorium decay series occurs in nature. When the series are physically undisturbed, an equilibrium is reached where the rate of decay of any short-lived member is equal to its rate of production. If elements are separated, this equilibrium is disturbed and the return to equilibrium over a period of time can be used as a dating method.

Marine corals are greatly enriched in uranium isotopes, in comparison with thorium isotopes. In addition, U^{238} and its daughter U^{234} are not in equilibrium in sea water (activity ratio = 1.15) because of preferential removal of U^{234} from weathering rocks. Both the decay of excess U^{234} and the growth of Th^{230} (daughter of U^{234}) in old corals can be used as dating

techniques. The calculated ages of old coral reefs by the use of these two methods agree satisfactorily with each other and also with available C^{14} dates on geologically related samples [31].

Sediments that accumulate on the ocean floor are initially enriched in the relatively insoluble thorium and protactinium isotopes with respect to their parent uranium. The decay of these unsupported daughters has been used to measure accumulation rates of ocean sediments. The conditions needed for valid ages are not always found (migration of isotopes in the sediments and mixing of sediment occurs); but when the appropriate conditions appear to be met, the measured disequilibrium ages agree with C^{14} ages on the same sediment cores [32]. Moreover, when large age discrepancies occur, the C^{14} age is always less than the disequilibrium age, indicating possibly more, not less, C^{14} in the past atmosphere [33].

III

For the benefit of those who followed the foregoing presentation with difficulty, I will summarize the main points.

1. The radioactive isotope abundance pattern in rocks can be scientifically explained at present only by radioactive decay processes.

2. The decay rates have been the same in all solar system material available to us. (Meteorites are thought to come from the asteroid belt between the orbits of Mars and Jupiter, about 2.8 times farther from the sun than Earth is.)

3. Other well documented and understood physical processes either support or do not contradict the evidence of radiometric dating.

4. Fossil organisms are definitely found in rocks at least 600 million radiometric years old and probably in the oldest known sedimentary rocks on earth.

5. Carbon-14 dating is in general agreement with other dating procedures, suggesting a fairly constant C^{14} level in the atmosphere in geologically recent times.

6. There is no well documented evidence suggesting that physical "laws" or processes operating in the inorganic world, at least during the time interval involved in this paper (about 3 billion years), are not those we can see and investigate today.

7. Many of the evidences used to argue for a short time scale of earth history (rapid sedimentation in certain areas, etc.) cannot determine absolute durations of physical time over large areas. Moreover, this characteristic of fluctuating rates of buildup of the geological record is inherent in the

operation of nature and is found on all scales — from the very thinly deposited laminae of shaly sediments (indicating alternating periods of fast and slow deposition) to explosive volcanic violence, earthquakes, and landslides, followed by little or no activity.

One can ask, of course, why the present isotope abundance pattern could not have been created instantaneously as we find it today, but this solution is not as satisfactory as it may appear at first. This would not be at all similar to the instantaneous creation of a tree with growth rings, because the isotope abundance patterns have no necessary relationship to the structure of rocks and minerals as growth rings do to the structure of a tree. Furthermore, this would not explain the existence of radiation damage, like fission tracks, associated only with radioactive minerals and in quantitative agreement with radiometric ages based on isotope abundances or the existence of radiometrically old rocks and minerals in various degrees of demonstrable genetic relationship to preserved fossils.

Again, one might postulate an abnormal disruption of nuclei during an episode such as the Genesis Flood. Since there is no intrinsic difference between radioactive and nonradioactive nuclei, one should expect that some nonradioactive isotopes would be affected by such an event, but available evidence gives a negative answer to this expectation. In short, if the events narrated in Genesis took place within the recent past, then this interpretation should find abundant support at the center of physical geology. Instead, when viewed from a broad perspective, the testimony of this field is uniformly against such an interpretation.

The conclusions reached here are admittedly incompatible with some of the literal interpretations of the beginnings of the book of Genesis. However, I believe there is sufficient justification for careful and objective examination of our position on the literalness of the biblical Creation and Flood stories and for careful consideration of the biblical and literary-historical evidence pointing to a figurative and theological interpretation of this material that has been presented by responsible, conservative biblical scholars [34].

It is most important that the church tolerate, and even encourage, constructive thought and necessary differences of opinion that will arise before a solution to these problems is clear. It is my sincere conviction that a realistic and objective attitude toward geological evidence will be found to be in harmony with the same attitude toward the Bible and will reinforce faith and confidence in an inspired Word, the writings of Ellen White, and the soundness of basic Adventist doctrine [35].

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The Church's Health Crusade

YARDSTICK OR TOOL?

48

HARLEY E. RICE

Is acceptance of the health teachings of the Seventh-day Adventist church a requirement for eternal salvation, a prerequisite for fellowship in the communion of the saints? Or is it just practical counsel for everyday healthful living? And if it is the latter, then how important is it to the church and the individual, and how is it related to salvation?

Few subjects can engender more emotion than the discussion of what the saints should eat, even though this is but a segment of the total health program of the church. And although the saintly diet can help maintain normal blood pressure, too frequently the discussion of it tends to produce high blood pressure. Thus, to non-Adventists the health message has become one of the most misunderstood teachings of the church, and perhaps church members misunderstand it themselves.

I

I grew up in a Seventh-day Adventist home; I was "born into health reform." My parents believed in health reform, Battle Creek style, and in this context I received my first concept of what being an Adventist entailed. It meant fomentations and cold mitten frictions when I was ill. It meant that I could not drink water for an hour before meals and for an hour after meals. (Those were the thirsty periods of my life.) It meant graham flour instead of white flour; my godly aunt made not only graham bread, but also graham macaroni and pie crust. (White flour had some indirect association with sin.)

Being a Seventh-day Adventist also meant vegetarianism, a breach of which was equivalent to partaking of the fruit of the tree of knowledge of good and evil. It meant that I could not go to the circus when it came to town, but was permitted to stand on the sidewalk and watch the parade. It meant that I was not to play with non-Adventist children in the neighborhood. (This was not quite in the category of sin, but it certainly contained the exposure to temptation.) It meant that I was glad when sundown came and Sabbath ended. It meant that I should always remember that any day I would be persecuted for my belief and would have to flee to the mountains. (I prayed that it would not be in the winter.)

Thus my early concept of religion related to diet, Sabbathkeeping, raising money for church school, and disassociation from the rest of the kids in town. Later a more mature understanding included the love of God, the sacrifice of Christ, salvation by grace, victory over sin through the power of Christ, a responsibility to take the gospel to the world, and a belief in the second coming of Christ (though I set no dates). For me as a child the health reform program outranked salvation, and vegetarianism was more important than the atonement of Christ for the sins of the world. This perhaps was not necessarily a bad start, for exact rules of conduct were more comprehensible to a small boy than philosophies and theological reasonings, which could be understood only with greater maturity. But the hangover of relative importance lingered in my life for a long time.

I spent my youth around Boulder, Paradise Valley, and St. Helena sanitariums. In these environments salvation was taken for granted, and virtue was related to long dresses, hydrotherapy, and meatless meals. This was the imprint made upon my life by the dedicated people who molded these wonderful institutions long ago. These people were saints in the true sense of the word, and their lives and ideals live on in the lives of many who came under their influence (although I was one of those who slipped away on Thanksgiving Day to partake of a small piece of turkey, with an emotional impact somewhere between wicked exhilaration and guilt). People came to Adventist sanitariums in those earlier days from far and near, but mostly from far. They fully understood that they were coming to a medically oriented resort known as a sanitarium, where breathing exercises, hydrotherapy, vegetarianism, evening worship, and Saturday night marches held sway. They came because they found something wholesome in the total program.

One of the difficult adjustments in my life was to realize that the evolution from sanitariums to hospitals altered much of this, and that now pa-

tients come to Adventist hospitals at the direction of a physician on the attending staff, seeking neither gluten cutlets nor baptism. They come for acute hospital care in which standardized hydrotherapy treatments and compulsory vegetarianism cannot play the same role as in quieter, simpler sanitarium eras. Time has taught a reluctant student that the greater objectives of the church — changing the lives of people by helping them understand themselves and then understand God — remain the same, but that the methods and approaches by which these continuing objectives are sought and realized must change with situations and times.

In the exuberance of youth long ago I became involved in tennis tournaments held in conjunction with an annual wine festival. Certain of the mustached saints took a dim view of a young Seventh-day Adventist competing for prizes in tennis at a wine festival. I suppose it was a foolish thing for me to do. I recall that when I scored a point, the grandstand on my side would shout "Granola! Granola!" and when my opponent scored, the grandstand on his side joined in the chant of "Pork! Pork!" This was the common conception of the health reform message: it was unrelated to health and was merely a series of negations which made people peculiar and perhaps more virtuous, but not necessarily more healthy. In this, of course, the saints were wrong.

Many years later the fact that the total Adventist health message was still not understood by the public was brought forcibly to my attention. On a certain (or uncertain) day I attended a banquet with a wide variety of hospital friends. It was on a day when our Catholic friends were partaking of no meat. It was at a location where the Jewish hosts were partaking of no dairy products. The bewildered caterer, realizing that I was neither, but still different, came and whispered in my ear, "Does your religion allow you to eat asparagus?" I confessed that I was unrestricted as to asparagus. Why he could not have inquired about something more palatable than asparagus I shall never know. His concept of my scruples was only that of unreasoned negations, and unfortunately, this concept lingers today.

II

I see four principal reasons for a health program and, correspondingly, four contributions that this health crusade can make to the church. To understand these reasons and contributions is to understand the purpose of the whole health program of the church.

The first and primary reason is better health. The health program has as its principal objective health — buoyant and abounding health. And al-

though good health does not make a man holy or pious, and absence of disease is not synonymous with victory over sin, there is a relationship between health and salvation. Abstemious living — adherence to good habits of eating, sleeping, exercising, resting, working, and thinking — brings its own reward of a clearer mind and healthier body. Clear minds are necessary to understand spiritual truths, and strong bodies are required to carry out the mission of the church to take the gospel to the ends of the earth.

Thus, while peanut butter will not save the soul, good eating habits will contribute to health, and health contributes to the mental acumen needed to understand spiritual truths. Gluten cutlets will not deliver one from sin, but a balanced diet will contribute to the development of a body capable of doing the will of God on earth. Sunshine and jogging will not constitute passports to the pearly gates, but these do contribute to clearer minds, stronger bodies, and better health on earth. The primary reward of the health program, then, is good health, and the fruitage of health is strong bodies and clear minds.

The second reason is establishing contact with people. The business of the church is to set salvation within reach of the multitude — to influence people to desire it, grasp it, and thus be saved by God's grace. Frequently Adventists conceive that the business of the church is to make Seventh-day Adventists, to make Sabbathkeepers, to make vegetarians, to operate hospitals, or to sell books. But these are only methods. Salvation is the only business of the church. Books, magazines, correspondence courses, television programs, radio broadcasts, and even hospitals are but various methods to achieve the end — which is to change the lives of people and effect their salvation.

Various methods are required to meet the needs of different segments of society. Evangelistic meetings attract one group of people, and radio broadcasts reach into homes and make contact with others who will never come to an evangelistic service. Similarly, the medical arm of the church is a means of touching the lives of people. Contact is made when people are sick and in pain, when they are likely to think about the serious values of life, to realize that life is brief at best. The medical ministry of the church tends to reach people in serious moments when they are receptive. This is why the Seventh-day Adventist church operates hospitals and not merry-go-rounds.

The broad application of the medical ministry frequently is not realized and understood. Some have considered the operation of sanitariums to be the special mission of the church; and indeed this was the case at one time.

These unique medically oriented resorts reached a segment of people that could not have been reached by any other avenue, and this method can still be effective in areas where the culture and habits of the people make such an operation possible. Others have felt that it was wicked to operate hospitals and that the church should have no part in them, but both operations are means of reaching people with the love of God — people who might not be as effectively reached by other avenues of the church. Every Seventh-day Adventist physician, dentist, nurse, and paramedical worker — wherever he works — is part of the medical ministry of the church, for each one meets people and has the opportunity to tell of the love of God.

Thus through health agencies the greatest opportunities are afforded to demonstrate the theology of the Seventh-day Adventist church reduced to behavior and practice in medical ministry. God is love. The church's duty is to demonstrate this to the world effectively, and thus help man understand God.

The third reason for the health work is public relations. This contribution is actually a result of the first and second contributions; a good reputation (and with it a degree of fame and publicity) is but the byproduct of good work. Publicity is never the purpose of good work; it is the fruitage of high endeavor. If the work is good enough, publicity is the inevitable result and cannot be avoided. The man who builds the better mousetrap will have a path beaten to his door. All a public relations department does is to put up a sign at the intersection with a finger pointing, lettered "Mousetraps Built Here." Thus the medical ministry of the church, as an inevitable consequence of its competence mingled with compassion, becomes a public relations agency for the church, making it well and favorably known. Christ did not need a public relations agent; his healing spoke for itself and multitudes heard and followed.

There is a desperate need in the world today for professionally sound, skillful medical ministry that can lessen suffering and extend life. There is also a desperate need for love, for sympathy, for understanding, for compassion. Adventist medical ministry is unique only when it combines science with compassion, competence with love, and skill with understanding and sympathy. When these are combined, the world takes notice.

This is the story of medical ministry that is featured in the literature of our day. Unselfishness is rare, and cannot go unnoticed in a selfish world. The medical ministry of the church, therefore, possesses the inherent capacity to become a great public relations agency for the church, utilizing its unique combination of pills and prayer, of surgery and sympathy, which is

soon on the lips of the multitudes and spread in printer's ink around the world. The inevitable result of friendship and kindness is the establishment of these elements in the hearts of mankind. Just the telling of the story causes these friendly feelings to rise to the surface. When later contacts are made, even under completely different circumstances and by different agencies of the church, the disposition to friendliness toward the church rises and disarms prejudice and opens both doors and hearts. The purpose of the health message is not public relations, but publicity is the inexorable byproduct.

The fourth reason is the creation of rewarding areas of service. The medical ministry of the church is a triumvirate: an idea, people, and things. The things — brick and mortar, equipment, machinery — are probably the least important of the three, although things are indispensable. An idea or a conviction without people is but an academic profundity; people give ideas and convictions the breath of life. The object of the medical ministry is people, and the life and breath of this ministry is people. Imbue people with dedication to an ideal and you have the most powerful force on earth.

In the business world there are many opportunities for Seventh-day Adventists to earn their livelihood and carve their careers, but few of these offer the satisfaction that participation in the medical ministry does. Here also the avenues to service are many for both men and women. Physicians, dentists, nurses, therapists, dietitians, technicians, engineers, cooks, bakers, and custodians are all needed. Involvement in the medical ministry provides adequate financial reward and, more important, it brings with it a chain of satisfactions not easily found in the business world: the joy of contributing to the success of the church's ministry of salvation; the satisfaction of lessening the pain and sorrow of mankind; the feeling that one is cooperating in a joint endeavor with the Great Physician.

Institutional environments usually constitute oases of compatibility in a vast desert of strange faces. The companions in work are equally motivated and are striving to reach a common goal more important than money. Problems of working on the Sabbath are largely solved. Circles of friends are made that constitute the richest reward short of heaven. The sheltered environment of Adventist health care institutions has spared many a youth exposure to the common temptations of the world until such time as maturity and experience have prepared him to cope with the sin, ruthlessness, and callousness it holds.

Thus the medical ministry of the Seventh-day Adventist church makes its great contributions: health to those who follow its principles; the opportunity to pour the love of God into hearts opened by illness and pain; the projection of the image of the church in its most favorable light; and the opportunity for respected, rewarding professional careers of Christian service.

It is incumbent on the church first to understand the role of this avenue of service. From understanding it is but a short and easy step to benefiting from the practice of its broad, scientifically supported, and rational principles. Participating in its ministry brings the love of God into countless open hearts that need it, and the reward to the participant is often even greater than the reward to the patient.

This medical ministry also carries its hazards and has done so since God first talked about health to Moses. The temptation lurks to use it to measure the piety and holiness of others. But it is a guide, not a yardstick; it is a tool of service, not a whip of conformity or punishment. There is a seldom quoted text which says, "Do not be over-righteous" (Ecclesiastes 7:17, New English Bible). The correct dosage can give vigorous health. An overdose of health reform can result in a delusion of virtue, a hallucination of piety, and the appearance of colored rainbows of self-righteousness — but it leads to leanness of the soul.

Authority in a University

ROBERT E. CLEVELAND

I

Universities and colleges, like cathedrals and parliaments, are a product of the Middle Ages. The Greeks and Romans had no universities in the sense in which the word has been used for the past seven or eight centuries. They did have higher education, but the terms may not be used synonymously. Though their instruction in law, philosophy, and rhetoric would be hard to surpass, it was not organized into permanent institutions of learning. Only in the twelfth and thirteenth centuries did the forms and features of organized education with which we are somewhat familiar emerge. In these matters we are the heirs and successors, not of Athens and Alexandria, but of Paris and Bologna.[1]

The contrast between the earliest universities and those of today is highly significant. Throughout the period of its origins, the medieval university had no libraries, laboratories, museums, endowments, or buildings of its own; it could never have met the requirements of an accrediting body. The medieval university had no board of trustees; it published no catalogue; it had no student organizations, except as far as the university itself was fundamentally an organization of students; it had no college newspaper, no football team, none of those "outside activities" which are the chief excuse for "inside inactivity" in the American university today.[2]

Important as these differences are, the fact remains that the universities and colleges of the last half of the twentieth century are the lineal descendants of medieval Paris and Bologna. They are "the rock whence [we] are hewn, . . . the hole of the pit whence [we] are digged." The fundamental organization is quite similar; the historical continuity is uninterrupted.

The university has always been a subject of discussion and frequently of controversy. In more recent years greater demands have been made on it by

larger and larger segments of society. Ralph McGill has written, "We cannot, anymore than past generations, see the fact of the future, but we know that written across it is the word Education."[3]

Universities will shape and be shaped by our national future. "The ivy walls have been breached." It is no longer possible to consider the problems of the campus apart from the problems of society in general. In the decades ahead, each college and university will be expected, as in the past, to advance and disseminate knowledge. In addition, each institution will be confronted with demands for assistance from many groups within the community. Adults will look to these institutions for opportunity to continue and improve their education. Business interests will look to these same institutions for the specialized training of employees, for technical advice in many fields, and for creative research. Government will contract for an increasing amount of research, for the training of young men approaching military service, for technical assistance in public projects at home and abroad, and for the support and augmentation of programs and institutions of higher learning in developing countries.[4]

The next few years will place unparalleled demands on the more than 2,000 American colleges and universities for adaptability, expansibility, and creativity. If these demands are to be met, as they must be, both administration and faculty must find improved ways of enlisting all members of the organization — trustees, academic and administrative officers, faculty members, professional service personnel, and students — in a dynamically improving *collaborative* enterprise. That effort must be equal to the task of repudiating inflexible practices, whether they concern the size of the institution or its classes, the traditional disciplines of knowledge, or established notions about the institution's constituency.[5]

II

There are those who are concerned that the contemporary university can neither govern nor restructure itself so as to be responsive to these rapidly changing conditions. Irving Kristal has "the gravest doubts that, out of all the current agitation for a 'restructuring' of the university, very much substance will come." The faculty controls educational functions and defines educational purposes, but "professors are a class with a vested interest in, and ideological commitment to, this status quo broadly defined. . . . Nor is the administration going to 'restructure' the university. It couldn't do it if it tried, and quite likely its efforts would be only halfhearted. University administration in the United States today combines relative powerlessness

with mere absolute mindlessness on the subject of education." And boards of trustees "represent a kind of 'stand-by' authority, ready to take over if the executive officers lead the organization into a scandalous mess."[6]

On the other hand, some believe that existing agencies and forces within the university organization do hold the potential for effective government and restructuring when necessary, if only these agencies and forces can be brought into proper alignment and relationship. People of this conviction hold that a team effort is necessary if success in meeting the needs of the future is to be attained.

Such a conclusion is based on several hypotheses. The first is that of the several forms of organizing and governing colleges and universities, the adversary form (perhaps best illustrated by the collective bargaining role of labor unions and by the union-like behavior of such organizations as the National Education Association) is diametrical to the professional concern and conduct of institutions of higher education. The unionist stand maintains that faculty are employees whose interests (essentially economic ones) are generally so at odds with those of central administration, trustees, and, indeed, the institution itself, that the essential function of faculty organizations should be to protect individual faculty members.[7]

Faculties should organize, as any other group interested in achieving a complex goal should be organized. But the purposes of organization should be to discover how best to render professional services through optimum utilization of the differing skills of the members of the institution. The union implies that presidents, deans, and department heads are not professional and are actually seeking to exploit the faculty members, who are professional. The opposite position is that the institution tries to deliver professional services through the industry of all its members — professor, librarian, or president.[8]

The second hypothesis is that the circumstances that once assigned to the college president almost complete authority to govern an institution and to use its resources as he judged best no longer obtain. The American college president's pivotal position grew out of the historical facts of frontier conditions: frequently he was the only person present at the founding of an institution; the only person available to obtain funds, construct buildings, and recruit and instruct students. He was the prototype of the single pastor who ministered to his congregation as he saw fit.

Through the years, institutions have become so complex that one person cannot possibly even oversee necessary activities, much less perform or control them. More significantly, numbers of competent, responsible faculty

members have become involved in the operation of the institution, with a distinct professional interest in how well it succeeds.

III

Frontier conditions required a president-centered organization. Contemporary conditions require an organization in which responsibilities are shared. In the search for appropriate organizational patterns to meet immediate and future problems, some direction may be obtained through "an examination of some of the failures or malfunctionings of the approaches used historically, or currently in vogue."[9]

Where faculties have gained full control over an institution, without the balancing force of a strong central administration, the institution has tended to stand still and to become more concerned with the welfare and prerogatives of faculty members than with the needs of students, parents, or the larger society.

One type of such malfunctioning is illustrated by the experience of a Midwest college whose president was on leave of absence in Washington, D. C., for nearly ten years. Meanwhile the governing body refused to appoint even an acting president. During that decade a carefully established, smooth-functioning program of general education was allowed to fall into disuse because authority to initiate curricular change reverted by default to faculty committees whose members found preoccupation with their own subjects and affairs more comfortable than making the effort to adapt courses to changing student needs. Without a president to weigh faculty interests against other criteria, departments tended to recruit and accord tenure to those who placed disciplinary and departmental loyalty above all else.

When the long "temporary" arrangement ended, the next president lasted less than two years. In trying to restore balance between administrative leadership and faculty control, he made enemies and thus lost the effectiveness necessary to achieve the results he might have had from a longer creative effort. Any president who follows a period of rampant growth of faculty hegemony is liable to have a short and violent regime, unless, of course, he tolerates continued faculty control — in which case the institution may well atrophy and die.[10]

A second type of failure or malfunctioning involves not a weak or absent president but a strong president preoccupied with limited interests. Such a president — for the sake of increasing the endowment, overseeing the physical plant, or maintaining advantageous trustee relationships — lets the

individual faculty members pursue individual activities as long as they do not disturb administrative tranquility. Columbia University is a good illustration of such a situation. From the days of Nicholas Murray Butler, Columbia had inherited a tradition of executive responsibility reflected in autocratic decisions made only after consultation with trustees, important alumni, donors, or, occasionally, important city officials. Faculty members were left free for scholarship and such instruction as they chose to provide; but they were not encouraged to involve themselves in institutional affairs.

As a result, strong local autonomy developed in schools and departments and was allowed to operate unchecked as long as there was no attempt to influence institution-wide policies or activities. There was no formal senate or other faculty organization that could consider the university as a whole, and an assembly of all the faculties was too large to do other than ceremonial university business. This sharp division of responsibility created a wide, unbridged gulf between the faculty and the administration. The faculty became more and more removed from the problems of student life, and this unconcern became all too evident to the students themselves. The central administration, to the extent that it was even aware of the problems, was unwilling to create a staff large enough to maintain even a semblance of institutional character or coherence.[11]

A third type of malfunctioning characterized San Francisco State College. In that situation, authority and prerogatives necessary for the effective functioning of central campus administration were allowed to filter downward to departments on the one hand and to be drawn upward to the office of the chancellor for the state college system on the other hand. Robert Smith presents the following analysis:

> The business-as-usual pattern of student, faculty, and administrative government was not adequate to the pressures for change and could not be quickly superseded by sufficiently mobile decision-making process in a climate of continuing tension marked by checkmating activities at several levels. The traditional dispersal of responsibility prerogatives and power within the academic community (power lodged in the departments) became an albatross in a multiple conflict situation. This, coupled with centralized control of the system of colleges at the chancellor-trustee level, seriously hampered the executive functions at the campus level.[12]

Undue concentration of authority in the hands of central administration can also be lethal, as the experience of Parsons College suggests. Parsons was the extended shadow of its president. He combined the "instincts of the jungle of the corporate world, the platform appeal of an evangelist, and an enormous capacity for work and food, and a facile charm" into a leadership role that allowed little room for middle ground response.

Other examples could be cited. Over-bureaucratized faculty authority, coupled with confused domains of faculty and administrative responsibility, results in malfunctioning. Direct trustee authority in purely academic matters is another route to malfunction. Examples of presidential failure to expand the administrative structure to keep pace with increased enrollment, physical plant, and budget are innumerable. There is governance through secrecy and the prevalent administrative attitude that what central administration does is not the proper concern of faculty members. The display of almost capricious departmental power comes about when the institution offers too much simply to recruit a research-oriented faculty.[13]

IV

From among the many possible models of university governance, two of them — the extremes of power concentration and of dispersion — have been discussed briefly. Systematic group participation is a third form worth discussing, and it may very likely be the answer for the immediate future. The idea of *shared responsibility,* which has been discussed in the literature of higher education for many years, has appeal. But though this approach has often been suggested, practical applications have not been achieved frequently — partly because the nature of the various factors of the campus equation has not been understood, and partly because the relationships among those factors have not been spelled out.

The idea of shared responsibility assumes that, with respect to educational and institutional matters, faculties are by nature conservative. Seldom has major educational innovation come from the faculty. Faculty members are reluctant to change; new ideas are not readily accepted. This is understandable. Faculty members tend to be solitary individuals, sometimes drawn into college teaching because that role allows them to study and cultivate a subject they find interesting. The departmental system, with its powerful and unique defenses for protecting individual interest, provides the citadel within which to cultivate one's own concern.[14]

It should not be suggested that this attitude is necessarily all bad. Such balance is needed to counter the effects of an overly aggressive central administration, which in the American tradition has been the single most important force on the campus. (In fact, if the more thoughtful of the militant students sincerely seeking university reform could realize it, their natural adversary is the faculty, and their natural ally is the administration.) In most instances it is the central administration that sees the broader purposes of an institution and seeks to move toward them. It is the central

administration that seeks innovation; that encourages self studies to create a climate favorable to reform and change; and that suggests new ideas and encourages their growth.

Actually, under ideal conditions these two forces, the administration and the faculty, are complementary. Institutions with an overly powerful, dynamic administration that is not checked by an effective faculty exercising the instruments of restraint cannot long remain in balance. Conversely, institutions atrophy and lose viability if the faculty gains enough power to thwart the efforts of a weak, ineffectual administration. Universities should be organized so as to bring the forces of faculty conservatism and administrative progressivism into "creative tension." But such an undertaking requires courage, skill, and energy.

Faculties should be delegated considerable authority over those matters for which their collective wisdom and expertise are most pertinent. While it is true that trustees ultimately must mediate between the supporting constituency and the institution, and therefore should always retain the right to act in a sovereign corporate capacity (except for situations that involve institutional survival), certain powers should be delegated to the faculty members through departments, committees, senates, and finally the corporate faculty itself.[15]

Faculties should have a large measure of authority over the various curriculums. They should have some influence, shared with administration, over their own membership, with the right to decide whether or not a person has the scholarly arts and skills needed in the department and will make an effective, representative colleague. Faculties should have considerable jurisdiction over student admissions and over graduation requirements, subject to general conditions imposed by the trustees. Last, faculties should have broad policy-making authority over the conditions of student life on campus, because the general conditions of the learning environment affect the student's responses to instruction and his assumption of responsibility for his own inquiry and learning.

Such faculty authority is significant, and many contend, in view of the conservatism of faculties, that granting this power may result in institutional stagnation. This danger can be minimized, however, by assigning counterauthority to administration. To presidents, deans, directors, and department heads should go participation in budget preparation and control. No president responsible for the financial liability of the institution can yield ultimate authority in this matter; however, he can exercise it both

directly and, more importantly, indirectly by holding administrative subordinates responsible and accountable.

Administration also has the power of appointing administrative subordinate officers. Through the appointment of a dean a president influences the tone and direction of a professional school; through the appointment of a department head a dean influences departmental activity. Supportive of these two prerogatives are the execution of policy, the possession of information, the generation of data, the right to propose agenda items, certain specified veto powers, and the traditional authority and status inherent in high administrative posts.[16]

Increasingly important is the role of the student in university governance. A current opinion holds that students ought to be voting members of committees, senates, departments, and even of boards of trustees.

In opposition are those who believe as follows: (1) Students are immature and lacking in experience appropriate to the responsibility of substantial participation in policy formulation, are impressionable at best, and at worst are often intellectually irresponsible. (2) Because of a short-term connection with the university, students have correspondingly limited loyalty, lack a sense of history or tradition, and bear no legal responsibility for the institution. (3) Students would be bored and impatient with what takes place during most faculty committee meetings and have nothing positive to contribute to the meetings. Probably they should be thankful they are not obliged to attend. (4) Finally, if students can do a better job than the faculty, they ought to be doing the teaching.[17]

These are the two extreme positions. The implication of the opposition opinion is that there would be no objection to greater student involvement if students could measure up to the standards of educated adults. In response it might be said that students *do* measure up well enough to make important contributions to the fellowship of learning. Further, students of college age today have many of the responsibilities of the adult world and are as mature as the general adult population. They can act as intelligently as adults when given meaningful responsibilities. Therefore, if they are denied participation, it is not because of their inadequacies but because faculty and administrators do not want procedures disturbed that now work for their own convenience and advantage.

The contributions students could make to institutional governance are worth considering. The university is the center of learning; consequently, what is learned in class is as important as what is taught. And who could be a better authority on what is learned than students? Since no method of

evaluating the classroom effectiveness of instructors has been widely accepted, there would seem to be merit in at least giving the learners, along with those who teach, the opportunity to seek for and influence change.[18]

It is merely to say the obvious to suggest that students have limited experience, that they lack legal obligation for the university, and that loyalty is circumscribed by personal interests. Is the situation much different with the faculty? Students may identify with a university as alumni in a way the faculty never will. As for administrators, when one considers that the average tenure of university presidents is about four years (hardly longer than the period spent by students likely to participate in the institution's governance), one must conclude that continuity cannot be the sole basis for involvement in policy formation.

The frequent fear that students intend to take over teaching responsibilities in the classroom is, of course, ludicrous and unfair. There is no evidence that more than a very few students want to take over the university, in the classroom or elsewhere. Students in increasing numbers, however, observe that the academic community, which they had reason to believe was composed of faculty, administrators, and students, actually does not include students in governance. They see in most universities, or at least in those with the greatest influence, that the "community" means faculty as the ruling class, administrators as second-class citizens — a necessary evil — and students as a necessary anvil. "But students have contributions to make, and the conviction grows that if students are required to act as anvil, they should also have a hand on the hammer."[19]

V

Any system of shared responsibility can succeed only if several conditions are present and functional.

First, as is obvious but often difficult to achieve, there must be a desire on the part of the faculty and the administration for shared responsibility — responsibility shared *among* administration, faculty, and students. Much of the current campus strife is the result of rampant elitism, which is the opposite of sharing.

Second, there must be a willingness on the part of trustees to make definite, formal grants of power and to realize that their role as protectors of constituent interests can be served best if they remain uninvolved with the details of administration (a professional undertaking). Similarly, administration and faculty must be willing to allow the other element discretion in its own sphere.

Third, there must be written constitutions, bylaws, statements of policy, and specified procedures to ensure due process. In the past, universities have operated on commonly accepted norms of behavior and conduct, because slowly growing educational institutions were not unlike primitive societies regulated by unrefined conventional wisdom. But a complex, rapidly expanding culture requires greater bureaucracy and specification of appropriate behavior.

Fourth, there must be greater openness on the campus, a willingness to share information and intelligence. Progress is being made, but it must be made more rapidly if the ideal of shared responsibility is to be realized. For instance, a president aware of impending budget imbalance cannot secure the benefit of faculty wisdom and faculty and student cooperation unless he is willing to distribute copies of real, not make-believe, budgets.[20]

"The great tradition of the universities stresses the value of community, of mutual respect, and concertive effort to achieve the humane life. These can be realized only through some version of shared — shared by all — responsibility for a professional undertaking."[21]

The shibboleth for higher education in a time of accelerating change is a line written in old age by the Athenian businessman-statesman-poet Solon: " 'As I grow old, I keep on teaching myself many new things.' Solon was writing from experience: for Solon's country, Attica, had been passing through changes in his lifetime which, in their magnitude and their speed, are comparable to those which we are having to try to adapt ourselves in our day."[22]

In the fairy tale, it took a child to call attention to the fact that the emperor was naked. Let us not leave to children the task facing us.[28]

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The Education of Adventist Administrators

66 RICHARD C. LARSON
WILFRED M. HILLOCK

One of the most valuable resources of the Seventh-day Adventist church is the managerial ability of the administrators in conferences and institutions. Skill in solving basic economic problems through efficient personnel relations and management of capital has played an important role in the success and growth of the church. The dynamic nature of our world requires that today's church leaders be better educated than their predecessors were. The purpose of this study is to explore the educational backgrounds of key administrators in the Seventh-day Adventist church and to see how the education of future administrators can be improved.

I

To gather information, we mailed a questionnaire to 208 administrators of the church. The list of these, chosen from the 1970 edition of the *Seventh-day Adventist Yearbook,* included officers of the General Conference, the overseas divisions, and the North American union conferences. Also included were presidents and treasurers of North American local conferences having more than 10,000 members, and presidents of conferences having 5,000 or more members. Administrators and board chairmen were included for all colleges with 500 or more students; university presidents and vice presidents; and administrators for all hospitals with a bed capacity of 150 or more, publishing houses, food factories, and other major organizations.

Slightly over 50 percent responded to the questionnaire; 105 of the 208 administrators returned the requested information. The category with the

highest proportion of response was that of presidents and vice presidents of general, division, and union conferences.

The results of the returned questionnaires were both expected and unexpected. For example, the proportion of Adventist administrators who have had college education is slightly higher than that of administrators in the largest business corporations in America. Eighty-six percent of Adventist administrators were graduated from college (TABLE 1), whereas major business corporations report that 80 percent of their board chairmen, 85 percent of their presidents, and 86 percent of their vice presidents are college graduates.

TABLE 1. Undergraduate Education

POSITION	NO COLLEGE	SOME DEGREE	COLLEGE DEGREE	TOTAL
General, division, and union conference officers	0	7	36	43
Local conference officers	0	2	21	23
Educational administrators	0	0	14	14
Institutional administrators	1	5	19	25
Total	1	14	90	105

TABLE 2. Highest Degree Earned

DEGREE	GC, D, U ADMIN	L ADMIN	E ADMIN	I ADMIN	TOTAL
Doctor of Philosophy	1	0	8	1	10
Doctor of Education	1	0	2	0	3
Doctor of Medicine	0	0	1	1	2
Bachelor of Laws	1	0	0	0	1
Master of Arts	8	6	3	4	21
Master of Science	0	0	0	2	2
Master of Hospital Administration	0	0	0	2	2
Master of Business Administration	1	0	0	1	2
Bachelor of Arts	19	9	0	4	32
Bachelor of Science	3	2	0	4	9
Bachelor of Theology	2	4	0	0	6
None	7	2	0	6	15
Total	43	23	14	25	105

LEGEND: GC — General Conference; D — Division Conference; U — Union Conference; L — Local Conference; E — Educational Administration; I — Institutional Administration

Forty percent of the administrators responded that they hold graduate degrees (TABLE 2). If educational administrators (all of whom hold graduate degrees) are eliminated from the calculation, 31 percent reported having completed graduate programs. Of the hospital administrators, 70 percent attained the master's level or higher.

Findings on undergraduate majors indicated that religion was the most common subject major, with 50 church administrators (48 percent) indicating this category. At least 1 person from each category indicated that he had majored in business or accounting, and a total of 26 administrators (25 percent) had studied business as a major for the baccalaureate degree. Other majors reported were: history 8, the sciences 5, English 3, education 2, speech and modern languages 1 each. Some who did not complete the bachelor's degree indicated a major area of study for the two or three years they had attended college.

Five men who had studied business as a major had not remained treasurers or institutional administrators, whereas 10 who majored in religion had become treasurers or institutional administrators. The most popular subject area for a second major or minor was history; 39 indicated this subject. Other frequent second areas were: religion 18, education 14, and business 7.

Respondents indicated that graduate study was not heavily oriented toward religion. Four areas of study were almost equally represented: 12 each in religion, business, and education, and 11 in history. The two other subjects with significant representation were hospital administration 5 and church history 4. Predictably, presidents tended to choose religion and church history; treasurers chose business subjects; and educational administrators studied education and history. Secretaries of the various units, for the most part, divided their graduate degrees among religion, business, and history.

The administrators surveyed included representatives from every Adventist college in North America and a number of Adventist schools overseas (TABLE 3). Older colleges, as can be expected, have a larger representation, Union College contributing the greatest number, 16.

Thirty-six of the 105 did not answer the question about what subject had contributed most to their effectiveness in their present positions. Of those who did answer this question, 34, the largest number, indicated business and economics as the most helpful. Of these, 19 were not in treasurer's work. Of the business subjects, accounting was indicated by 22 as the largest contributor. Nineteen named religion courses as primarily contributing to

TABLE 3. Colleges Attended

COLLEGE	GC, D, U ADMIN	L ADMIN	E ADMIN	I ADMIN	TOTAL
Union College	6	5	1	4	16
Non-Adventist College	3	4	0	4	11
Andrews University	5	4	1	0	10
Columbia Union College	8	2	0	0	10
Pacific Union College	4	1	0	4	9
Walla Walla College	3	2	2	1	8
Loma Linda University	2	1	1	2	6
Atlantic Union College	3	0	0	1	4
Avondale College	2	0	0	1	3
Canadian Union College	0	0	0	2	2
River Plate College	1	0	1	0	2
Southern Missionary College	1	0	1	0	2
Helderberg College	0	0	0	1	1
Marienhoehe Seminary	1	0	0	0	1
Madison College	1	0	0	0	1
Newbold College	0	0	0	1	1
Oakwood College	0	1	0	0	1
Southwestern Union College	1	0	0	0	1
Not Named	2	3	7*	4	16

* It was difficult to determine the undergraduate schools of educational administrators, since they had attended several colleges and universities at both graduate and undergraduate levels.

their present effectiveness, and 6 gave credit to the behavioral sciences. Many disciplines were indicated by 1 or 2 administrators, but the only other subject with more than 2 was speech, which was mentioned by 4.

Even more difficult to answer was what subject had contributed least to effectiveness in the respondent's position. Here, 46 percent failed to respond. Many apparently thought that all their courses had made a contribution; others thought that some subjects could have been given less emphasis in the undergraduate program. Among the subjects most often indicated were science, history, languages (including Greek and Hebrew), applied arts, and statistics. History, the most chosen second major or minor, was taken by 37 percent, and also figured prominently in graduate work; but it was also a close second to science as the subject that contributed least to the respondent's present position (20 percent of 54 percent response).

For the most part, the administrative persons were at least 15 years beyond the baccalaureate degree (TABLE 4). Only 2 of the 105 respondents were less than 35 years of age, and 65 was the effective retirement age. TABLE 4 provides a distribution of the present ages of the group surveyed.

TABLE 4. Age Distribution

AGE	GC, D, U ADMIN	L ADMIN	E ADMIN	I ADMIN	TOTAL
Under 35	1	0	0	1	2
36 to 40	0	2	2	4	8
41 to 45	1	7	4	4	16
46 to 50	7	2	4	2	15
51 to 55	12	6	1	3	22
56 to 60	11	3	2	9	25
61 to 65	7	2	1	2	12
Over 65	3	1	0	0	4
No response	1	0	0	0	1
					105

II

Each administrator was asked, on the basis of past educational experience and the professional demands of his position in church administration, what suggestions he could offer for the improvement of college and university curriculums for future Adventist administrators. Although there were some sharply conflicting opinions, there were also some opinions held in common.

The respondents generally agreed that the selection and training of church executives has been too much on a trial-and-error basis and that more specific programs should be designed for future administrators. Many thought that such programs should be reserved for those who have been especially selected. A division secretary expressed these ideas:

> There is a need to develop a curriculum specifically designed to train leaders and administrators for the church — a curriculum with a more definite focus. There seems to be emphasis on general technical skills, but I wonder if some study should not be given to the conceptual and human relations skills. It appears also there should be some method of selecting persons of talent and aptitude for leadership, and a plan for encouraging enrollment in the course. A type of internship plan might help to solve some of the trial-and-error methods of present leadership.

According to the president of an overseas union conference, "church administrators attain their dizzy heights by accident rather than design. This should not be so. Courses in administration are needed. I hope they will be provided on many levels."

A local conference president also supported this view: "Up to this point, for the most part, the church has depended on raw natural talent and practical experience. However, it is becoming obvious that this method alone

will no longer keep up with the growth of the church and its institutions. We need to start recognizing [young] administrative talent and directing people into both formal and practical learning positions."

The idea of an administrative training program was widely supported by church leaders. A General Conference officer suggested that a new approach be structured: "If some program for inservice training could be structured, future administrators would be greatly helped. Perhaps our system of appointing men as administrators, especially presidents, without specialized training has weaknesses."

Some respondents suggested that the education of future administrators should be adapted to a specific type of administration. A union conference treasurer thought that the term "Adventist administrator" is too broad, and that the training "should be considered on the basis of the type of administration the student might be looking forward to in church work. A curriculum should be designed to fit him adequately for that aim."

An associate secretary of the General Conference commented that church administration "means many things — and makes different demands, depending on what area one is in. Hospital administration, publishing house administration, and school administration are technical fields, and each one needs men especially prepared for it. Administration of a conference makes a different demand. Here one must not only administer in the usual sense of the word but must also act as spiritual adviser, counselor, public speaker, and, in effect, pastor to the organization he represents."

Many respondents made specific suggestions about the content of curriculums for future administrators. A vice president of the General Conference recommended courses in public relations (or communications), management, finance, statistics, and business law. "When I attended college," he said, "there was really nothing offered to prepare one to work in administration. Things have improved, but there needs to be strengthening of courses that would help qualify those who will be in church administration." A local conference president recommended basic courses in business administration, personnel management, and counseling. One administrator suggested training in how to get along with people and how to preside over a committee or a board.

Many conference presidents thought that they should have taken more business courses. For example, one said, "I believe we should put more emphasis on business subjects. This may mean less of science, languages, and history. Fortunately, before my college days I had a business background which has been beneficial in my work."

"It would be very helpful," said a university official, "if future Adventist administrators could have greater exposure to the thinking of persons who have been successful in modern management, methods of problem solving, data processing and information systems, personnel training and management, etc. Of equal importance is a knowledge of communications, in both a technical and a social sense. To all this, of course, should be added significant exposure to the humanities, so that administrators and managers may be worthwhile human beings first of all."

Many expressed concern for inclusion of a course specifically aimed at providing better understanding of the organization, policies, and practices of the church. A union conference secretary-treasurer said that here is one of the worst deficiencies of the present educational program.

What is called for, it appears, is a blend of the courses now offered in religion, behavioral sciences, and business administration. A church leader in Europe expressed it this way: "Even theology majors need greater emphasis on practical subjects such as business. The ability to cope with finance successfully is essential to every administrator, particularly in European conferences and institutions. However, an equal necessity is a firm understanding of practical religion if the conferences and institutions administered are to do their part in church progress."

An associate secretary of the General Conference stated that a basic course in accounting should be more widely required. A university administrator said, "Behavioral sciences are becoming more and more important." Administrators educated in theology sensed their need for a better understanding of theology. A conference treasurer suggested that "all prospective Adventist administrators should be urged to take some work in religion and homiletics."

A minority disagreed with the idea of a specialized curriculum for administration. One conference president said, "The conference administration is so varied and so changing that book learning and theoretical planning are totally inadequate." A hospital administrator, anxious that the church not attempt to provide graduate study in administration, said, "I do not believe that we have the resources to compete with professionals in the large universities, and I fear it would tend to develop inbreeding."

III

One opinion to which we, along with many of the respondents, take exception is that training for future administrators should differ according to the type of administrative position the trainee is looking forward to. We

hold that there is a universality to administration; that the principles of planning, organizing, staffing, directing, and controlling are the same in any enterprise; and that spiritual leadership is necessary in any branch of the church if the units are to move forward in their mission.

It appears that in practice the Adventist church has subscribed to the idea of the universality of management proposed by management scholars since the time of Henri Fayol and Frederick Taylor. The careers of many Adventist administrators trace a pattern through a number of so-called types of administration. It is not unusual, for example, for a conference administrator to become the leader of an educational institution, or for a treasurer to become a president. Hospital administration can serve as a background for conference administration. In each case, the reverse is also true.

The essential ingredient for effective leadership is that an administrator understand and apply principles that will move people toward goals, focus their attention on defined objectives, and secure their cooperation in achieving these. A thorough understanding of church objectives and of skills in the methods of influencing people should be the key elements in any training program for church administrators.

In summary: Adventist church leaders are of the general opinion that an administrative curriculum should be developed. Many believe that a procedure should be devised to select those who show leadership traits. There is a division of opinion as to whether the training program should be offered on the graduate level or the undergraduate level. It is widely accepted that the administrative curriculum should be followed by an internship program. Suggestions for curriculum content are varied, but the emphasis is on religion, business administration, communication skills, and the behavioral sciences.

Shall We Subsidize the Student or the College?

74 ROBERT H. HERVIG

The debate over what are the most desirable policies for federal and state governments to follow in aiding public higher education rages with increasing intensity. In this context it may prove fruitful for the Seventh-day Adventist church to reexamine its own policies seemingly hallowed by tradition and therefore often unchallenged. In particular, the church should consider the possibility that aid given to institutions provides "disguised cash subsidies to those United States citizens who need it least" and that "direct student aid is by far the most potent stimulant of institutional diversity and competition that is available."[1]

As matters now stand, all Adventist colleges and universities receive substantial operating and capital improvement grants from church conferences in fairly stable and generally escalating annual amounts. These grants operate to reduce the amount of tuition that would otherwise have to be paid by students if the level of educational services is to be maintained. Since each student pays the same tuition rate, the grants, or subsidies, are passed on to each student, in effect, without any regard for his need for such aid. The church helps the only child of the millionaire precisely to the same extent as the child who is totally on his own.

The traditionalist is quick to say, "But we've always done it this way. And besides, the church has to treat everyone the same." The first statement hardly warrants comment. The second claims credentials of equity and fairness that demand appraisal. Are all really treated the same? And should they be? Let's examine some of the present practices.

Most large Adventist churches operate elementary schools. Although tui-

tion charges may be fixed at a uniform amount for each student, churches invariably maintain a "student aid" fund to assist families unable to meet the full cost. Operating under the so-called Temple Plan, some churches assume the entire burden of school costs through contributions of the membership as a whole, and attendance is then open to the children of all members. Obviously, therefore, on the elementary level the church endeavors to adjust the charges to families (including those who have no children in school), at least partially, on the ability-to-pay principle.

The same practices prevail to a lesser degree in Adventist secondary schools and colleges. Here the local churches play a less prominent role, although it is not unusual for an individual church to sponsor one or more of its young people beyond the elementary level. Private loan or scholarship funds were the chief sources of such limited aid as was available until the federal and state governments stepped into the picture. During the past decade in particular, governmental agencies have released a vast sum of dollars to aid students in meeting rapidly rising college costs.

The interesting thing about these government funds is the manner in which they have been distributed. Funds could have been given as operating grants to various colleges to help cover operating costs — so as to keep tuition from rising so rapidly and to help all college students equally. But government agencies seem to have been wise enough to realize that some students need no help and others need a great deal of help. Therefore, much of this money has been released through a system that makes loans and grants to individual students on the basis of demonstrated need. What the government has been saying, in effect, is that the student who can afford to pay the full cost of his education should do so, whereas the poor student who is on his own or whose family can help very little should receive a great deal of assistance. Furthermore, the machinery for determining an equitable distribution of these funds has been set up and is currently being used by all Adventist colleges and universities.

It seems, therefore, that someone should suggest that we reevaluate the church practice of channeling directly into the institutional budgets those dollars earmarked for support of college and university operations.

As I have already indicated, the practice of using general church funds to help those students who especially need help is well established, particularly on the elementary level, and to a lesser degree on the higher levels. It is now pertinent to observe that this year at least two Adventist colleges are setting aside from their depreciation funds substantial sums to be used for grants to needy students. The machinery for determining individual

need has already been created (in the form of the College Scholarship Service) and has been used by all Adventist colleges for years in distributing federal funds to students; so this is no problem.

I suggest, however, that student aid is at least a questionable use of depreciation funds. Would it not be more logical to take those general church funds that come to the college in the form of operating grants and convert all or part of them to student aid funds for allocation to individual students, using the same criteria and machinery that we are already using to distribute the federal grants?

What would be the financial effect if we were to use all of these operating grants for aiding the student who needs help rather than to give the money to everyone in the form of lower tuition, as we now do? At the La Sierra campus of Loma Linda University, for example, it would mean raising tuition rates by approximately $125 per year. The relatively affluent student would pay the full cost of his education, and the university would have about $185,000, in addition to government and private funds, to assist the students who are at the lower end of the economic spectrum. The $185,000 might be given in the form of outright grants or in the form of long-term, low-interest loans similar to National Defense loans, possibly with cancellation features for students entering church employment. The form of the aid and the conditions attached to it are policy matters that would evolve out of discussion and debate.

If such a proposal were to be adopted, perhaps it could be put into effect gradually over a period of several years. For obvious reasons, it could also be achieved best by a cooperative program involving all Adventist colleges. (It is encouraging to note that there is beginning to appear among the church educational leaders a recognition of the need to move away from competition toward cooperation. Here is an opportunity to try our wings on an issue unlikely to disturb greatly those "dreadful dragons," the vested interests!)

Inevitably, and rightly, the question will be raised as to whether or not this proposal is in harmony with the counsel of Ellen G. White. I think it is. These words provide an example: "Many are too poor to obtain without assistance the education that they require. The churches should feel it a privilege to take a part in defraying the expenses of such. . . . Besides this, in each conference a fund should be raised to loan to worthy poor students; . . . in some cases they should even receive donations."[2]

This is an appeal to both churches and conferences to provide not only loans but also grants directly to students, strictly on the basis of individual

need. No concern here about "invasion of privacy" or "treating everyone alike"! The next paragraph completes the student aid package by calling attention to work opportunities by which students might "partly defray their expenses."[3] Many other references can be cited also.

Well, there we have it: grants, loans, and work opportunities, all given directly to students on the basis of need. It sounds much like the federal government program, doesn't it? One might be tempted to wonder if the federal authorities have secretly been reading Ellen White publications! Or could this be a case where the "children of this world are wiser than the children of light"?

My proposal is that Adventist colleges, as their first act in what we hope will soon become the New Era of Cooperation under General Conference leadership, will agree to convert all conference operating grants into student aid funds, over a five-year period, using existing machinery to distribute funds to those students most in need.

Let's end the "disguised cash subsidies" to those who need them least, as far as operating grants are concerned. There will still remain the much larger capital grants for new construction as a continuing channel of direct aid to the institution itself.[4]

REFERENCES AND NOTES

1 Robert H. Haveman, New federal support to institutions and students: What emphasis?, *Liberal Education* 56:309-316 (May 1970).

2 Ellen G. White, *Testimonies for the Church* (volume six of nine volumes; Mountain View, California: Pacific Press Publishing Company 1900), p. 213.

3 White, p. 214.

4 I hope the views expressed in this brief article will stimulate a bit of dialogue.

LETTERS

I greatly appreciated and profited by Allan W. Anderson's philosophical-theological survey of Genesis 1-3 [summer 1970]. And Gary Land is so right in affirming that we must not confuse Adventist apologetics with history [summer 1970].

WILLIAM G. WIRTH
Pasadena, California

Although our church colleges and universities do not subscribe to the publish or perish dictum, with a growing number of Adventist scholars we should be more productive in our respective fields than we have been in the past. One deterrent is the lack of a press similar to the university presses which have served the cause of scholarship so well for so long. An "Adventist University Press" might be established with minimal costs by contractual arrangements with a high quality independent printing firm to publish selected volumes in this manner.

A few years ago the Alumni Association of the School of Medicine of the College of Medical Evangelists operated in some such fashion the San Lucas Press. At that time faculty productivity had not assumed the proportions it has now, and in time the project was abandoned. The basic idea, however, still has much to recommend it.

A recent penetrating and perceptive review by Gary Land [History from an Adventist Perspective, summer 1970] points up the importance of having history that is good history and not apologetics. Church publishing houses are rightly designed to carry forward the evangelistic function of the church. Their resources are not necessarily such as can be devoted to the critical evaluation, production, promotion, and sale of purely scholarly monographs.

The organization and sponsoring of some type of Adventist University Press would render a great service to the productive Adventist scholar in that it would assist in enabling him to produce sound work that would be taken seriously by the academic community in general. The normal course of university press activities in promotion would also regularly bring these works to the attention of libraries, scholars, and teachers everywhere. Such a definite arrangement would likely attract endowment funds from a variety of sources to assist in publishing worthwhile studies that might have only a limited sales potential.

GODFREY T. ANDERSON
Loma Linda, California

Congratulations to you and to Martin Turner for *Project White Coat* [summer 1970]. It appeared to be well researched, and I appreciated its forthrightness, not only in revealing the nature of the CBW research and its applications carried on at Fort Dietrich, but in raising the question of the church's present posture toward the military. I wonder if Saul, holding the coats of the men who stoned Stephen, would

qualify as a noncombatant. In its eagerness to show loyalty to civil government, the 1934 General Conference may have placed the church in a morally compromised position.

MARSHALL BREWER
Riverside, California

A slant on separation of church and state: *"As to religion, I hold it to be the indispensable duty of government to protect all conscientious professors thereof, and I know of no other business which government hath to do therewith."*

Who said it?

Suppose it were the devil. Would that make it suspect? Or Isaiah. Now is it true? The fact is — it was Tom Paine. *Now* what is it?

Does it strengthen or does it weaken the First Amendment proscription of church and state intermingling and intermeddling? That is to say, what does it do, if anything, to the long and jealously guarded wall of separation between church and state which many Americans seem to think of as totally inviolate. Never mind here the many attacks against it waged by those in both church and state.

If the separation concept is false, then we have nothing to fear but fear itself. If it is true, and American, and freedomly, why don't we confess our sins against it and square our practice of freedom with our long and loud — sometimes even gigmanic — protestations?

Also, if it is true, how come we can seem so smug in criticizing endlessly our Catholic friends for violating the wall when we also seem so willing and ready to join them in [so doing]?

No, this is not a salvation concept, or an appeal to make it into one. Just a plea for us to be true in word *and* in deed to that which we have said long since and which we believe with historical pride — and also with such decibellic and holocaustic gusto.

DONALD F. HAYNES
Glendale, California

NOTES ON CONTRIBUTORS

ALAN P. DAVIES (Poem) is a junior English major at Atlantic Union College. In 1969 he edited the college literary magazine, *Contours*.

HAROLD W. CLARK (Traditional Adventist Creationism), now professor emeritus of biology at Pacific Union College, taught there from 1922 to 1956. His bachelor of science degree was conferred by Pacific Union College (1922) and his master of arts degree by the University of California (1933). He has written: *The New Diluvialism; Genes and Genesis; Wonders of Creation; Crusader for Creation; Genesis and Science;* and *Fossils, Flood, and Fire.*

ROBERT H. BROWN (The Age of Meteorites), president of Union College, received the bachelor of arts degree from Union College (1940), the master of science from the University of Nebraska (1942), and the doctor of philosophy from the University of Washington (1950). He was chairman of the physics department at Walla Walla College and later was vice president there. His articles have appeared in several periodicals.

BRENDA J. BUTKA (Resurrection II), a caseworker for the Jackson County Department of Social Services in Michigan, earned the bachelor of arts degree at Andrews University (1970).

ROSS O. BARNES (Time — and Earth's History) is a graduate student in earth sciences and geochemistry at the University of California, San Diego. He earned the bachelor of arts degree from Andrews University in 1967, and from 1967 to 1968 he was assistant instructor in physics.

HARLEY E. RICE (The Church's Health Crusade) was associate secretary of the General Conference Department of Health from 1958 until his retirement in 1970. He has been a hospital administrator for seventeen years: from 1941 to 1949 at the New England Memorial Hospital and from 1949 to 1958 at Porter Memorial Hospital.

ROBERT E. CLEVELAND (Authority in a University) is vice president for academic affairs at Loma Linda University and provost of the University's La Sierra campus. He earned the bachelor of arts at Union College (1948) and the master of arts (1950) and doctor of philosophy (1957) degrees at the University of Nebraska. Doctor Cleveland contributed an article to the winter 1970 issue of SPECTRUM.

RICHARD C. LARSON (The Education of Adventist Administrators) is associate professor of accounting and management and chairman of the department of business and economics at the College of Arts and Sciences, Loma Linda University. He received the bachelor of science degree from Loma Linda University (1950) and the master of arts and doctor of philosophy degrees from Michigan State University (1959, 1968).

WILFRED M. HILLOCK (The Education of Adventist Administrators), assistant professor of accounting and management at Loma Linda University, earned the bachelor of science degree from Loma Linda University (1959) and the master of business administration at Indiana University (1960). He has been treasurer at the La Sierra campus of the University and secretary-treasurer of the Western India Union.

ROBERT H. HERVIG (Shall We Subsidize the Student or the College?) is La Sierra campus business administrator and assistant professor of accounting and management at Loma Linda University. He holds the bachelor of arts degree from Andrews University (1935) and the master of business administration from Northwestern University (1941).