

EDITORIAL

A MATTER OF FAIRNESS

The various lines of argumentation which have been presented in recent years by those who have been promoting the teaching of either the general theory of evolution or creation in public schools reveal some significant inconsistencies. These seem to tell us that we need to do more careful reasoning regarding the premises which guide our thinking and conduct.

In 1967 when repeal of Tennessee's anti-evolution law was under consideration, the president of the National Science Teachers Association, speaking in behalf of evolution, presented an argument from the standpoint of the need for academic freedom. He stated: "Society cannot tolerate any obstruction of the process of academic inquiry and the dissemination of information and ideas." This idea, that evolution must have a fair chance to present its case, has been promoted many times when the teaching of evolution has been interfered with. Hence it is surprising that one notes that when the California State Board of Education was considering the inclusion of the concept of creation in science textbooks, the various scientific and academic bodies defending the general theory of evolution said virtually nothing about academic freedom. Apparently academic freedom was not what the evolutionists really had in mind. Freedom to study the scientific evidence for evolution — yes, but freedom to study the scientific evidence for creation — no.

Creationists have not been paragons of consistency either, although in this case their inconsistencies do not appear to be as glaring as those of the evolutionists. For instance, earlier in this century, creationists were actively promoting in several states legislation that would make it illegal to teach evolution, because they considered it to be false, while recently they have been promoting the inclusion of creation along with evolution. Should error be thus tolerated?

Actually we are somewhat sympathetic to the view of presenting both creation and evolution in the public schools, not because we believe that neither or both theories are correct — we do not —, but because we have respect for the rights of those whose views differ from ours. What is done in private schools is more a matter of concern to those who support those private schools. We are not addressing ourselves to that aspect now except to mention that we hope intellectual honesty and thoroughness will prevail.

Each side of this controversy has at times promoted legislation that would make the teaching of opposing views illegal in public schools. It is

easy to forget how difficult it is to legislate truth. Such attempts appear to betray a degree of insecurity regarding the survival of personal opinions. Personally we are not at all afraid to allow the concept of creation to be compared to the general theory of evolution, as we believe that the evidence for creation by a designer is quite overwhelming. But if the idea of creation is not even allowed mention in science textbooks, as is the current practice, how can students, and society as a whole, draw correct inferences? Should information be thus stifled? Should not the students in the classrooms of our public schools have the privilege of making their own choice? The present position of the evolutionists means that many students will never have a chance to hear about the scientific evidence for design and a designer.

Also, the present practice of considering only the theory of evolution in science textbooks seems to be definitely against the desires of the majority of the citizens, at least in California. (See *Origins* 1:94-95 and this issue, p 42). In addition to this, a sizable portion of the citizenry believes in creation (see also p 42 of this issue), and by sanctioning the suppression of their views in the classroom, we have in effect a violation of the equal protection clause of the Fourteenth Amendment of the United States Constitution.

Should we allow this intellectual oppression to continue? We hope that a sense of fairness will promote a change.

Ariel A. Roth

REACTIONS

Readers are invited to submit their reactions to the articles in our journal. Please address contributions to: ORIGINS, Geoscience Research Institute, 11060 Campus St., Loma Linda, California 92350 USA.

Re: Clausen: An evaluation of the use of growth lines in geochronometry, geophysics, and paleoecology (*Origins* 1:58-66)

Number 2 of *Origins* put in its appearance yesterday, and I have been reading it as I walk to work. I note your lament that no one has yet picked Number 1 to pieces. Under such circumstances an editor naturally begins to wonder whether anybody has read the product of his labors. Such, I opine, is not the situation with *Origins*. Perhaps, in response to your lament, I should set about doing a bit of nit picking on Number 2, but as far as I have read I have found nothing to take exception to. In fact, as you may imagine, I was happily pleased that Dr. Clausen worked a good bit of astronomy into his article. In that area I can check him out, and what he writes reflects the present state of the discipline accurately and lucidly. Keep up the good work.

Raymond F. Cottrell
*Book Editor, Review & Herald Publishing Assn.
Washington, D.C.*

Re: Brand: A philosophic rationale for a creation-flood model (*Origins* 1:73-83)

I found Dr. Brand's application of Kuhn's paradigm concept to the conflict between the creation-flood model and the uniformitarian model very interesting. I question, however, the view of the creation-flood model as a "new" paradigm challenging the established uniformitarian paradigm. Historically the creation-flood paradigm is much older and the situation is rather more like the creation-flood paradigm being the old established paradigm now almost completely defeated by the revolutionary uniformitarian paradigm. And creationists find themselves not in the position of advocating a revolution to a new paradigm but rather attempting to show that the nearly won revolution by uniformitarians was unwarranted, like a deposed ruler using guerrilla warfare and minor skirmishes to keep alive the fight while stirring up popular support for a counter-revolution.

In practice I admit that it makes little difference. Creationists were so thoroughly defeated and in fact had a paradigm so slightly developed that they could but poorly defend it. So for all practical purposes we might as well view the counter-revolution as a new revolution.

Terry L. Anderson
*Assistant Professor of Physics
Walla Walla College,
College Place, Washington*

ARTICLES

C-14 AGE PROFILES FOR ANCIENT SEDIMENTS AND PEAT BOGS

R. H. Brown

Director, Geoscience Research Institute

It is sometimes proosed that the correlation between C-14 ages and depth as found in peat bogs and sediments demonstrates the validity of the C-14 dating technique. The comprehensive study presented below shows that such a conclusion is not warranted, since, in the great majority of cases, a linear relationship between depth and C-14 concentration does not exist.

INTRODUCTION

In the development of the radiocarbon dating technique, it was recognized that calibration against an independent method of dating past events was necessary for conversion of radioactive carbon measurements into real time. After the development of this technique Dr. Willard Libby was able to demonstrate an approximate one-to-one correspondence between radiocarbon age and real time over a range extending from the present into the early part of the second millennium B.C., provided that the specimen received its carbon from the biosphere during a relatively brief interval of time and was effectively isolated chemically since that time (Libby 1955). Hl. de Vries, H. E. Suess, M. Stuiver and Elizabeth Ralph, utilizing dendrochronological techniques, subsequently led out in the development of refinements for converting C-14 ages into real time (See Olsson 1970). The work of C. W. Ferguson to extend conversion of C-14 dates over an additional three millennia to beyond 7000 B.P. ("before the present") using bristlecone pine wood is well known (Olsson 1970). Excellent conversion charts and graphs covering the range from A.D. 1800 to 5350 B.C. have been published recently by the University of Pennsylvania (Ralph et al. 1973).

There is need for a basis on which to interpret radiocarbon ages in excess of 8000 B.P. other than by uncertain extrapolation. Furthermore, the presently available conversion system covering the 4000 to 8000 B.P. range rests on an insecure foundation due to the unique problems of bristlecone pine dendrochronology (insensitivity of growth ring sequences) and the reliance on C-14 dating to establish a master ring chronology which in turn is used to calibrate C-14 ages. Bristlecone pine dendrochronology presently supports the concept that prior to 1000 B.C. the relative C-14 level in Earth's atmosphere was higher than the value that has been maintained with little variation over the past three millennia.



FIGURE 1. Section through an ancient peat bog near the town of Sydney Mines, Nova Scotia, Canada. The peat is the darker and thicker layered material which forms the main part of the picture; it rests on lighter colored lithified sediments.

The investigation reported in this paper was undertaken in the hope of making some progress toward a better understanding of the relative C-14 activity in the biosphere during prehistoric times and toward an improved perception of the real time significance that may be attached to C-14 ages.

PEAT AND SEDIMENT PROFILE OBSERVATIONS

Peat bogs (Figure 1) and sediments that involve organic material contain information concerning C-14 activity in the biosphere that covers

the entire range of radiocarbon dating to “infinite age.” Unfortunately, this information is available only in a relation between two dependent variables. The three-dimensional relationship between radiocarbon age, feature depth and real time can only be seen in projection on the plane in which a C-14 age versus feature depth profile may be displayed. Real time is a hidden variable that extends normal to this plane. Lacking direct data concerning the relationship between either feature depth or C-14 age and real time, we can hope that a study of the empirical relationships between these two dependent variables will enable us to draw some useful and soundly based conclusions concerning the manner in which either of them have related to real time.

Idealized relationships that may be expected between C-14 age and feature or formation depth are illustrated in Figure 2. In plotting these profiles, I have chosen to present C-14 age on the ordinate axis to emphasize that it is a dependent variable. Plots of C-14 age versus depth can be visually classified as A-type, B-type and C-type. Under strictly uniform conditions an A-type linear profile would be produced. Real-time-dependent changes in the relative C-14 activity of the biosphere or in the rates at which sediments and bogs accumulate could produce profiles of either the B-type (convex toward the depth axis) or the C-type (concave toward the depth axis). Samples of A-, B- and C-type profiles that have been reported in the literature are shown in Figures 3, 4 and 5, respectively.

FIGURE 2. PROFILE TYPE ILLUSTRATION. The departure of the extreme age point from a linear relationship is given by δ . The C-14 age range over which the deeper portion of the profile departs from linearity is given by γ .

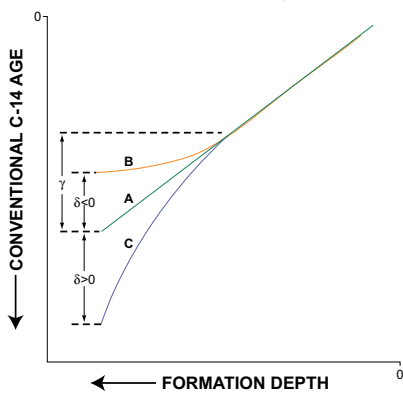
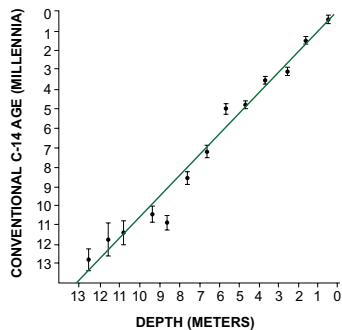


FIGURE 3. SAMPLE A-TYPE PROFILE. Torren's Bog (See Table 1).



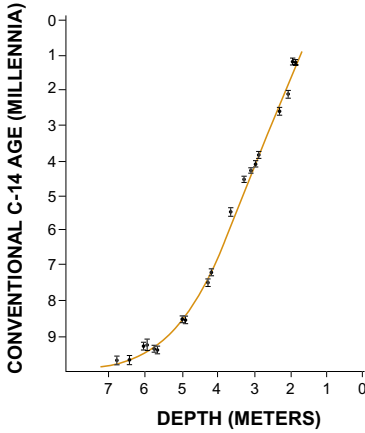


FIGURE 4. SAMPLE B-TYPE PROFILE. Trummen (See Table 1).

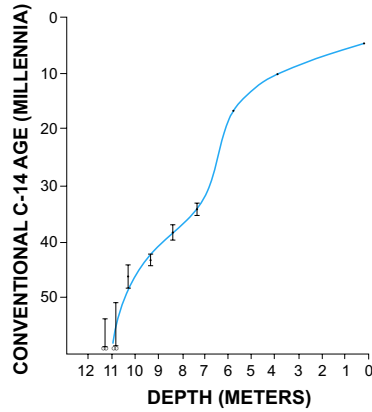


FIGURE 5. SAMPLE C-TYPE PROFILE. Padul IV (See Table 1).

Variants of the C-type are illustrated in Figures 6 and 7. Each point represents the measured value and \pm one standard error.

To make the analysis of a large number of features as objective as possible, a quantitative description of feature profile is necessary. The ordinary mathematical description of curvature would be useful only for profiles that are a straight line or a segment of a circle. A shape factor designation that has been found useful describes the profile in terms of the departure of the extreme end point (maximum age) from a linear relationship. As depicted in Figure 2, we set δ equal to the amount by which the C-14 age for the extreme end point departs from a linear relationship. The C-14 age range over which the extreme age portion of the profile is non-linear is represented by γ . This construction assumes that a straight line can be satisfactorily fitted to the data points for a more recent portion of the feature.

The profile shape factor S may then be defined as a logarithmic function given by Equation 1.

$$S = \ln (1 + \delta/\gamma) \quad \text{Equation 1}$$

Accordingly

- $S = 0$ for strict A-type profiles,
- $-\infty < S < 0$ for the B-type profile range of possibility,
- $0 < S < +\infty$ for the C-type profile range of possibility.

TABLE 1

FEATURE TABULATION

Reference is to **Radiocarbon** (New Haven, CT: Yale University), **volume**:page, unless noted otherwise. C-14 Age Range gives the total range in conventional C-14 years (5570 year half-life) of profile data given in the stated reference. Shape Factor is described in connection with Equation 1 of the accompanying text. Asterisk (*) indicates non-linear profile shape based on only one datum point at maximum of age range.

FEATURE	REFERENCE	C-14 AGE RANGE	PROFILE SHAPE FACTOR
A-Type Profile			
PEAT			
Hangklip, S. Africa	12:453	360 - 11,140	0
Red Moss Bog, England	12:592	4,370 - 9,798	0
Ballynagilly, Ireland	13:112	695 - 9,595	0.23
Tregaron S. E. Bog, Wales	14:240	2,922 - 10,205	0
Stockbergsmymren, Sweden	9:392	430 - 9,280	0
Sur-Les-Bieds, France	9:031	4,430 - 9,360	0.14
Kirchner Marsh, Minnesota	5:312	1,660 - 10,230	0 - 0.17 [0.08]
Torren's Bog, Ohio	9:324	420 - 10,960	0
Hershop Bog, Texas	12:253	1,520 - 10,920	0
SEDIMENT			
Sacred Lake #3, Kenya	12:448	3,285 - 33,350	0
Zombepata Cave, Rhodesia (charcoal)	15:550	2,110 - 37,290	0
Lake Victoria, Uganda (Pilkington Bay)	11:600	3,240 - 14,730	0 - 0.25 [0.12]
Kyoto, Japan	15:042	7,050 - 12,340	0
Lake Zeribar, Iran	11:593	8,100 - 22,000	0
Belle Lake, Ireland	16:007	5,490 - 12,235	0
Lake Vuolep Njakojaure, Sweden (shallow)	11:442	2,370 - 9,420	0
Selent Lake V, Germany	15:276	106 - 14,180	0?
Round Lake, Indiana	15:361	655 - 9,345	0
Myrtle Lake, Minnesota	11:575	2,680 - 11,120	0
Mediterranean Core 95	15:390	2,835 - 13,895	0
Middle American Trench, W. Coast of Mexico	10:270	2,080 - 11,500	0
Walvis Ridge, S. Atlantic	11:651	4,320 - 37,000	0
B-Type Profile			
PEAT			
Hallarums Mosse, Sweden	9:404	4,585 - 10,170	-0.82
S. Mjölstötmyren (B), Sweden	9:389	765 - 9,725	-0.72
Råbacka, Finland	10:269	3,510 - 9,430	-1.05
Jewell Bog, Iowa	10:255	2,365 - 11,640	-1.43
Denmark Bog, New Jersey	9:323	2,290 - 11,500	-0.53
Boriack, Texas	12:625	3,700 - 15,460	-0.35
Valle de Laguinillas, Colombia	11:355	6,510 - 12,320	-2.12
SEDIMENT			
Gandioli, Senegal	16:080	2,000 - 34,300	-2.37*
Lake Nojiri, Japan	11:595	1,530 - 11,800	-0.42

TABLE 1 (continued)

Timor Sea, Indonesia	9:279	2,320 - 19,000 and >30,000	-2.16*
Trummen, Sweden	10:040; 11:434; 12:535	1,130 - 11,730	-0.50
Selent Lake #IIN.W. Germany	15:273	1,300 - 24,830	-1.11 - 0 [-0.55]
Mid-Atlantic Ridge, S. Atlantic	11:651	5,940 - 30,100	-0.92
C-Type Profile			
PEAT			
Altnahinch, Ireland	15:220	1,525 - 9,555	0.53
Slieve Gallion, Ireland	13:113	2,670 - 9,660	0.54
Sluggan, Ireland	12:296; 13:124; 454,465; 16:272	985 - 12,360	0.82
Din Moss, Scotland	15:536	5,341 - 12,251	1.10
Ageröd, Sweden	5:208	430 - 10,680	1.43
Barsebäckmossen, Sweden	15:496	4,810 - 9,640	1.74
Hallviken, Sweden	9:395	1,305 - 9,860	0.32
Tisjön, Sweden	5:207	720 - 7,630	0.85
Meldorf, W. Germany	9:224	2,690 - 11,950	1.02
Hanhijänkä, Finland	16:254	1,660 - 9,680	0.77
Ayat, Central Ural Mtn. region, U.S.S.R.	10:461	3,510 - 9,780	0.31
Bog Remmeski, Estonia	13:79	2,560 - 10,770	1.03
Kalina, Estonia	12:239	1,415 - 9,130	0.39
Niederwil, Switzerland	14:43	4,960 - 12,780	0.45?
Padul IV, Spain	14:30	4,980 - 46,440, and >54,000	1.55
Disterhaft Farm, Wisconsin	13:479	2,850 - 15,560	0.65
Pretty Lake, Indiana	11:144	920 - 13,375	0.67
Colo Bog, Iowa	10:255	3,100 - 13,775	0.64
McCulloch Bog, Iowa	10:258	3,170 - 14,500	0.46
Woden Bog, Iowa	10:258	2,830 - 11,570	1.22
Brown's Lake, Ohio	11:145	565 - 10,915	0.68
Muscotah, Kansas	12:321	5,100 - 23,040	3.33*
SEDIMENT			
Kaisungor B, Kenya	12:447	765 - 27,750	2.78
Lake Elmenteita, Kenya	14:120	8,740 - 29,320	0.51
Lake Victoria, Uganda	11:551	860 - 9,550	0.28
Lake Huleh, Israel	11:591	2,480 - 32,900	0.80
Lake Jih Tan, Taiwan	11:597	4,200-35,500 and >47,000	1.15
Lake Yueh Tan, Taiwan	11:551	1,280 - 9,670	0.85
Lake Keilambete, Australia	12:568	610 - 14,300	1.27
S.W. Australia coast	9:280	5,900 - 10,000 and >25,000	0 - 1.90 [0.95]
Blea Tarn, England	15:557	4,476 - 9,872	0.38
Nant Ffrancon, Wales	15:157	4,256 - 10,080	0.60
Lake Vuolep Njakajaure, Sweden (deep)	11:443	2,410 - 8,980	0.65*
Ranviken Bay, Sweden	11:431; 12:536	750 - 12,670	1.06
Striern, Sweden	12:541	740 - 12,090	1.03
Könkäänlampi, Finland	16:254	1,660 - 9,680	1.18

TABLE 1 (continued)

Lake Pappilanlampi, Finland	11:068	9,200 - 20,800	2.06 - 2.26 [2.16]
Dolni Véstonice, Czechoslovakia(loess)	9:100	15,350 - 49,900 and >52,000	0.86?
Plöner See, N.W. Germany	13:327	1,140 - 10,810	2.55
Segeberger See, N.W. Germany	12:528	1,890 - 12,690	0.52
Selent Lake #I, N.W. Germany	15:272	380 - 10,170	1.74
Selent Lake #IV	15:274	920 - 17,390	2.16
Selent Lake #VI	15:276	780 - 30,930	3.90
Boniger See #I, Switzerland	12:367	6,030 - 10,430	1.20
Boniger See #2	12:367	2,700 - 8,370	0.85
Charcot Seamount, N.E. Atlantic	16:091	3,800 - 26,500 and >35,000	0.36
Golf du Lion, France(shell)	15:324,328	6,900 - 31,500	1.14
Longetray, France (rockshelter charcoal)	15:524	4,640 - 12,720	0.59?
Venice composite, Italy	Nature 244:339	5,000 - 46,000	2.03
Antifreeze Pond, Alaska	13:302	5,690 - 29,700 and >36,000	1.05
Lake Hill, Alaska	11:563	2,620 - 17,800	1.25 - 1.76 [1.50]
Lofty Lake, Alberta	13:289	3,460 - 11,400	0.58
Lake Quassapaug, Connecticut	11:567	1,020 - 12,330	0 - 0.76 [0.38]
Rogers Lake, Connecticut	11:550	630 - 10,510	0.80
Berry Pond, Massachusetts	15:360	995 - 12,680	1.30
Bog D, Minnesota	11:576	2,720 - 11,000	0.98
Rutz Lake, Minnesota	11:573	1,100 - 12,000	0.40
Kalaloch, Washington	11:579	16,700 - 42,700 and >47,000	1.34
Rockyhock Bay, N. Carolina	15:360	6,655 - 25,020	2.12
Singletary Lake, N. Carolina	10:263	5,750 - 35,800 and >40,000	1.11
Blake Plain C-19, W. Atlantic	15:393	4,130 - 15,995	1.53
Campeche Bank, Yucatan	9:314 10:347	16,340 - 40,7008 936 - 15,000 and >41,000	1.983.35

Data for the features that have been included in this study are presented in Table 1. This listing contains all significant localities that have well-established profile trends to or beyond 9000 B.P. as given in *Radiocarbon*, vols. 8-16 (1966-1974; vol.16, #3 is not included), and selected features from volume 5. Also included is a summary of data for the Venice coastal region that were published in *Nature*, vol 244 (1973). Since a subjective element is involved in curve plotting and determination of appropriate values for δ and γ , individuals who may wish to check this data should not expect to always agree precisely with the author's selection of shape

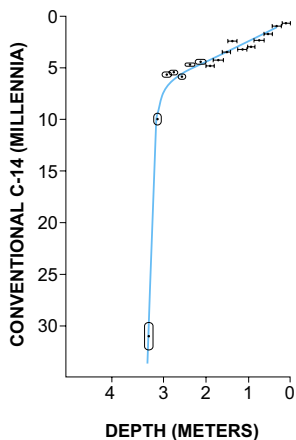


FIGURE 6. VARIANT C-TYPE PROFILE. Selent Lake VI (See Table 1).

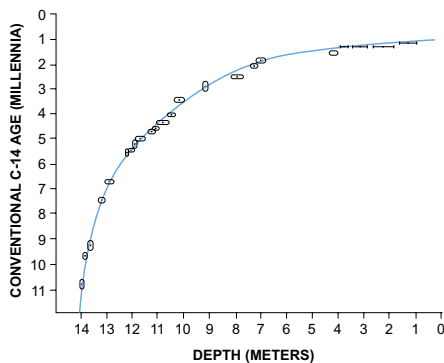


FIGURE 7. VARIANT C-TYPE PROFILE. Plöner See (See Table 1).

factor. Cases for which significant uncertainties exist are indicated in Table 1. An effort has been made to bias shape factor determinations toward zero (straight-line type profile) while being open-minded toward non-zero possibilities so that any conclusion reached will be trustworthy.

ANALYSIS OF COMPOSITE PROFILE CHARACTERISTICS

The profile shape factors from Table 1 are plotted in Figure 8. In this plot, shape factors have been grouped within ranges 0.25 shape factor units in width. Thus all shape factors between +1.00 and +1.24 are plotted in the first column to the right of +1. Those between +1.25 and +1.49 are plotted in the next column. All profiles for which $-0.24 < S < +0.24$ have been classified as A-type; and all profiles visually judged to be satisfactorily described by a straight line have been assigned a shape factor of zero and arbitrarily plotted between -0.25 and +0.25. According to this convention any profile for which $-0.22 < (\delta/\gamma) < +0.28$ is considered to be A-type, i.e., departure of the extreme age point from a linear relationship is within approximately one-fourth the C-14 age range of the curved portion of the profile.

Table 1 contains 98 features. Of these 22 or 22.4% have A-type profiles, 13 or 13.3% have B-type profiles, and 63 or 64.3% are C-type. The average shape factor for these profiles is 0.60 (within the third column between 0 and +1 of Figure 8), which corresponds to an average d/g

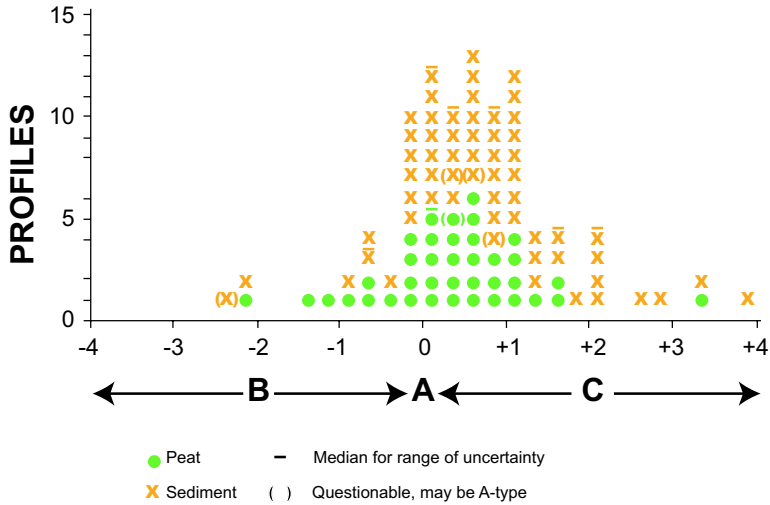


FIGURE 8. PROFILE SHAPE FACTOR SUMMARY. Number of profile shape factors failing within a given integral range 0.25 shape factor units in width. Profiles visually judged to be best represented by a straight line (A-type) are arbitrarily plotted between -0.25 and +0.25.

value of 0.82. Since the features for which this average has been computed do not all have an identical C-14 age range nor inflection at the same C-14 age, a quantitative interpretation of this average is uncertain. The value 0.82 is large enough to positively rule out compaction as the primary cause for the predominance of C-type profiles.

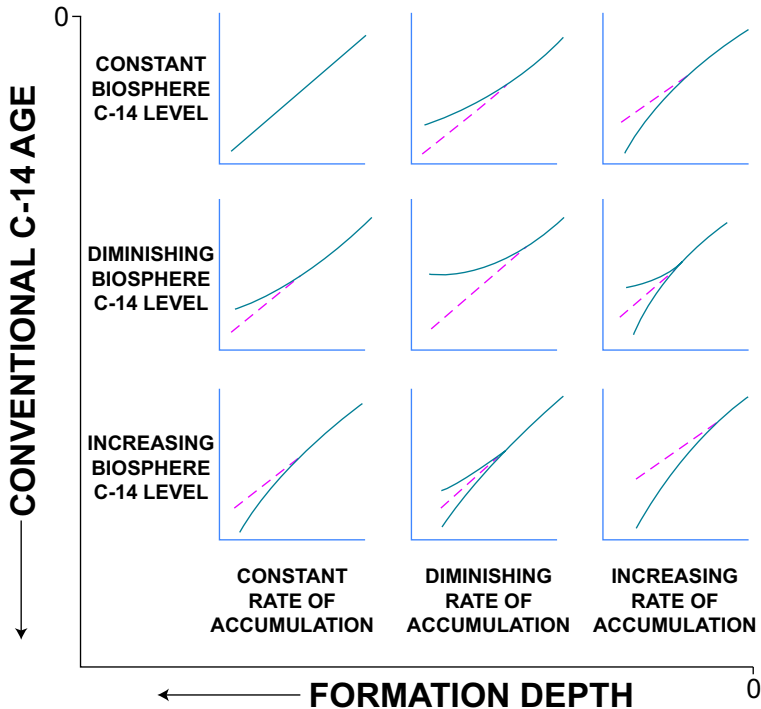
It seems to be clearly established that the predominant tendency is for ancient peat bogs and sediments to have a C-type profile. The various possibilities for profile development are given an idealized representation in Figure 9. A constant relative C-14 level in the biosphere and a uniform rate of accumulation will produce a perfect A-type profile, as shown in the upper left corner of Figure 9. Opposing changes in the C-14 activity level and the rate of accumulation can also fortuitously combine to produce an A-type profile, as indicated at the right of the second row and in the center of the third row of Figure 9. A C-type profile is seen to be the result of an increasing rate of formation, an increasing level of C-14 activity in the environment, or a combination of increase in both factors.

CONCLUSIONS

Explanation in terms of an increasing rate of formation accumulation for the 64% tendency toward C-type profiles found in this study requires

conditions that were relatively unfavorable, on the average, for peat bog growth and sediment accumulation (erosion) over the time covered by C-14 ages ranging between approximately 5000 B.P. and in the order of 30,000 B.P. The requisite conditions are a warm, dry climate or an arctic climate. Such conditions are not in accord with prevailing concepts concerning glaciation and ancient climate (Flint 1971); nor are they in accord with deductions concerning the probable consequences of a recent worldwide flood. These considerations, combined with recognition of the extremely steep early portions of those peat bog and sediment profiles that extend to the 30,000 and 40,000 B.P. regions, suggest explanation predominantly in terms of an increase in the relative C-14 level of the biosphere. This explanation also contributes to a rational basis for harmonizing C-14 ages with the chronological implications of the first eleven chapters of Genesis.

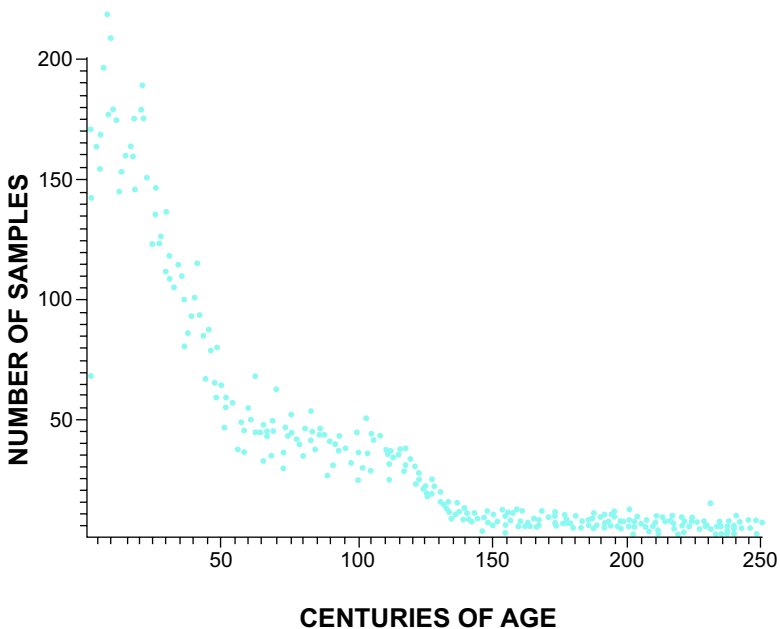
FIGURE 9. PROFILE INTERPRETATION GUIDE.



The existence of A- and B-type profiles for periods which are predominantly characterized by C-type may be accounted for as the consequence of local situations in which the initial rate of bog growth or sediment accumulation was so rapid as to counteract or overbalance, respectively, the effect of increasing C-14 activity on the feature profile. Such conditions may be expected during a period of cool pluvial climate, particularly when vegetation is being reestablished.

The suggestion that the specific C-14 activity in the biosphere was increasing as a general trend during prehistoric time is reinforced by Figure 10. In this figure over 10,000 radiocarbon age determinations that were reported between 1950 and 1965 are plotted versus centuries of C-14 age. Although it may be argued that the C-14 dating results available by the end of 1965 contain a representative sampling of the entire age range, it also should be recognized that accessibility and archaeological interests probably have favored a disproportionate collection of recent

FIGURE 10. FREQUENCY OF SAMPLES AS A FUNCTION OF C-14 AGE. Data from: Deevey ES, Flint RF, Rouse I, editors. 1967. Radiocarbon Measurements: Comprehensive Index, 1950-1965. New Haven, CT: Yale University Press. Plot courtesy Dr. H. C. Sorensen.



and intermediate dates. With due allowance for such possible bias, Figure 10 indicates plateaus in the availability of C-14 dates over the C-14 age ranges of 30,000-14,000 and 12,000-6,000.

These plateaus could indicate periods of rapid increase in the specific C-14 activity of the biosphere. During such periods the average specific C-14 activity of organisms at death would be constantly increasing, with production of a smaller number of specimens with a given initial activity level than would be the case under a constant level of C-14 activity. For such specimens a ± 50 year “window” in present measurement of residual activity would correspond with only a few years or possibly months during growth. Accordingly, the representation in Figure 10 could indicate rapid increase in the biosphere C-14 activity level during the period corresponding to 30,000-14,000 C-14 years, less rapid increase in this level over the period corresponding to 12,000-6,000 C-14 years, and approximate constancy of this level over the past 3,000 years (as confirmed by historical and dendrochronological calibration). Transitions would occur during the intervening periods.

A rapidly increasing C-14 activity level in the supporting environment also accounts for the anomalous C-14 ages associated with the Chekurovka mammoth — 26,000 for hair and 5,610 for overlying peat (*Radiocarbon* 8:320, 321); the Fairbanks Creek musk ox — 24,000 for scalp muscle tissue and 17,200 for hair (*Radiocarbon* 12:203); the Union Pacific mammoth — 11,300 for most recently formed ivory and 5,000 for wood fragments in the surrounding gravel (*Radiocarbon* 8:172, 173); and the Ferguson Farm mastodon — 8,900 for bone collagen and 6,200 for gyttja from within skull cavities (*Radiocarbon* 10:216).

The data covered in this report do not support the 10% decrease in biosphere C-14 activity level required by the currently accepted bristlecone pine master chronology between 5500 B.P. and 2500 B.P., unless it can be established that there has been a preponderant tendency for increased rates of sediment accumulation and bog growth over the past 5,000 years. This conclusion gains greater force on a detailed examination of the individual profiles listed in Table 1 (the g region of one-half the C-type profiles listed begins between approximately 5000 and 10,000 B.P., with one-fourth beginning below and one-fourth beginning above this range).

A general trend of increasing biosphere C-14 specific activity levels over the range of real time covered by C-14 ages between 40,000 and 5000 B.P. is strongly indicated, if not well established, by this study. Consequently C-14 ages in the prehistoric range should be expected to be progressively in excess of the real time involved.

Further refinement and expanded development on the suggestions contained in this report should prove fruitful. For example, it would be

desirable to determine the average profile trends for various geographical regions and for various portions of the C-14 age range.

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ARTICLES

MAN: CREATURE AND EXPLORER

J. Mailen Kootsey

*Assistant Adjunct Professor of Physiology
Department of Physiology & Pharmacology
Duke University Medical Center
Durham, North Carolina*

Is your brain the same as a computer? What is the hope of reality being fully understood? How does creativity fit into the scheme of physical laws? In answer to these questions, the author raises some thought-provoking ideas.

INTRODUCTION

As a person who is engaged in the study of life and who also believes in a God who reveals Himself as the sole source of life, I am faced with the following dilemma: How is it possible to believe that life can come only from one source and yet work every day as though life may be so common that its last mystery may evaporate at any moment? Is it necessary to split work and curiosity from philosophy and isolate them into separate compartments, or is it possible to weld them into one coordinated whole? Many — even the majority of scientists — have solved this problem in their minds by rejecting the belief in a creator or by watering down His position and function to a level compatible with their supposed understanding of nature. Those who persist in retaining both belief and curiosity are often regarded as somewhat schizoid.

Man's own nature often becomes the central issue in this controversy. Man is at once a mysterious creature with free will, creativity and capacity for abstract thought and at the same time is a part of the living world he studies. The dual role of man as investigator and subject confuses the issue further by adding powerful emotions. How can you be scientific and objective when discussing free will in an orderly universe if you begin by assuming that you have free will and would be loath to admit otherwise!

Scientific approaches to the study of life¹ have ranged between two extremes. In the mechanistic view, everything — including living matter — ultimately reduces to basic laws of physics and chemistry that can be unfolded in the laboratory. The vitalist, on the other hand, draws a sharp distinction between the organic and inorganic with the former containing something different in principle. Vitalism, as an understanding of the essence of life, appeals to the human ego because it makes living matter

much more special than inorganic matter; it allows the possibility that man may be different from animals in quality and not just in quantity. On the other hand, vitalism, by definition, puts the essence of life beyond the reach of science and thus is hardly a suitable companion philosophy for scientific curiosity.

The mechanistic view of life seems much more appropriate for a society that is so thoroughly committed to scientific explanation. Our society expects logical scientific understanding on every subject from our origins to the extension of our life. However, mechanistic explanations of life were resisted from the first because they point to the logical conclusion that man is also a machine, fully explainable by the laws of physics and chemistry and therefore not the unique and mysterious creature that he imagines himself to be. J. Müller,² Claude Bernard³ and others first suggested a century or more ago that the inner workings of the human body could be understood by the methods of science, but we are just now getting accustomed to the idea. Down deep inside we don't really want to be reduced to equations and tables and analyzed like machines.

So we are faced with the questions: Must the dignity and mystery of life disappear as we confidently go on prying loose nature's secrets and how do we reconcile this curiosity with our belief in a creator God?

COMPLETENESS

First, I would like to consider man's capability for understanding the natural world. What is the likelihood of finding the ultimate set of natural laws, a set that could account for every fact to be discovered in nature?

The most obvious limitation to the study of the natural world is our very restricted set of facts, but there is a more fundamental limitation. To understand it we have to consider the methods of study.⁴ The process starts with the compilation of facts. It is only a start, though, because facts pile up too rapidly and of themselves provide no means of making predictions about the future. The next step is to assemble a list of general statements which might summarize all the facts, along with a grammar for combining and relating the general statements. One then asks for each fact: Does it follow from the general statements alone and in combination according to the chosen grammar? If the answer is "yes," one can go on to the next fact. If "no," a change has to be made in the general statements or grammar, and the testing process starts all over again. Together, the general statements and the grammar form a theory.

It does not take much experience in theory building to see that a lot of time can be saved by substituting symbols for facts and grammatical rules. Once this has been done, it can be seen that theories in many areas of science have basically the same form. Much duplicated effort can then

be saved by studying symbol manipulation by itself, independent of any specific facts; this study is the world of mathematics. It was in the middle of the 19th century that George Boole and other mathematicians began to set down the formal rules of logic used in the process of deduction — going from general statements to a specific conclusion.

About the turn of the century, mathematicians addressed themselves to an important and fundamental question: Given a theory, is it always possible to decide whether a statement is or is not valid according to the theory?^{5,6} In 1919, Emil Post showed in his thesis that a certain simple theory of numbers is complete, meaning that there is a guaranteed process which will affirm or deny the validity of any statement in the language of the theory. In 1930 Kurt Gödel was able to prove the same thing for a whole class of theories. Mathematicians were hopeful that time would bring similar proofs for all classes of theories. Thus it was a surprise when, in another paper just one year later, Gödel showed that a broad and important class of theories was incomplete. Even though such a theory might be internally consistent, one cannot be sure of finding out whether a statement is true or false according to the theory.

Applied to a specific area of science, this result means that we can never say that we have arrived at the final set of laws. Not only are we limited by a small sample of facts, but as we go on finding new ones we cannot always be sure of knowing whether the new fact requires a modification of theory or not. Scientists are not discouraged by this limitation, however. We proceed on confidently, either using theories known to be complete or we hope not to be faced with the unprovable statement. Even with something as familiar as gravity, we have to settle for the confidence gained from long experience. To be completely honest, though, we have to admit that any day or any second might bring the fact which destroys our cherished “law.”

To illustrate this pragmatic approach to the understanding of nature, let us consider the properties of machines. There is a common idea that machines are “little pieces of nature” which are completely understood by man and therefore can be manipulated by him at will. The fear of mechanistic ideas of life is really the fear that sooner or later man himself will be put in the same category as the machine. On closer inspection, however, machines are not quite this simple. The “machine” really exists only as a concept in our mind; what we see and touch is an object built from our limited knowledge of nature to correspond to that concept as closely as possible. For example, take the common playground see-saw. In concept, the see-saw “machine” is a perfectly balanced lever resting on a frictionless pivot. However, in real life we are happy with an unbalanced board that may bend and crack and probably has splinters, a squeaky and

rusty pivot, etc. We tolerate these differences between the concept and reality because our theories can't account for all of them and because our bodies can quickly learn to adapt to them. To be sure, some machines come a lot closer to their conceptual counterpart than a playground see-saw, but the difference is in degree, not in kind.

BRAINS AND COMPUTERS

The subject of the brain springs to mind immediately when considering the limits of the study of life. Most of us might be willing to have our digestive organs or even our senses reduced to the level of machines, but there is one part that we definitely do not want to have oversimplified and manipulated: the human nervous system. Closely related to the subject of the brain is the development of computers. It is practically a truism of our day that the influence of computers is growing and that they are a threat to human individualism and freedom. I am going to pass over that tempting point and concentrate on a more fundamental question: How have the many advances in computer hardware and program structure and the increased knowledge of the nervous system altered our understanding of the human mind? Are they edging us closer to regarding the brain as a machine and therefore completely predictable and devoid of free will?

Some scientists definitely think so. One has put it in the form of a book title — *The Machinery of the Brain*⁷ — with the book's cover showing the inner workings of an ancient pocket watch superimposed on a man's head. The logic employed to arrive at such a conclusion is roughly as follows: computers and brains are alike in many ways. Both computers and brains are information processing devices, gathering information from sensors or senses, operating on it, and producing output ranging from printed text to glandular secretions. Computers and brains are constructed alike — they are both electrical in nature and both are made up of a complex array of interconnected small logic elements. Computers can be programmed to do many things humans do that fall under the category of "thinking," such as pattern recognition, language translation, problem solving, etc. Nervous systems, especially of some insects and animals, have been observed under some circumstances to show automatic or preprogrammed characteristics. Computers are built on a structure of strict logic and produce only predictable results. Since brains and computers are so much alike, it is likely the mind operates on a similar basis except it has many more components to work with than we are presently able to put together in one computer.

Let us now examine each of these ideas in greater detail. It is true that the brain has the characteristics of an information processing device such as the modern digital computer. This, however, is a very broad and general

statement and implies little more than the relationship of cause and effect. It should not be construed as implying anything similar about the nature of the processing.⁸ Getting across the Atlantic can be accomplished either by boat or plane, but that does not imply that boats and planes are alike in principle, construction, or limitations. Even the breakdown of the nervous system into input devices, a processor, and output devices is now known to be an oversimplification. The eye was once compared to a camera that simply relayed to the brain moving pictures of the outside world. Now the eye itself is known to be an information processor; it sends on to the brain only selected and biased information. The frog's eye⁹ reports to its brain only certain details of what it sees — primarily the presence of small moving shapes (insects for food) and large shapes (possible predators). Information selected by the human eye is not as specific; cells are grouped together to detect such general characteristics as edges and movement.

It also appears true that the brain is essentially electrical in nature with its “circuitry” broken down into smaller elements called neurons (10). One could even extend the analogy further and point out that neurons have a certain threshold or discreteness property producing states comparable to the “true” and “false” of digital logic. There the similarity ends. Neurons differ from logic elements both in their input-output relationships as well as in the number of interconnections with other neurons (Figure 1) — averaging 100 to 1000 per neuron in the brain versus 10 or less per gate in a computer. While digital logic elements operate according to a strict mathematical formalism, we know virtually nothing about the language of the brain. Only a little is known about the input-output relationship of neurons, and we know of no system such as Boolean algebra to help us make use of their properties. The brain is basically a parallel device while most digital computers are serial in operation. It has been estimated that the brain can handle 100,000 or more messages simultaneously while the largest computers can handle less than 100. (Many computers appear to be capable of more by switching rapidly from one job to another.)

The next statement about computers and brains in essence compares their behavior: Is it true that computers are now or soon will be able to imitate human thinking? In 1950, Turing¹¹ described what is now accepted as a minimum test for a machine to pass if its activity is to be called thinking. The test begins as a game with three people — a man and a woman in one room and an interrogator in another room. The interrogator is allowed to ask questions of the man and woman (whom he knows only by neutral identification, say the letters A and B) and they answer his questions. The object of the game for the interrogator is to figure out which is the man and which is the woman; it is the goal of the other two

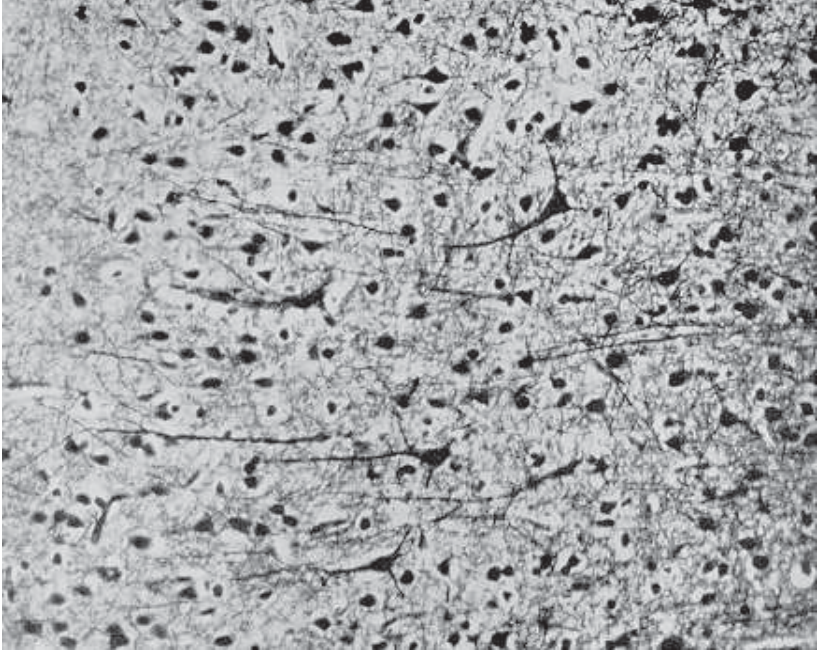


FIGURE 1. Thin section through the cortex of a human brain, magnified about 300 times. The neurons can be identified by the presence of elongated dark processes going out from the larger cell body. They are the largest cells in the picture. Only a few of the numerous connecting processes for each neuron are represented in this thin section. The smaller cells are supportive neuroglia cells.

to try and make the interrogator form the wrong identification. So that voice tones don't give the answer away, the questions and answers are passed back and forth by teleprinter. Now, Turing says, suppose we substitute a computer for the man or for the woman. If the computer is just as successful as the man or woman at fooling the interrogator, then we might say that the machine was capable of "thinking."

Of course no computer has come close to passing the Turing test. The immediate goals for computer behavior have been much more modest: game playing, language translating, problem solving, and pattern recognition. Dreyfus¹² has pointed out, in a book entitled *What Computers Can't Do*, that in each of these areas, the pattern has been the same: early dramatic success followed in a few years by unexpected difficulties.

Machine translation, for example, began in the early 1950s with the production of the first mechanical dictionary by Oettinger in 1954. There was encouraging success at first, getting together enough memory to

hold a reasonable-sized dictionary and writing programs that replaced each word with its translated counterpart. The resulting text was rough and unpleasant and in many cases simply unreadable or misleading. It was finally recognized that translation involved much more than substitution for words or phrases. The phrase “out of sight, out of mind” might, for example, turn into the equivalent of “invisible idiot”! The problem is that words and phrases frequently have more than one meaning and the human translator selects the most likely one based on the context and on his past experience. In essence what needs to be done, then, is to give the computer not only a dictionary but the cumulation of experience in the real world with objects and concepts with which the human translator comes equipped. In 1966, a report from the National Academy of Sciences National Research Council concluded that machine-aided translation was worthwhile, but that there was “no immediate or predictable prospect of useful machine translation.”

Each of the other areas has encountered similar fundamental problems. In game playing, it rapidly became obvious that only a few games like tic-tac-toe and Nim could be played (and won) by machines following rules covering all possibilities. In other more interesting games like chess, the total number of possible moves to be investigated mounts up too fast even for a computer. In planning a move in chess, if the computer was to consider each of the 30 possible moves of each player and look 2 moves ahead, it would have to consider 810,000 combinations. To look 10 moves ahead (about one fourth the length of an average game) would require inspection of 3×10^{29} possibilities. At the rate of one million per second, this would take 10^{15} years — and that for just the first move! The human player obviously uses shortcuts called heuristic methods, but it is not clear what the methods are or how they are found.

In problem solving, the impasse is the computer’s need to have the problem defined explicitly, while the human is able to recognize (by methods unknown) the essential elements of a problem.

We might summarize all these difficulties by saying that the human works well with a large array of ill-defined facts and in situations of considerable uncertainty while the computer must have both facts and rules defined clearly.

Some remarkable examples of automatic behavior triggered by signals from the environment have been observed in insects and animals. Consider the little *Sphex* wasp¹³ that lays its eggs in the paralyzed body of a cricket which it catches and buries in a hole in the ground. The wasp has a very definite routine which it follows in burying the cricket: it brings the cricket to a prepared hole, lays it down and goes into the hole for a last inspection. It then comes out and carries the cricket in. If this routine is interrupted,

say by moving the cricket away while the wasp is in the hole, the entire inspection routine is repeated. The wasp can be interrupted over and over again with the same result; it apparently never tires of the repetition nor does it think of omitting the inspection.

Other observations frequently quoted as evidence of automatic behavior are the brain stimulation experiments in rats and other animals. An electrode is inserted into a specified region of the brain. Electrical stimulation then produces a well-defined behavior pattern such as anger, fear, or satisfaction. A rat given the opportunity to stimulate itself by pressing a bar¹⁴ will (if the electrode is properly placed) repeatedly press the bar at a high rate ignoring fatigue, hunger, and thirst until it simply drops from exhaustion! These experiments indicate that there is probably an area in the brain responsible for each of these emotions, but they are not proof that the emotions are automatically triggered by external stimuli.

I submit that it is not appropriate to extrapolate from these observations on wasps and rats to the human brain and to state that human behavior is also programmed and automatic — only more complex. Some parts of the human nervous system are obviously automatic — like the reflex which removes a hand quickly from a hot stove — and perhaps we are governed by external stimuli to a greater degree than we would like to admit, but it does not follow that everything humans do is the result of preprogramming!

On the basis of the foregoing arguments, I conclude that there is no reason to believe that scientists will, in the near future, be able to write down a set of equations or flow chart an algorithm governing the operation of the human brain. While its study is interesting and may result in some useful aids to human thought processes, extrapolating from present progress to the final result is like the man who, after climbing to the top of the tallest tree, announces that he is on his way to the moon!

LAW PLUS CREATIVITY

It might well be argued that nature is governed by a set of fixed laws, but that man simply has little or no hope of finding the right set. All of science is based on this assumption because scientists begin by presuming nature to be regular and repeatable. The question then is: Would nature be dull and uninteresting if we did find a complete set of laws? Is the ultimate goal of science simply the determination of basic laws? I submit there is more to nature than just basic law. Before I am accused of supporting vitalism, let me give some examples and explain what I mean.

Let us suppose you are learning to play a game — one that does not depend on a random event like the roll of dice and one that does not require physical prowess. First you learn the rules of play and the object

of the game. Would you say at that point you have the game mastered and that it would be uninteresting to proceed further? Of course not; the real interesting part of the game — the strategy and response to the opponent — begins after the rules are learned.

Or suppose you want to be a writer. You begin by learning the rules of grammar and syntax and possibly how to organize your material. But this is just a beginning. You will also need some other abilities that are not quite so easily defined and taught — how to select an interesting topic, how to choose words with skill and imagination and weave them together artfully. You aren't an architect just because you know how to calculate the load on a support column and how thick to make the insulation. It takes something more to turn heaps of material into a structure that both fulfills a need and is pleasing to the eye.

In each of these examples, rules play an essential part. They provide the regularity and set the limits, but they are not the end of understanding — only the beginning. The interesting part is what can be done within the rules — something, I think, well described by the word “creativity.” The game player is creative if he can develop a strategy that ensures the object of the game — while obeying the rules. The writer is creative if he can communicate an idea successfully — without alienating the reader by breaking the rules of grammar. The architect is creative if he can produce a design which is functional and esthetically interesting — and which doesn't collapse under load.

What we see in the natural world can be thought of in the same terms: subject to basic laws and regularity, yes, but even if we did know those laws precisely, we still wouldn't have conquered and “explained” the natural world. Within the laws there is latitude for creativity beyond man's wildest imagination, latitude wide enough to include the complex processes of life as well as the simpler structures of the inorganic world. It is not necessary to look beyond the fundamental interactions of physics and chemistry for an explanation of life, because we have no idea of the limits to what can be accomplished using these building blocks. There is at present no shred of evidence that organic structures are subject to different laws than inorganic. There is only our skepticism that such complicated processes can come from such simple building blocks. Insofar as I can see, the main reason we have for this skepticism is the difficulty we have in being creative within these same limits and the difficulty we have in trying to figure out how Someone with more ability than ourselves has worked within the same rules.

Up to now, science has concentrated to a large extent on finding the fundamental rules in nature. I see us now undergoing a change in emphasis to a broader and much more complex study: how the fundamental building

blocks and laws of nature are used to make up the structures that we see, both organic and inorganic. The study of chemistry and bulk materials is a beginning, but we are challenged even more by the complex structures and interactions in the living world.

Shortcomings in our methods cause the difficulty in finding out how fundamental laws are used in complex structures. The only way we know is to build up a model of the complex structure using only the fundamental laws and our idea of how it is built and then see if the model behaves in the same way as the real thing. Model-making is usually accomplished with mathematics rather than with real atoms, because the mathematics itself doesn't add more uncertainty to the model. With all due respect to mathematicians, the tools they provide are only barely adequate to begin the job of understanding natural structures, even with the aid of powerful computers. I do wish the mathematicians success in developing more powerful methods, because unless some other method of study is found, our success in understanding how nature's basic rules are utilized depends on them!

PURPOSE

I would now like to return to the analogy of the game player. We have discussed the rules and the strategy of play, but what about the object of the game? We have seen the difficulty man has in deciphering the laws of nature and how those laws are used. What are man's chances of at least figuring out the object of the game?

Among the many authors that have written on the meaning and definition of life, there is quite general agreement that one of the characteristics of life is "purposiveness," i.e., individuals and even organs and smaller structures all seem to be constructed with a purpose or goal in mind. The human body, for example, depends for its very life on the oxygen intake and carbon dioxide eliminating functions of the lungs. The lungs, therefore, have a clear and necessary purpose in ensuring the well-being and survival of the body and they are constructed to accomplish this job most effectively.

When it comes to deciphering the purpose of an individual, however, we encounter evidence for two distinctive and quite opposite points of view. The view that is by far the more popular is that each individual — whether amoeba or man — has as its first and foremost goal self-survival. According to this viewpoint, every characteristic of an individual — shape and coloration, means of obtaining food, method of defense, social habits, etc. — are all geared toward survival of the individual at the expense of competitors.

There is also evidence for the contrary point of view, that the ultimate purpose of every individual lies in making its contribution to an overall

pattern in nature. Those who hold this view argue that there really is no such thing as an isolated individual; everything depends on everything else and each, in contributing to the general welfare, ultimately assures its own well-being.

Supporters of both of these views can cite substantial evidence in nature, so what do we do?

I think this is precisely the situation Ellen White had in mind when she wrote that “to man’s unaided reason, nature’s teaching cannot but be contradictory and disappointing. Only in the light of revelation can it be read aright.”¹⁵ So once again man finds a limitation. Even the object of the game in which he finds himself both participant and observer eludes him. But for this all-important question, man is provided with an answer directly from the One who made the rules and who works so masterfully and creatively within them. Through His revelation, in person and in word, we learn that the ultimate result of undivided self-interest is self-destruction and that the evidence for self-survival as a goal in nature is real, but is transient and will soon be eliminated.

GOD IN NATURE

God’s revelation of Himself to us is quite clear on one point: that He is the originator and the source in nature. But He also reveals Himself as being continually involved with His creation, and here we run into some difficulty. How do we understand His involvement in terms that are compatible with our scientific efforts toward deciphering nature? To me, the most tantalizing statements on this subject are the following: “But the power of God is still exercised in upholding the objects of His creation. It is not because the mechanism once set in motion continues to act by its own inherent energy that the pulse beats, and breath follows breath.”¹⁶ And in another place: “Not by its own inherent energy does the earth produce its bounties, and year by year continue its motion around the sun. An unseen hand guides the planets in their circuit of the heavens. A mysterious life pervades all nature — a life that sustains the unnumbered worlds throughout immensity, that lives in the insect atom which floats in the summer breeze, that wings the flight of the swallow and feeds the young ravens which cry, that brings the bud to blossom and the flower to fruit.”¹⁷

I see three possible ways of understanding God’s continual interaction with nature, any one or combination of which would fit the descriptions I just quoted. First, we might understand God’s power in nature to be His continual upholding of the regularity that man calls natural law. Science has no way of proving that this regularity must exist or continue; we only observe it and depend on it. Second, we might understand God’s influence

beyond creation to be felt through the design of created objects, i.e., that He creates with built-in contingencies to take care of all possible future situations. Third, we might postulate that God exerts a direct influence in ways that we are not consciously aware of. He might do this either through a kind of natural process that we have never observed or He might use familiar laws in unfamiliar ways. There is good evidence that man's thought processes can be influenced (even by other men) without his being aware of it.

I can do no more than offer these possibilities for your consideration. I think it is well to keep in mind, however, that God reveals Himself as working in regular, constant, and orderly ways. Thus I think it is safe to say that God's primary interaction with nature will also be regular, constant, and dependable. Contrast this with the objects that man constructs. He may plan them to be automatic, but they inevitably require corrective supervision to make them do what they were intended, simply because man's capacity for planning ahead is so limited.

Part of God's interaction with His creation may be in the form of what man calls "miracles." This doesn't tell us much about His method, though, because we are not in a position to say whether miracles are or are not outside the regular laws of nature.

CONCLUSION

Summarizing, we can say that it is not necessary to invoke fundamental laws outside of those deciphered or potentially deciphered by physics and chemistry to explain life and mind. I come to this conclusion not because I know how to construct living matter or a mind with free will within known physical law, but because I cannot find an instance in living systems where physical law is broken and because man has such limited ability to use basic laws creatively, even, in fact, to decipher how they are used in nature. Analyzing the fundamental regularities in nature is likely to occupy the attention of some scientists into the foreseeable future. I see in living systems an even greater challenge: to learn how a few fundamental particles and interactions are used to construct systems of such great variety and complexity. While there is little hope of ever understanding nature, life, and mind completely, we can, if guided by a revelation of the central purpose in nature, at least hope to gain a greater appreciation of the God who created man in His own image.

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ARTICLES

THE CRUELTY OF NATURE

Gerald Wheeler

Assistant Book Editor

Southern Publishing Association

Nashville, Tennessee

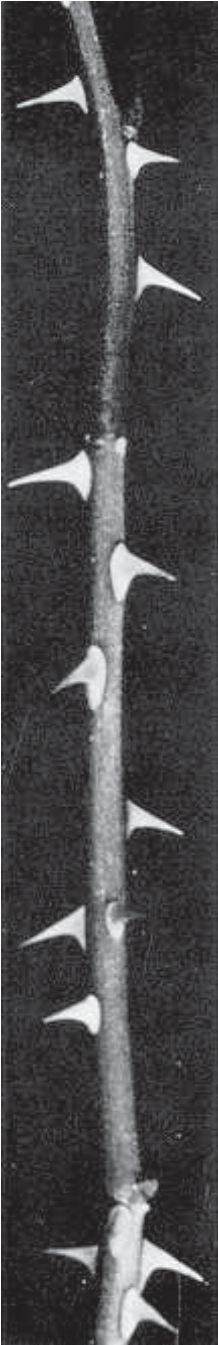
Many who look at suffering in nature find it difficult to believe that an intelligent designer is the creator of life. Some reflections on this conclusion are presented below.

1. The sea wasp, a small, fragile jellyfish of the South Pacific, can kill a human being within seconds after draping its tentacles over his body.
2. The female lobster may carry 97,000 developing embryos on her abdomen. Only 1 out of 5000 will survive long enough to reproduce.
3. The desert locust undergoes a population explosion. The resultant overcrowding triggers the development of wings which enable it to mass migrate. Streaming out of the desert, the insects devastate the plant life in their path, plunging an impoverished nation into a famine.
4. Each year medical researchers frantically race to produce a vaccine for the latest strain of the flu virus. Perhaps before they succeed a new form will have mutated into existence.

Many Christians think of nature as beneficial and beautiful. But as we are all too aware, it has its ugly, cruel, and dangerous side. Mankind dies from accidentally eating toxic plants, suffers the ravages of epidemics, and struggles to protect his food crops from disease and plant and animal pests. The Christian — particularly the Christian scientist — has to explain such things within the context of his world model, his Christian conceptual framework.

The conservative Christian believes that God created the universe and its basic life forms. According to Scripture,

FIGURE 1. Prickles — (often called thorns) — one of the many examples of the cruelty of nature.



when God originally made life, He considered it “good” (Gen 1:25). Did God judge the goodness of His creation by a different standard, or has something happened to it in the meantime?

Christians have grappled with the problem of evil in nature in various ways. Some have suggested that God established evil to emphasize and favorably contrast with His goodness. Others have seen nature’s harshness as a divine punishment on fallen man. Thus, for example, William Kirby wrote in one of the famous *Bridgewater Treatises* on natural theology that God created fleas, lice, and intestinal parasites after the fall of Adam and Eve to torment sinners.¹

The existence of evil in a nature created by a good God has always been a real problem to Christianity. An incident in the life of Charles Darwin illustrates the kind of struggle it puts people through. He once wrote to his botanist friend Dr. Asa Gray about his declining religious faith:

I am bewildered. I had no intention to write atheistically. But I own that I cannot see so plainly as others do, and as I should wish to do, evidence of design and beneficence on all sides of us. There seems to me too much misery in the world. I cannot persuade myself that a beneficent and omnipotent God would have designedly created the Ichneumonidae with the express intention of their feeding within the living bodies of caterpillars, or that a cat should play with mice.²

Darwin found one solution to his dilemma by concluding that living things were evolving to higher levels through the operation of simple laws of matter and energy. The apparent cruelty and suffering was just an unfortunate result of organisms adjusting to their environments. In the 1844 draft of what eventually became *The Origin of Species*, he concluded:

It is derogatory that the Creator of countless Universes should have made by individual acts of His will the myriads of creeping parasites and worms, which since the earliest dawn of life have swarmed over the land and in the depths of the ocean.³

By adopting the concept of evolution, he thought:

We cease to be astonished that a group of animals should have been formed to lay their eggs in the bowels and flesh of other sensitive beings; that some animals should live by and even delight in cruelty; that animals should be led away by false instincts; that annually there should be an incalculable waste of the pollen, eggs, and immature beings...⁴

The problem is real — we cannot ignore it without reaping the consequences. But the Scriptural model does have an explanation of the evil in nature.

The Bible indicates that the perfect state God established on earth did not last long. When the first man and woman disobeyed their Creator’s simple prohibition against sampling the fruit growing on the tree of the

knowledge of good and evil, they rejected God and alienated themselves from Him. He had placed them in a perfect world, but they had demonstrated that they were no longer spiritually and psychologically capable of handling such. They needed a place more suitable for their fallen, weakened characters. After God led them to admit their changed condition by asking where they were — thus forcing them to admit why they were hiding — He revealed the kind of earth they would from then on have to cope with (Gen 3:14-19). “Cursed is the ground because of you,” He declared to Adam, “in toil you shall eat of it all the days of your life; thorns and thistles it shall bring forth to you; and you shall eat the plants of the field” (Gen 3:17, 18).

Adam and Eve now faced a world quite different from the one they had known until then. Growing food would be more difficult. Fruit had grown bountifully about them in the Garden of Eden (Gens 1:29; 2:9, 16). But now they would have to depend more on the harder-to-cultivate field plants (Gen 3:18). The phrase “In the sweat of your face you shall eat bread” suggests what Adam would have to contend with as he grew food. Apparently plants needed attention from men even in paradise. God had put Adam “in the garden of Eden to till and keep it” (Gen 2:15). Now vegetation would get out of hand much more quickly and on a larger scale. Weeds are nothing more than plants that compete strongly against cultivated ones.

After Cain murdered his brother Abel, he found it still more difficult to raise crops. God told him, “When you till the ground, it shall no longer yield to you its strength” (Gen 4:12).

In the beginning God created a balanced nature with every organism completing its strand of the intricate web of life. But after man’s fall, new forces started to tatter that web. Environmental conditions deteriorated. Reflecting man’s declining moral and religious life, chaos also crept into the physical world. Another crisis marred the earth’s ecology when, because of man’s actions, God sent a global catastrophe to devastate the earth’s biosphere.⁵ The geological disaster of the flood upset the whole balance of nature. The world around us today is reconstructed from the pieces and debris surviving the flood. We may never fully know its impact on living things and their ecological relationships.

With the passage of time the effects of the fall have accumulated. The physical world had so altered by the time of the early Christian church that the apostle Paul, anticipating Christ’s return, wrote that “creation itself will be set free from its bondage to decay and obtain the glorious liberty of the children of God. We know that the whole creation has been

groaning in travail together until now” (Rom 8:21, 22). Employing the symbol of childbirth, Paul tells of a world seeking and needing restoration.

Scripture recognizes the existence of evil and suffering in nature, but at first glance it almost seems as if God Himself is responsible for it. Genesis 3 relates several curses God placed on the serpent, on Eve, and on nature. In Genesis 4:11 God curses the ground because of Cain’s crime. Since the Bible declares that God set a curse on the physical world, does that make Him responsible for the poisonous stings of scorpions, bacterial infections, and the reign of tooth and claw?

Before jumping to any conclusions, however, we must see how Scripture defines a divine curse.

After Cain killed his brother, God called down evil on the first murderer. In response, Cain complained, “My punishment is greater than I can bear. Behold, thou has driven me this day away from the ground; and from thy face I shall be hidden” (Gen 4:13, 14). That God had withdrawn Himself and left Cain to take care of more of his own affairs upset him. He realized that the soil would no longer produce as well for him as it had done before his crime. Cain knew that God would cease to as actively insure good crops. A fundamental premise of the Biblical world model is that nature does not operate independently of God. Nature is under His direction (Neh 9:6) and, left to itself, would break down and perish.

We see in the book of Job an illustration of what happens when God lessens or removes His active protection and control. God asked Satan what he thought of Job’s loyalty and character (Job 1:8). Satan discredited the patriarch’s allegiance, charging that Job worshipped and obeyed God only to insure His protection and material support (v 9, 10). To prove his allegation, Satan urged God to remove His protection and then see how Job would act. God did so, permitting Satan to attack him.

The book of Job clearly demonstrates the source of Job’s difficulties. It shows what results when God withholds His control of events on our planet. Order breaks down, and Satan does everything he can to push things to chaos.

The authors of the Bible understood and feared lest God in any way lessen or abdicate His rulership, whether in the spiritual or physical realm. “Your iniquities have made a separation between you and your God,” Isaiah announced, “and your sins have hid his face from you so that he does not hear” (Isa 59:2). All Scriptural models of nature must take into account the historical reality of the fall and the consequences of sin. Sin is a state of alienation from God. Man, when he fell spiritually, cut himself off from God. To keep from immediately destroying a race now by nature

antagonistic to Him, God stepped back. No longer did He participate as directly in events on earth. And each time He placed a curse on our planet, He loosened His divine reins on nature a little more. And as humanity persisted in their rebellion, their behavior forced Him to let nature increasingly break down.

When Israel prepared to enter Canaan, God set before them the choice of a curse or a blessing (Deut 11:26-29). If they would follow His leading, He would insure them ample rain for their crops and pastures. But if they worshipped nonexistent gods, the land would receive no rain (see v 13-17). The two rainy seasons of Palestine would no longer continue. God had made them happen. If the Hebrews chose the curse, He would not always cause the rains to occur. Their actions prevented Him from blessing nature as much as He would like.

The Hebrews often reminded themselves that if they did not reject God, He would not be forced to spurn them. If they thwarted God so He could not be their Protector and Sustainer, they would find themselves not at the mercy of a God of order, but in the power of Satan, the originator of chaos, ruin, and decay. Many times the Hebrews feared that God would separate Himself from them — or even that He actually had. “How long wilt thou hide thy face from me?” David pleaded in Psalm 13:1. “O Lord, why dost thou cast me off?” (Psa 88:14).⁶ Through the prophet Isaiah, God told Israel that because of their behavior, “When you spread forth your hands, I will hide my eyes from you; even though you make many prayers, I will not listen; your hands are full of blood” (Isa 1:15).

Because of man’s rebellion God has had to limit His guidance of the natural world. And Satan, as we have seen in the case of Job, immediately steps in to fill the vacuum. Here we come to the core of any Scriptural model which attempts to explain imperfection in a world created perfect. The Bible documents a universal conflict between good and evil. Satan has questioned God’s right to rule the universe and seeks to usurp His place. Instead of quelling Satan’s rebellion through force, God has decided to vindicate His right to authority and power by letting Satan demonstrate on a limited scale the consequences of his rule. The earth has become the arena where Satan reveals his inability to govern. Satan not only seeks to control humanity, but also the earth’s life forms and physical forces.⁷

Christ, in His parable comparing the gospel’s impact on individual minds, explained the existence of the unconverted in the church through the symbolism of tares or weeds growing among wheat. When asked where the tares came from, He said, “An enemy has done this” (Matt 13:28). Perhaps here we can find an analogy or symbol for the

origin of poisonous plants and animals and the carnage and decay we find throughout nature. God has to let the universe witness and be convinced of Satan's true character. The best way to reveal another person's motives and nature is to permit him to expose himself. It is a painful process for both God and man, but it is the only way God can forever immunize the universe against the principle of sin. Satan must condemn himself, and does so as much by the way he abuses and distorts nature as what he does with human lives.

The devil was once an especially honored angel (see Isa 14:12-15). He has intelligence and experimental knowledge far beyond that of human science. As man's increasing rejection of God forced Him to withdraw His protection over nature, Satan has turned the earth into a laboratory of destruction. He is systematically trying to destroy God's creation.⁸

The overwhelming majority of scientists would be aghast if someone suggested they consider the role Satan plays in nature. As a fundamental tenet of modern science they rule out of their study and theories anything relating to the supernatural. Instead their whole approach to nature involves explaining everything in it on the basis of physically demonstrable forces. But the Christian who centers his world view around a Biblical model considers such an approach as incomplete and inadequate. He also regards the distinction between the natural and supernatural as in many ways artificial. He believes that the scientist is leaving out of his world view other forces which also influence nature. In the case of Satan one can keep an eye out in the laboratory or field for destructive or degenerative forces. Although science cannot treat supernatural powers as it does other forces, it can include them in its paradigms and mental constructs just as it does other unverifiable assumptions. The Christian scientist should operate on the assumption that God and Satan are as much a part of total reality as any physical, chemical, or biological law.

To study nature without taking into account the impact Satan has on it is like examining ecology while ignoring man's influence because he has a highly developed conscious intelligence and the rest of life apparently does not. Yet man has always played a major role in fashioning the balance of nature we see today. The Scripturally oriented Christian believes that we should also recognize Satan's twisting and reweaving of the fabric of life. To understand reality, we must take into account everything in it — including nature, man, God, and Satan.

Few would deny the existence of evil. Through Scripture we discover Satan as its source. The very nature of evil is to distort and corrupt. As God has withdrawn His protection and control over nature, Satan has set

out to destroy. That God's decreasing guidance would lead to nature's breaking down on its own was not enough for him. The vast knowledge and intelligence which he retained even after his expulsion from heaven he has — according to the Biblical model — turned against God's physical creation.

As God lifted His sustaining hand from the natural world, a number of things started happening. How Satan has attacked nature, what processes he used, we have no exact way of knowing. As with so many other things, Scripture does not supply details. But we can draw some conclusions from the apparent results, and we can develop analogies from how man affects or manipulates nature. Though it would horrify most scientists to hear it said, we are moving from the known to the unknown in a manner similar to the way one uses some more widely accepted explanations of nature.

First, from Genesis 3:18 we know that God specifically said thorns and thistles would appear. Thorns are modified stems in which the growth process has gone awry. The apical meristem usually functions only briefly, after which it either sloughs off or matures into tough, thick-walled cells. Drought conditions will stimulate some plants into developing thorns. In this case God may have more directly caused thorns and thistles to arise since He mentioned them beforehand. But more likely they followed the pattern of Satan's other interference with nature.⁹ If the latter is the case, Satan would have quickly learned which factors would alter a terminal bud into a thorn instead of a regular stem. Then he would see to it that as many plants as possible with the tendency toward modified stems passed the trait on. He would make sure that thorns became a part of the plant's genetic makeup. Spines — modified leaves — would follow a similar pattern.

Delving into biochemistry, Satan could discover how to transform a harmless substance into a poisonous one. A change of 2 out of the 574 units of the protein part of hemoglobin results in sickle-cell anemia.

Factors from different parts of the same organism will interact to produce a deadly combination. The tobacco plant forms nicotine when chemicals manufactured in the leaves and roots act upon each other. A tobacco plant grafted onto a tomato root has no nicotine. Just as man can breed living things to enhance or eliminate a particular physical characteristic — including toxicity — so can a highly intelligent being like Satan. He has a whole world of life-forms at his disposal to experiment on, plus the assistance of the other fallen angels.¹⁰ Consider another analogy. Man has bred chickens with greatly increased egg-laying ability. Here is an

accomplishment differing only in magnitude from what I believe Satan could have done to the reproductive rates of countless other organisms.

Sometimes an organism will become dangerous by simply getting out of its normal habitat. Bacteria of the gastro-intestinal tract are very specific where they live. If they stay there, they do not harm the host. But if they accidentally get into another area they may cause malabsorption, interfere with fat absorption, or even synthesize proteins or other metabolic products which cause diarrhea.¹¹

Genetic material has an inherent, though limited, ability to mutate. As God lessened His control on nature after the entrance of sin, DNA and other genetic material apparently became more unstable. Satan, in his search for destructive agents, could take advantage of the fact. This seems particularly illustrated in the development of disease organisms.

A perfect world would have no pathogenic organisms. Bacteria, for example, would play only beneficial roles in the ecology of a paradise. Even Eden had refuse. Flower petals and discarded fruit parts would litter the ground unless something broke them down into useful organic matter. Bacteria would have done the job then as they still do now. Cattle cannot digest the cellulose of grass without the help of microorganisms. In addition, bacteria fix nitrogen in legumes. Other varieties aid in digestion and secrete vitamins as the B complex group. *Escherichia coli* produces vitamin K. *Bifido-bacterium bifidus* protects breast-fed infants against the dysentery bacillus and other intestinal pathogens. Bacteria mutate and reproduce rapidly. Satan could take advantage of such capacity by selecting strains that secreted toxic substances.

The same situation would happen to protozoa and fungi. At first they were solely beneficial, helping to decompose organic matter. The protozoa inhabiting the intestinal tract of termites break down the tough fibers of cellulose. But under Satan's intervention, such organisms probably began to prey on living things. Fungi turned from their necessary task of decomposing dead plant parts to parasitizing live tissues. Insects that originally consumed dead organic matter have also gotten out of hand.

Parasitism is a graphic illustration of nature's degeneration. Both plants and animals now attack other living organisms. Some animals discarded everything but their digestive and reproductive powers. Tapeworms are little more than digestive and sex organs. *Sacculina*, a parasite of crabs, has no digestive system of its own. Yet its larval form is still a free-swimming nauplius, the first developmental stage of a crustacean after it leaves the egg. Instead of maturing into a normal barnacle, it becomes only a mass of filaments spreading through the crab's tissues.

Just as the reign of sin produced thorns and toxins in plants, animals developed their deadly changes. The bee's stinger, for example, is a modified ovipositor. In bees and wasps the ovipositor no longer aids in laying eggs, but has been greatly altered into a weapon. Some animals began secreting deadly substances. The venom of poisonous fish apparently derived from a secretion produced by the glands which coat most fish with a protective slime. The spines that deliver it are modified fin rays.

After man's fall animals began to prey on each other. Those with the right digestive systems, teeth, and claws could kill and devour other animals — provided their behavior changed in that direction. Being a carnivore is as much psychological as it is physiological. Parrots are mostly vegetarians even though they have the beaks and claws of a carnivore. The kea parrots of New Zealand ordinarily grub up roots. But a dwindling food supply will goad them into attacking sheep. The parrots rip open their backs and feed on the kidney fat.

Man can breed animals for particular behavioral traits — for example, Tennessee walking horses and sheepherding dogs. In nature the forces of evil selected destructive behavioral patterns just as man has selectively developed dogs with savage dispositions.

Space does not permit discussion of sin's other channel of impact on nature — fallen man¹² — but we can see that Scripture contains an adequate model to explain our present world. God did not create the evil and suffering we find in nature. The Bible clearly indicates its true source. Scripture gives the Christian scientist a foundation from which to begin his exploration of how the forces of evil reshaped a world created perfect.

ENDNOTES

1. Kirby W. 1835. On the power, wisdom, and goodness of God as manifested in the creation of animals, and in their history, habits, and instincts. London, p 7-9.
2. Darwin C. 1958. The autobiography of Charles Darwin and selected letters. NY: Dover Publications, p 249.
3. Darwin C. 1963, The essay of 1844. In: Darwin for Today: the Essence of His Works. NY: The Viking Press, p 222.
4. Ibid.
5. "Now the earth was corrupt in God's sight, and the earth was filled with violence. And God saw the earth, and behold, it was corrupt; for all flesh had corrupted their way upon the earth. And God said to Noah, 'I have determined to make an end of all flesh; for the earth is filled with violence through them; behold, I will destroy them with the earth'" (Gen 6:11-13). One wonders what biological implications the phrase "all flesh had corrupted their way upon the earth" might have.
6. See similar laments and appeals in Job 13:24; Psalms 10:1; 22:1; 27:8, 9; 30:7; 43:2; 44:9, 24; 89:46; Lamentations 5:20.

7. Satan's use of physical forces we see illustrated in the book of Job where he employed "fire" from the sky and a great wind against Job's possessions and family (Job 1:16, 19). Ellen G. White alludes to his manipulation of natural phenomena (White: EG. 1950. *The great controversy between Christ and Satan*. Mountain View, CA: Pacific Press Publishing Association, p 589, 590).
8. Ellen G. White writes, "He (Satan) has studied the secrets of the laboratories of nature, and he uses all his power to control the elements as far as God allows" (Ibid., p 589).
9. Ellen White comments that "He (God) never made a thorn, a thistle, or a tare. These are Satan's work, the result of degeneration, introduced by him among the precious things..." (White EG. 1948. *Testimonies for the church*, vol. 6. Mountain View, CA: Pacific Press Publishing Association, p 186).
10. For a recent non-technical discussion of how man is learning to modify or develop new types of plants on the genetic and molecular level, see: Galston AW. 1974. Bios: molding new plants. *Natural History* 83(9):94-96.
11. Keusch GT. 1974. Ecology of the intestinal tract. *Natural History* 83(9):70-77.
12. The author explores this theme and God's role in counteracting disruptive forces in nature in a forthcoming book, *Who Put the Worm in the Apple?* Nashville, TN: Southern Publishing Association.

NEWS AND COMMENTS

THE CUPERTINO STORY

Attempts to include creation theory in the science classes of the public schools continue in the state of California. Largely through the efforts of a dedicated group of citizens in Santa Clara County, the question of inclusion of scientific creation in science classes has become, according to local newspapers, “one of the hottest controversies to hit the area in years.”

CITIZENS FOR SCIENTIFIC CREATION

In January 1974, some of the same individuals who had polled Del Norte County (see *Origins* 1:94-95) conducted a state-wide workshop on scientific creation, resulting in the formation of “Citizens for Scientific Creation” (CSC). The primary interest of this group was in developing a program whereby creation theory could be taught to students in the science classes of the public schools. While realizing that children should be made aware of the concept of evolution, they believed it should be presented only as one of several possible explanations for origins. To avoid religious controversy and denominational doctrine, only *scientific* evidence for creation theory should be included.

A similar CSC was set up in Santa Clara, and a poll of nearly 2000 residents in the Cupertino Union School District, the largest elementary school district in California, revealed that a total of 84.3% agreed that creation theory should be included with evolutionary theory. When the respondents were asked about their personal convictions regarding origins, 44.3% believed in creation, 32.4% were unconvinced either way, and 23.3% believed in evolution. On the night of May 14, the results of this poll were presented before the Cupertino School Board, with the recommendation that a committee be formed to develop a curriculum for teaching concepts of origins. The report of the poll was then sent to the district staff for review.

PROTESTS BY RELIGIOUS LEADERS AND THE ACLU

Shortly thereafter, the American Civil Liberties Union (ACLU) protested the plans to develop such a curriculum, arguing that the teaching of the Biblical story of creation would be teaching religion in the public schools, which was unconstitutional. Local ministers also sided with the ACLU, saying that Genesis was a theological myth which could not be supported by science. Other letters to the school board questioned the validity of the poll, charging it with being ambiguous and misleading.

On June 13, the trustees discussed the letters, then voted 4 to 1 to support the teaching of “the major theories of the origin of life in the public schools.” Superintendent Donald Todd was asked to implement the decision, perhaps with the assistance of a citizens’ advisory committee. With the absence of the teachers during the summer, productive work was delayed until the fall.

DISTRICT RULING

Late in September 1974, the deputy county counsel, Robert T. Owens, issued his decision concerning the legality of teaching scientific creation:

The State Board has indicated that the science course of study should not include considerations pertaining to the origin of life. The district’s course of study for science, therefore, should not include this topic.

In order to comply with the district guidelines, the administration decided to adopt instructional materials in the social sciences that present creation as an alternative theory of origins, but from a philosophical or religious base, not a science base. The CSC remains actively involved in gathering possible teaching materials together for this purpose.

The CSC has also taken another approach, by presenting the concept of scientific creation before the public. This is being done by community education programs, such as lectures and a debate between a creationist and an evolutionist, at a local college. The CSC is considering a future seminar and a possible workshop for teachers.

Nancy Stake, Cupertino poll-coordinator and member of the Santa Clara CSC, reports that action for creation theory in the public schools has been initiated in seven other California school districts, and that letters asking how to instigate similar appeals for scientific creation have been coming in from other parts of the United States.

Katherine Ching

NEWS AND COMMENTS

THE CARLSBAD MEETING

Every year scientists and other professional people gather in various places for conventions where individuals working in the same field meet together to present newly discovered information and share ideas with their colleagues. Then armed with renewed inspiration and encouragement, and perhaps a few new ideas combined with constructive criticism on their old ideas, they return home ready for more productive research.

Each year one group meets for a convention that is in some respects different from the usual scientific gathering, both from the standpoint of the subjects considered and from the breadth of approach employed. This group with the title of Bible-Science Subcommittee of the Biblical Research Committee of the General Conference of Seventh-day Adventists is unusual in that its membership involves both theologians and scientists, although the latter predominate. The subjects under study are those areas where science and Scripture have a common interest. This committee performs an important function in bringing together individuals with diverse training to work together towards an improved understanding of earth history using both science and sacred history as a basis for study.

The April 1974 meeting was held in Carlsbad, New Mexico. This locale was selected so as to give the participants a first-hand view of the famous Permian fossil "reef." World-famous Carlsbad Caverns is dissolved out of this so-called reef.

Fourteen formal presentations, numerous discussion sessions, and three afternoons of field study were packed into three intense days. Two papers were presented by theologians. Gerhard Hasel of Andrews University gave a detailed study on the Biblical view of the extent of the flood. His conclusion was that the phrases used in describing the flood and the context and syntax all strongly indicate a universal flood. The writer of the Genesis story could not have expressed himself more explicitly on this point than he did. Dalton Baldwin of Loma Linda University discussed the nature of faith, and the relation between faith and science. Commitment in action to the most probable available presuppositions is a good way of doing science. The same applies to religion.

One topic which has been very much under consideration by this committee is the relation of the geological record to the Biblical flood. Papers by Ariel Roth of the Geoscience Research Institute, Leonard Brand, Arthur Chadwick, Berney Neufeld, and James Riggs of Loma Linda University, and Ray Hefferlin of Southern Missionary College addressed themselves to various aspects of this intriguing subject. Among the topics considered were various models of geological processes which may explain the thin but very widespread nature of marine and land deposits

found in sediments. The relation of megabreccias and other unstable sedimentary patterns to a catastrophe such as a worldwide flood was also considered. Data was presented indicating that the earth could support enough vegetation at one time to account for the existing supplies of coal and oil; hence the quantities present do not pose a restriction on a model that proposes their formation in one event such as the worldwide flood described in Scripture. Various models synthesizing different interpretations were also considered. A report was given on experimental studies indicating that the fossil footprints in the Permian Coconino sandstone were more likely formed under water than above water. This, of course, has significant inferences for a flood model. The intriguing question of an expanding earth was also discussed. The implications of such a model are very complex and deserve further study.

David Rhys, graduate student, and Raymond Cottrell of the Review and Herald Publishing Association both presented series of NASA satellite pictures illustrating the usefulness of these in the interpretation of the past history of the earth. The broad geographical perspective thus available is an invaluable tool.

Several speakers addressed themselves to the matter of time as it relates to the past history of the earth and the universe. Some attempts have been made in the past to use the growth lines present in fossil molluscs as an age-dating method. Recent research indicates that this technique is to be viewed with a great deal of caution (see *Origins* 1:58-66). Conrad Clausen of Loma Linda University who has been studying this method also suggests that the study of these growth lines may contribute to creation theory in fields such as paleoecology. Robert Brown, Director of the Geoscience Research Institute, discussed a number of avenues of evidence related to the age of the universe and the earth.

The entire committee spent three afternoons viewing the major features of the famous Permian “reef,” part of which is exposed in the Guadalupe Mountains. The gross features of this reef are reminiscent of a true reef, but the paucity of frame builders in the reef core casts serious doubts on its ever having been a wave-resistant structure as would be expected for a true reef.

The participants left the meeting with a new supply of eagerness to return to their research so that new advances in their understanding of the past history of the earth can be achieved before the next meeting, which will be held in central Oregon, at the site of well-studied tertiary deposits.

Leonard Brand

NEWS AND COMMENTS

CREATION CONVENTION II

The second Creation Convention, held in Milwaukee, Wisconsin, August 18-21, 1974, drew participants from as far away as Alaska, England, Netherlands, and West Germany. Over 425 individuals were registered, some 350 of which attended the Convention banquet.

Activities of the convention centered around the theme "A Challenge to Education." Throughout the morning and afternoon sessions three distinct programs were conducted concurrently — technical presentations related to the validity of Scripture testimony regarding origins, popular-level essays on creation science, and workshops on creation witness.

The convention also featured three large displays of literature related to creationism, an exhibit of work that is being done to secure an academically and constitutionally fair treatment of origins in the public schools, a continuous showing of films and filmstrips on creationism and related topics, and a computer terminal that analyzed various models for interpreting carbon-14 dates.

At the close of this Milwaukee meeting, it was announced that plans are beginning to be developed for sponsorship of a third Creation Convention in 1976, probably in Minneapolis, Minnesota, with smaller interim conventions for the Seattle, Washington, area in 1975 and the New York area in 1977.

A report of the first Creation Convention held two years earlier is given in *Origins* 1:35-36. Each of these conventions was sponsored by the East Wisconsin chapter of the Bible-Science Association.

R. H. Brown

LITERATURE REVIEWS

Readers are invited to submit reviews of current literature relating to origins. Mailing address: ORIGINS, Geoscience Research Institute, 11060 Campus St., Loma Linda, California 92350 USA. The Institute does not distribute the publications reviewed; please contact the publisher directly.

THE ORIGINS OF LIFE ON THE EARTH. Stanley L. Miller & Leslie E. Orgel. 1974. Englewood Cliffs, NJ: Prentice-Hall. 229 p.
SPECULATIONS AND EXPERIMENTS RELATED TO THE THEORIES ON THE ORIGIN OF LIFE: A CRITIQUE. Duane T. Gish. 1972. San Diego, CA: Institute for Creation Research. 41 p.

Reviewed by Ian M. Fraser, Chairman, Department of Physiology & Pharmacology, Loma Linda University

In recent years there has been a strong interest in possible mechanisms for the spontaneous generation of life, and a steady flow of books and other publications have recorded the results and speculations arising from these studies. The two recent volumes in this flow of literature which are the subject of this review present contrasting approaches to the problem. The volume by Miller & Orgel appears to be one of the better documented and most objective of those which seek to provide support for the theory of the spontaneous origin of life. By contrast, Gish's book represents one of the few serious, well-documented attempts to present a detailed critique of these theories from the standpoint of a creationist. It is particularly interesting to read both books concurrently and notice the differences in approach to and interpretation of the same basic experimental data. Of course, as in any field of science, much of the data is conflicting and thus does not necessarily lend unequivocal support to either viewpoint.

Miller & Orgel are deeply committed to the belief that life arose by a long process from simple organic precursors. Their book, although relatively small, attempts a rather complete presentation of the whole field ranging from the formation of the solar system through all the intricacies of the syntheses of both simple molecules and complex polymers necessary for life; they tackle the problems of the origin of the most primitive organism, the origin of optical activity and subsequent biochemical evolution with equal zeal. They consistently maintain a surprising objectivity regarding the available data and are frequently critical of the findings and theories of other workers in the field even though they all share a common perspective on the problem. Of course, they do minimize some of the problems which a creationist viewpoint

would tend to emphasize, and they make no serious attempt to consider the creation of life as a likely solution to the difficulties they point out.

Gish is equally committed to the belief that life arose by special creation and marshalls an impressive array of soundly based scientific criticisms of the possibility of spontaneous generation. Not surprisingly, but perhaps unfortunately, Gish does not leave quite as strong an impression of objectivity in evaluating the evidence as do Miller & Orgel and tends to fall into overkill in some of his arguments. I suspect this criticism will not be welcomed by some zealous creationists, but I feel it is a weakness of his presentation. However, Gish must be praised for an ingenious and painstaking analysis of the many weaknesses at every step in current theories of spontaneous origin of life. He writes with a good grasp of the many chemical problems involved in this area and can be quite devastating in his logic. Curiously, Miller & Orgel concede many of his points in their book either directly or indirectly.

Both volumes discuss the composition of the primitive atmosphere as a key factor in any theory of the origin of life. Gish points out that the idea of a reducing atmosphere was developed by Oparin and Urey as a necessary condition for the formation of organic compounds needed for living things. Miller & Orgel are frank to admit the problems and their own preconceptions in this area. "Geological and geophysical evidence is insufficient to allow us to state with any precision what conditions were like on the surface of the primitive earth. Arguments concerning the composition of the primitive atmosphere are particularly controversial. It is important, therefore, to state our own prejudice clearly. We believe that there must have been a period when the earth's atmosphere was reducing, because the synthesis of compounds of biological interest takes place only under reducing conditions" (p 33).

Gish places Abelson's theory of an atmosphere of CO, N₂ and H₂O against the methane-ammonia atmosphere of Urey but points out further that there is little evidence that outgassing of the primitive earth would produce either type of atmosphere. Gish further cites work by Davidson & Brinkmann which suggests that the oxygen concentration in the earth's atmosphere would have reached an appreciable fraction of its present level very early in the earth's history. Miller & Orgel consider most of the same evidence but cling to their admitted prejudice that a reducing atmosphere must have been present long enough for the formation of compounds needed to begin life on the primitive earth.

With this assumption, Miller & Orgel turn to a consideration of sources of energy and the nature of possible reactions involved in prebiotic syntheses. Although Gish does not concede the basic assumption of a reducing atmosphere, he proceeds to attack experiments of the type

described by Miller & Orgel. Both these authors have been active investigators in attempts to synthesize molecules of biological importance under primitive earth conditions; Miller became famous for the production of amino acids by sparking a mixture of CH_4 , NH_3 , H_2O and H_2 . Gish is particularly critical of this type of experimentation because of the immediate removal of the products of the reaction, once formed, from the energy source in order to prevent their destruction. Since there were no organic chemists present on the primitive earth to accomplish this, he contends (with the support of work by Hull) that it would be impossible for any significant quantities of useful compounds to accumulate. Miller & Orgel devote a chapter to the problems of stability of prebiotic organic compounds and another to concentration mechanisms but do not really answer Gish's criticisms.

Orgel has worked extensively on the formation of purines from HCN and pyrimidines from cyanoacetylene. A major problem in this area which he concedes and Gish emphasizes is that the concentrations and the conditions required are unlikely to be attained under any readily conceivable primitive earth conditions. The next step in the synthesis of the nucleic acids, the formation of nucleosides, is conceded by Miller & Orgel "to be unexpectedly difficult, so much so that no really satisfactory method has been reported" (p 112). Gish naturally emphasizes this as well as pointing out the serious difficulties encountered in synthesizing sugars and the high reactivity with amino acids of such sugars as might be formed.

Despite the low probability that any amino acids or nucleosides could accumulate sufficiently for polymerization, Miller & Orgel proceed to discuss possible mechanisms for protein and nucleic acid synthesis under prebiotic conditions! They report little success and conclude the chapter with the statement that "this chapter has probably been confusing to the reader"; Gish exploits this confusing situation in his discussion. Interestingly, Miller & Orgel discount the significance of the thermal synthesis of polypeptides developed by Fox almost as much as does Gish!

In a few brief pages, Miller & Orgel discuss the fantastic problems of going from random polymers to the most primitive organism. They devote most of the discussion to the problem of the origin of the genetic code and conclude that "we clearly do not understand how the code originated." Gish attacks the problem of ordered polymers from the probability standpoint and, as usual, leaves one breathless with improbabilities. Impressive as such calculations are, the validity of the assumptions used should not be accepted uncritically.

Gish devotes considerable effort to demolishing the significance of Oparin's coacervates and Fox's proteinoids as precursors of the primitive cell. From the standpoint of Miller & Orgel, he is wasting his time since

they do not give serious consideration to either of these approaches. On the other hand, Gish does not emphasize the very serious problem posed by optical activity; Miller & Orgel devote a chapter to discussing some possible but unimpressive solutions.

As a final evidence of their faith, Miller & Orgel devote a chapter to biochemical evolution and another to the origin of life elsewhere in the universe. A remarkably frank and objective summary of the successes and failures of their approach concludes their book. Gish concludes by affirming his faith in the necessity of the creation of life on the basis of a brief discussion of the complexities of the functioning and replicating cell.

Clearly the creationist stands on higher ground in the controversy over the origin of life. Miller & Orgel are to be praised for their objective although unrecognized (by them) revelation of this situation, but criticized for not conceding the inadequacy of their own philosophic presuppositions. Gish is to be criticized for over-reaction to the fanciful speculations of the less objective colleagues of Miller & Orgel, but praised for gathering the arguments for the creation of life in a positive and well-documented manner. Thus both books contribute significantly, even if inadvertently, to the development of a scientific base for creation.

GENERAL SCIENCE NOTES

THE *SPIRORBIS* PROBLEM

Harold G. Coffin

Geoscience Research Institute

A marine spiral tubeworm, called *Spirorbis*, is usually overlooked by beachcombers and collectors because it is only about 3 mm in diameter. This worm secretes a hard tube of calcium carbonate around its body which is coiled like a miniature snail and could easily be mistaken for one. It does not crawl around in mud, but attaches its tube usually to some hard object such as rocks and seashells, or sometimes to softer seaweed.

Spirorbis and all the other members of the family Serpulidae live in salt water. None have ever been found in fresh-water. The larva of this worm, called a trochophore, looks like a miniature pear-shaped speck with bands of cilia around it. Several other kinds of sea animals also have trochophore larvae, but no fresh-water animal has ever been known to produce larvae of this kind. *Spirorbis* is found quite generally in the oceans around the world.

In the fossil record, *Spirorbis* is also common. In the coal measures of Nova Scotia, I have observed *Spirorbis* fastened to the outside edges of mussels. Apparently the fossil *Spirorbis* had the same kind of relationship with the mussel as its modern counterpart. This worm is distributed throughout, the geological record, and on the basis of the standard geological time scale, *Spirorbis* has been in existence for nearly 500,000,000 years. When found, fossil *Spirorbis* are frequently seen attached to sea creatures — corals, lampshells, molluscs, and other marine animals and plants. Thus it appears that the fossil worm, when alive, also lived in the sea. Because it lives only in the ocean today, its trochophore larva is characteristic only of ocean-living animals, and it is found in the fossil record attached to marine animals, we can conclude that *Spirorbis* is and always has been a sea-dwelling creature. But this brings us to an interesting dilemma.

Spirorbis is often found associated with coal. In order to understand the importance of this, we need to know how those who do not recognize a worldwide catastrophe such as the Genesis flood hypothesize that coal was formed. These individuals tend to interpret the past according to the present, and by looking at the processes of geology going on today, they

draw conclusions regarding what has happened in the past. Where can coal be observed now in the process of formation? Accumulations of plant debris in peat bogs, salt marshes, and swamps are said to represent coal in its beginning stages of formation. If the bogs etc. were buried, the plant material would eventually become coal. This is known as the peat-bog theory for the formation of coal.

The little worm creates a problem for this theory. *Spirorbis* will not live in peat bogs, because this is not the right kind of environment, yet sometimes its shells are found in great numbers in coal. The interpretation that *Spirorbis* was always a sea animal conflicts with the interpretation that coal is produced by buried peat bogs.

To overcome this difficulty, geologists have postulated that during the supposed hundreds of thousands and millions of years when coal was being produced., *Spirorbis* was a fresh-water animal instead of a salt water animal. We have already noticed all the evidences against this, but this change in interpretation is necessary to resolve the conflict. The only reason for making this change in the proposed environment for *Spirorbis* during the coal-forming time is that it is found with the coal which is not thought to have been produced in a salt water habitat. But there are other ways to account for coal.

The flood described in the book of Genesis, which is said to have covered the whole earth, could have produced conditions which explain the presence of *Spirorbis* in coal. Probably forests of trees eroded from the land floated about in the seas before being buried. There was sufficient time for the tubeworm larvae to attach themselves to trees, pieces of wood, and other vegetation in the water. When the material was buried and when it eventually changed into coal, the spiral bodies of these worms were preserved with it.

The association we thus find between plants common to land and a marine worm can best be explained by a model of a worldwide flood such as described in the Bible.

EDITORIAL

THE PERVASIVENESS OF THE PARADIGM

During the 18th century a number of museums of Europe discarded their meteorite specimens because they were considered to be relics from a superstitious past when people believed that rocks fell out of the sky. The embarrassment of being associated with such unscientific samples was more than some curators were willing to bear. At that time the scientific community, led by the French Academy of Sciences, had expressed its view against the existence of meteorites, and their opinion prevailed. Since then it has been well documented that rocks do fall out of the sky.

The loss of these rare specimens was serious, but much more important is the inadequacy of the patterns of human thought illustrated by these incidents. Prevailing opinion is too frequently equated with truth, and important decisions are made on this basis. The history of man's search for truth reveals a disturbing pattern. Often large groups of individuals adopt particular ideas, believing them to be true. These are later replaced by opposing views which in turn are replaced by others. This cycle has been repeated many times. Often each view has a large group of followers. This instability makes it proper to wonder if current opinions can have the certainty of truth that its adherents usually imply they have. Some also wonder if new ideas are better than old ones.

A number of students of the history and philosophy of science including Barber (1961), Kuhn (1970), Kearney (1971), and Brush (1974) have addressed themselves to these questions. Their opinions are not very encouraging and the latter three raise serious doubts regarding the prevailing idea that science is a steady advance towards truth. One of the more explicit accounts of the dilemma is given by Kuhn (1970) who proposes that ordinary science is the refining of broad universally accepted scientific concepts "that for a time provide model problems and solutions" (p. viii). He calls these broad concepts "paradigms." A change from one paradigm to another is referred to as a scientific revolution. Because paradigms are universally accepted, they are seldom questioned, even though science claims to actively oppose dogma (Brush 1974). Kuhn further emphasizes that if a scientist does not fit his queries into an accepted paradigm, these are likely to be rejected as metaphysical or too problematic. The longevity of the paradigm is enhanced by such an attitude as well as by the fact that one tends to feel more secure when one is on the side of prevailing opinion.

In view of this it may be well to remind ourselves of the incisive dictum that if we always go by the majority, there is little chance for progress.

The tendency for humans to group themselves under the protection of prevailing schools of thought, thus betraying a singular lack of independence, is in part what prompted T. H. Huxley to state: "'Authorities', 'disciples', and 'schools' are the curse of science; and do more to interfere with the work of the scientific spirit than all its enemies" (Bibby 1960, p 18). Man's efficiency as a seeker for truth is also questioned by Winston Churchill when he states: "Men occasionally stumble over the truth, but most of them pick themselves up and hurry off as if nothing happened." Since the paradigm has broad acceptance, it is less likely to be questioned than a concept that is considered equivocal, and the change from one paradigm to another is quite difficult since there is so much inertia to overcome (Barber 1961).

Recently it has been argued that such a paradigm change may not be generated by the greater problem-solving ability of the new paradigm. To put it more directly the new paradigm may have less data to support it than the old one. Philosophical arguments may be the primary motives for change. Kuhn (1970, p 151) labels the change as a "conversion experience." Brush (1974) and Kearney (1971) propose that a new paradigm may replace an old one even though it is not as good a scientific solution. Kuhn has the same reservations when he states: "We may, to be more precise, have to relinquish the notion, explicit or implicit, that changes of paradigm carry scientists and those who learn from them closer and closer to truth" (p 170).

It is obvious that the group-like behavior of the scientific community when it works within or shifts from one paradigm to another betrays a lack of independent thought and a lack of caution on the part of the individual scientists. It is also true that numerous examples of paradigm shifts toward what is now considered to be a more erroneous position can be cited. However we have confidence that what is called ultimate truth exists and that a pursuit which tries to bring agreement of concepts with the more factual data of nature, such as science does, should bring us closer to that truth. There may be many false paradigms along the way, but eventually we should get closer to our goal as more of this data of nature is incorporated into prevailing concepts.

The lesson for us now is that we should not be unduly influenced by prevailing paradigms; history suggests they will change, and because of this we should exhibit a greater degree of independent thought, basing our conclusions more on factual data than on generally accepted opinions. Specifically regarding the questions of special concern to this journal, those of origins, the paradigm of evolution (we are speaking of the general

theory of evolution) compared to creation should be evaluated in terms of the recent findings in nature more than in terms of the popularity of either idea. Since the recent discoveries in molecular biology have shown that the spontaneous origin of life and meaningful genetic changes are much more improbable than was previously believed, and since further search in the fossil record confirms the ubiquitous nature of the gaps between major kinds of organisms as would be expected for creation, we feel it is time that the scientific community give serious thought to questioning the paradigm of evolution. The new data demands it.

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ARTICLES

OXYGEN AND EVOLUTION¹

G. E. Snow

*Associate Professor of Biology
Andrews University*

and

G. T. Javor

*Associate Professor of Chemistry
Andrews University*

Evolutionary theory proposes a chemically reducing atmosphere during the early history of this earth. This is considered necessary for the production and survival of many necessary compounds associated with life. Some recent data raise serious questions regarding the plausibility of such a model. The authors discuss some of this evidence.

When we take a breath of air, we do it for the purpose of providing oxygen to our body tissues. Without the continuous supply of this gas neither we nor the great majority of organisms on the earth could exist for more than a few minutes. It may come as a surprise then to learn that oxygen is potentially poisonous to all life forms.²

During the normal course of metabolism in living tissues, oxygen may combine with protons (H^+) and/or electrons (e^-) to form a superoxide radical (O_2^-) or a hydroxyl radical ($OH\bullet$) or a molecule of hydrogen peroxide (H_2O_2). Any of these products of oxygen cause havoc in the organism by significantly modifying the structures of the molecules that participate in the chemical reactions of life. Fortunately in all oxygen-using organisms we find elaborate enzymatic systems operating which render the toxic products of oxygen harmless.

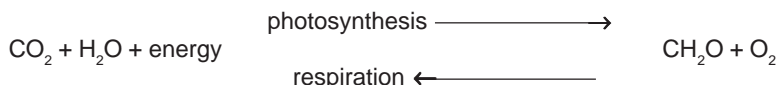
A relatively small number of species do not have this enzymatic system to protect themselves from the toxic products of oxygen. Such organisms, called anaerobes, can only exist in the absence of oxygen, for simple exposure to air quickly kills them. Anaerobic organisms, as a rule, are simpler in structure than the oxygen-requiring ones and therefore in the evolutionary model they are thought to be most like the first organisms on earth. As a logical corollary, evolutionists postulate the existence of an oxygen-free atmosphere on the primitive earth. This primordial atmosphere would have consisted of mainly hydrogen, ammonia, methane and water vapor. In contrast, our present atmosphere contains mostly oxygen (21%) and nitrogen (78%).

Although Pasteur's work in the last century gave generally accepted evidence that life could not arise spontaneously from non-living sources under current environmental conditions, by the middle of this century the topic of spontaneous generation of life once more became one of major interest. In the last 25 years a number of laboratories throughout the world have been engaged in experiments to produce components of living cells under "primitive earth" conditions.

A measure of success has been achieved by these workers. Biologically significant substances, such as amino acids (the building blocks of proteins), purines and pyrimidines (some of the building blocks of nucleic acids), certain vitamins and simple sugars have been synthesized under postulated "primitive earth" conditions. However, in all successful experiments free oxygen was absent. When oxygen was present, no biologically significant substances were formed.³

Currently evolutionists assume that free oxygen was all but absent during a significant portion of the earth's 4.5 billion year history. It was during this oxygen-free period that the first life forms were thought to evolve. Then, with the emergence of photosynthetic plants, free oxygen began to be released into the atmosphere as a by-product of photosynthesis, until the present atmospheric level of this gas was reached.^{4,5}

Photosynthesis may be represented by the equation:



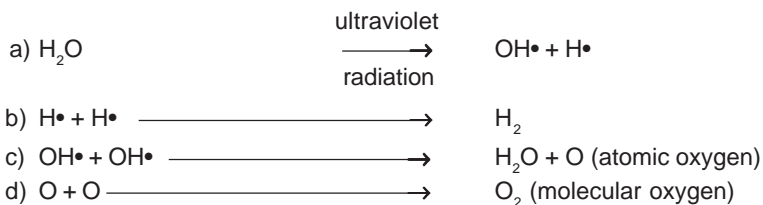
Much of the oxygen produced during photosynthesis is used up during respiration by animals, decomposers and the plants themselves to yield carbon dioxide and water once more. The only net gain to the atmosphere in oxygen is proportional to the amount of reduced carbon (CH_2O) not used up in respiration (see equation above). This remaining reduced carbon in plant material will eventually be reoxidized to carbon dioxide and water except for that which is buried in the crust of the earth. The quantity of this buried material can serve to approximate the net gain in atmospheric oxygen which could have been produced by photosynthesis. Current estimates of the mass of organic carbon in sedimentary rocks is 6.8×10^{21} grams.⁶ Assuming that all of this carbon was in the form of CO_2 prior to photosynthesis, we can account for the existence of 18.2×10^{11} grams of oxygen, which is about 15 times more than what there is in our atmosphere at present. The excess amount has presumably been absorbed by the "oxygen sink" processes, such as the oxidation of iron, sulfur and volcanic gases. It would thus appear that the above-presented evolutionary scenario is based on sound scientific reasoning.

Additional considerations of the natural processes involved, however, challenge the validity of this evolutionary scheme. Dr. Van Valen, a member of the committee on evolutionary biology at the University of Chicago, questions the notion of the slow build-up of oxygen in our atmosphere.⁷ He indicates that photosynthesis by green plants may be an inadequate explanation for the early accumulation of oxygen. According to him the net production of oxygen today and throughout Phanerozoic time (0.6 billion years), is about equal to that absorbed by the continuous “oxygen sink” processes. How could there be any net oxygen accumulation in the atmosphere during an earlier period of presumably much less photosynthesis and a larger “oxygen sink”?

Van Valen postulated several possible solutions to this problem, none of which were to his liking, and concluded: “... the cause of the original rise in oxygen concentration presents a serious and unresolved quantitative problem.”⁷

Dr. Carruthers of the Naval Space Research Laboratory in Washington, D.C. pointed out an additional difficulty with the initial rise in atmospheric oxygen by green plant photosynthesis. An atmosphere void of oxygen would not contain the ultraviolet-absorbing ozone layer. Any photosynthesizing organism, by definition, would be exposed to light radiation and doubtless would be destroyed by the lethal short wavelength ultraviolet rays.⁸

Ultraviolet radiation, on the other hand, plays an important role in the production of atmospheric oxygen. It has been known for some time that in the earth’s upper atmosphere, above the ozone layer, molecules of water are shattered by the strong ultraviolet radiation of the sun.



The eventual products of this reaction, as indicated above, are atomic and molecular oxygen and hydrogen. Hydrogen being lighter than air escapes the earth’s atmosphere while oxygen remains.

Calculations for the production of oxygen by the photodissociation of water vapor were made by Dr. Brinkman of the California Institute of Technology, using certain assumptions where data was not available. He found that this process could produce 32 times the amount of oxygen currently found in our atmosphere and that a minimum of one fourth of

this atmospheric level of oxygen should have been present for more than ninety-nine percent of this earth's history.⁹

These results were awarded a mixed reception, because of their unfavorable implications for current evolutionary postulates. Then, pictures taken by a special camera placed on the surface of the moon during the Apollo 16 mission revealed that substantial amounts of hydrogen are leaving the earth's atmosphere, due to the action of ultraviolet radiation on the water vapors of the upper atmosphere.¹⁰ This finding shows that the photodissociation of water is a significant physical reality and an important source of atmospheric oxygen.¹¹ Dr. Carruthers, who directed these experiments during the Apollo 16 mission, cites a presently lower rate of oxygen production than Dr. Brinkman (about 10 times lower), but indicates that in the past these rates could have been several times greater.⁸

More recently, the Mariner 10 spacecraft flew by the planet Venus and radioed back to earth information about the composition of its upper atmosphere. Unexpectedly, the atomic oxygen (O) content of the upper atmosphere of Venus was found to be similar to what it is on earth.¹² Since it is very unlikely that oxygen is being produced on Venus by photosynthesis in plants, it follows then that it must be produced by the photodissociation of water vapor.⁹

All available evidence taken together seems to indicate that it is no longer tenable to postulate the existence of long periods of an oxygen-free atmosphere at anytime during the earth's history. But the presence of oxygen in the atmosphere rules out the possibility of any biologically significant compounds being formed in the "primitive atmosphere." This realization has forced some scientists to propose that biological building block substances such as amino acids were actually brought to earth by meteorites.¹³ This amounts to admitting their inability to postulate a scientifically valid mechanism, which could yield even the simplest building blocks of biologically important polymers in the context of chemical evolution.

The concept of spontaneous generation of life is the only logical alternative to the Biblical account of creation. Evolutionists, rejecting the Mosaic account of our origins as a myth, have enthusiastically advocated this other alternative. They have turned to the book of nature to gain support for their concepts. But "...the book of nature and the book of revelation bear the impress of the same master mind, they cannot but speak in harmony. By different methods and in different languages, they witness the same great truths."¹⁴

The validity of this statement is apparent when we consider the origins of atmospheric oxygen and the chances for the spontaneous generation of life. The book of nature tells us that if oxygen has always been in the

atmosphere of our earth, then life could not come about by a slow step-by-step self-organization of matter, but rather through a creative act by the One who commanded that "...the earth bring forth living creatures after their kind."¹⁵

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ARTICLES

DINOSAUR TRACKS AND GIANT MEN

Berney Neufeld
Department of Biology
Middle East College
Beirut, Lebanon

Reports of the presence of humans in the lower parts of the geologic column have been both intriguing and dubious. Read on....

WHY?

In the 1930s Dr. Roland T. Bird, a paleontologist from the American Museum of Natural History in New York, was collecting fossils in the southwestern United States.¹ It was near the end of a rather unproductive season, winter was coming on, and it was time for him to return to the museum. But, walking by a store in Gallup, New Mexico, he saw a sight that left him “a great deal more than startled,” for there in the window were two tracks in stone. “On the surface of each was splayed the near-likeness of a human foot, perfect in every detail. But each imprint was 15 inches long!”¹ Inquiry revealed that dinosaur-like tracks were also available, and that both varieties of tracks had come from the Glen Rose region of central Texas.

Dr. Bird traveled to Texas and found dinosaur prints by the score exposed in the bed of the Paluxy River. He uncovered many additional tracks and collected the best of these for the museum by breaking up the 12 to 16-inch thick sheet of limestone in which they were embedded. These trackways, in carefully numbered pieces, were hauled to New York City on flatcars and a portion of this material has been reassembled and is on display today in the dinosaur hall of the American Museum of Natural History.

Did Dr. Bird find any human-like tracks in Texas? Apparently not, or it seems that he would have reported them, for he drove a quarter of the way across the continent in search of such tracks.² In the years following Bird’s excavations there have been many stories and rumors reporting giant human tracks found associated with the dinosaur tracks of the Paluxy River. According to the standard geological time scale, the last dinosaur died about 60 million years before man should have come on the

EDITOR’S NOTE: Original pagination of this article was 64-76.



FIGURE 1



FIGURE 2

FIGURE 3

FIGURE 4



FIGURES 1-4. Tracks that are purported to have come from the Paluxy River, Texas. These specimens are from the Columbia Union College, Takoma Park, Maryland, collection. The color and texture of the tracks in 1, 3, and 4 appear to be identical. Track 2 is a rock of lighter color and finer grain structure than the others. The holes in some of the tracks are from earlier attempts to determine the origin of the tracks. The ruler is six inches long in each instance.

scene. Large mammal tracks of any sort found in association with dinosaur tracks would be a valuable piece of data in the continuing development of theories of earth history. The persisting rumors of the existence of giant man-like tracks in various collections reported to have come from Texas led some of my colleagues and me to a decision to make a careful study of the evidence.

METHODS

Study Area

Paluxy River, north of Glen Rose, Somerville County, Texas. The riverbed was examined for 1-2 miles upriver and downriver from Dinosaur State Park. Some tributaries were also examined. Much of the detailed work was done on the McFall farm 2 miles upriver from the State Park.

Location of Tracks

As far as was determined, all the dinosaur tracks are in a single limestone layer 6-16 inches thick.³ An examination of this limestone reveals it to be rich in plant fossils. The track layer lies beneath a few inches of blue-gray clay. Above the clay is another limestone layer.

Preparation of the Tracks for Study

The River carries a great deal of sediment, and tracks quickly become filled with mud. A stiff broom was used to brush sediment out of the tracks. Often it was necessary to sweep large areas of river bottom beneath a few inches of water to survey for possible tracks. Most of the tracks are below water level, and dikes were built around them for detailed study.

Study of Tracks

Photographs were taken of tracks from different light angles and perspectives. Tracks in series were photographed *in toto* and individually, and plaster of Paris casts were made of the interesting ones.

There are a number of dinosaur and mammal-like tracks owned by individuals and organizations (see Figures 1-4). These tracks were cross-sectioned with a diamond rock saw to determine whether they were made by feet or *by hand*. If a track was made by a foot the compression of the layers within the mud should conform to the track when viewed in cross-section. If the track was carved from hardened rock, then a cross-section should show the layers of the rock ending abruptly at the edge of the track in a manner analogous to a stream-channel cut through layers of sedimentary rock.

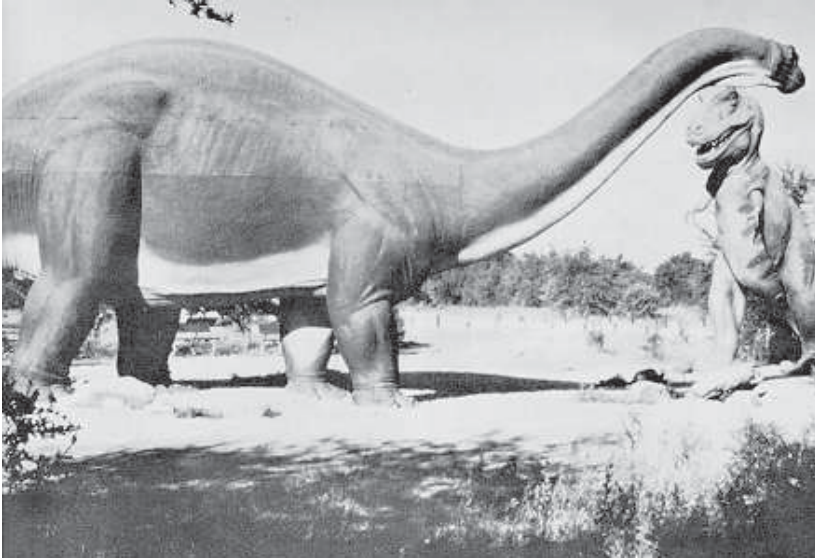


FIGURE 5. Models of the dinosaur track makers. These models, on display in Dinosaur State Park, Texas, represent the probable makers of the tracks we saw in our studies. The left model is the herbivore *Aptosaurus*; the right model is *Allosaurus*, a large carnivorous dinosaur which walked on its hind feet making a bipedal three-toed trackway.

RESULTS AND DISCUSSION

Tracks in situ

Aptosaurus (Brontosaurus, the “Sinclair dinosaur,” Figure 5). These tracks were rare in the area studied. Up to 3 feet in diameter and 18 inches deep, with the claw marks plainly visible, they are exciting, to say the least.

Three-toed Tracks

(*Allosaurus*, Figure 5). Most of the dinosaur tracks observed fell into this category. Their distinctive bird-track-like shape makes them detectable even when badly eroded. One trackway could be followed for over 100 yards along the river bottom. A new trackway of this type was partially uncovered in which the tracks were 18-24 inches long and up to 10 inches deep (Figure 6).

Elongate Tracks

Several series of this sort have been discovered. The tracks are approximately 18 inches long and 5-8 inches wide. There appears to be



FIGURE 6. Three-toed dinosaur trackway. This trackway is located behind the McFall farm a couple of miles upriver from Dinosaur State Park. The most distal two tracks were excavated from under the original sediments.



FIGURE 7. Elongate tracks — upriver series. This trackway is located on the McFall farm a half mile upriver from the tracks shown in Figure 6.



FIGURE 8. Series 2, shallow elongate track, the scale is in inches.



FIGURE 9. The upper plate man tracks. The two darker depressions in the center of the upper half are sometimes interpreted as toe marks.

no question that some represent the passing of a biped. All present examples of these prints are badly eroded, and the details of the tracks are quite indistinct. Three of these trackways are discussed in detail below.

Series 1 (Figure 7): Located on the upriver side of the McFall farm, these tracks are on the south bank of the river several feet above the river bottom. The imprints are 2-6 inches deep, and the trackway is visible for a dozen tracks or so. At the downriver end the prints disappear where the bank has been eroded away beneath them; on the other end they turn under the overlying bank. This overlayer has been dug away for several feet and two additional tracks have been uncovered. These tracks have been interpreted by some to be giant human tracks headed upriver. Examination of the downriver end of the tracks (toward the lower edge of Figure 7) reveals that several of them show the print of a three-toed dinosaur. It is not clear how the prints acquired their elongated shape, but it is obvious that the tracks cannot be both man and dinosaur.

Series 2 (Figure 8): This series is located at the downriver end of the McFall farm and has been studied by several groups in the past. The tracks are under water and are very shallow, running parallel to the river along the north bank. On the downriver end, they turn towards the river and are lost due to erosion. Apparently the same occurs upriver. The tracks are ½-1 inch deep, and their general form can be described as moccasin prints. Casts were made of the entire series. Comparison of these to the Series 1 elongate tracks has led to the conclusion that at least two members of the series are badly eroded dinosaur tracks. The upriver ends of these prints appear to be divided into the typical three-toed pattern.

A few feet downriver from these is the three-toed dinosaur trackway discussed above (Figure 6). These tracks are in a beautiful state of preservation. It appears that if these tracks were eroded down to the shallowness of the elongated track series nearby, they would look much like the shallow tracks of the nearby series. If any track in a series is from a dinosaur, it must be assumed that the entire series was made by the same creature. The elongate tracks of Series 2 probably represent the last vestiges of a three-toed dinosaur trackway.

While it is difficult to demonstrate that these highly eroded tracks are reptilian, it is more difficult to show convincingly that they represent the passing of a hominid wearing soft-soled footwear. This track-containing layer is covered with bipedal dinosaur tracks. Except for the slight suggestion of a hominid form represented by this series, there is no verifiable evidence for the existence of bipedal man-like tracks in this layer. Were such evidence to exist, this series would *at best* be regarded as ambiguous data. In the absence of such other data, the most likely possibility is that these tracks are of reptilian origin.

Series 3 (Figure 9): These are probably the most famous “man” tracks of the Paluxy River.⁴ They are located in the State Park area and are in the limestone layer that overlies the dinosaur track layer. This is significant because no dinosaur tracks have ever been found in this layer. The tracks are indistinct and badly eroded. They are about 12-15 inches in length, with 2 or 3 tracks possibly visible. Above water much of the year, they have been frequently examined. Often, in order to contrast the tracks with the surrounding rock for photographic purposes, they have been painted with oil. The tracks appear to have soaked up some of the oil and now contrast with the surrounding matrix even without treatment. In my opinion these footprints are not tracks at all, but represent random erosion marks in the surface of the limestone plate. The surrounding surface is covered with erosion marks of almost every imaginable shape. Individuals have reported visualizing the tracks of practically any mammal species on this surface. These “man” tracks have been observed for over a decade by Dr. Dexter Beary, chairman of the Biology Department of Southwestern Union College, Keene, Texas. He says that the big toe appears to be more distinct at the present time than when he first observed the “footprint” about 15 years ago (Figure 9). The print shown in Figure 9 is by far the best of the series. It is only with a great deal of imagination that a bipedal trackway can be seen at all.

Holes in the Riverbed. There are several places in the river bottom where large pieces (2-3 feet in diameter) of the track-containing rock has been removed. Local residents say these holes are where tracks have been taken from the riverbed. Examination of the holes makes it clear that limestone blocks have been removed from these sites in the past. Some of the holes they recall as the source of human-like tracks. However, tracks *in situ* are of much greater value than samples whose origins are not well authenticated.

Tracks in the Laboratory

Dinosaur Tracks, Loma Linda University. A rather eroded three-toed dinosaur track was purchased from Mr. McFall which his son had “recently” removed from the Paluxy River. It has been sectioned and the compression of the limestone substrata is clearly evident (Figure 10). The bending of the “mud” layers to conform with the track shape is exactly what would be expected when a print was formed by a foot stepping onto soft layered material. The layers deeper in the mud remain undisturbed.

Tracks at Columbia Union College. Dr. Don Jones of Columbia Union College, Takoma Park, Maryland, has a number of tracks whose origin is reported as the Paluxy River. The collection includes a right and left human footprint, a pair of three-toed dinosaur tracks, and a large cat

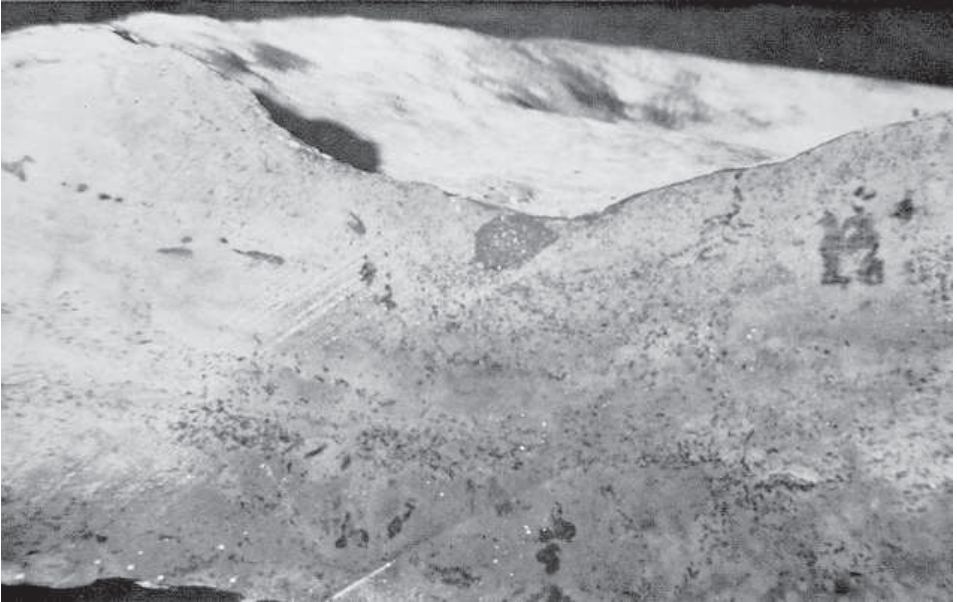


FIGURE 10. Cross section through a genuine dinosaur track. The more granular layer just beneath the track is depressed conforming to the shape of the track.

FIGURE 11. Cross sections through carved man-like track showing that the layers are not depressed at the edge of the track. Both this track and the one shown in Figure 12 are from the Columbia Union College collection. The sectioning was done by Dr. Don Jones of that institution.





FIGURE 12. Cross section through a carved dinosaur-like track.

print (Figures 1, 3, 4). All of these, in separate blocks, appear to be in the same type of limestone. They also have a single human track of inferior quality that is in a limestone of a different color and texture from that of their other prints (Figure 2). One of the three-toed dinosaur tracks and both types of man prints have been cross-sectioned. In each instance the rock layers end abruptly at the edge of the track, indicating that they are not the result of a foot stepping into soft mud but are produced by carving (Figures 11, 12).

Clifford Burdick, a consulting geologist from Tucson, Arizona, has a man-like track and a cat-like track. Both have been sectioned, and the evidence is equivocal. Some cross-sections give a slight indication of carving, others of conformation. The difficulty with these tracks is that they are in blocks of limestone whose pattern is more mottled than layered.

Local old-timers in the Paluxy River area tell that tracks were both excavated and *carved* as a source of income during the depression years. Both of these collections may well be carvings from that period.

Other Tracks. There are numerous stories claiming that other tracks exist or have existed in the past. I have been unable to locate any of these tracks and feel that if they do exist, they should be cross-sectioned to determine their validity. If genuine mammal tracks are found, it will still be necessary to determine where they came from. The limestones in the area studied are distinctive, and should be identifiable by their mineral and fossil compositions.

CONCLUSION

The Glen Rose region of the Paluxy River does not provide good evidence for the past existence of giant men. Nor does it provide evidence for the co-existence of such man (or other large mammals) and the giant dinosaurs. It seems likely in retrospect that the rumors of giant-man tracks had their origin in the discovery of tracks similar to the elongate tracks of Series 2.

Does this mean the concept of antediluvian man and the flood story is incorrect? — no. It may be only evidence that those men at that time did not cohabitate with dinosaurs. “To ignore all such reports, because they are sometimes inaccurate would be like refusing to listen to the weather forecast because the predictions sometimes fail to materialize. To accept all such reports as factual would be like believing without verification all the claims made by an automobile dealer or a real estate salesman.”⁵ In any kind of investigation, but especially when investigating the past where data is more equivocal, caution and thoroughness should characterize the work done, and conclusions should not be drawn prematurely.⁶

ACKNOWLEDGMENTS

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ENDNOTES

1. Bird RT. 1939. Thunder in his footsteps. *Natural History* 43(5):255.
2. What Dr. Bird actually saw can, at this point, only be known to him. Through the auspices of Dr. Eugene S. Gaffney, Assistant Curator of the American Museum of

Natural History, I have attempted to locate the field notes made by Dr. Bird in Glen Rose. They are not on file at the Museum in New York City. Dr. Gaffney asked Dr. Bird (retired in Florida) for his notes; however these were not found.

3. We found no exceptions to this statement, but we did not follow, continuously, the various layers along the several miles covered by this survey.
4. Taylor SE. 1971. The mystery tracks in dinosaur valley. Bible-Science Newsletter 9(4):1-3, 6-7. Films for Christ Assn. (R.R. 2, Eden Road, Elmwood, IL 61529) has released a film entitled "Footprints in Stone" based on this work. Our conclusions differ from theirs.
5. Ritland RM. 1970. A search for meaning in nature. Mountain View, CA: Pacific Press Publishing Assn., p 232.
6. Additional references: Bird RT. 1954. We captured a 'live' brontosaur. National Geographic, May, p 707-722; Cook N. 1969. Dinosaur tracks. Texas Parks and Wildlife 27:3-5; Ingalls AG. 1940. The carboniferous mystery. Scientific American 162(1):14.

ARTICLES

THE BIBLICAL VIEW OF THE EXTENT OF THE FLOOD

Gerhard F. Hasel

*Professor of Old Testament & Biblical Theology
Andrews University*

Was the flood a local or a worldwide event? What does an analytical study of the Genesis account of the flood reveal?

The Biblical flood narrative represents the story of the greatest incision in world history. The events described in Genesis 6:5-9:17 are reported in the same matter-of-fact language as the remainder of the book of Genesis¹ and thus claim to be understood in its plain and literal sense. The Genesis flood story is neither legend² nor myth³ and neither parable, allegory nor symbol.⁴ It is written in the straightforward genre of historical narrative in prose style.⁵ For the purpose of the following discussion the entire flood narrative of Genesis 6:5-9:17 is considered as a literary unity⁶ of a single account of the flood.⁷

I. THE ISSUE

There are two conflicting schools of interpretation regarding the extent of the Genesis flood. Traditionally the Biblical flood narrative has been understood to refer to a universal catastrophe of worldwide dimensions.⁸ The rise of uniformitarian evolutionism has been a primary catalyst in challenging the traditional position. On the basis of considerations from the natural sciences, commentators and interpreters began to seek for a limited flood theory or a relative view of the Genesis flood. H. E. Ryle in his commentary on Genesis written in 1914 states forthrightly, "Geology has shown that no such universal Deluge has ever occurred."⁹ Significant in this assessment is the acknowledgment that on the one hand the Biblical picture portrays a "universal Deluge" which is not denied and on the other hand "geological science has demonstrated that a Flood has never simultaneously covered the whole surface of the globe...."¹⁰ Ryle resolves this conflict by suggesting that the Genesis flood should be understood as a "symbol,"¹¹ i.e., as a non-historical event which teaches a great theological truth without being rooted in an actual universal event.

From our own time comes the approach of the liberal Catholic scholar C. Schedl who has just published a multivolume *History of the Old Testament* (1973). His discussion of the extent of the flood is primarily concerned with "the geographical extent of the flood" which in the view

of the writer of Genesis must be understood in terms of “the geographical universality of the flood.”¹² Schedl quickly points out that “particularly with the paleontological investigation of the earth’s crust, a growing tide of reflection has been mounting against the geographical universality of the flood.”¹³ On the basis of the evidences from the natural sciences, Schedl argues that the Biblical narrator formulated “the flood narrative, just as the creation narrative, [from] the Ancient Near Eastern picture of the world....”¹⁴ What he means to say is that since the “picture of the world” was limited in its geographical scope, the geographical universality of the flood is limited to that same picture of the world. Since Schedl argues for the limited geographical picture of the world for the flood on the basis of that of creation, a logical conclusion would be that there was also a geographically limited creation described in the creation account.¹⁵ This is, however, what neither Schedl nor other critical scholars think is conceivable. The approach outlined in this paragraph considers the Genesis flood story limited in geographical scope on the basis of the historically conditioned limitation of the world view of ancient Near Eastern man. Biblical writers are considered to reflect the limitations of their pagan predecessors and contemporaries.

The majority of scholars of the liberal critical school maintain however that Genesis indeed described a flood of world-wide dimensions, one that is to be understood in terms of global geographical extent.¹⁶ This should, of course, not be understood to imply that they actually accept as historical fact the Genesis description. Although liberal critical scholars in general recognize that the Genesis picture is that of a universal flood of global scope, they are also united in their view that this picture can no longer be understood in a literal sense. The non-literal (mythic, legendary, parabolical, symbolic, theological) understanding is based almost exclusively upon geological and anthropological consideration of modern times. The recent article in the well-known *Interpreter’s Dictionary of the Bible* states, “The belief in a deluge covering the whole earth and destroying all men and animals except those preserved in an ark has largely been given up.”¹⁷ Scholars of the liberal critical school readily point out that the narrator of the universal flood picture indeed believed what he wrote.

The problem accordingly is not one primarily of the Biblical text but one of critical and liberal scholarship. Langdon B. Gilkey, himself belonging to the liberal school of scholars, writes incisively of modern scholarship that it is “half liberal and modern on the one hand, and half Biblical and orthodox on the other, i.e. its world view or cosmology is modern while its theological language is Biblical and orthodox.”¹⁸ He states “What has

happened is clear: because of our modern cosmology, we have stripped what we regard as ‘the Biblical point of view’ of all its wonders and voices...we have rejected as invalid all the innumerable cases of God’s acting and speaking.”¹⁹ This is a most revealing self-analysis. He also uncovers why the liberal critical school arrives at its understanding of the Biblical text. “First there is the job of stating what the Biblical writers meant to say, a statement couched in the Bible’s own terms, cosmological, historical, and theological.”²⁰ Often critical scholars seek to understand Bible writers on their own terms; if the Biblical picture is in conflict with the modern understanding of the world and man, then the Biblical view is reinterpreted in such a way so as to remove its conflict with that of the modern conception.

There is a great number of scholars who do not follow the hermeneutical categories of critical Biblical scholarship. A common feature of those who are conservative or evangelical in their theological outlook is their high esteem of Biblical authority and inspiration. This does not allow them to treat lightly the point of view of the Biblical writer because he reveals divine truth and not just ancient religious points of view. Biblical statements are authoritative and binding for faith. On the basis of this common starting-point two avenues are open when there is a conflict between a modern understanding of natural phenomena and a Biblical truth. Let us consider the two avenues of conservative/evangelical scholars.

One school of thought more or less accepts the uniformitarian interpretation of geological and other natural phenomena²¹ and the modern evolutionary concept of anthropology²² seeking a harmonization by interpreting the flood narrative in Genesis in non-universal terms.²³ In other words this school of thought more or less shares with liberal critical scholarship the modern, evolutionary interpretation of natural phenomena. This pre-understanding leads them to read the Biblical writer in such a way that any conflict with their preconceived ideas is avoided. From the hermeneutical perspective it is evident that the modern pre-understanding serves as a key for the interpretation of Biblical data. This approach operates obviously with an external key which is designed to unlock Scripture. The question of what the Biblical writer actually meant to say recedes into the background if it is not indeed completely disregarded in order to establish harmony between the modern pre-understanding and the Biblical data. This approach implies that contextual and internal considerations are submerged or even sacrificed.²⁴ In the final analysis this approach does not allow that the inspired revelation of Scripture has any formative function in the interpretation of the book of nature.

The other school of thought among conservative/evangelical scholars maintains that an external principle and approach to Biblical interpretation built on modern pre-understanding robs the Biblical data of being interpreted objectively. It seeks to be as sensitive as possible to both the issues for faith in the area of nature and its interpretation and the area of Biblical revelation and its own interpretation. It attempts to control external influences on Biblical interpretation and seeks to operate in terms of the Biblical context. The modern pre-understanding is thus opened to questions concerning its premises and a prioris. A new interpretation of natural data is sought on the basis of Biblical creationism and catastrophism which is in conflict with scientific uniformitarianism.²⁵

In one aspect this approach is akin to that of the critical school's attempt to grasp what the Bible writer meant to say. This is done by paying most careful attention to the terms, phrases, idioms, expressions, etc., which the writers employed and to understand these within their own linguistic and contextual connections. This means to refuse to let external notions influence what a Bible writer actually meant to say. He is allowed to speak for himself which means that although he is a man of his own time, culture, and language, he nevertheless was able to express correctly and authoritatively the divinely revealed truth committed to him. No Bible writer must be interpreted by means of an ancient or modern world view. He must be allowed to speak for himself. The unique nature of the inspired Biblical testimony makes it imperative that only other inspired writings can have a determinative bearing on Biblical truth.

The discussion of these basic issues has set the stage for our inquiry with regard to the Biblical evidence for the question of the extent of the flood in the witness of the Bible. This investigation is carried out in order to determine on the basis of the witness of the Bible whether or not the flood is depicted as a worldwide catastrophe or whether it is of limited geographical extent.

II. THE BIBLICAL WITNESS

A. The Matter of Terminology

1. The Term "Earth." In the announcement of the flood it is stated "God saw the earth" (Gen 6:12) and the "earth was corrupt in God's sight" (6:11), the "earth was filled with violence" (6:11, 13). God decreed to "destroy them [all flesh] with the earth" (6:13) by bringing a flood of waters "upon the earth" (6:17). The aim of the flood is that "everything that is on earth shall die" (6:17). The term "earth" occurs by itself or in the phrases "upon the face of all the earth" (7:3; 8:9) a total of 46 times²⁶

in Genesis 6:5-9:17. The Hebrew term employed in all of these instances is *ʿereṣ*. The Septuagint translates this term consistently with the Greek equivalent *gē*, “earth.”²⁷ The English authorized versions (English Revised Version, American Revised Version, Revised Standard Version, New Jewish Version, Jerusalem Bible, New English Bible, New American Bible) translated the Hebrew term consistently with “earth” with the exception of the New English Bible which renders *ʿereṣ* in two instances with “world” (6:11, 12). It is recognized that the term “earth” gives the flood narrative a universal outlook.

Supporters of the local flood theory have pointed out that the Hebrew term *ʿereṣ* can mean “land” so that we should read “land” and “all the land” respectively instead of “earth.”²⁸ It is entirely correct to recognize that the term *ʿereṣ* does not always or even in the majority of its 2504 usages²⁹ in the Old Testament mean “earth” in a global or worldwide sense. Space does not permit a detailed investigation of the ranges of meaning of *ʿereṣ*, the noun which ranks as number four in frequency of usage in the Old Testament.

The formula “heaven and earth” which is employed 41 times in the Old Testament³⁰ and the sequence “earth and heaven” (6 times [31]) is the standard Hebrew expression for the totality of the world made up of the globe (“earth”) and the surrounding atmospheric heavens (“heaven”). It is the Hebrew surrogate for the term “world” (Greek *kosmos*) for which the Hebrew had no single expression.

It is by no means clear why the translation “land” with its *geographical* and political limitations should be the meaning in the flood narrative. Why could it not be the physical usage of *ʿereṣ* in the sense of “ground” upon which man stands (Gen 24:52; Exod 8:12, 13; Amos 3:5; 9:9; Ezek 28:17; Psa 147:6; etc.) or the “dry land” in contrast to the water (Gen 1:10)? Is it because the former is too narrow for a local flood theory and the latter too broad? Is the choice made on the basis of what fits best a given preconceived hypothesis? We agree whole-heartedly with F. A. Filby, who strongly supports a local flood theory, in his emphasis “that the meaning [of *ʿereṣ*] must be determined by the context.”³² Indeed we firmly support the notion that in understanding correctly the terminology of the Genesis flood narrative one must pay most careful attention to the context and situation of the narrative within the framework of Genesis and the whole Bible. Of equal importance are grammatical and syntactical relationships. If the context is considered in determining the meaning of the terminology in the Genesis flood narrative, then it does not matter whether *ʿereṣ* “has more often a limited meaning than a universal one.”³³ The quantitative

argument has no force because each usage is determined by its own context. Let us proceed on the basis of contextual considerations which permits the text to speak for itself and guards against uncontrolled and arbitrary interpretations.

Proof-texts cited in support of the local flood theory such as “the land of Shinar” (Gen 10:10),³⁴ “the whole land of Havilah” (Gen 2:11), “the whole land of Cush” (Gen 2:13), “the land of Nod” (Gen 4:16), “the land of Canaan” (Gen 11:31), Egypt (Gen 13:10), Philistia (Gen 21:34), Moriah (Gen 22:2),³⁵ have in each case the term ʔereṣ employed in a limited geographical or political sense. That these texts have no bearing whatever on the meaning of the term ʔereṣ in the Genesis flood narrative is evident from the following consideration: In each of these examples (and they could be multiplied many times over) the term ʔereṣ is followed by a genitive which contextually limits ʔereṣ to a geographical area or political territory. None of the 46 usages of ʔereṣ in the Genesis flood narrative is ever followed by a genitive and thus is not parallel or analogous to the usage of ʔereṣ in the texts cited by supporters of the local flood theory. In other words, the context of each of the above examples cited in support of the local flood theory indicates without doubt that ʔereṣ has a limited meaning. This kind of contextual indication must always be present for a limited geographical meaning of ʔereṣ .³⁶ Since it is absent from the usages in the flood story the universal meaning of ʔereṣ remains firmly supported.

2. The Phrase “the Face of all the Earth.” In two instances the flood story adds the adjective “all” (*kol*) to the noun “earth” (ʔereṣ). Noah is commanded to take seven pairs of all clean animals and birds and a pair of unclean animals into the ark “to keep their kind alive upon the face of all the earth” (Gen 7:3; cf. 8:9). The idea of “all the earth” (*kol-hāʔāreṣ*) is undoubtedly universalistic. It is argued that “all the earth” need not be understood in a strictly literal sense because there are passages in which “a universal meaning...is modified by the context.”³⁷ Among the texts cited in favor of a limited interpretation of “all the earth” are Exodus 10:5, 15; Numbers 22:5, 11; 1 Kings 4:34; 10:24; 2 Chronicles 36:23 and Genesis 41:57: “Moreover, all the earth came to Egypt to Joseph to buy grain, because the famine was severe over all the earth” (Revised Standard Version). Do these texts, which employ according to their context the phrase “all the earth” (*kol-hāʔāreṣ*) in the sense of “the whole land,” imply that this limited idea must be the meaning of this phrase in the flood story or other parts of Scripture? If “all the earth” should always mean “the whole land,” then the Lord’s claim that “all the earth is mine” (Exod 19:5)

would mean not more than merely a local deity's claim of possession of only "the whole land" as pagan gods claimed. Obviously the context of Exodus 19:5 demands the universal meaning of "all the earth" which is God's. When the Lord says "there is none like me in all the earth" (Exod 9:16), He means the entire globe and not a local country.³⁸ Again we must affirm that the context must be allowed to determine the meaning of "all the earth" each time it appears. It is unsound hermeneutically to read indiscriminately from one context to another. Furthermore, the actual phrase in Genesis 7:3 and 8:9 is "the face of all the earth." This is the phrase that needs further attention.

What is the contextual meaning of "all the earth" in the flood story? At the opening of the Genesis flood narrative the impending destruction is linked explicitly to the sinfulness of man whom the Lord had "made" (Gen 6:5) and "created" (v 6). "The connection between Creation and the Flood is a very real one...."³⁹ God made man sinless but now he is so sinful that he must be destroyed. Man was created to have dominion over all creatures and "over all the earth" (*kol-hā'āreṣ*, Gen 1:26) which is the entire globe and, not just the "dry land" (Gen 1:10), because his dominion includes the creatures on land and "the fish of the sea" (Gen 1:26). Man and beast have become so corrupt that the appointed survivor Noah is instructed to take a limited number of land creatures and birds on board the ark "to keep their kind alive upon the face of all the earth" (Gen 7:3). This explicit contextual link between creation and flood is a clear indication that "all the earth" in Genesis 7:3 and 8:9 has more than a local and limited meaning.⁴⁰

Inasmuch as the phrase in Genesis 7:3 and 8:9 is "the face of all the earth" it appears that there is a further qualification through the addition of the expression "the face of" (*pēnê*). It is striking that the identical Hebrew phrase rendered in English as "the face of all the earth" is used for the first time in the creation narrative. In Genesis 1:29 God informs man, "Behold, I have given you every plant yielding seed which is upon the face of all the earth...." Here "the face of all the earth," with "the face of" clearly being a metaphorical expression,⁴¹ refers to the "surface"⁴² of the "dry land" (Gen 7:22). After the two instances in the flood narrative, the same phrase appears for the last time in Genesis in the story of the Tower of Babel⁴³ where man is dispersed by God "upon the face of all the earth" (Gen 11:4, 8, 9) which is a scattering over the whole world.⁴⁴ The evident universal usage of this phrase in the book of Genesis supports the universal view of this phrase in the Genesis flood story. "Earth" or "the face of all the earth" in the flood story is in each instance universal in meaning.

It may be parenthetically inserted that the non-universal phrase concerning the famine which was spread “over all the face of the earth” (Gen 41:56) has a subtle difference in word order and is thus not identical in meaning to the phrase used in Genesis 1:29; 7:3; 8:9; 11:4, 8, 9 as linguistic usage and context indicate. On the basis of context and style Genesis 41:56 does not do away with the universal meaning⁴⁵ of the phrase “the face of all the earth” in the flood narrative (Gen 7:3; 8:9).⁴⁶

The question has been raised why the Genesis flood story does not employ the Hebrew term *tēbēl*⁴⁷ which means “dry land”⁴⁸ or “world”⁴⁹ in the sense of “continents.”⁵⁰ This term appears 39 times in the Old Testament⁵¹ but never in Genesis or the other books of Moses. The reason why this term is not employed lies in the fact that *tēbēl* appears only in poetic texts whereas the flood narrative is prose. Therefore the lack of this universalistic term of the flood narrative does in no sense imply a non-universalistic meaning for the term “earth.” This argument from silence which does not even consider the contextual and poetic usage of a term is best to be dispensed with.

3. The Phrase “Face of the Ground.” The phrase “face of the ground” (*pēnē ha-ʾadāmāh*) appears five times in the Genesis flood story in a variety of connections. God “will blot out man whom I have created from the face of the ground” (Gen 7:4). After “everything on the dry land⁵² in whose nostrils was the breath of life died” (Gen 7:22), it is stated that “he blotted out every living thing that was upon the face of the ground, man and animals and creeping things and birds of the air; they were blotted out from the earth” (v 23). It should be observed that in verse 23 the phrase “face of the ground” is parallel in thought to “the earth” in the same passage. Another parallelism is found between “the waters had subsided from the face of the ground” (Gen 8:8) and “the waters were still on the face of all the earth” (v 9). The third parallelism appears between the phrase “the waters were dried from off the earth” (v 13b) and the statement “the face of the ground was dry” (v 13c). These usages and their parallelism indicate that “face of the ground” is an expression which means the surface of the dry land in its most universal sense.

The observation that the extent of “ground” (*ʾadāmāh*) would be determined by the term “earth” (*ʾereṣ*), which is made by some supporters of the local flood theory,⁵³ is entirely correct. The explicit parallelism (“face of the ground” = “earth” 7:23; 8:8f.; 8:13) demands such an interpretation. We have already seen that “earth” and “face of all the earth” points into a single direction, namely the entire surface of the global mass of land.

It is again striking that the expression “face of the ground” is employed for the first time in the creation narrative which has an undeniable universal emphasis. According to Genesis 2:6 “a mist⁵⁴ went up from the earth and watered the whole face of the ground.” The “face of the ground” is the “surface”⁵⁵ (so also New American Bible, New English Bible, Anchor Bible) of the dry land or ground.⁵⁶ The Hebrew term translated “ground” ($\text{=}^a\text{d}\bar{a}\text{m}\bar{a}\text{h}$) appears in the Old Testament 225 times⁵⁷ with the basic meaning of “ground, soil.”⁵⁸ The most universal usage of $\text{=}^a\text{d}\bar{a}\text{m}\bar{a}\text{h}$ is “earth.”⁵⁹ It can also mean the “ground” upon which man stands⁶⁰ which can separate⁶¹ and which carries the creeping things (Gen 1:25; 2:6) and as the term “earth” and “face of all the earth” (Gen 7:23; 8:8-9, 13). There is no contextual indication whatever for a limited usage.⁶⁴ We must “read the [flood] account whole-heartedly in its own terms.”⁶⁵

4. The Phrase “All Flesh.” The 13 usages of the expression “all flesh” in the flood story⁶⁶ with the express notation that God will “make an end of all flesh” (6:13), “destroy all flesh” (6:17), and the statement of the subsequent fact that “all flesh died” (7:21f.) gives the unmistakable impression of universal destruction. B. Ramm has suggested that “*all* does not mean *every last one* in all of its usages.”⁶⁷ It is entirely correct that “all” (*kol*) which is employed in the Hebrew Old Testament 5404 times⁶⁸ does not always express totality. But it should be remembered that its basic meaning is “totality”⁶⁹ and that it is always expressive of totality with rare exceptions where the individual context provides a clear indication. If this were not so, then grand confusion would result because the word “all” would then never mean “all” but something less than “all,” something less than totality.

With regard to the formula “all flesh” a syntactical consideration does not even leave it an “open question”⁷⁰ whether it is “all” in a restrictive sense or in the sense of totality. The formula “all flesh” in the Hebrew appears as a genitival construction *kol-bāsār*. If *kol* (“all”) appears in construction before an indeterminate (i.e., without article or possessive suffix) noun (in our case “flesh”), then the meaning is totality⁷¹, i.e., “*all flesh*” in the sense of “*all men or all living creatures.*”⁷² In one of the 13 usages in the flood narrative the *kol* appears before a determinate noun, i.e. *kol-hābāsār* “all the flesh” (7:15).⁷³ In such a case “*kol...expresses unity*”⁷⁴ and “entirety.”⁷⁵ This same rule of Hebrew syntax applies to the determinate genitival construction “all the earth” (*kol-hā-āreṣ*) in Genesis 7:3 and 8:9 which means “the whole earth”⁷⁶ in its entirety. Inasmuch as “all (the) flesh” in the Genesis flood story includes both man *and* animals⁷⁷ as has been shown in detail above, there can be no doubt about the fact

that the destruction of “all (the) flesh” refers to the destruction of men and animals on land and in the air in their totality and entirety. This fact is underlined by the explicit statement that “only Noah was left, and those [members of his family and land animals and birds] that were with him in the ark” (7:23). “These alone were left after the universal destruction,” states U. Cassuto⁷⁸ quite appropriately.

5. The Phrase “Every Living Thing.” Another expression of totality is “every living thing” (*kol-hāḥay*) which appears in Genesis 6:19 where “every living thing of all flesh” is to be brought into the ark by pairs.⁷⁹ This expression encompasses birds, animals, and creeping things (v 20). Here again *kol* (“all”) is followed by a determinate noun which indicates that *kol* “has the meaning of the entirety, i.e. all, the whole.”⁸⁰

The translation “every living thing” in the text of Genesis 7:23, “He blotted out every living thing that was upon the face of the ground, man and animals and creeping things and birds of the air,” is expressive of the same threefold division of creatures as in 6:9 but also includes man. The Hebrew phrase, however, is not identical to the one in 6:19 but to the one in 7:4: “and I will blot out every living thing that I have made from the face of the ground.” In 7:4, 23 the phrase is *kol-hayecûm*. The term *yēqûm* is used aside from the two usages here only once more in the Old Testament (Deuteronomy 11:6). Its meaning is “existence,”⁸¹ “living being”⁸² or “what is living.”⁸³ Since *kol* (“all”) is again determinate the idea expressed is that God blotted out “all existence” in their entirety of what was living of living beings from the face of the whole earth with the flood waters. There is hardly any stronger way in the Hebrew to emphasize total destruction of “all existence” of human and animal life on earth than the way it has been expressed. The writer of the Genesis flood story employed terminology, formulae, and syntactical structures of the type that could not be more emphatic and explicit in expressing his concept of a universal, world-wide flood.

6. The Phrase “Under the Whole Heaven.” The phrase “under the whole heaven” (*taḥat kol-hāššāmāyim*) in Genesis 7:19, “and the waters prevailed so mightily upon the earth that all the high mountains under the whole heaven were covered,” “may not be so easily disposed of,”⁸⁴ says G. L. Archer, a supporter of the local flood theory. The famous commentator F. Delitzsch has stated, “But if the water covered ‘all the high hills under the whole heaven,’ this clearly indicates the universality of the flood.”⁸⁵ The critical scholar J. Skinner comments that “7:19, 20 not only asserts its [the flood’s] universality, but so to speak proves it, by giving the exact height of the waters above the highest mountains.”⁸⁶

Most supporters of the local flood theory do not discuss the phrase “under the whole heaven.” But those who attempt to come to grips with this serious difficulty for their hypothesis point out that “heaven” (*šāmāyim*) “can mean ‘sky’, or the visible part of heaven within the horizon (e.g. 1 Kings xviii.45).”⁸⁷ 1 Kings 18:45 reads, “And in a little while the heavens grew black with clouds and wind, and there was a great rain.” The context here clearly indicates that “heavens” means sky. But the context of Genesis 7:19 is entirely different! In addition the syntactical usage of “heaven” in both passages is entirely different. Dare we neglect the specific usage of a term? Certainly not. While in 1 Kings 18:45 (*šāmāyim* (“heavens”) appears by itself, in Genesis 7:19 *kol* (“all”) is in construct state to the determinate (i.e. with article) noun *šāmāyim*. It has been shown several times before that this syntactical relationship expresses totality and entirety. This is to say that the waters submerged all the high mountains of the totality and in the entirety under the atmospheric heavens. The way it is written in the Hebrew excludes any local or limited concept of “heavens.” The phrase “under the whole heaven” indeed clearly asserts the universality of the flood.

It has been objected that if we understand the phrase that “all the high mountains” were covered with the flood waters at elevations above that of Mt. Everest that the “rarified atmosphere” would “render all but a few creatures insensible in a very few moments for lack of oxygen.”⁸⁹ To this it has been responded that “all such concerns are misplaced, for it is an elementary fact that atmospheric pressure depends on elevation relative to sea level.”⁹⁰ On the other hand, there is no Biblical evidence for Mt. Everest or other high mountains to have existed at the time of the flood and consequently it is not necessary to “assert that the waters mounted to a depth of six miles.”⁹¹

Let us briefly summarize. The Genesis flood narrative provides ample evidence of being an account which is to be understood as a historical narrative in prose style. It expects to be taken literally. There is a consistent and overwhelming amount of terminology and formulae such as the frequent usages of “earth” and “all the earth,” “the face of the ground,” “the dry land,” “all flesh,” “under the whole heaven,” which on the basis of context and syntax has uniformly indicated that the flood story wants to be understood in a universal sense: the waters destroyed all human and animal plus bird life on the entire land mass of the globe. To read it otherwise means to force a meaning on the carefully written and specific syntactical constructions of the original language which the text itself rejects. This universal emphasis with its picture of a worldwide flood finds additional supports from other considerations.

B. The Flood and the History of Beginnings

1. Genealogies. The universality of the flood is to be inferred also from the parallelism of antediluvian and postdiluvian genealogical lines. The whole antediluvian world is populated from the offspring of Adam, namely Cain (Gen 4:17-24) and Seth (4:25-26) in the great genealogical list of Genesis 5:1-31. As Adam is in the Bible's view the father of pre-flood man, so Noah is the father of post-flood man. As from Adam's sons the whole world was populated, so from Noah's sons the entire earth is once more populated. This is the clear claim of the postdiluvian genealogical list called the Table of Nations of Genesis 10:1-32. From Noah's sons arose the nations of the world: "...and from these the nations spread abroad on the earth after the flood" (Gen 10:32). The experience of the Tower of Babel spreads them across the entire globe (Gen 11:1-9).

2. Blessings. We have noted frequent allusions in terminology and thought to the creation story. Another important aspect indicating the universality of the flood from which Noah and his family are the only human survivors (Gen 7:23) concerns the blessing. After man had been created as male and female, as the pinnacle of creation, God bestows His divine blessing upon him by saying, "Be fruitful and multiply and fill the earth..." (Gen 1:28). On the basis of this charge the antediluvian world is populated with human beings.⁹² These very words are spoken also to the survivors of the destructive flood: "And God blessed Noah and his sons, and said to them, 'Be fruitful and multiply and fill the earth'" (Gen 9:1). As prediluvian man "had" his beginning with Adam, so postdiluvian man has his beginning with Noah. Man after creation and after the flood receives the same divine blessing. With both there is a new beginning. The corollary of the fact that with first man the prediluvian world is populated is the fact that with man surviving the flood the postdiluvian world is populated anew. In this example of blessing we note again that the focus of the first eleven chapters of Genesis including the flood story is the entire world in its global dimension and not a limited geographical area.

3. Covenant. In making a covenant with Noah, "your descendants after you, and with every living creature that is with you, the birds, the cattle, and every beast of the earth with you" (Gen 9:9-10), God pledges unconditionally that "never again shall all flesh be cut off by the waters of the flood, and never again shall there be a flood to destroy the earth" (v 11). Not only is the covenant itself of a universal nature valid in perpetuity for "all flesh" saved in the ark, but the covenant sign in the form of the rainbow is universal (v 12-17). It is a worldwide witness to the worldwide

flood and a world-wide witness that “the waters shall never again become a flood to destroy all flesh” (v 15). If there had been a limited flood, then there would have had to be a limited covenant and covenant sign. The universality of both the covenant and the rainbow witnesses to the universality of the flood.

III. CONCLUSION

Our investigation of the term “earth” and the phrases “the face of all the earth,” “face of the ground,” “all flesh,” “every living thing,” and “under the whole heaven” has consistently shown that this is universalistic language pointing into a single direction of a flood of global scope. Indeed the writer of the Genesis flood story had no means at his disposal to make this more explicit than he actually did. Context and syntax uniformly indicated that the writer wished to convey the picture of a world-wide flood which covered the entire antediluvian land masses which destroyed all human, animal and bird life that existed on them.

Additional supports for the universal concept of the flood offered themselves in the parallelism of antediluvian and postdiluvian genealogies, in the blessings spoken by God over first man on earth and over man surviving the flood, and in the universal covenant and the world-wide covenant sign in the form of the rainbow.

In conclusion we cannot refrain from referring to the typological analogy of a worldwide flood of which the apostle Peter spoke. His inspired words build on the worldwide destruction of the antediluvian world by water. The next universal destruction of the world will be by fire. “The world that then existed was deluged with water and perished. But by the same word the heavens and the earth that now exist have been stored up for fire, being kept until the day of judgment and destruction of ungodly men” (2 Pet 3:6-7). God will again interrupt the steady rhythm of the world; He will again carry out what He has foretold.

ENDNOTES

1. Kaiser WC. 1970. The literary form of Genesis 1-11. In: Payne JB, editor. *New Perspective on the Old Testament* (Waco, TX), p 59-60. Kaiser sums up his study as follows. “Genesis 1-11 is prose and not poetry. The use of *waw* consecutive with the verb to describe sequential acts, the frequent use of the direct object sign and the so-called relative pronoun, the stress on definitions, and the spreading out of the events in a sequential order indicates that we are in prose and not in poetry. Say what we will, the author plainly intends to doing the same thing in these chapters that he is doing in chapters 12-50.”
2. Since H. Gunkel in 1901 applied the form-critical method to the book of Genesis (1901. *Genesis*. Göttingen) and concluded that the narratives of Genesis are *Sagen*

- (sagas, legends; see his: 1964. *The Legends of Genesis: The Biblical Saga and History*. Corruith WH, translator [NY], which is a translation of the first part of his famous 1901 commentary) many have followed his distinction. Cf. Skinner J. 1930. *Genesis* (International Critical Commentary, 2nd ed.; Edinburgh) p iii-xxiv.
3. See: Öhler A. 1969. *Mythologische Elemente in Alten Testament* (Stuttgart), p 85-101; Morgenstern J. 1965. *The Book of Genesis* (NY), p 80.
 4. See: Ryle HE. 1914. *The Book of Genesis* (The Cambridge Bible for Schools and Colleges; Cambridge), p xxxix: "The Deluge...is related as a symbol of Divine judgment upon sin, and as a typical example of Divine deliverance: while the description of its physical characteristics follows the exaggerated account of popular tradition."
 5. Eissfeldt O. 1965. *The Old Testament: An Introduction*. Ackroyd PR, translator (NY), p 12-56, distinguishes among the prose types those of (1) "speeches, sermons, prayers," (2) "records" and (3) "narratives" of a poetic and historical nature. According to the intention of the author of Genesis 6:5-9:17 the proper category should be historical narrative written in prose style.
 6. The source division of the Genesis flood narrative began with J. Astruc in 1753 who was followed by J. G. Eichhorn [1779. *Urgeschichte*, I]. Since K. Budde [1883. *Die biblische Urgeschichte* (Gen. 1-12, 5) untersucht (Leipzig)], the source division of the flood story in a J and P strand has become an accepted norm of critical scholarship, see: Westermann C. 1973. *Genesis* (Neukirchen-Vluyn), I, 66-73; Habel NC. 1971. *Literary Criticism of the Old Testament* (Philadelphia), p 28-42; and many others. For those opposing this source division, see the following note.
 7. There is a growing number of scholars of differing schools of research that oppose the source division of the Genesis flood story. Among the most incisive studies are the following: Jacob B. 1930. *Die biblische Sintfluterzählung, ihre literarische Einheit* (Berlin); Frühstorfer K. 1945. *Die noachische Sintflut* (Linz); Rabast KH. 1951. *Die Genesis* (Berlin), p 162-164; Nielsen E. 1954. *Oral Tradition* (London), p 93-103; Cassuto U. 1934. *La Questione della Genesi* (Florence); Kidner D. 1967. *Genesis* (Chicago), p 97-100. These studies have indicated that the prevailing theory of a source division of Genesis 6-9 is wholly unsatisfactory and gives rise to insolvable problems which are avoided if the story in its present form is considered a literary unity (cf. Thomson HC. 1909. *The assured results of modern criticism tested by the flood narrative*, in *Biblische Studien* [Neukirchen], p 178-183, 245-254.
 8. See the surveys by J. P. Lewis (1968. *A Study of the Interpretation of Noah and the Flood in Jewish and Christian Literature* [Leiden]; St. Lach (1961. *Die biblische Sintflut in der gegenwertigen Exegese*, p 5-60).
 9. Ryle, *The Book of Genesis*, p 109.
 10. *Ibid.*, p xxxiv.
 11. *Ibid.*
 12. Schedl C. 1973. *History of the Old Testament. The Ancient Orient and Ancient Biblical History* (Staten Island, NY), I, 397.
 13. *Ibid.*, I, 398.
 14. *Ibid.*, I, 397.

15. It is of interest that Schedl considers the creation account as a “grandiose religious poem” (*ibid.*, I, 248) which is to be understood as “theology” (*ibid.*, I, 237ff.).
16. It is not necessary to provide an exhaustive list. The following are representative. Procksch O. 1950. *Theologie des Alten Testaments* (Gütersloh), p 145; Skinner, Genesis, p 165: “[the narrator] not only asserts its universality, but so to speak proves it, by giving the exact height of the waters above the highest mountains.” von Rad G. 1965. *Old Testament Theology* (Edinburgh), I, 156: “...it represents the Flood as a calamity which affected the whole world.” *Idem.* 1961. *Genesis. A Commentary* (Philadelphia), p 124: “...we must understand the Flood, therefore, as a catastrophe involving the entire cosmos.” Speiser EA. 1964. *Genesis* (Anchor Bible; Garden City, NY), p 55, speaks of a “universal catastrophe” with the “annihilation of all life outside the ark.” Sarna NM. 1966. *Understanding Genesis* (NY), p 55: “In the Bible, the Flood is a cosmic catastrophe.” Köhler L. 1957. *Old Testament Theology* (Philadelphia), p 178; Vriezen TC. 1970. *An Outline of Old Testament Theology* (2nd ed.; Newton, MA), p 397; Noth M. 1972. *A History of Pentateuchal Traditions* (Englewood Cliffs, NJ), p 237; Keel O, Kuchler M. 1971. *Synoptische Texte aus der Genesis* (Freiburg), II, 117, 122; Manly EH. 1968. *Genesis. The Jerome Biblical Commentary* (Englewood Cliffs, NJ), p 16: “The cosmic nature of the flood is stressed, just as creation had involved a cosmic ordering.” Fohrer G. 1972. *Theologische Grundstrukturen des Alten Testaments* (Berlin), p 201: “The flood is a destruction of the world, the first world is inundated through it!” Zimmerli W. 1972, *Grundriss der Alttestamentlichen Theologie* (Stuttgart), p 151, speaks of “a world-wide flood catastrophe.”
17. Marks JH. 1962. *Flood (Genesis)*, in *Interpreter’s Dictionary of the Bible* (Nashville), II, 283.
18. Gilkey LB. 1962. *Cosmology, ontology, and the travail of Biblical language. Concordia Theological Monthly* 33:143.
19. *Ibid.*, p 152.
20. *Ibid.*, p 153.
21. Carnell EJ. 1959. *The Case for Orthodox Theology* (Philadelphia), p 96: “The prima-facie meaning of the Flood is that the entire earth was submerged. But geological evidence fails to verify a universal flood.” See the recent essays by Davis A. Young (1973. *Some practical geological problems in the application of a mature creation doctrine. Westminster Theological Journal* 35:268-280), and the response by J. C. Whitcomb, Jr. (1973. *The science of historical geology in the light of the Biblical doctrine of a mature creation. Westminster Theological Journal* 36:65-77).
22. On this point, see: Whitcomb JC, Jr., Morris HM. 1971. *The Genesis Flood* (Grand Rapids, MI), p 36-54.
23. An outstanding proponent of this approach is: Ramm B. 1954. *The Christian View of Science and Scripture* (Grand Rapids, MI), p 229-249. Among those who follow it of recent date are: Cansdale GS. 1970. *A universal flood: some practical difficulties. Faith and Thought* 98:61-68; Filby FA. 1971. *The Flood Reconsidered* (Grand Rapids, MI), p 81ff.; Patton D. 1966. *The Biblical Flood and the Ice Epoch* (Seattle), p 64; Mitchell TC. 1962. *Flood. The New Bible Dictionary* (Grand Rapids, MI), p 427f.; Mallowan MEL. 1964. *Noah’s flood reconsidered.*

- Iraq 26:62-82; Raikes LR, 1966, The physical evidence of Noah's flood. Iraq 28:62-63.
24. Although it is evident that a subconscious influence of modern scientific opinion is at the root of the motivation to interpret the Biblical flood narrative as a local event (W. S. LaSor of Fuller Theological Seminary fears that Biblical catastrophism "will fail to impress the secular scientific mind." Eternity [August 1961], p 43) together with the acceptance of interpretation of scientific data from various fields, very few interpreters of an earlier era held that Genesis did not necessitate a belief in a worldwide flood (see Poole M. 1670. Synopsis; Stillingfleet E. 1662. Origines Sacra).
 25. Among the writers who attempted to use this approach with more or less consistency are: Clark HW. 1966. The New Diluvialism (Angwin, CA); Rehwinckel AM. 1951. The Flood in the Light of the Bible, Geology and Archaeology (St. Louis); Whitcomb & Morris, The Genesis Flood; Coffin HG. 1969. Creation: Accident or Design? (Washington DC); Schaeffer FA. 1972. Genesis in Space and Time (Downers Grove, IL), p 133f; Whitcomb JC, Jr. 1973. The World That Perished (Grand Rapids, MI) in which he also gives a careful refutation of the critique of The Genesis Flood by J. R. von de Fliert (p 111-128).
 26. Genesis 6:5, 6, 11, 11, 12, 12, 13, 13, 17, 17; 7:3, 4, 6, 10, 12, 14, 17, 17, 18, 19, 21, 21, 23, 24; 8:1, 3, 7, 9, 11, 13, 14, 17, 17, 17, 19, 22; 9:1, 2, 7, 10, 10, 11, 13, 14, 16, 17.
 27. The only difference is in Genesis 8:17 where in the LXX omits one usage of the three. For the New Testament usage of *gē* with the meaning of "earth," "land" as a dwelling-place of man, "land" as distinct from water, "ground" in the sense of that upon which man stands or which is fruitful, see Sasse H. 1964. *gē*. Theological Dictionary of the New Testament 1:667-681.
 28. So especially Filby, The Flood Reconstructed, p 82f. Cf. Mitchell, The New Bible Dictionary, p 427: "⇒*Ereš* can mean 'land' (eg. Genesis x .10)...." Archer GL, Jr. 1964. A Survey of Old Testament Introduction (Chicago), p 194.
 29. Schmid HH. 1971. *ʔereš* Erde, Land. In: Jenni E, Westermann C, editors. Theologisches Handwörterbuch zum Alten Testament (Zürich), I, 229.
 30. Genesis 1:1; 2:4; 24:3; Exodus 20:11; 31:17; Deuteronomy 3:24; 4:26, 39; 30:19; 31:28; Isaiah 37:17; Jeremiah 10:11; 23:24; 32:17; Ezekiel 8:3; Psalm 113:6; 115:5; 121:12; 124:8; 134:3; 135:6; 146:6; etc. Cf. Hartmann B. 1960. Himmel und Erde im Alten Testament. Schweizer Theologische Umschau 30:221-224.
 31. Genesis 2:46; Ezekiel 8:3; Zechariah 5:9; Psalm 148:13; 1 Chronicles 21:16; Jeremiah 10:11b.
 32. Filby, The Flood Reconsidered, p 82.
 33. Ibid.
 34. Mitchell, New Bible Dictionary, p 427.
 35. Filby, The Flood Reconsidered, p 82; cf. Archer, Survey of OT Introduction, p 194.
 36. Schmidt, Theologisches Handwörterbuch zum Alten Testament, I, 232f.
 37. Filby, The Flood Reconsidered, p 83.
 38. Among the many indisputable texts that use "all the earth" in a universalistic sense are Genesis 1:26, 27; 2 Kings 5:15; Isaiah 13:9, 11; 6:3; 10:14; 12:5; 14:7, 26; 25:8;

- 54:5; Jeremiah 45:4; 50:23; 51:7; Zephaniah 1:8; Habakkuk 2:20; Zephaniah 1:18; 3:8, 19; Zechariah 1:10, 11; 14:9; Psalm 8:2, 10; 57:6, 12; 66:1, 4; 96:1, 9; 82:1; 100:1; 108:6; etc.
39. Sarna, *Understanding Genesis*, p 56.
 40. Ottosson M. 1973. *Theologisches Wörterbuch zum AT* 2:523, a critical scholar points out that this is the meaning in both Genesis 1:26, 29 and 7:3; 8:9 plus in many other Old Testament texts.
 41. Holladay WL. 1971, *A Concise Hebrew and Aramaic Lexicon of the Old Testament* (Grand Rapids, MI), p 293.
 42. Koehler L, Baumgartner W. 1958, *Lexicon in Veteri Testamenti Libros* (Leiden), p 766; Fohrer G, editor. 1973. *Hebrew and Aramaic Dictionary of the Old Testament* (NY), p 223.
 43. It may be noted that a recently discovered Sumerian tablet contains a Sumerian story which recalls the time when all spoke the same language. See: Kramer SN. 1968. The Babel of tongues: a Sumerian version. *Journal of the American Oriental Society* 88:108-111. Note also the discussion by Sarna, *Understanding Genesis*, p 63-80, who wrote before this recent discovery.
 44. Ryle, *Genesis*, p 147.
 45. This has been argued by some, see Kinder, *Genesis*, p 94, note 1; Kline, *New Bible Commentary*, p 88.
 46. The only other instance of the phrase “the face of all the earth” in the Pentateuch is found in Deuteronomy 11:25: “no man shall be able to stand against you; the Lord your God will lay the fear of you upon the face of all the earth which you shall tread, as he promised you.” Most English versions (Revised Standard Version, New English Bible, New American Bible, New Jewish Version, New American Standard Bible) abbreviated the phrase upon contextual grounds to “upon all the land” which is the meaning provided by the context.
 47. Archer, *Survey of OT Introduction*, p 194.
 48. Koehler & Baumgartner, *Lexicon in Veteri Testamenti Libros*, p 1017f.
 49. Holladay, *A Concise Hebrew and Aramaic Lexicon of the Old Testament*, p 386.
 50. Fohrer, *Hebrew and Aramaic Dictionary of the Old Testament*, p 386.
 51. Stolz F. *בל* trauern. *Theologisches Handwörterbuch zum Alten Testament*, I, 28.
 52. The Hebrew term for “dry land” is *hārābāh*, used seven times in the Old Testament (Gen 7:22; Exod 14:21; Josh 3:17; 4:18; 2 Kings 2, 8; Ezek 30:12; Hag 2:6. cf. Koehler & Baumgartner, *Lexicon in Veteri Testamenti Libros*, p 330) and rendered by the lexicons as “dry ground” (Koehler & Baumgartner, *Lexicon in Veteri Testamenti Libros*, p 330), “dry land” (Holladay, *A Concise Hebrew and Aramaic Lexicon of the Old Testament*, p 115), or “that which is dry” (Fohrer, *Hebrew and Aramaic Dictionary of the Old Testament*, p 91). This term is not identical to the one for “dry land” in Genesis 1:9f. which is *yabbāšāh*, used 13 times in the Old Testament (Koehler & Baumgartner, *Lexicon in Veteri Testamenti Libros*, p 310).
 53. Mitchell, *New Bible Dictionary*, p 427; cf. Archer, *Survey of OT Introduction*, p 194.
 54. The Hebrew term *ʔed* which appears only here and in Job 36:27 is variously interpreted, i.e. either as “mist” (Luther, Delitzsch, Budde, and many others),

- “source, well” (Holzinger), “underground water” (Dillmann, Speiser), or “stream” (Albright, Cassuto, W. G. Lambert, H. Renckens).
55. Koehler & Baumgartner, *Lexicon in Veteri Testamenti Libros*, p 766; Fohrer, *Hebrew and Aramaic Dictionary of the Old Testament*, p 223.
 56. For *pēnê hā^adāmāh*, see Exodus 32:12; 33:16; Numbers 12:3; Deuteronomy 6:15; 7:6; 14:2; 1 Samuel 20:15; 2 Samuel 14:7; 1 Kings 13:34; Isaiah 23:17; Jeremiah 25:26; 28:16; Ezekiel 38:20; Amos 9:8; Zephaniah 1:2f. with the meaning “upon the surface (face) of the ground (earth).”
 57. Schmid HH. *^adāmā* Erdboden. *Theologisches Handwörterbuch zum Alten Testament*, I, 57.
 58. Holladay, *A Concise Hebrew and Aramaic Lexicon of the Old Testament*, p 4; Koehler & Baumgartner, *Lexicon in Veteri Testamenti Libros*, p 13f. For the various shades of meaning, see: Plöger JG. *Theologisches Wörterbuch zum AT*, I, 95-105.
 59. Genesis 12:3; 28:14; Amos 3:2; 9:8; Deuteronomy 6:15; 1 Kings 13:34; etc.
 60. Exodus 3:5; 8:17.
 61. Numbers 16:30f.
 62. Leviticus 25:20; Ezekiel 38:20; Hosea 2:20.
 63. For more restrictive usages, see Plöger, *Theologisches Wörterbuch zum AT*, I, 57-60.
 64. Against those who would seek to restrict the explicit universal meaning and import of these terms, cf. above note 53.
 65. Kidner, *Genesis*, p 95.
 66. Genesis 6:12, 13, 17, 19; 7:15, 16, 21; 8:17; 9:11, 15a, 16, 17.
 67. Ramm, *Christian View of Science and Scripture*, p 241, refers in support of his claim to Psalm 22:17, John 4:39, and Matthew 3:5.
 68. G. Sauer, *kōl* Gesamtheit. *Theologisches Handwörterbuch zum Alten Testament*, I, 829.
 69. Koehler & Baumgartner, *Lexicon in Veteri Testamenti Libros*, p 435; Holladay, *A Concise Hebrew and Aramaic Lexicon of the Old Testament*, p 156; Fohrer, *Hebrew and Aramaic Dictionary of the Old Testament*, p 122.
 70. Kidner, *Genesis*, p 94, is more cautious than Ramm in leaving it an “open question.”
 71. Koehler & Baumgartner, *Lexicon in Veteri Testamenti Libros*, p 435; Holladay, *A Concise Hebrew and Aramaic Lexicon of the Old Testament*, p 157.
 72. Kautzsch E, Cowley AE. 1970. Gesenius’ *Hebrew Grammar* (2nd ed.; Oxford), p 41, para. 127c. Cf. Meyer R. 1969. *Hebräische Grammatik* (3rd ed.; Berlin), II, 17, par. 4c.
 73. Among the 46 Old Testament usages of “all flesh” (see Mandelkern, *Concordantiae*, p 241) there is only one other example which is determinate (Isaiah 40:6).
 74. Holladay, *A Concise Hebrew and Aramaic Lexicon of the Old Testament*, p 157.
 75. Kautzsch-Cowley, *Gesenius’ Hebrew Grammar*, p 411, par. 127b.
 76. Holladay, *A Concise Hebrew and Aramaic Lexicon of the Old Testament*, p 157; Koehler & Baumgartner, *Lexicon in Veteri Testamenti Libros*, p 435.
 77. It is used in this total sense of man and animals also in Numbers 16:22; 18:15; 27:16; Deuteronomy 5:26; Job 34:15; Psalm 136:25; Jeremiah 12:12; 25:27, 31; 45:5; Daniel 4:12 [9]; Isaiah 66:16.

78. Cassuto, Commentary on Genesis, II, 97.
79. The translation of “two of every sort” for *šēnayim* in 6:19, 20 is impressive, because this dual has a collective force which ought to be rendered into English by “in pairs” with 7:2, 3 specifying the exact number. Cf. Kitchen KA. 1966. *Ancient Orient and Old Testament* (Chicago), p 120; Martin WJ. 1955. *Stylistic Criteria and the Analysis of the Pentateuch* (London), p 15f.
80. Kautzsch-Cowley, Gesenius’ Hebrew Grammar, p 411, par. 127b. Cf. Brockelmann C. 1956. *Hebräische Syntax* (Neukirchen), par. 73c, 124a.
81. Fohrer, *Hebrew and Aramaic Dictionary of the Old Testament*, p 113.
82. Koehler & Baumgartner, *Lexicon in Veteri Testamenti Libros*, p 398.
83. Holladay, *A Concise Hebrew and Aramaic Lexicon of the Old Testament*, p 141.
84. Archer, *Survey of OT Introduction*, p 194.
85. Delitzsch F. 1949. *Genesis. Commentary on the Old Testament* (reprint; Grand Rapids, MI), p 146.
86. Skinner, *Genesis*, p 165.
87. Mitchell (*New Bible Dictionary*, p 427), Filby (*The Flood Reconsidered*, p 83), and Ramm (*Christian View of Science and Scripture*, p 241) also refer to Deuteronomy 2:25, “the peoples that are under the whole heaven” in a local sense. We must point out that in this instance “the peoples” are contextually qualified and limited to those “who shall hear the report of thee.” In Deuteronomy 11:25 the phrase is even further limited to mean “all the land that you shall tread.” It should be noted that there is a textual problem in Deuteronomy 2:25 where the word “heaven” is omitted in Hebrew manuscripts, the Lucianic recension, Origen, and the Syriac.
88. See above notes 72 and 80.
89. So: Custance A. 1958. *The Extent of the Flood*, p 9, as cited by Whitcomb, *The World That Perished*, p 45.
90. Whitcomb, *The World That Perished*, p 45.
91. Ramm, *Christian View of Science and Scripture*, p 242.
92. Fohrer, *Theologische Grundstrukturen des AT*, p 202: “The first world has disappeared, a new world has begun. This is the reason why the narrator repeats the words of creation for animals and a little later for man: ‘Be fruitful and multiply.’ This is the reason for him giving in Genesis 9:1-17 the new charter for life for the new Noahite world.”

NEWS AND COMMENTS

THE TEXTBOOK CONTROVERSY IN TENNESSEE

When the State of Tennessee approved the 1973 statute which required inclusion of creation theory along with evolution in the public-school textbooks (see *Origins* 1:86-93), it seemed that creationists had finally won a major victory.

Opposition, however, set in immediately. Opponents of the "Genesis Law" denounced it as being an updated version of the anti-evolution law that had been used to convict John T. Scopes of teaching evolution in 1925.

Two Nashville attorneys brought a lawsuit on behalf of the citizen's group called Americans United for the Separation of Church and State. In September 1974, as a result of this suit, Nashville Chancellor Ben H. Cantrell issued a memorandum opinion, deciding that the demand for equal time was an act "respecting the establishment of religion" and thus violated the First Amendment to the United States Constitution. He stated that the legislature had attempted to place the Biblical account of creation above other theories. Apparently he ignored the provision in the Genesis Law that allowed for the use of supplementary materials to meet the requirements of "equal time" for alternative theories, for he reasoned that it would be impossible to include all theories of man's origins in the textbooks. Therefore, he concluded, the act was really saying, "We don't care what other theories are included, just be sure the Genesis account gets equal time."

The Chancellor further defended his decision by citing the criteria established by the Supreme Court for evaluating "establishment of religion" claims. The act was constitutional if it had a secular legislative purpose, neither advanced nor inhibited religion, and if it did not foster excessive government entanglement with religion. In his opinion, this singling out of one account of origins was "inferential of an essentially sectarian, religious purpose underlying this public act." Because it was "altogether impossible" to include all accounts within the context of a basic high-school survey course, he ruled the law invalid.

While the proceedings in Nashville were going on, the National Association of Biology Teachers (NABT) also retained counsel to challenge the constitutionality of the Genesis Law.

In their federal suit, the NABT attorneys maintained that the requirement to give equal attention to the Biblical account of creation along with evolution was an attempt to impose *religious* beliefs on the

public-school students. The state meanwhile argued that this law represented a fairness doctrine for educators.

On April 10, 1975, the U. S. Court of Appeals for the Sixth Circuit issued its ruling 2 to 1 in favor of the NABT, the only dissenting vote being on procedural grounds. Circuit Judge George Edwards noted that “for a state to seek to enforce such a preference by law is to seek to accomplish the very establishment of religion which the First Amendment to the Constitution of the United States squarely forbids....The antecedents of today’s decision are many and unmistakable. They are rooted in the foundation soil of our Nation. They are fundamental to freedom.”

In August, two more separate rulings were issued. The Tennessee Supreme Court rejected the state’s contention that the law represented fairness, saying, “we concur in the holding of the 6th Circuit Court of Appeals that (the statute) violates the First Amendment to the U. S. Constitution and further hold, for the same reasons, the act violates Article I, Section 3, of the Constitution of the State of Tennessee.”

In another decision, the U. S. District Judge Frank Gray, Jr. agreed with the Supreme Court’s ruling, saying that the Genesis Law violated the First Amendment prohibitions of preferential treatment for certain religious beliefs. He argued that the requirement to give equal attention to all the theories of origins was unreasonable, for “every religious sect, from the worshippers of Apollo to the followers of Zoroaster, has its belief or theory. It is beyond the comprehension of this court, how the Legislature, if indeed it did, expected that all such theories could be included in any textbook of reasonable size.”

With these separate, but unanimously adverse, rulings, it would appear that the creationists have been defeated in their attempt to see scientific creation taught in the public schools of Tennessee. Since creationists, who pay for public education, are discriminated against by current practice in public schools, the issue will probably arise again. The equal protection clause of the Fourteenth Amendment to the United States Constitution is also involved. Its applicability remains to be tested.

Katherine Ching

NEWS AND COMMENTS

TEXTBOOK HEARING IN CALIFORNIA

In May 1975, the citizens of California and the State Board of Education faced another round in the controversy over the teaching of creation in the public schools.

On May 8 a public hearing was held in Sacramento, at which time interested parties could present their opinions on some of the textbooks that were being proposed for use in the public schools for 1976 to 1981. Most of the 67 speakers, in their allotted 5 minutes, addressed their remarks to one of two issues: the treatment of minorities or the teaching of creation.

After the public hearing in November 1972, the State Board had voted not to include creation in the science textbooks, but to discuss the creation and evolution theories in the social science texts. A perusal of the social science texts chosen for adoption by the Curriculum Commission made it evident that they had chosen to ignore the Board's decision and had not approved any books which included both creation and evolution.

Dr. John R. Ford, President of the State Board of Education, opened the hearing by reporting a record number of petition signatures and letters urging the inclusion of creation material — “the greatest number I have ever received on any measure.” He continued by stating, “I think it's fair to say that to date the members of this Board have received a total of about two hundred thousand letters, telegrams, cards, signatures, or other indications of public opinion about the teaching of evolution and creation.”

Concluding that the Board had a mandate in this regard because of the expressions of opinion, Dr. Ford urged: “According to the framework we have adopted, the various views of human origins must be seen as part of the total intellectual culture. The publishers have blatantly omitted any presentation of both sides as we requested them. None of the books up for adoption contain creationist materials.... We have Curriculum Commission members who do not follow the Board's directions. They are acting as independent agents. We must follow the framework.”

In the public hearing that occupied the remainder of the day, 16 of the speakers addressed themselves to the creation issue. The tone of this hearing was in sharp contrast to the 1972 hearing (see *Origins* 1:29-34). At that time the press lined the side of the room with cameras as about half of the speakers urged the teaching of both creation and evolution, and the other half argued that only evolution should be taught. In the 1975 hearing, the press was not very conspicuous, and the anti-creationists did not bother to come. Of the 16 speakers who spoke directly to the issue of

creation and evolution, all were in favor of including creation in the textbooks.

In spite of the petitions, letters, and speeches, the Board did not vote to include any creation material in the list of accepted books. The vote was 5 to 5, one vote short of the majority needed to pass any motion. Three of those who voted against creation teaching were recently appointed by Governor Edmund G. Brown, Jr.

Some creationist groups are now threatening court action or other legal means of pursuing the issue. Dr. Ford indicated privately that one problem is the lack of quality material on creation that would be acceptable for public schools. Another problem is less obvious to the casual observer. At the time of the Scopes Trial (1925) the evolutionists were contending that academic freedom demanded that evolution should be taught. Now that the tables are turned and the people of California want both creation and evolution to be taught, evolutionists are fighting this. Perhaps academic freedom is not the real issue in their minds, and one wonders if there isn't a concerted effort to eliminate a competing theory. The outcome of this session also makes one wonder about the usefulness of public hearings, since it appears that several of the members of the State Board of Education chose to ignore the desires of their constituents who support the public schools. A survey in the largest elementary school district in California (see *Origins* 2:42-43) indicates that a vast majority of the citizens of California want both creation and evolution taught. This survey also suggests that more people in California believe in creation than in evolution.

Leonard Brand

LITERATURE REVIEWS

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OLD TRADITIONS ON TRIAL

THE NATURE OF THE STRATIGRAPHICAL RECORD. Derek V. Ager. 1973. NY: John Wiley & Sons. 114 p.

Reviewed by Ariel A. Roth, Geoscience Research Institute

This is a delightful book. It is refreshing to find an author who is willing to question the well-established ideas that are too often taken for granted. Ager's basis for challenge comes both from extensive field observation and from the recent trends in geology towards catastrophic interpretations. These trends propose that a fair proportion of the sediments of the crust of the earth have been laid down by catastrophes with long periods of quiescence between.

The author, who is a well-recognized authority in the fields of paleoecology and stratigraphy, is well aware of the controversial nature of his presentation. However, he is unabashed and "unrepentant" (p xiii) and hopes his book "will stimulate thought and argument, even rage" (p xiv). Apparently this work is being well accepted. Other reviews in the literature (see list at the end of this review) are generally favorable. This is especially true of the most authoritative reviewers.

The impact of the argumentation in this book comes mainly from the broad spectrum of data referred to. This is not the usual pattern in scientific research where specialization is emphasized. Ager states, "Experts always tend to obscure the obvious" (p 7). A broad approach is important, especially in trying to make proper deductions from the more tentative data of the past history of the earth. The one serious criticism this reviewer has of the format of this work is that very few references to the data of the scientific literature are given in the text. At the end of the book an annotated bibliography is included, but such an arrangement is very unhandy for the serious student who wants to re-evaluate the specific data presented.

The author takes a strong stance in favor of catastrophism for the geologic history of the earth. He occasionally appeals to meteorites as a cause, even mentioning that a giant one "falling in the Atlantic would produce a wave twenty thousand feet high" (p 23). Some of his views fit in well with the Biblical account of earth history. He realizes this and

categorically dissociates himself from any such views. While referring to extraterrestrial causes he states,

This is a heady wine and has intoxicated palaeontologists since the days when they could blame it all on Noah's flood. In fact, books are still being published by the lunatic fringe with the same explanation. In case this book should be read by some fundamentalist searching for straws to prop up his prejudices, let me state categorically that all my experience (such as it is) has led me to an unqualified acceptance of evolution by natural selection as a sufficient explanation for what I have seen in the fossil record (p 19, 20).

This reviewer qualifies as a member of the lunatic fringe described above and happily notes that neither he nor other such qualified individuals are inmates of mental institutions!

The author begins the text by presenting evidence of unusually widespread sedimentary units relating a number of highly characteristic layers found on several continents. As an example, correlation is proposed between the colorful Painted Desert formation of the southwestern United States (Triassic, Chinle), with similar deposits as far away as the eastern seaboard of the United States, Spain, Germany, Bulgaria and the Atlas Mountains of Africa. He generally attributes the uniqueness of various deposits to climatic control, but also points to evidence for high energy conditions during deposition which can result in extensive transport. Widespread correlation even on a small scale is evident from lithological units of 100 feet or less in thickness in western Canada which persist for over 180,000 square miles.

Ager then addresses himself to the fossils. After recognizing the ubiquitous gaps in the fossil record, he adopts a catastrophic attitude toward evolution, where long periods of stable equilibrium are interrupted by rapid events of speciation. Ager has apparently not analyzed or does not accept the quantitative data (Eden 1967, Salisbury 1969) that indicates that the standard geological time scale is far too short a period for evolution to proceed even on a continuous basis. The author says more than he intends when he appropriately concludes by stating "palaeontologists cannot live by uniformitarianism alone" (p 26).

The inconsistency between the relatively rapid rates of deposition going on under present conditions compared to the thinness of the sedimentary layers of the earth which should be much thicker if the earth is very old is evidence to Ager that "the stratigraphical record is...one long gap with only very occasional sedimentation" (p 34). It may not have occurred to the author that if there are such long gaps between sedimentary events one should find at those gaps the evidence of the passage of time in the form of normal irregular erosional features, for if there is not sedimentation, there must be erosion. No place on the surface of our restless earth is free of the effects of one or the other of these processes.

In a chapter which is called "Catastrophic Stratigraphy," an elegant defense for rapid action in sedimentation is put forth. The author speaks of graded beds 20 meters thick, deposited in a single "whoosh" of turbid water, and of the transport of "pebbles" over 40 meters in diameter. Such events are considered spasmodic. In the following chapter called "Catastrophic Uniformitarianism" the importance of these catastrophes is further emphasized. The author's breadth of interest and spicy style is apparent in his statement, "The disastrous Lisbon earthquake of 1755 not only shook that city and the faith of the 'Age of Reason' (including Voltaire's ever hopeful *Candide*), it also considerably modified the local sea-floor and its sediments" (p 46). Later he adds, "The hurricane, the flood or the Tsunami may do more in an hour or a day than the ordinary processes of nature have achieved in a thousand years" (p 49).

It is Ager's opinion that a great deal of sediment deposition is in a lateral pattern instead of a slow, widespread vertical accumulation. This is used to explain the time transgressive (diachronous, or different age) deposits where within a sedimentary unit the fossil pattern of distribution is not parallel to the lithologic (rock layer) pattern. He also proposes to help solve the boundary disputes between various parts of the geological column by defining only the lower boundary of each unit, thus avoiding the argumentation over where the top of the previous unit ends. This would work quite well if the bottom of the units were well defined, but they are not.

Ager lists various possible mechanisms that may cause the catastrophes evident in the geological record. He gives due recognition to the paucity of modern parallels for what we see in the sediments of the earth, stating, "It can hardly be argued that either carbonate or coal measure deposition is going on around the world today in anything like the way it has in the past" (p 80). He suggests the possibility of extraterrestrial forces such as meteorites and changes in cosmic ray flux to explain geological and paleontological changes. He protects himself from the usual criticisms given these less testable hypotheses by appealing to the authority of other scientists with similar ideas: "I make no apology for joining a distinguished band of predecessors" (p 83).

The last part of the book is an attempt to synthesize the new ideas of plate tectonics with what is seen in the stratigraphical record. Here catastrophism is mentioned once more: "...and again, I think, we are beginning to see a somewhat 'catastrophic' picture" (p 83). He concludes his stimulating treatise by pointing out that the "history of any one part of the earth, like the life of a soldier, consists of long periods of boredom and short periods of terror" (p 100). We unhesitatingly propose that the long periods of boredom may not have been so long. It does not necessarily take very long for nothing to happen.

Anyone interested in the past history of this earth should read this book. The author's extensive field experience and breadth of knowledge are particularly valuable. He has accumulated an impressive amount of data in favor of catastrophism and his interpretations help to account for many features of the crust of the earth that have not been explained by generally accepted views. Perhaps an even greater contribution is that the author has shown that a number of older geological traditions can be challenged by factual data.

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LITERATURE REVIEWS

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ARK FEVER

NOAH'S ARK: FACT OR FABLE? Violet M. Cummings. 1972. San Diego, CA: Creation-Science Research Center. 352 p. THE ARK FILE. Rene Noorbergen. 1974. Mountain View, CA: Pacific Press Publishing Association. 207 p.

Reviewed by Katherine Ching, Geoscience Research Institute

Numerous attempts have been made to produce tangible evidence supporting the Scripture text which says: "And the ark rested in the seventh month, on the seventeenth day of the month, upon the mountains of Ararat" (Gen 8:4). The "ark-aeological" literature usually contains first-hand accounts of various expeditions with varying degrees of success and failure.

Cummings and Noorbergen, however, give more than personal accounts of expeditions and research; they both endeavor to give a history of sightings and attempts to verify the sightings.

Cummings' book describes her husband's almost-thirty years of research through interviews and expeditions to Mount Ararat (located on the eastern border of Turkey). After preliminary chapters which give the Genesis flood account and speculations about "what it would have been like to be there as the ark was being built and boarded," Cummings proceeds to describe the thirteen reports of sightings of the ark on Mount Ararat since 1840 (the year that a giant earthquake opened a chasm in Mount Ararat). As further investigations into these rumors were made, frustrations abounded, for concrete evidences (i.e., photographs, newspaper clippings, and personal diaries) had been either destroyed or lost, and somehow the seekers after the ark story continually found themselves facing dead-ends. Ventures undertaken by the Sacred History Research Expedition, the Oriental Archaeological Research Expedition, the Archaeological Research Foundation, and the Scientific Exploration and Archaeological Research ended in conflicts with government permits and red tape, or, once getting clearance, inability to reach the area where the ark was thought to be.

Throughout her book, Cummings appears to be striving to prove that the ark is in fact on Mount Ararat, and, using all of the accounts of its sightings, she concludes that the Biblical custom of establishing truth “at the mouth of two witnesses, or at the mouth of three witnesses” (Deut 19:15) might be applied to sightings of the ark. In the published sighting of the ark by two Russian aviators, in which 95% of the story was proved to be built largely on imagination, Cummings proposes that the possibly 5% factual evidence does seem to indicate the existence of the ark on the mount.

Her book gives the overall impression that, despite some evidence to the contrary, those who believe in God’s word still believe the ark is hidden on the mount, protected from destruction by God.

In contrast, Noorbergen covers the same story of research and expeditions, but with a different viewpoint. After receiving the “Ark files” from Dr. A. J. Smith, President of the Oriental Archaeological Research Foundation, his interest in the search was revived. This led him to accompany expeditions to Mount Ararat. He begins his book by citing a mixture of flood legends, myths, and Scripture as evidence that the ark is probably on the mountain. While stating that the Genesis flood account should be the basis for all ark research because it is the oldest sacred account, he then appears to place the other accounts on the same footing with the Biblical account.

His following chapters duplicate Cummings’ reports of the modern-day sightings, but instead of leaving these as possible evidences for the existence of the ark, he seems determined to see how many flaws he can find in each story. In each case, he triumphantly points out possible discrepancies and calls them hoaxes. Although he insists the ark is hidden on Ararat, Noorbergen sounds generally more cynical and negative than Cummings and leaves one with the feeling that the ark might never be located.

Both books are interesting reading, especially if one does not rely on “happy endings.” One wonders what impact the discovery of Noah’s ark would have on a world that suffers from doubt, credibility gaps, and an increasing immunity to sensationalism. Both authors expect too much from the Ark discovery: Cummings believes it could end the controversy between evolutionists and creationists, and Noorbergen appears to see the discovery as proof for a *worldwide* flood.

GENERAL SCIENCE NOTES

TURBIDITES

Ariel A. Roth

Geoscience Research Institute

On November 18, 1929, an earthquake shook the New England coast and the Maritime Provinces of Canada. This earthquake, known as the Grand Banks Earthquake, loosened a large mass of mud on the edge of the continental shelf. The mud then slid down the continental slope into the deeper part of the North Atlantic Ocean. It eventually spread over the abyssal plain at the foot of the slope, parts traveling over 500 miles. One might think that a mass of loose mud flowing in the ocean would quickly mix with the sea water and lose its integrity as a separate unit, but this is not the case. The mud has a greater density than sea water because it is a combination of water and an abundance of heavier rocks, sand, silt, and clay particles. This heavier mud flows beneath the lighter sea water somewhat like water flows on land beneath lighter air. Only a small amount of mixing takes place between the mud and the overlying water. Such an underwater mudflow is called a turbidity current, and the new mud layer deposited as the flow stops is referred to as a turbidite.

Fortunately for science, but unfortunately for commercial telegraphy, 13 transatlantic cables that were in the way of the Grand Banks turbidity flow were broken, some in two or three places. The first break of each cable was precisely timed by the interruption of the teletype machines and its location determined by resistance tests. Those cables that were closest to the epicenter of the earthquake near the top of the continental slope broke almost instantly, while further away an orderly succession could be followed as the mudflow broke successive cables. Rates of travel were calculated to be sometimes greater than 50 miles per hour. The last cable, more than 500 miles out, was broken a little over 13 hours after the earthquake. It has been estimated that the resulting turbidite coming from this mudflow covered more than 100,000 square miles and had an average thickness of 2-3 feet.

To have such widespread deposits laid down so rapidly may seem quite unusual, yet it appears to be a fairly common phenomena. In Lake Mead large quantities of sediments accumulate at the eastern end where the Colorado River enters the lake. Occasionally a turbidity type of current

transports some of this sediment to the opposite end of the lake which is over 100 miles away. The same phenomenon has been observed in lakes in Switzerland, and in 1954 several cables were broken by an earthquake-induced turbidity current which originated on the coast of Algeria and flowed into the Mediterranean.

Turbidites have certain characteristic features such as grading (the gradual change in particle size from coarse to fine as one goes up through the deposit), grain orientation, and special contact and internal features. Because of this they can be identified in ancient sediments found in the crust of the earth. In a world-wide catastrophe such as the flood described in Genesis, one would expect a significant number of these, and this is the case. Their abundance and widespread distribution in sediments which are found high above sea level and over large areas of continents further increase the credibility of such a catastrophe. Single turbidites may be scores of feet thick and the volume of the flow producing some of the larger ones is estimated at more than twenty cubic miles.

Since the advent of the turbidite concept 25 years ago, there has been a significant revolution in the interpretation of a large number of sedimentary deposits. Tens of thousands of graded beds piled upon each other, which were previously interpreted as being slowly deposited in shallow water, are now interpreted as the result of turbidity flows. Even the interturbidite layer, which consists of sediments found between some turbidites, is occasionally interpreted as the result of rapid deposition. This new concept indicates that some events in the past history of the earth may have proceeded much more rapidly than was previously believed.