

Creation Research Society Quarterly

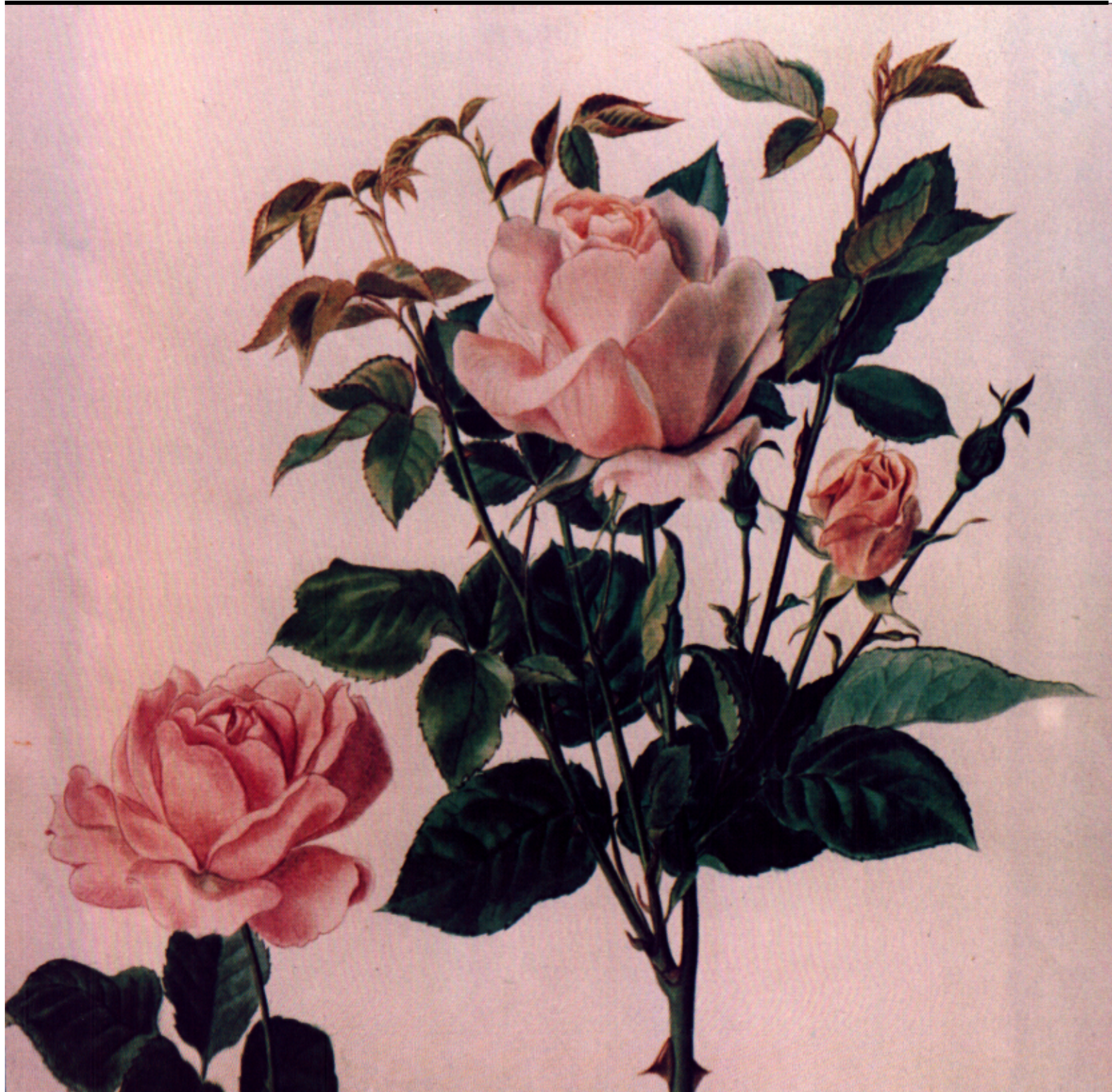
Haec credimus:

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

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COVER ILLUSTRATION

On the front cover is shown a painting of the famous Queen Elizabeth rose, developed by Dr. Walter E. Lammerts, who is a founding member and former President of the C.R.S., and was first Editor of the Quarterly. Recently this rose received an international award. Here is Dr. Lammerts' account of the event.

Queen Elizabeth Given Award as the World's Favorite Rose

While I was in Chile, S.A., the Organization of World Rose Societies met in Pretoria, South Africa. It was their fourth world convention and was called Rosafari '79. At this meeting they selected my rose Queen Elizabeth as the "World's Favorite Rose." Before I left, Judge Milton Cadsby, of Ontario, Canada, called urging me to attend the meeting, since he thought it might be given the award.

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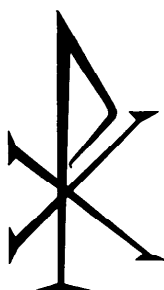


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LATE PALAEOOLITHIC BARLEY FARMING

DAVID J. TYLER*

Received 8 January, 1980

The transition from a food-gathering way of life to a food-producing way of life is widely considered to be a major development in the history of mankind. It is generally recognized that a prerequisite for the rise of civilization is the ability of man to plan his food supplies by arable and livestock farming. The change from Palaeolithic hunter/gatherer communities to Neolithic farming communities is termed the Neolithic Revolution—a fundamental change in the social life of pre-historic man.

A recent challenge to the conventional view has come from Wendorf and his colleagues,¹ who have reported on their archaeological excavations at Wadi Kubbanaiya, near Aswan in Egypt. Numerous grinding stones and occasional mortars and pestles have been recovered from Late Palaeolithic sites, indicating that the ancient inhabitants of the wadi used cereal grains for food. In addition, a few carbonized grains of barley

have been found. Wendorf and his co-workers have considered whether the barley grains were wild, or domestic, or in transition from the one to the other. Morphologically, there are similarities with domestic barley, and the tentative conclusion is that “the barley represents a very early stage in the process of domestication”. Radiocarbon dates from the sites are mainly in the range 17,000-18,000 b.p., which places them about 10,000 radiocarbon years prior to the evidences of grain production in other regions of the Near East. The authors comment: “A reasonable explanation for the abundance of barley in Wadi Kubbanaiya, for its importance in the economy of the inhabitants of the wadi, is that the barley, whether wild or domestic, flourished there in part through the intervention of man. If so, we may regard Wadi Kubbanaiya as an example of an early food-producing society, and the ambiguity of the botanical remains may indicate that it was actually an incipient food-producing society.”

The situation, tentatively reconstructed, is that the in-

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Cover Illustration

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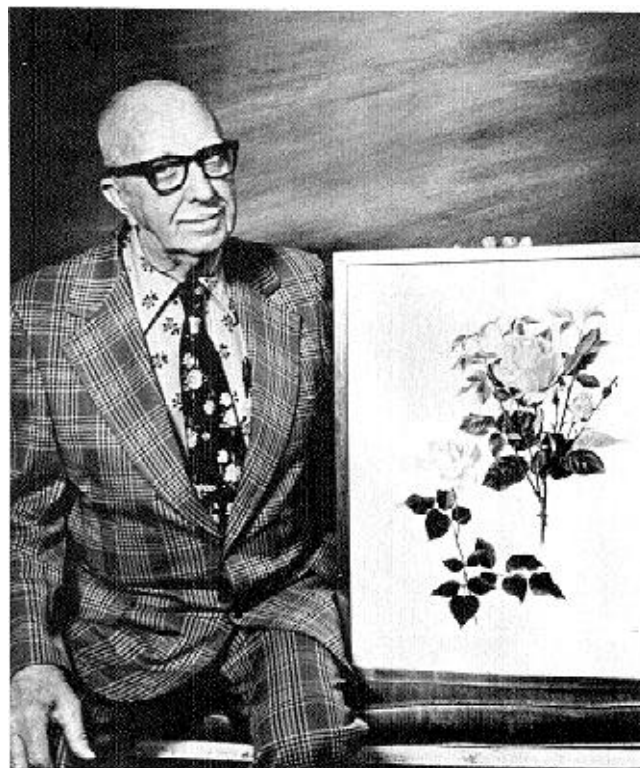
However, I had already bought my steamship tickets for the voyage from Buenos Aires to Valparaiso, Chile, and also from Valparaiso home to San Francisco; so unfortunately could not accept his kind invitation. I appointed Ralph Moore, the famous breeder of miniature roses, to accept this award for me. In his letter to me Ralph Moore writes: “It is interesting that the award was first given to the rose Peace at Oxford, England, at the Third World Conference; and it was chosen winner with a score of 72 points. In the present choice of Queen Elizabeth the score was the same—72 points.”

The award is an original painting of this variety by the famous Swiss artist, Lotta Gunthart, which is reproduced on the front cover. It is indeed a very lovely painting as may be seen by the illustration; and I am very grateful that this most interesting rose received this award. If Queen Elizabeth grows in other countries as well as it does in Chile, I can readily see why it is so popular. There it grew to a height of over ten feet and was six to eight feet in diameter! This was in the area south of Santiago, Chile, particularly from Chillan south through Temuco and Osorno. Perhaps it would be worth while to make a study of just why the soils in this rather large area are so excellent for growing roses.

On page 3 is shown a picture of Dr. Lammerts with the painting which was awarded. His many friends are glad with him at this well-deserved recognition.

Incidentally, if to originate a flower such as this is such a feat as to call for recognition at an international

convention, is it not extremely unrealistic to suppose, as is maintained under evolution, that other flowers and living things could have come about by chance and accident?



Dr. Walter E. Lammerts, with the painting which he received when his Queen Elizabeth rose was chosen as the World's Most Popular Rose.

Late Palaeolithic Barley Farming

(Continued from page 3)

novation of barley cultivation occurred in the life of this palaeolithic community and yet it made no noticeable difference in their cultural development. Wendorf *et al* write: "Barley appears to have been no more than simply another resource used as part of a broad-based economy. If our interpretations of the Wadi Kubbania evidence are correct, then it would seem, in this case at least, that the development of food production was one of the great nonevents of prehistory."

The role of radiocarbon dating in archaeological studies of this kind can hardly be underestimated, and it is the antiquity of the evidences for barley production that makes this case so interesting. However, it has been pointed out² that if the C-14 dates are reinterpreted according to a non-equilibrium model, conclusions which are radically different will follow. It has been argued that conventional C-14 dating tends to stretch out real time in the neolithic and palaeolithic periods, making them far longer than they really are. If these 10,000 years of radiocarbon time represent, in real time, a few generations, then the discoveries cease to be anomalous and controversial.

Wendorf's article raises other questions which are

merely noted here. Whilst the authors refer to multiple occupation levels, they also describe them as deflated. By this they mean that expected layers of sand and silt between occupation layers are absent. "Most of these sites are now heavily deflated and appear as large, dense concentrations of artifacts on the surface, palimpsests of several occupations brought together by erosion." Is erosion responsible for bringing the occupation layers close together? Or is this another indication that C-14 dates inflate time-spans in prehistory?

From a Biblical perspective, it is expected that the principles of farming were known from the earliest times. Wendorf *et al* may not be so far from the mark when, in this particular case, they refer to the innovation of food production as a nonevent. It is suggested, therefore, that a more profitable line of enquiry is to consider why aspects of farming practice are *absent* from a society, rather than speculate on how farming was initiated.

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- ¹Wendorf, F., R. Schild, N. El Hadidi, A. E. Close, M. Kobusiewicz, H. Wieckowska, B. Issawi, H. Haas. 1979. Use of barley in the Egyptian late Paleolithic. *Science* 205 (4413):1341-1347.
²Tyler, D. J., 1978. Radiocarbon calibration—revised. *Creation Research Society Quarterly* 15(1):16-23.

BIOGEOGRAPHY FROM A CREATIONIST PERSPECTIVE: II. THE ORIGIN AND DISTRIBUTION OF CULTIVATED PLANTS

GEORGE F. HOWE* AND WALTER E. LAMMERTS**

Received 7 January, 1980

A model is developed for the origin and distribution of cultivated plants from the standpoint of rapid creation, the fall, the flood, and a post-flood dispersal from the area of Asia Minor. It is assumed that each type of plant was created separately but that crop plants vary as to the length of time they have been under human cultivation.

Certain plants appear to have been domesticated very early and it is proposed that these represent forms which were cultivated before the flood and then propagated by Noah and his descendents. Data from archaeology fit such a view in that many crop plants are found to have been cultivated first in mountain highlands in the mideast and only later elsewhere. Vavilov's "centers" of crop plant origin are reevaluated as centers of post-flood agriculture.

Other cultivated plants seem to have been domesticated more recently. It is assumed that these were unknown to Noah as crop plants but were later brought under culture. Ancestors for most cultivated plants are completely lacking, a fact that supports creation rather than evolution.

The processes of mutation, selection, cultivation, hybridization and polyploidy are analyzed in relation to the history and development of corn, wheat, apple, rose, orchid, and strawberry varieties. While many very interesting modifications have been achieved, there has not been any evolution of new species that would persist under natural conditions.

Cultivated Plants Have No Ancestors

All plants were formed by the Creator as separate "kinds" which have not varied beyond rather narrow limits since the time of creation. In Genesis 1:11 it was reported that God made the "fruit trees," the "grass," and the "herb yielding seed after his kind." Certainly numbered among the created plant species were those

which man was later to cultivate for food, fabric, and other products. The commentators Keil and Delitsch understood the scope of this creation act as they wrote. "These three classes embrace all the productions of the vegetable kingdom."¹ If the Bible record is accurate, we should find no evolutionary forerunners of the cultivated plants.

The geneticist Darlington rejected the scriptural view, writing that once upon a time people used to think that horticultural plant types were the "... gift of the gods..." but that such belief was shaken about 150 years ago when it was found that there were "... new and equally valuable crop plants existing exclusively in America."² What Darlington did not understand is that

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the limitation of some domesticated plants to America does not in itself strike down the idea that God created the original species which man has used in horticulture. In order to discredit the creationist position, whole series of fossil and living "links" would be required, showing that cultivated taxa indeed arose as offshoots from an ancestral evolutionary tree. Such evidence is completely lacking. Not only are the broad lines of familial ancestry for flowering plants nonexistent, but also there is a paucity of transitional forms needed to show the descent of most genera and species,³ and this is admitted by evolution-minded workers, as evidenced in the following quotations:

"With most domesticated plants the wild ancestral species are unknown or doubtfully known."⁴

The geneticist Vavilov "... was convinced that most cultivated plants are quite dissimilar to their nearest relatives ..."⁵

This matter of missing ancestors for crop plants loomed as such a problem to C. D. Darlington that he entitled one whole section of his book covering pages 161-163 "Loss of Ancestors". Since the ancestors of cultivated plants do not exist, Darlington countered by suggesting that they had necessarily been lost:

"Yet another consequence of the natural process of cultivation which is to be expected on our view is that the cultivated forms of a species should sometimes have extinguished their wild ancestors."⁶

He attributed this routine loss of ancestors to such factors as rapid evolution, recent ecological changes, and genetic crossing. Darlington implied on page 161 that loss of ancestors was actually inevitable:

"The extinction of wild ancestors is, however, another way of saying the occurrence of complete domestication."

Thus when one seeks steps to show how cultivated plants might tie back into the roots of angiosperm ancestry at the species, genus, and family level, he is told that the process of domestication by its very nature obliterates the developmental steps! This is a peculiar argument, but somewhat reminiscent of how evolutionists attempt to deal with scarcity of fossil links and supposedly "helpful mutations". And furthermore the main fact still stands that ancestries are in each case lacking; and this is direct support for the belief that no such ancestries ever existed.

(The Domestication of Animals)

While there are many features of animal domestication which are very similar to the cultivation of plants, the former subject is a broad one which deserves separate coverage. Although very little has been written by creationists on this subject, the creation scientist C. E. Turner recently reviewed certain key literature sources from the vantage of scripture.⁷

Although he brought up many points, Turner's major conclusions were as follows:

1. Domesticated animals did not arise gradually from wild ancestors.
2. The Creator marked out from the beginning certain creatures which were intended to be most useful to man.
3. Domesticated animals appeared quite recently (within 10,000 years or less from the present.)
4. Domestication of animals has yielded some changes (as with the dog) but all of this has been "Strictly within the

domestic species" and is a matter of man's having been "... allowed by God to improve breeds and yields by selective breeding."

5. Domestication of animals is an attempt on man's part to recover the loss which he has experienced in this regard since the fall; "... domestic animals descended from those described as 'good' in the beginning, deteriorating in the hands of fallen man, until scientific enlightenment produced improved Western stocks from the time of the Reformation and the consequent progress of the Seventeenth Century."

Creation View Fosters Cultivation of New Plant Types

In Genesis 1:29 it was recorded that every green herb on the face of the earth was given to man for seed and every tree for fruit. Darlington quoted Charles Darwin as believing that in ancient times man was "... compelled by severe want to try as food almost everything which he could chew or swallow", which Darlington himself then described as "... a view with much biblical corroboration."⁸ Here is a tacit admission that the biblical view fosters research and experimentation into plants as a source of human food.

We must not conclude from this passage, however, that man in some way will find great food value in every plant. This biblical statement describes the plant world before the fall brought thorns, thistles, and perhaps numerous biochemical changes. But the passage still applies in the sense that every species of plants must serve as a food for at least one species of animal. Furthermore, the biblical emphasis surely does encourage additional experimentation and research in quest of new crop plants. The sunflower, for example, was undiscovered as a source of oil and food until the last century. Perhaps as the mindset of Genesis 1:29 penetrates crop plant research more fully, man will discover other species which could help satisfy his growing needs for food, fuel, and forage.

The Impact of the Fall on Plant Cultivation

In Genesis 2:9 it is apparent that God caused every fruit tree to grow out of the ground in the Garden of Eden, where they were assembled for the convenience of Adam and Eve, although it is assumed that these plants likewise grew elsewhere. After his disobedience (Genesis 3:24), man was driven from the garden but the fruit trees (with the exception of the tree of life and the tree of the knowledge of good and evil) must have been growing outside the Garden. Nothing is told of what happened to the tree of knowledge of good and evil but the tree of life appears in Revelation 22:2 where it is shown to thrive in the New Jerusalem—a city which is to descend from heaven where it is to rest on a new earth to be formed after the present earth has been destroyed.

At the time of the fall, Genesis 3:17-19, the soil began to yield thorn- and thistle-laden plants. L. H. Fisk has pointed out that this advent of thorns must be "pre-Devonian" in terms of historical ecology,⁹ which simply means that thorns came to plants before the flood. Also, the soil became more resistant to man's agricultural efforts so that he could secure its benefits only by the

sweat of his face. Thus we may assume there were no plants with thorns or thistles before the fall nor were there any obnoxious weeds. God transformed the biotic world to such an extent that the apostle Paul wrote "... the whole creation groaneth and travaileth in pain together until now (Romans 8:22). This curse doubtlessly entailed much biological intervention with the Creator producing comprehensive revisions in the digestive tracts and dental apparati of carnivorous animals. Plants from various botanical families produced thorns. The true thistle, for example, is a member of the sunflower family. One plant in the mint family, however, (*Salvia carduacea* or thistle sage) has thistles and resembles the true thistle so closely that the non-botanist might mistake it for the real item.¹⁰ Since all of this genetic intervention at the time of the fall was implied but not mentioned, the Bible does not rule out the possibility that the Creator worked rapidly after the flood to modify existing species for their new habitats, as Lammerts has suggested elsewhere.¹¹

Effect of Cultivation on Plant Species

The Creator endowed many plants with a high potential for variation. This has allowed the formation of many varieties within various species of cultivated plants, as evidenced in the cabbage group which includes cabbage, cauliflower, kohlrabi, brussel sprouts, broccoli and kale in the same species. Some of our presently useful species may have been cultivated since the time of creation, like wheat and possibly apples. Others like the sunflower and the strawberry have been brought into domestication in very recent times. In his very helpful article on domesticated plants and animals, Harlan makes the point that "Domestication involves genetic changes that make the plants better suited to the conditions of man-made environments and less well adapted to the conditions of natural environments."¹² He added that, "... the domesticated races of maize, wheat, rice, potato, sweet potato, and most other crops would all die out without human intervention." Thus the stringless bean may be preferred for eating, as the geneticist Tinkle pointed out;¹³ but this may have little or nothing to do with the success such a plant can have in nature, outside of man's care.

Human cultivation of plants involves selection for types that have greater yield to man or greater ease of handling. It is likely that genetic irregularities such as gene mutations, chromosomal breaks and changes in chromosome number (polyploidy) began to occur after the fall. Although such changes are largely negative, in some cases they play a stellar role in formulating new varieties of crop plants under man's auspices. Thus even genetic irregularities have helped man achieve specific goals in plant breeding. However, as W. J. Tinkle indicated, this selection within crop plants such as sugar beet and corn has absolute limits and does not produce new species.^{14, 15}

Polyploidy, Plant Breeding, and Agriculture

A plant breeder may put pollen of one species onto stigmas of another species, leading to hybridization. Subsequently the chemical "colchicine" can be applied

to cause doubling of chromosome number in the hybrid zygote, producing an "allopolyploid" (also called an "amphidiploid" because of its regularity in chromosome pairing during meiosis.) Allopolyploids may be fertile and manifest some very useful properties. Then too, colchicine may be used on the stem tips of non-hybrid plants and thereby induce autopolyploids which may yield larger fruit or flowers than the diploids while generally being less fertile. It is possible that early plant breeders knew about polyploidy. But even if ancient people did not understand chromosome doubling and the use of colchicine, some allopolyploids and autopolyploids may have arisen by chance in populations of plants under their cultivation. Such novelties surely would have come to the attention of the plant breeders and would have been preserved.

Apparently polyploidy occurs at a regular low rate in natural populations. The cytogeneticist Swanson has discussed this at great length concluding that things a botanist would call a "species" may at times be formed from one or more preexisting species by a process of natural allopolyploidy.¹⁶ Lammerts, however, attributes nearly all of this polyploidy to a period of intense activity by the Creator after the flood, when existing species were modified rapidly with resulting hybridization and segregation into derivative species. Although Howe sees this post-flood activity as a distinct possibility, he likewise believes that the Creator may have carried out some of the polyploid speciation gradually and he feels that a certain amount of this may still be bringing changes in both cultivated and natural populations—although much more slowly in the latter since man is not involved as the agent in controlling selection.¹⁷

Whatever may be said about variation at the species level as regards polyploidy and selection, Swanson arrived at a negative conclusion concerning polyploidy in the origin of genera and higher taxa:

"The above enumeration of various aspects of polyploidy leaves one evolutionary question to be answered. Can polyploidy lead to the formation of categories higher in the taxonomic scale than species? The direct evidence presently available seems to provide a negative answer, for the species derived through hybridization and polyploidy do not depart radically from their diploid ancestors either morphologically or ecologically. The general belief is that most of the hereditary changes leading to generic and familial differentiation originate at the diploid level, and that polyploidy is actually a conservative and, indeed, a deterrent factor in preventing the segregation necessary for the establishment of divergent lines. Gene variation and aneuploidy offer greater possibilities for such divergence, while polyploidy offers continued stability and survival to already established gene combinations."¹⁸

Thus, however polyploidy arose, Swanson makes it exceedingly plain that the real evolutionary steps did not transpire at the polyploid level but had to occur among the diploid ancestors of the polyploid species—polyploidy itself being a "conservative device" and a "deterrent factor" in the development of major categories!

Creationist writers have likewise criticized the efficacy of polyploidy as a means of macroevolutionary change. Thus the geneticist Klotz while recognizing the existence of chromosomal aberrations and changes in chromosome number, concluded that they really contribute nothing that is new.¹⁹ Lammerts has argued cogently that some of the "species" that are supposed to have arisen by natural allopolyploidy may have originated by several other means such as diploid merogeny in which an unreduced pollen grain asexually forms an embryo.^{20, 21}

Mutations, Selection, and Horticulture

A particular gene mutation, variant allele, chromosomal aberration, or polyploid change has a much greater chance of being incorporated into the genetics of a species if that species is under human cultivation. One hardly needs to mention the well-known fact that mutations are largely harmful! Even among the mutations that show one "helpful" facet, the multiple aspect of gene expression (known as "pleiotrophy") regularly dictates that other manifestations of the same mutation will be "harmful" to the species in its natural environment. Thus in man himself the mutation for synthesis of hemoglobin-S in the red blood cells instead of hemoglobin-A is "helpful" only if the population is severely subject to malaria. Although the hemoglobin-S does confer slightly greater resistance to malaria on the heterozygotes or hybrids, it is frequently lethal, causing sickle cell anemia in the homozygotes! The mutation for albino in mammals (e.g. squirrels) is harmful and is weeded out of wild populations by the effect of what is called "natural selection." Only when man intervenes (as at Olney, Illinois) do white squirrels become prevalent!²²

Likewise in roses that are subjected to neutron irradiation, some mutations occur which are of certain interest to rose breeders. However these mutations are routinely inferior to the original stock as regards vigor and viability²³ and would be eliminated if the species were not under domestication, as Lammerts has shown.

In observing populations of California poppy and other flowering herbs,²⁴ we found that generally the deviant phenotypes prevalent in a moist year are almost totally lacking when the population faces a regular crisis of drought in other years. Although the gene pool contains alternative alleles for various loci and although other modifications such as aberrations and polyploids may be present, these deviant types are routinely reduced in number as the population faces environmental vicissitudes. If man begins to domesticate such a plant, on the other hand, he may for reasons of his own select such deviants, caring for them and providing the special environment which they now require. By this means generous changes can come within sections of a species in a very short time.

One should not use the term "evolution" as Harlan did ("... domestication is an evolutionary process...") to refer to these changes because in most cases the forms produced are unable to persist in nature without man's intervention and most have not undergone enough change to be classified as distinct "species." Harlan wrote that:

"... the domesticated races of maize, wheat, rice, potato, sweet potato, and most other crops would all die out without human intervention."²⁵

Usually these horticultural forms are merely strains or varieties within a given species and the word "evolution" is inapplicable unless by "evolution" one simply means a change of any magnitude!

As more became known about the processes involved, the pace of selection would have quickened. The rate at which man improves crop plants has also increased recently because the population pressure has made it pay off. Little was done with the beet for over 1800 years and then the development of five types occurred rapidly—garden beets, chard, mangels, sugar beets, and foliage beets. The pea was used since before the Christian era but experienced more improvement in the last 100 years than in the previous 2000.

Darlington attributed changes arising in plants cultivated by early people to what Charles Darwin had called "unconscious selection" and had described as "... the mere act of preserving the most favored and neglecting or destroying those less valued."²⁶ But there is no reason to refer to such selection as "unconscious" because human purposes were being fulfilled. There is likewise no reason to refer to the results as "evolution" because the boundaries of the "kinds" were not transgressed. In fact, it is likely that the mere act of tilling the soil and raising plants under field conditions will eventuate in horticultural varieties. Under field culture larger forms, some of which are polyploids, "... can compete favorably with earlier forms on arable land with higher nutrition."²⁷ Harlan noticed that these developments were not new species but simply, "... morphological monsters that are completely dependent on man for survival: these plants are fully domesticated."²⁸ Mendel viewed changes in all plants as simply variations *within* the species. He understood the huge impact that agriculture itself had on plant forms:

"... our cultivated plants are members of various hybrid series, whose further development in conformity with law is varied and interpreted by frequent crossings *inter se*. The circumstances must not be overlooked that cultivated plants are mostly grown in great numbers and close together, affording the most favourable conditions for reciprocal fertilization between the varieties present and the species itself."²⁹

Was Ancient Man Really "Primitive"?

Cain was a "tiller of the ground" so that agriculture began immediately after creation and the fall. In the scriptural perspective, man did not start as a primitive creature but originally had a level of intelligence at least as great as that which he presently possesses. These early people were probably very busy working with plants; and with the long lives people had, they may have developed many lovely flowers and luscious fruits. They most certainly practiced plant breeding, selection, and agriculture from the very beginning.

It is difficult for the creationists to distinguish clearly between pre-flood and post-flood remains. It is possible, of course, that the pre-flood habitations of man were largely obliterated in the deluge and that the only arti-

facts we may correctly assign to the pre-flood period are such things as the historian Van Fange has reviewed: the baked clay figures, mortars, beads, nails, an iron pot, and other obviously human products buried at great depths, sometimes even in coal seams.³¹ Thus there may be no way to examine this very interesting period of pre-flood agriculture other than to analyze the oldest deposits, generally studied by archeologists, which presumably correspond to the early post-flood remains. The Jarmo discoveries of the mideast, the Ocampucho Cave, the Tehuacán remains in Mexico, and the Ayauccho deposits for example are dated at 6000 to 7000 B.C. We suspect that these are early post-flood remains and should be given a much more recent date. Nevertheless they are certainly very old; and still they contain the following crops—einkorn wheat, emmer wheat, barley, lentils, peas, scarlet runner beans, maize, squash, gourds, lima beans, and others.³² These data fit with the belief that certain crops were under cultivation as far back as human archaeological deposits can be studied, which shows that man has always been agriculturally oriented. Thus the “hunting” and “gathering” stages which are supposed to have preceded agriculture by many centuries were simply non-agricultural human societies that existed contemporaneously with agricultural societies at various localities after the flood. Actually A. C. Custance has demonstrated that most of the diverse fossil human skulls and archaeological remains fit squarely with a post-flood dispersion model and require no recourse to evolution theory.³³

The Post-flood Dispersal of Cultivated Plants

In Genesis 6:21 Noah was commanded to take food onto the ark. Very likely seeds, cuttings, buds, and scions of all the finest existing varieties of fruits, ornamental trees, and shrubs were saved. Noah had over 120 years to plan such a venture. Furthermore in Genesis 8:11 an olive leaf is mentioned, having been brought back by a bird after the flood. This indicates that there was survival of certain previously cultivated plants outside the ark through such possible means as seed sprouting, floating mats of vegetation, or even regrowth of pre-flood stems after the waters subsided. And some species presently cultivated may have been as yet unnoticed by agriculturalists and would have survived like other wild forms during the flood.³⁴

Genesis 8:13 contains the statement that “Noah removed the covering of the ark and looked and behold, the face of the ground was dry.” Although it is sometimes assumed that the entire earth was dry at this specific time, and alternative view is probably closer to the truth. Noah could not see the whole earth so these comments most likely had reference to the local situation—a dry mountain valley where he could get started once again with his farming enterprise.

Authorities agree that the most ancient remains of cultivation come from areas of moderately high altitude in Kurdistan! This most significant fact ties in closely with the flood model for dispersal of cultivated plants by Noah and his descendants. Darlington wrote, “The earliest settlements in Kurdistan are dated at about 7000 B.C. and lie at altitudes between 2000 and 4000 feet.”³⁵ Continuing, Darlington pointed out that

the deposits contained emmer wheat and two-rowed barley. Harlan produced a map showing ancient agricultural centers as dots, most of which surround the very region where the ark landed—Jarmo, Ali Kosh, Palegawra Cave, Cayonu, and Catal Huyuk. From these various archaeological sites remains of barley, einkorn wheat, emmer wheat, lentils, peas, goats, sheep, cattle, pigs, and dogs are reported.³⁶ The dates like 7000 B.C. given by Harlan and others for this near-eastern outburst of agriculture probably collapse down to something like 3400 B.C. when the vagaries of the C¹⁴ dating method are taken into account.

Below the 4000 foot level at this time the earth was probably still covered with water or was in such a moist condition that it was altogether uninhabitable. Only later were people able to move to Kurdistan and cultivation eventually reached the lower plains. A progression of C¹⁴ dates shows that agriculture gradually appeared on the plains and at lower altitudes as time elapsed. By way of analogy, we should remember that as recently as 150 years ago it was necessary to insert lines of drainage tile into the swamp prairies in such areas of the middle-western United States as northern Illinois to convert this very moist land into suitable terrain for raising crops. Lake Tulare was the largest lake west of the Rockies in 1870. It was fed by the Kern and Kings Rivers, and was described in 1862 as extending for 60 miles north and south, being 36 miles across at its widest and covering 800 square miles. The sidewheel steamer, Marie Androsa, was used to carry hogs and cattle across this lake. In the 1800’s people could go almost halfway to Bakersfield by steamer through an area which is now virtually dry, as Lammerts has reported.

For several thousands of years while man was cultivating plants in mountain highlands and valleys, undoubtedly sedimentary strata were still being deposited in vast oceanic areas from which the water was gradually receding. Noah probably grew these particular plants from the reserve of grape and other cuttings he had on the ark. Authorities are amazed by the fact that agriculture started around the world at about the same time. Thus Harlan wrote on page 95:

“For reasons we can only speculate about, people in various parts of the world all seem to have begun the process of domestication at about the same time.”

In the creation-flood view this seemingly spontaneous onset of agriculture at various points simultaneously would stem from a migration of Noah’s descendants.

A creation-flood view also affords an explanation for the fact that crop plants appear to emanate from one “center” of ancient agriculture or another, as Howe indicated earlier, “It is at least possible that valuable plants stored on the ark were preserved by the children of Noah. If certain economic plants were cherished by different races, one would expect to find important crop plants coming from several centers of post-flood civilization.”³⁸

Probably propagules of many cultivated plants were carried and used by post-flood peoples as they traveled and repopulated the earth. Accordingly, early man started migrating from the mid-eastern highlands to

other places, carrying various propagules such as seeds and cuttings. Darlington assumed much the same series of events from the evolutionary standpoint in that agricultural use of plants followed a pattern of expansion from early centers.³⁹ The key difference between Darlington's concept and a creation model is that he believed this spread of agriculture was an evolutionary phenomenon and we assert instead that the geographical spread of plant cultivation was the natural result of man's post-flood migration.

"The timing of the development of cultivation in different regions is what one would expect on the assumption that the earliest cultivators, supported by their regular food supplies, had gradually multiplied and under pressure and crowding had moved into new regions in search of new land."⁴⁰

This statement of an evolutionist supports a post-flood dispersion model so well that no comment is needed!

People moving to a certain locality may have lost some crops that thrived quite well in other areas of migration. Undoubtedly Noah's descendants discovered that each particular crop plant grew best in certain specific post-flood habitats. At each "center" of civilization man specialized in some crops rather than others for reasons such as difference in climate, soil, and human preference.

It is likely that some of these post-flood centers actually lost particular cultivated crops by losing propagules in transit or as a result of repeated failure to raise the plant under the prevailing weather conditions. Ultimately one set of crop plants would have been thriving well in one particular locality while a very different set was being grown at other centers, although the plants were for the most part all derived from the ark supplies.

No apologies need be made for assumptions involved in the foregoing argument. Any historical analysis of plant geography must be in some measure speculative and this is especially true of the evolution theory. A model is either strong or weak in so far as it is able to encompass the existing data of science and in terms of the number of assumptions which it requires on its behalf.

Returning to the creationists' problem of why corn is found in ancient deposits from Central America but not from Asia Minor, it seems that chance likewise may have played a role. Presumably settlers in the near-east had both wheat and maize. But maize is temperamental in varying environments, as Dobzhansky has pointed out. A type suited to Iowa may be worthless in Peru and vice versa. Tropical varieties of corn are adapted to short days while corn from temperate zones requires long summer days for successful yield.

Probably pre-flood corn was adapted to the tropical climate and uniform length of days throughout the year. If settlers in Asia Minor started with the same corn as those who happened to end up in Central America, it would fail to develop in Asia Minor because the days would be too long (not to mention other aspects in which this corn would be unsuitable in that habitat.) By the same token, the settlers ending up in Central America would have had resounding success with such corn.

Evidently the long day types of corn were developed much later.

One might intelligently turn this whole question around to the evolutionist and ask why was wheat found only in Asia Minor and related areas. We believe the creation view has the best answer to both questions.

Vavilov's "Centers" of Crop Plant Origins

Schery and Darlington discussed centers of plant origin, referring frequently to the works of Vavilov and the botanist, De Candolle.^{41,42} Vavilov had assumed that the place where a particular crop plant showed its greatest diversity must have been the place from which it originated. This idea, coupled with archaeological studies, led to the popular belief that there were certain key areas of plant evolution.

It is possible, however, that these "centers" of origin proposed by Vavilov were simply centers of crop culture after the flood. The fact that many of them are in the heartlands where the ark rested is at least suggestive. Even Darlington assumed that we must take Vavilov's centers of origin as "... centers of development".⁴³ Darlington also asserted that Vavilov's view was too simple in the face of current facts. He felt that it was too general and that different "... species in cultivation ... develop by utterly diverse processes ..." A flood creationist would agree with Darlington on these points and would add that centers of diversity and development for crop plants surely correspond to centers of human habitation after a post-flood migration.

Likewise Harlan has objected to Vavilov's evolutionary oversimplification and wrote that: "... what once seemed to be well-defined centers tend to fade or to become vague or indistinct. My own viewpoint has changed with the evidence, and what I thought and wrote 20 years ago bears little resemblance to my present assessment of the situation."⁴⁴ Harlan found that, "... the domestication of pigs is found all the way from Europe to the Far East. Cattle of various kinds were tamed over most of the same range. With respect to plants, much the same is true of rice in Asia, of sorghum in Africa and of beans in the Americas ..." Thus Harlan was impressed by the fact that the same crop plant or animal showed up independently from various points that Vavilov would have classified as separate centers of evolution. Harlan suggested that this happened because "... these food plants were widely distributed and were manipulated by various peoples over their entire range." But it is equally possible that these crops show up in many centers simultaneously because they were carried there by Noah's descendants. Harlan concludes one section of his article with this amazing summary:

"Each may have been repeatedly domesticated at different places or may have been brought into the domestic fold in several regions simultaneously. At least we cannot point with any confidence or precision to a single center of origin for these particular plants and animals."⁴⁵

Some Crops First Domesticated After the Flood

It is possible that some of our horticultural plants are those which were first brought under cultivation after

the flood. This may account for the so-called "appearance" of particular new crops at more recent levels in agricultural sites. Writing of ancient humans, Darlington put it this way:

"But in doing so they had changed the character of some of their crops, they had lost others, and they had picked up many new ones. They had certainly begun with peas and lentils already in Kurdistan; and early they had also had flax which under irrigation became cultivated for its oil-seed as linseed.

But in crossing Asia they had picked up new grains, millets and buckwheats, and in entering China they had acquired soya bean and much later, rice."⁴⁶

The origin of each of these crops may not be exactly as Darlington has postulated but the germ of his idea is that ancient man in early migrations may have begun cultivating wild plants that showed promise.

Like his ancestors, post-flood man may have experimented with plants, cultivating previously wild forms and thus introducing them as new crops. This in itself may explain why some of our agricultural plants seem to arise at various later dates in archaeological and recorded history.

Darlington sensed an apparent conflict in all of this, however:

"On the one hand it is supposed that the movement of men spread cultivation over the whole of the Old World. On the other hand it is assumed that the movement ceased and was followed by a separation and isolation of great regions."⁴⁷

Yet there is no conflict here if we take the Babel experience and possible continental rifting into account. Early man's post-flood migration would have caused the movement and spreading of agriculture.

Then the tower of Babel and possibly continental rifting would have separated and isolated peoples. Thus an apparent conflict in Darlington's view (migration followed by isolation) is erased in the biblical perspective.

A Bible based explanation for these archaeological events is both profound and simple. It accounts for the plants which seem to have been cultivated since time immemorial as those which were domesticated by Adam's descendants *before* the flood. Yet it allows that the other species were not brought into cultivation until post-flood times and this explains the cultivated plants which manifest a more recent origin. It likewise provides an explanation for the seemingly contradictory facts that agriculture at first spread from an ancient center but then underwent isolation.

The History of Corn

Pollen attributed to corn was discovered by Baarghorn in a core taken from what is presently the site of Mexico City and assigned a date of 80,000 years (see Mangelsdorf p. 539, Baker p. 78). While creationists are not impressed by this interglacial date based on uniformitarian evolutionary assumptions, they are most interested in the fact that corn was evidently present even before its archaeological remains were deposited in various caves. Mangelsdorf *et al.* concluded that, "... this fossil pollen settles two important questions. It shows that corn is an American plant and that the



Figure 1. Artist's reconstruction of wild corn—adapted from Mangelsdorf. Although Mangelsdorf labeled this material "wild corn," such cobs may have been produced by another variety of cultivated corn available to ancient people. Evidently this reconstruction rests on three different fragments found at two or more levels in the San Marcos Cave. Beadle has suggested that these plants represent an ancient cross between teosinte and corn itself. Sketches by John Schilling.

ancestor of cultivated corn is corn and not one of corn's relatives, teosinte or *Tripsacum*."⁴⁸ But G. W. Beadle maintained recently that these 5 pollen grains were too large to have been the pollen grains of the small ancient corn which must have had very short silks. Beadle concluded that these grains were contaminants in the drilling core.⁴⁹

Archaeological deposits of corn which have been given the oldest date are those of the Tehuacán Caves in Mexico (5200 B.C.) Mangelsdorf and colleagues made a thorough study of these deposits and reported that at the lowest levels corn had very small ears and male flowers (tassels) attached to the cob (see Figure 1).

At other levels, continuing on up to that which is assigned a date of 240 A.D., this smaller type of corn was intermingled with various types of cobs that more closely resembled modern corn. See Figure 2.

Mangelsdorf *et al.* reconstructed what they called "wild corn" from fragments found at different cave levels:

"A well preserved cob, an intact husk system consisting of an inner and outer husk of the Abejas phase in the San Marcos Cave, and a piece of staminate spike from the Ajalpan phase of the same cave provide materials for a reconstruction of Tehuacán wild corn."⁵⁰

Evidently the "wild corn" reconstruction, like so many in the realm of human anthropology, is a composite product of several different fragments and may not

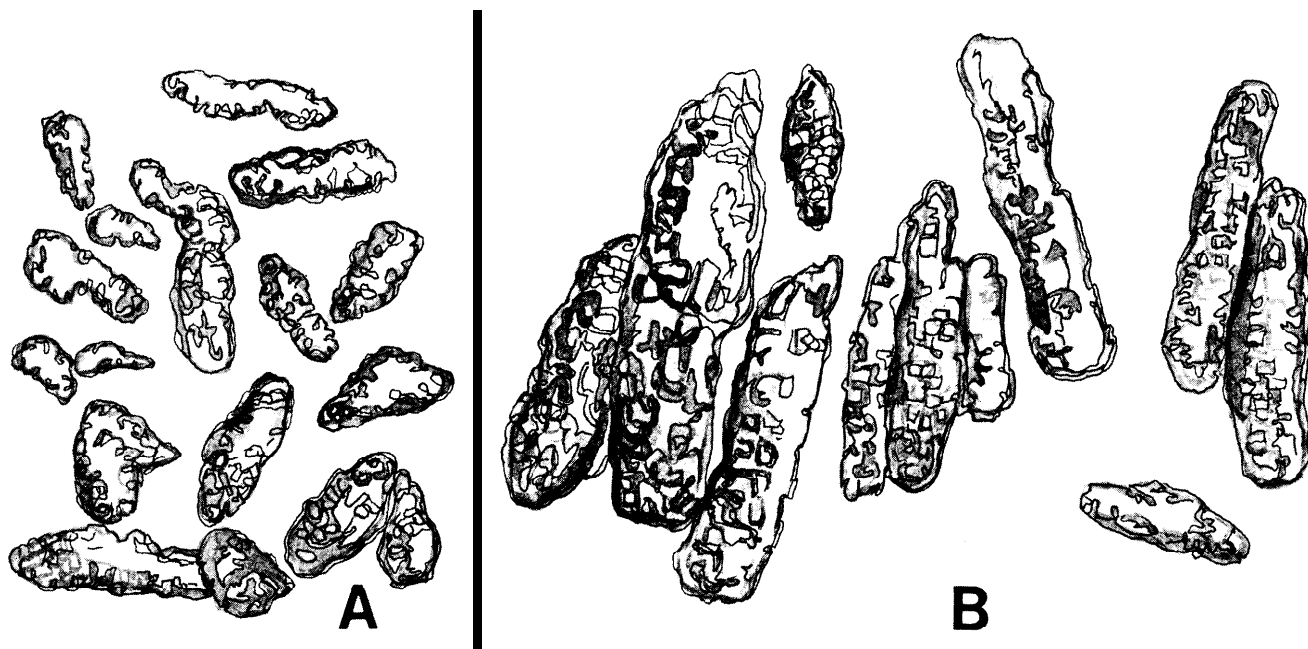


Figure 2. A drawing of cobs from the San Marcos Cave based on a photograph by Mangelsdorf (actual size). Mangelsdorf designated the cobs on the left (A) "wild corn" and those on the right (B) as "early cultivated corn." Some of the cobs from the cultivated corn are just as small as those attributed to wild corn. Perhaps these were all produced by various forms of corn raised by early man—none of them being truly "wild" or ancestral. Or they may have resulted from ancient hybridization between teosinte and corn as Beadle suggested. Sketches by John Schilling.

represent anything that ever existed in its own right. In the face of all this it is not surprising that Dobzhansky⁵¹ concluded that the "how" and the "where" of corn's origin are still unknown.

Mangelsdorf *et al.* assumed that the "wild corn" went extinct because man took over its best areas of cultivation and because it interbred with the cultivated corn types—thus being genetically swamped out of existence. But after considerable discussion of this so-called "wild corn" and other cobs, Mangelsdorf and his collaborators came to the surprising conclusion that:

"There has been no change in the basic botanical characteristics of the corn plant during domestication. Then, as now, corn was a monoecious annual bearing its male and female spikelets separately, the former predominating in the terminal inflorescences and the latter in the lateral inflorescences, which, as in modern corn, were enclosed in husks. Then, as now, the spikelets were borne in pairs; in the staminate spikelets one member of the pair was sessile, the other pedicled. The only real changes in more than 5000 years of evolution under domestication have been changes in the size of the parts and in productiveness."

"... Despite a spectacular increase in size, productiveness under domestication, which helped make corn the basic food plant of the pre-Columbian cultures and civilizations of America, there has been no substantial change in 7000 years in the fundamental botanical characteristics of the corn plant."⁵²

Describing Mangelsdorf's reconstructed wild corn, Dobzhansky put it this way:

"This is already a developed, cultivated, not a wild, plant; but it is a dwarf compared to the ear in modern corn."⁵³

A creationist viewing these same data would suggest that probably the corn with the little cobs was simply one of many varieties possessed by early people in Central America. As they progressed in their corn breeding, these people abandoned that variety for others that were more productive. If this particular kind of corn had tassels attached to the ear, such a characteristic has been found in modern corn and it depends simply on a shift of alleles at two gene loci.⁵⁴ Thus one need not postulate that this early corn was necessarily "primitive" because of its tassel morphology.

No discussion of the history of corn would be complete without adequate mention of teosinte which is a tall, grass-like plant with leaves not quite as broad as those of corn (see Figure 3). In some earlier papers, Archeson, Vavilov,⁵⁵ and then Darlington⁵⁶ asserted that teosinte was somehow the ancestor of corn.

"... the tremendous range of variation of this species [corn] under cultivation makes it more likely that it arose by selection under cultivation from plants closely resembling *Euchlaena mexicana* or annual teosinte, a plant which exists both as an arable weed and in cultivated forms as a forage grass."⁵⁷

Beadle has recently revived this same idea that corn came directly from teosinte. Based on large scale breeding experiments, he has concluded that corn and teosinte differ from each other by only five gene pairs.⁵⁸ To make such a claim, he used a method known to geneticists by which one may ascertain the number of



Figure 3. An ear of teosinte (*Euchlaena mexicana*) with sheathing leaves—sketch after photograph on page 79 of Baker. Some workers believe this plant was the ancestor of corn, others believe it arose from a cross between corn and a grass, *Tripsacum*. We see at least one other possibility: that both corn and teosinte are distinct “kinds”, separate since the creation.

pairs of segregating alleles which differ between two parents by crossing them to produce an F_1 hybrid population and then crossing those F_1 individuals among themselves to yields an F_2 . The worker must then determine how many of the F_2 organisms are as extreme as either parent and from the expression $1/4^n$ he can solve for “ n ” which is the number of gene pairs which differed between the original parents.

If one offspring among sixteen is as extreme as one of the original parents, for example, two gene pairs would be involved because $1/16 = 1/4^2$ where $n = 2$. Thus Beadle found about one in 500 of the offspring was exactly like the teosinte parent in his F_2 . He therefore concluded that only 5 gene pairs differ between teosinte and corn because $1/500$ is more than $1/4^n$ where $n = 5$; for $4^5 = 1024$.

A careful analysis of page 116 in Beadle’s paper, however, reveals that he did not produce a simple F_2 generation as this computation demands but instead performed a backcross of his F_1 (corn X teosinte) hybrid to teosinte before proceeding to produce the F_2 generation. This extra backcross thrown into the sequence certainly invalidates Beadle’s claim that only 5 pairs of segregating genes distinguish corn from teosinte.

In his studies, Beadle showed by crossing corn and teosinte that repeated back crossing of the hybrid to teosinte yields a plant that has a small ear closely resembling the Tehuacan cobs which Mangelsdorf considered to be “wild corn.” These ancient small cobs may thus have been the result of similar crosses between corn itself and teosinte thousands of years ago. But if so, such evidence fits our contention that something quite like modern corn must have existed back in those early days for teosinte to hybridize with it to yield the ancient miniature variety!

In his paper, Beadle attempted to forge a strong case for similarity between corn and teosinte. In the charac-

teristics where corn and teosinte vary, he maintained that teosinte has the traits that would be of greatest survival value in the wild environment—reduced seed production under environmental moisture stress and disarticulation of individual fruits from the stalk, for example. Where teosinte has a gene that leads to production of fruit inside a hard fruit case, pod corn has the “tunicate” mutation in which the fruit cases are replaced by a series of shallow cups and the kernel is encased in a husklike covering. Beadle maintained that this tunicate mutation would have changed teosinte into something like pod corn. Although Beadle dealt specifically with this tunicate locus only, we suspect that teosinte and corn differ at many other gene loci. Beadle concluded that most probably teosinte was the direct ancestor of modern corn and that:

“... cytologically and genetically corn and Mexican teosinte could even be considered one species.”⁵⁹

If it could be demonstrated that corn and teosinte are varying forms of the same species, then corn was one of those crop plants that was derived from wild forms by descendants of Noah after the flood.

Beadle does not show in stepwise fashion how the five factors were added to teosinte to convert it to corn. If they occurred as mutations, the Aztecs must have been quite accomplished plant breeders to have combined such a complex group of genes.

Following a different line of reasoning based on other evidence, Mangelsdorf and his coworkers assumed that the fossil corn pollen was valid and not contamination. On that basis they concluded that teosinte is an unlikely evolutionary progenitor for corn because the dates assigned to the earliest teosinte deposits are relatively recent—1800 B.C. in feces from Romero’s Cave,⁶⁰ while corn pollen is present in deposits that are assigned an age of 80,000 years!

Instead of assuming that teosinte was an ancestor of corn, Mangelsdorf at first maintained that teosinte was the product of hybridization between corn and *Tripsacum* (gama grass). Mangelsdorf and Reeves hybridized corn with teosinte and corn with *Tripsacum*. Baker summarized the results of the corn x *Tripsacum* cross as follows:

“Yet, from the partially fertile hybrids between these very dissimilar plants, further generations were raised and some plants from these generations resembled teosinte in a number of characters. If teosinte really originated this way, it would represent a case of hybridization between a crop plant and a weed growing nearby to produce another weed.”⁶¹

We hardly need to state that if the foregoing did occur, it does not explain the origin of corn! But Stebbins had certain reservations even about the cross between corn and *Tripsacum* because the styles of corn had to be artificially shortened to make the process work—something that would seldom if ever occur in nature.⁶²

In facing the evidence against the origin of corn via *Tripsacum*, Mangelsdorf more recently proposed that modern corn came from wild popcorn also known as “pod corn” and that teosinte came from this same wild corn by way of mutation. But Beadle argued that “If

corn could have given rise to teosinte, surely the reverse is also possible. I would say it is much more probable since teosinte is a highly successful wild plant and corn is not."⁶³

Evolutionists are thus unsettled at this point in time as to the origin of corn. Some of them argue vigorously that teosinte came from wild corn while others assert with equal vigor that corn arose from teosinte.

What they both neglect is that a strong third alternative is possible as we indicated earlier—that teosinte and corn are simply two very similar species which have existed independently since the time of creation. Certainly creationists and others should begin to undertake research on aspects of the origin of corn such as the following:

1. Try genetic experiments similar to those undertaken by Beadle but involving a true F_2 generation to find how many genes actually differ between corn and teosinte and what these genes are.
2. Reinvestigate the discoveries at San Marcos and Tehuacán caves to see if there was a discreet layering of corn (as Mangelsdorf implied) or if there was actually somewhat of a mixture at various levels—evolution theory having been used to segregate the corn into successive “stages”.
3. Recheck all C^{14} dates and correct these according to preflood factors.

The Changes in Wheat

Wheat is a crop that is as ancient as archaeology itself. Both diploid and tetraploid wheats are found in the Jarmo deposit, dated at 7000 B.C. The basic number for one chromosome set or genome in wheat is 7 ($n=7$). In the diploid wheats (such as *Triticum boeoticum* and *Triticum urartu* of today), the nuclei have two of each chromosome type or 2 sets, giving a total of 14 ($2n=14$). These diploid wheats are sometimes called “einkorn” wheats because the individual flower stalklet produces just one grain (see Figure 4).

The tetraploid wheats like *T. dicoccoides* and its cultivated descendant *T. dicoccum* are called “durum” wheats are used to make macaroni and spaghetti. They have 28 chromosomes which is exactly twice the number present in the diploid strains and four times the haploid genome number, 7.

Finding a situation like this where chromosomes fall into a series based upon a common number such as 7, biologists are tempted to assume that the tetraploid strains arose by hybridization of two diploid types followed by a doubling of chromosome numbers (“allopolyploidy” or “amphidiploidy” as described earlier.)

It was previously assumed that the grass *Aegilops speltoides* (also called “sitopsis”) hybridized with diploid wheat (*Triticum boeoticum*) in such a manner. If we let the symbol A represent a genome (set of 7

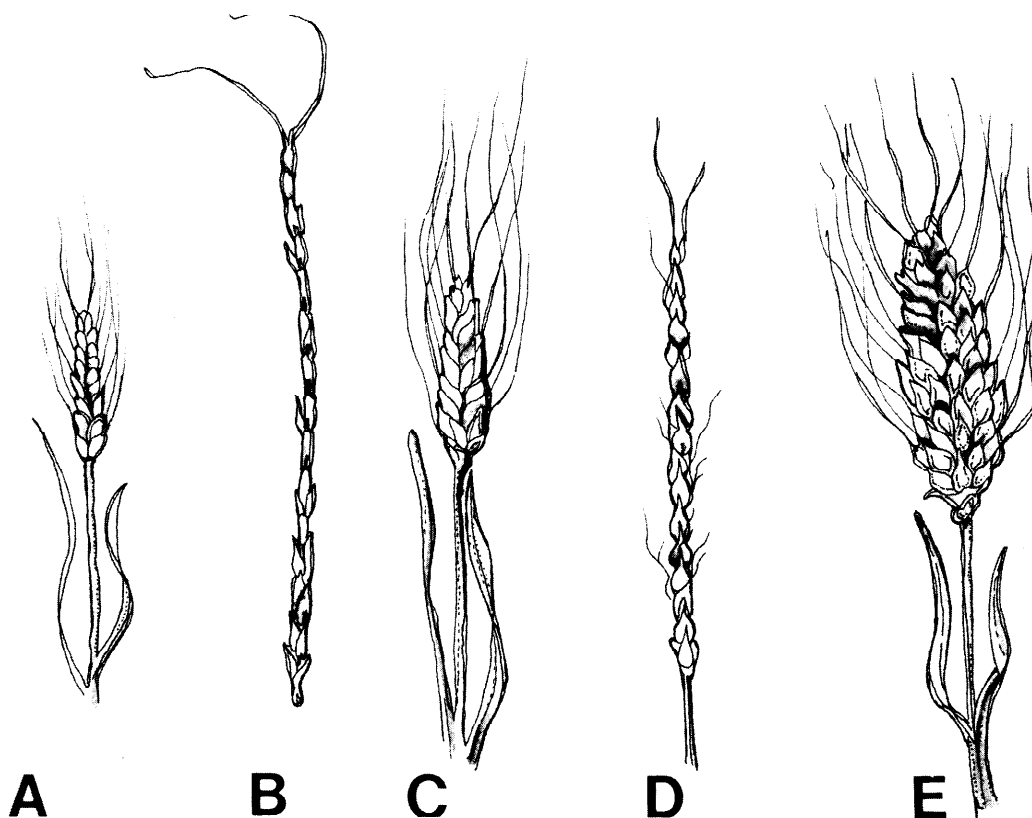


Figure 4. Three types of wheat and two species of *Aegilops* grass. A. A cultivated form of diploid einkorn wheat, $2n=14$. B. *Aegilops speltoides*, a grass. C. Tetraploid macaroni wheat, $2n=28$. At first it was imagined that tetraploid wheats such as this arose by allopolyploid crosses involving the grass *A. speltoides* and one of the diploid wheats. Later, Johnson demonstrated the probability that these tetraploid wheats arose from an allopolyploid cross between two different types of diploid wheat without the involvement of *Aegilops speltoides*. D. *Aegilops squarrosa*, goat grass. E. Hexaploid bread wheat, $2n=42$. Much evidence supports the belief that tetraploid bread wheats such as this arose from an amphidiploid cross involving the grass *A. squarrosa* and one of the tetraploid wheats. In all of these proposed events, no real “evolution” can be said to have occurred but only some crosses and chromosome doubling that represents the sort of variation possible within the created “kinds.” Sketches by John Schilling based on Harlan, Baker, and to some extent on Stansfield.”

chromosomes) from the *T. boeoticum* wheat and let *B* represent the other genome, then *T. dicoccoides* (the wild tetraploid wheat) may be symbolized AABB (28 chromosomes in all). It has been assumed and widely reported^{64, 65} that tetraploid wheat arose by a gamete of diploid wheat (*A*) uniting with a gamete from the grass *Ae. speltoidea* (*B*) and then doubling (AB→AABB) to produce a cell from which arose the wild type of tetraploid wheat which we now call *T. dicoccoides* and from which were derived cultivated strains of tetraploid wheat such as *T. dicoccum*.

Recently, however, Johnson and coworkers have reported several types of experiments and numerous chromosomal observations that point toward a different ancestry for the *B* genome of tetraploid wheat. He performed electrophoretic analyses of seed albumin from two diploid wheats (*T. boeoticum* and *T. urartu*) and the wild tetraploid wheat *T. dicoccoides*. He found that the electrophoretic profile of proteins in the tetraploid had a distribution of bands such as would be expected if it had arisen as an allotetraploid of the two diploid wheats, *T. boeoticum* and *T. urartu*.⁶⁶ Hybridizing the two diploid strains of wheat (*boeoticum* and *urartu*), he induced tetraploidy by means of colchicine.⁶⁷ Similar amphidiploid crosses were made using *T. boeoticum* and *Aegilops speltoidea*.

The results of the cross between *boeoticum* and *urartu* wheats on the one hand produced an amphidiploid that closely resembled the wild tetraploid wheat (*T. dicoccoides*) while the cross with *Ae. speltoidea* did not:

"The synthetic *boeoticum-urartu* amphidiploid was virtually identical morphologically with the wild tetraploid wheats, whereas various *boeoticum-Sitopsis [Aegilops speltoidea]* amphidiploids were markedly different."⁶⁸

According to these data the progenitor of the tetraploid emmer wheats arose by an allopolyploid cross between two diploid wheat strains and did not involve the grass *Aegilops speltoidea*.

While both Baker⁶⁹ and Johnson have assumed that man's role was only that of bringing the two putative parent wheat types close to each other by cultivation, such an event was more likely the result of deliberate hybridization practiced by early plant breeders since the tetraploid wheats were already present in the earliest Jarmo deposits.⁷⁰

But the story of wheat does not stop here. There is yet another strain which is hexaploid, having 42 chromosomes or exactly six times the basic number 7. There are several hexaploid varieties which may be discussed collectively as *T. aestivum* or *T. vulgare*, the "bread wheats". Besides the *A* and *B* genomes already discussed, the hexaploid wheats contain another genome labeled *D* and their entire chromosome genome complement may be symbolized AABBDD. Johnson⁷¹ confirmed that the donor of this *D* genome was the grass *Aegilops squarrosa* (not to be confused with *Ae. speltoidea* which Johnson ruled out as a contributor of the *B* genome in the tetraploid). The electrophoretic profiles of albumin proteins produced by a 2:1 mixture of proteins from the cultivated diploid wheat, *T. dicoccum* and the grass *Ae. squarrosa* very closely simulated the pattern produced by electrophoresis of seed albumin

from the hexaploid bread wheat, *T. Aestivum*. Evidently after a gamete from the diploid *T. dicoccum* (carrying the *A* and *B* genomes) united with one from the grass *Ae. squarrosa* (carrying the *D* genome), the fertilized egg (ABD) underwent doubling (AABBDD) producing a cell from which grew the hexaploid progenitor of our modern bread wheats (see Figure 4).

It is difficult to perform this cross, although Lammerts has repeated it following the instructions of Johnson. Lammerts is also presently striving to secure perennial or ornamental wheat by crossing *T. orientale* which has lovely black beards with the perennial rye (*Secale cereale*). The *F*₁ hybrids are vigorous but sterile and thus far chromosome doubling has been unsuccessful.

In 1944 McFadden and Sears succeeded in making the cross to produce the hexaploid bread wheat. It is somewhat presumptuous, however, to postulate that such a complicated series of events could occur naturally since all these wheats are obligately and tenaciously self-fertile. It would be difficult to imagine a situation in which a cross between the tetraploid wheat and the grass *Ae. squarrosa* would occur naturally. Instead the wheat *T. dicoccum* would simply fertilize itself unless the flowers were emasculated very early in development. Another factor which points to man's intervention is the understanding that the cultivated tetraploid wheat, *T. dicoccum*, and not the wild tetraploid *T. dicoccoides*, was the putative parent of the hexaploid. But even if the cross somehow occurred spontaneously, surely man preserved it.

In summary, the derivation of hexaploid wheat illustrates the principle that polyploid crop plants are regularly based on specific preexisting diploid types—einkorn diploid wheats, for example, being still in cultivation! There is no reason to believe that the original diploid wheat strains arose from anything but wheat—which was evidently created as a separate entity. Yet the tetraploid macaroni wheats and the hexaploid bread wheats both show evidence of having been produced by allopolyploid crosses which implicate man's care and intervention. And although these are significant changes we have discussed, they can hardly be classed as "evolution" if by such we mean that a new entity, (able to perpetuate itself in nature) has arisen. Rather, as in the case of corn, we have data that fit quite naturally with the idea that the basic diploid species were created and then later certain modification took place under the selective cultivation of man.

The Origin of Rose Varieties

Only a very few rose varieties trace back as far as 1500 AD, and only *Rosa centifolia* seems to have been known to the Romans before 270 B.C.⁷² It was as late as 1810 that the original tea rose with double blush pink flowers was introduced into England from China where it grew without much care. Oddly enough, the oriental people were not much interested in the rose and did very little to improve the species, which was mostly single-flowered and occurred in white, light pink, salmon pink and light yellow colors.

The pale yellow double flowered variety *R. x odorata ochroleuca* or Park's Yellow Tea-scented China was in-

roduced into England in 1824. By crossing forms of this particular type between themselves and with *R. chinensis* the modern tea rose was developed. Later this was crossed with other garden roses to give the hybrid teas. None of these varieties, however, had the lovely dark golden yellow to coral to flame colors we now enjoy.

The years 1900-1920 begin the golden era of modern rose breeding. Following the inspiration of a dream, or one might say a vision, Marie Pernet-Ducher pollinated the hybrid perpetual Antoine Ducher with pollen of the Persian Yellow, a variety of *R. foetida persiana*. Though many pollinations failed, finally one hip developed and actually set a few seeds. Even more wonderful, one of the seeds germinated, and the resulting seedling was the startling golden orange to nasturtium red Soleil d'Or. From it, all the deep golden yellow and flame colored roses we now admire so much developed.

The Pernetiana yellow rose line traces from Soleil d'Or to Mme. Melanie Soupert (1906), to Rayon d'Or (1910), to Constance (1915), and finally to Souv de Claudius Pernet, introduced by this distinguished couple in 1920 and named in honor of their son Charles who was killed in World War I. This variety was the culmination of the Pernetiana line as far as the Pernet-Ducher family is concerned. It is a fragrant pure sunflower yellow. Their work however, was continued by F. Guillot who crossed Souv. de Claudius Pernet with an unnamed seedling also of Pernetiana stock, and succeeded in creating the famous Soeur Therese with the long streamlined bud, introduced in 1930. Thus a period of over thirty years of inbreeding had been carried on by the famous French rose breeders.

The red rose ancestry line is even more complex. The main line of development traces from the salmon flesh tinted yellow seedling of Ophelia (1912) crossed to the rosy carmine Mrs. Charles E. Russel (1914) resulting in the greenhouse rose, Premier (1918), a dark velvety rose-red. Then the fragrant glowing crimson Hoosier Beauty crossed with Premier resulted in Sensation (1922), which has a scarlet crimson color. Meanwhile Kordes in Germany had been intercrossing the Pernetiana roses Willowmere and Mme. Caroline Testout and one of the most promising seedlings of this union was in turn hybridized with Sensation, resulting in the lovely light red variety Cathrine Kordes (1930). Kordes then crossed the crimson to maroon red W. E. Chaplin (1929) with Cathrine Kordes, and obtained the justly famous Crimson Glory (1935). By this time the effects of inbreeding the red rose line were becoming obvious; for, though a beautiful deep red of exquisite bud form, Crimson Glory did not grow very vigorously in many gardens, particularly on the west coast. Accordingly it seemed to Lammerts rather important that the best varieties of the yellow and red rose lines be intercrossed in order to restore as much as possible of the original vigor, by the phenomenon of hybrid vigor, which usually occurs when very distinctive lines with a species group are intercrossed. Just as expected, most of the seedlings from these crosses were very vigorous, and one of them, Charlotte Armstrong, combined vigor with a very lovely streamlined spectrum red bud. It resulted from crossing Soeur Therese with Crimson Glory, and

quite evidently the lovely bud form of Soeur Therese had been combined with the dark red color of Crimson Glory, to give the spectrum red bud of Charlotte Armstrong, longer even than Soeur Therese.

Many beautiful roses were developed from Charlotte Armstrong, such as the orange to Indian red Sutter's Gold hybridized by Herbert Swim, as well as his pink to apricot Helen Traubel.

Meanwhile in 1944 a most unusual Floribunda rose was introduced by Mathias Tantau. It was a very vigorous hybrid of Baby Chateau x *R. roxburghii* and had large sprays of lovely slightly fragrant cinnabar-red flowers. Because this was such a wide cross Lammerts felt that it should give a much needed boost in vigor to the Charlotte Armstrong line of hybrids. He therefore crossed Charlotte Armstrong with Floradora, the hybrid described above, and grew a rather small population of not more than a hundred plants since he expected that intercrossing would be necessary to recover good bud form and the unusual color of Floradora. Though all the seedlings were quite vigorous, one was unusually so. It had unusually clear pink flowers of a carmine rose color, and bore them singly and in clusters. The foliage was very large and glossy, of a dark green color and abundantly clothed the plant. Quite clearly this was neither a floribunda or hybrid tea in habit of growth. At the All America Rose Selection meeting there was unanimous approval of it as being worthy of an award but much perplexity as to how it could be introduced. Since it was so tall and vigorous in habit, and bore its flowers both singly and in clusters it was decided to create a new class for it, namely the Grandiflora class. Meanwhile Manfred Meyberg had secured permission of the Queen of England to name it in her honor should it receive an award. Accordingly it was introduced as Queen Elizabeth in 1954, as the first of a new class of roses. Since then there have been quite a few grandifloras but not one of them has quite the combination of vigor and bud form, characteristic of it. When in Chile in October and November of 1979 Lammerts was amazed to see plants of it over ten feet high and six feet in diameter, literally covered with flowers. It is also used as a hot-house rose in Chile. This award-winning rose is pictured in Figure 5 and on the cover of this issue.

We have gone into considerable detail as regards the rose breeding activities of various individuals to show that rose breeding is a complicated sort of business. Most certainly new varieties of roses could never arise spontaneously under natural conditions. If by some strange fluke of chance rearrangements of genes from two different species, a vigorous new variety did come into being, it would soon be lost because of poor seed production and germination.* Thus vigorous as Queen Elizabeth is, even this variety would soon disappear were it not kept alive by asexual reproduction, i.e. budding into understock, forcing by the removal of the understock cane, after bud union, and careful growth of the young little plants. Though many very beautiful

*Those plants which did germinate would grow into plants either very weak in growth because of defective gene recombinations, or quite sterile and so incapable of continued reproduction.



Figure 5. Queen Elizabeth Roses. The history of modern rose varieties such as this one illustrates the fact that plant breeding is a complicated business and that useful new varieties do not just arise by chance. But all of this is not "evolution" since only the original species of roses from which these varieties were developed would continue to survive under natural conditions.

rose varieties have been created by various rose hybridizers in the past several hundred years, only the original species roses from which these varieties were developed will continue to survive under natural conditions.

A Brief History of The Strawberry

Beginning on page 3262 of *Bailey's Cyclopedic of Horticulture* is a history of the strawberry from which the following details have been extracted.⁷³ They have been in garden cultivation for less than 600 years, and in commercial agriculture for less than 200 years. The wood strawberry (*Fragaria vesca*) was first raised in French gardens. The wild strawberry of North America, *F. virginiana*, was brought to Europe early in the 1600's. Neither showed much promise as a cultivated plant. *F. chiloensis*, which was native to the Pacific coast of America, was introduced to Europe from Chile in 1712 by a Frenchman, M. Frazier. Both *virginiana* and *chiloensis* are octaploids having 56 chromosomes. The basic chromosome number in strawberry is 7. Although *chiloensis* produces large berries, it was not popular either because of its low yield and the poor quality of its fruit.

By the mid 1800's, the Pine strawberry (so-called because of its pineapple fragrance) appeared. It became the principal forerunner of our modern garden fruit. The origin of the Pine strawberry is unknown. Some believe that it came as a hybrid of *F. chiloensis* with *virginiana* in gardens of Europe.

Great progress was made by T. A. Knight who grew 400 hybrid seedlings in 1817 and from them selected the varieties Downton and Elton. As G. M. Darrow has indicated in his U.S. Dept. of Agriculture publication *The Strawberry*, these hybrids were all probably seedlings resulting from the crossing of *F. chiloensis* and *F. virginiana*, and these varieties were used by later strawberry breeders.

But the first of our modern large strawberries was the Keen's Seedling, originated by Michael Keen, of England, in 1819; and it was a Pine. From Keen's Seedling have developed most of the varieties grown in Europe today. Our modern American varieties were developed from the Hovey which is also partly a Pine, having resulted in all probability from backcrosses of the European hybrids to the American wild strawberry—*F. virginiana*.

Since wild strawberries grew abundantly, there was no garden culture of strawberries in America until about 1770. Several European types were introduced but did not gain popularity. Americans preferred the transplanted wild plants called Scarlet (*F. virginiana*).

Commercial culture in the United States began shortly after 1800 near certain large eastern cities such as Boston, New York, and Philadelphia. The varieties first used were called Large Early Scarlet, Hudson's Bay, Early Hudson, and Crimson Cone—improved types of *F. virginiana*.

Hovey was the first strain to result from handcrossing by the Bostonian C. M. Hovey. It was successful as an amateur variety but not as a commercial strain. Interest grew, and as a result the Wilson (developed by James Wilson of New York in 1851) was the first commercial strawberry in this country. Like some of the others, it was a derivative of Hybrids of *chiloensis* and *virginiana*.

A. F. Etter of Ettersburg, California, worked with *F. chiloensis* and California mountain types of strawberry such as *F. californica* and *F. virginiana* var. *platyphala*. Varieties presently raised in California trace back to strains that he introduced and they also carry factors derived from lines introduced in the eastern United States.

In 1979 R. Bringhurst and his associate V. Roth released three short-day commercial and three neutral-day garden varieties to the trade. These are patented. Their parentage is very complicated as may be seen from the pedigree of the variety Brighton which is shown in Figure 6.

Obviously varieties so highly heterozygous as these will not breed true from seed, and in due course unless cared for under garden conditions and propagated by runners as roses are by budding will revert back to the parental species *F. virginiana* and *F. chiloensis*.

Thus strawberries represent that class of fruits which have been cultivated for just a short time. Evidently they were not part of the repertoire of crops carried by Noah and his descendants in early migrations. The history of the strawberry also shows that long time periods are by no means necessary to account for a great deal of diversity, once plant breeders become interested in developing species which have the genetic potential for improvement.

In the above discussion it should be noted that although simple selection had a part to play in the origin of commercial varieties, by far the most important progress was due to *planned hybridization*. Not only is this true of the strawberry but of such diverse crops as corn, wheat, apples, roses, begonias, and especially the orchids which we study next.

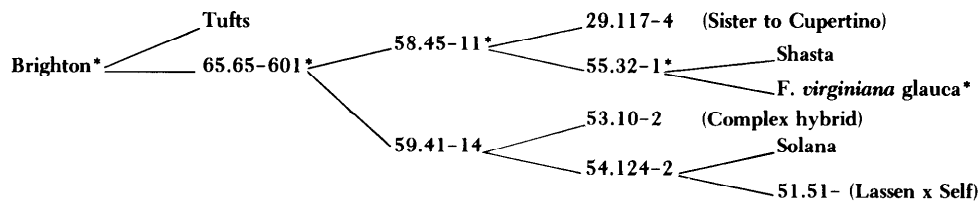


Figure 6. The pedigree of the Brighton strawberry, a day-neutral type introduced recently. The asterisk indicates the presence of the day-neutral trait in each generation.

On the Origin of our Modern Orchids

The orchids as they occur naturally are a vast assemblage of plant species (over 15,000 of them) occurring over all parts of the world except the polar regions and the great deserts. However, about 80% of the species occur in tropical and sub-tropical zones, where they are found mostly in the mountainous areas. As individual plants they are seldom abundant in any place. The most widely distributed species are found in the north temperate and sub-arctic zones, and include such forms as *Calypso bulbosa*, *Microstylis monophyllos*, *Liparis lasselii*, and species of the genus *Orchis*. The tropical Asian and American regions furnish by far the most genera and species, relatively few coming from tropical Africa.

At first the growing of seedlings from the imported types was most indifferently successful. It was found ultimately that special root fungi were necessary for the germination of the seed. Orchid growers now normally place pieces of the roots infected with this mycorrhizal in the sphagnum bed in which seedling are grown.

The first orchid hybrid to be produced in cultivation was *Calanthe dominii*, a cross between two other species. It was raised by a Mr. Dominy in the nursery of James Veitch & Son and flowered in 1856. In 1861 the same grower produced the first bigeneric hybrid, *Goodyera dominii*, a cross between *Haemeria* (*Goodyera*) *discolor* and *Dissinia marmorata*. There are now over 5000 interspecific and intergeneric orchid hybrids.

There are at least two facts of great interest here to creationists. One is the very great recency of the knowledge and importation of the many species. Thus in "Species Plantarum" in 1763, Linnaeus described only 36 species under the genus *Epidendrum* which at that time was made to include all epiphytic orchids from the tropics. In 1805, however, in his edition on "Species Plantarum" Willdenow already listed 391 species of orchids including 140 epiphytic ones.

In the nineteenth century, due to the work of many collectors, the number of known tropical species rose rapidly. Attempts to cultivate the tropical orchid did not begin until early in the eighteenth century, and it was not of importance commercially until about the middle of the nineteenth century. By this time the newly imported species were commanding fantastic prices, and this served as a spur greatly to increase the search for tropical orchids.

The other important fact which we as creationists may deduce from this history of the orchids is that once man gets really interested in a certain plant, things hap-

pen mighty fast! Who knows then how rapid the development of such plants as the tetraploid wheat, our modern hexaploid wheat, and corn really were?

Data Regarding the Origin of the Apple

According to Bailey, the apple has been cultivated since time immemorial. Charred remains of its fruit have been found in the prehistoric dwellings of Switzerland. As creationists we do not acknowledge the usual glacial time scale and yet it must be conceded that the culture of apples was apparently quite ancient.

The apple comes from *Pyrus malus*, and the crab apples from *Pyrus baccata*. Large-fruited crab apples such as the Transcendent and Hyslop have come as hybrids between the two.

Actually, most of the varieties which we now grow are rather recent discoveries. Thus the Baldwin was found by Samuel Thompson while surveying in Wilmington, Massachusetts, in 1793. The "Primate" apple was introduced by Calvin D. Bingham in 1840 on his farm near Camillus, New York. The famous Northern Spy apple was found in a seedling orchard planted by Heman Chapin about 1800. This orchard was near Bloomfield, New York. The Wealthy was found by Peter Gideon among seedlings grown by him on his ranch near Excelsior, Minnesota in 1864. As early as 1773 Thomas Jefferson recorded in his "Garden Book" the grafting of the Newtown Pippin in Albemarle County, Virginia.

Although the apple may have been grown from time immemorial, the varieties could not have been very outstanding, or it would not have been so relatively easy for farmers to have found so much better ones. More research is needed on the origin of the apple from our young-earth creationist viewpoint.

The apple exemplifies that class of cultivated plants which was grown for many years but improved only in very recent times.

Although we might discuss the history of many other cultivated plants, the stories of these few show that some were cultivated before the flood (wheat, apple, and probably corn). Others like strawberry, rose, orchid, and sunflower seem to have been brought into civilization in recent times. All crop plants manifest the marks of design in two important aspects:

1. The original types each appear to have been *created* and not to have descended from anything unlike themselves.
2. Directed changes after creation from man's activities in cultivating, selecting, and hybridizing

various strains. Thus the entire pattern of origins for cultivated plants fits squarely with a scientific model which includes the creation, the fall, and the flood.

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THE DOMESTICATION OF ANIMALS†

C.E.A. TURNER*

The evolutionist postulates the gradual emergence of man from the *lower* forms of life; and similarly the development of animals from primitive types. While man is *supposedly* about one or two million years old, the history of his domestic animals is remarkably brief. He seems to have been a long time reaching the stage of the farmer!

'Domestication' is understood to mean that certain animals, including mammals, birds, and insects (!) are associated with the domestic life of man. They are kept by him and near his domicile, with their movement and mating under his control. This does not mean that all such animals are tame (few bulls are!) or responsive to man's attention except for food.

Professor F. E. Zeuner, PhD, DSc, FSA, FGS, FZS, a definite evolutionist, surveyed this history very thoroughly in his book, 'A History of Domestic Animals' (Hutchinson, London, 1963). While archaeologists' conclusions may be founded on dubious dating methods, it is interesting to trace and follow their findings. Zeuner regarded domestication as linked with economics, as animals supply such human requirements as food, clothes and transport. He also connected it with religion in that animals were worshipped or used as sacrifices. The proportion of all animals domesticated to this day is very small indeed, and is restricted largely to a few families.

The dog, Zeuner thought was the first domestic animal, helping man in hunting and herding. Evidence produced shows this occurring by 6000 BC and largely in the Near East. Mention is made of the dog (or was it a wolf?) being in Denmark about 8000 BC. Changes have been effected in the size, colour, skull, skeleton of body and limbs, the hair and soft parts by breeding. Yet the animal remains a recognizable dog, whether it be the diminutive Chihuahua or the Great Dane; and no evidence of evolution of new species is in the slightest degree apparent. Several different breeds of dogs, including the greyhound, and possibly the mastiff appear on Egyptian pottery of around 4000 BC.

The sheep and goat, Zeuner regarded as being domesticated by 6000 BC, and evidence of this he thinks is found in Persia dated 6700 BC. At Jericho at about the same date the goat appeared. Sheep in Western Asia are labelled as existing at 5000 BC.

Cattle were used by man before 4000 BC. Those in Mesopotamia are dated 4500 BC. Evidence is given for domestic cattle being in Egypt about 3700 BC. There they included sacred bulls, and those used for transport, milk, hides and possibly blood like the Masai practice in East Africa today. Domestic cattle are supposed to have come from the wild aurochs. By recent experiments in crossing it has been possible to reproduce these creatures. This demonstrates anything but evolution—rather the existence of the one gene pool.

Indian water-buffaloes were said to be in Ur before 2500 BC and in N.W. India. These are particularly valuable to man, their milk being richer than the cow's, the butter more solid and less easily turned rancid in the warm climates. They are stronger than oxen and more resistant to disease. Other bovines used in the East include the banteng, mithan, gayal and zubu from early times. There is no historical reference to the yak before the Roman era.

The evidence for the earliest use of the elephant as a beast of transport comes from the India of 2500 BC.

The horse, oft quoted by evolutionists, does not seem to have been used domestically until it appeared in Mesopotamia about 3000 BC. The onager (half ass) drew chariots at Ur 2500 BC. and the common ass was used as a beast of burden in Egypt about 3000 BC.

Zeuner states surprisingly that the earliest record of the camel as a domestic animal is that connected with Abraham, Issac and Rebekah in Genesis 24.

The pig he thinks to have been kept from about 7000 BC. Under the Mosaic Law of course it was classed as unclean. This would appear desirable because of its scavenging habits and susceptibility to disease, especially trichinosis due to the worm *Trichinella spiralis*.

Egypt appears to have been the scene of numerous experiments in the domestication of animals. The period of maximum endeavour was 2650-2200 BC. Tomb pictures show a variety of animals being used. These include the antelope, fallow deer, gazelle, ibex and oryx, frequently with collars. One picture shows an elk being milked. Hyenas were kept for hunting and food. Dated at 1500 BC, another picture portrays a cheetah with a collar, tamed for hunting. Such activities suggest the need to acquire animal food, and the interest of the rulers in animals for sport. Mummies have also been found of the mongoose, an animal so useful for destroying snakes and rats.

Fossils of cats associated with man have been discovered, but do not indicate early domestication as there are no essential skeletal differences between wild and domestic types. It was probably well domesticated in Egypt by 3000 BC and possibly in India by about 2000 BC. The animal was valued for the protection from rodent pests that it gave to man's food; and thousands of mummies of cats have been found in Egypt. There it was worshipped or regarded as sacred to the cat-headed goddess Bast or Bastet about 1600 BC, and whose temple was at the city of Bubastis in the Nile Delta.

In the New World, Zeuner did not find evidence of earlier domestication forthcoming. Bones of the alpaca and llama, animals of the camel group, have been found in Peru and dated from 2550 BC. The guinea pig was apparently kept for food by the Incas. The dog and the horse also appear as fossils, but whether they were domesticated is not clear.

Zeuner gives a considerable amount of information about birds. He regards the pigeon and the goose as domesticated by 7000 BC. The duck was also tamed early. The domestic fowl appeared in the Indus Valley

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about 2000 BC. Pelicans were certainly kept for their eggs in Egypt by 1400 BC, and cranes were kept about that time, while cormorants were used for fishing. Quails were also known in Ancient Egypt.

The history of the ostrich is obscure until modern times, according to Zeuner, but in the ancient book of Job we read of the bird in some detail. Its identity there is in no doubt through reference to the feathers, hatching and speed of movement. (Job 39: 13-19).

The keeping of fish in special ponds for food was a practice in Ancient Egypt and Mesopotamia. This is another aspect of domestication if not 'taming' creatures for human use.

Regarding insects, it seems silk moths were bred in China possibly by 3000 BC according to Zeuner. He devotes considerable space to the description of the honey bee and describes its supposed evolution from pre-historic times. His idea is that they were fostered before 8000 BC, and probably in Egypt about 2600 BC, but certainly by 625 BC. He regards them as developing (but did they?) from a bumble type and gradually changing in their structure and way of life. This is hardly good evidence for evolution, for a bee is a bee for all that, and is still well within the kingdom, phylum (arthropoda), class (insecta) and even order (hymenoptera) which last includes such dissimilar creatures as ants!

The book 'Seed to Civilisation' by Charles B. Heiser, Jr., of Indiana University, U.S.A., gives the views of another evolutionist, published just ten years later than Zeuner's, in 1973. He thinks man has been on the Earth for two million years and changed from being a hunter of animals and gatherer of plants only 10,000 years ago. Then he became more settled, less dependent on the wild and more dependent on domestic sources of supply. Heiser regards agriculture as developing first in the Near East, but 'the explanations of why and how man invented agriculture, are far from certain.'

Dogs, he thinks, may have inspired (!) domestication and that they were domesticated by 8400 BC in the New World and by 7400 BC in the old. Sheep were kept by man, in his opinion, from 9000 BC and possibly goats; cattle from 7000 BC, with their earliest remains dated at 6300 BC. All domestic animals, he states, have been used for sacrifice. Regarding evolutionary progress he admits, 'No basic plants and animals have been domesticated in historic times.'

J. L. Lush, Professor of Animal Breeding at Iowa State College, in his article on Domestication of Animals in the Encyclopaedia Britannica, 1968, thinks they were chosen for aesthetic and utilitarian reasons. He admits methods have to be surmised only from the activities of primitive peoples and ancient cave paintings and carvings. While some young animals were and are kept as pets, they are not all tameable. He states 'Domestication did not change the laws of inheritance,' also 'Some possibility for domestication may still exist, but no important species has come completely from the wild to the domestic condition within historic times.'

His dates correspond largely to those of the two authors quoted above with reference to cattle, sheep and swine at about 7000 BC, chickens in S.E. Asia at 2500 BC and the cat in Egypt at 2000 BC. He thinks horses were mounted about 3000 BC.

George Cansdale, BA., BSc., former Superintendent of the Zoological Society of London, published his book 'Animals of Bible Lands' in 1970 (Paternoster Press, London). He deals with the subject in detail and includes such chapters as 'The Cattle Upon a Thousand Hills', 'Beasts of Burden', and 'Fowls after Their Kind'.

He regards the goat as being the first domestic animal after the dog, with the wolf as its probable ancestor. Regarding the sheep, which followed from about 5000 BC, he thinks its origin and early history complex and disputed, and that some authorities believe the *wild ancestor of the sheep has long since become extinct!* Cattle he would suppose were descended from the extinct aurochs later than the above. He refers to the camel as dating from 3000 BC in Egypt, and the ass or onager drawing a wheeled vehicle in Mesopotamia at about the same time. He states 'The early history of the horse is hard to sort out', and that, 'In the horse this development has gone to the limit.' Does he mean that evolution has stopped?

Fowls, Cansdale states, have the Red Jungle Fowl of India as thier ancestors, and were domesticated there before 2000 BC. He gives the Rock Dove as the ancestor of pigeons, and thinks they were first domesticated for eating before 2500 BC in Egypt and possibly by 4500 BC in Mesopotamia. He describes the honey-bee as being kept in Egypt by about 3000 BC.

He states 'The taming of these animals is a striking fulfilment of the prophetic (!) command to man: "Have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the Earth". (Genesis 1:28.) Over the course of years *man has brought into a domestic state a wide range of animals . . .*' or so he thinks!

The unsatisfactory feature of this book by a practising evangelical Christian, is that he commences the study from the wrong end. Leaning heavily upon Zeuner, whom he quotes appreciatively, he seeks, like other evolutionists, to trace the origins of the domestic animals back to supposed wild ancestors, using the uncertain data of the archaeologist. This is quite unnecessary. Commencing with the Biblical account of creation, he might well have seen the domestic animals descended from those describes as "good" in the beginning, deteriorating in the hands of fallen man, until scientific enlightenment produces improved Western stock from the time of the Reformation and the consequent progress of the Seventeenth Century.

The creationist can, however, take heart from all the evidence submitted, for it shows that even the evolutionist cannot honestly push back the emergence of domestic animals beyond 10,000 years or less. This figure is of the same order as the Biblical date of the creation of man and animals.

In the Genesis record the description of the creation of the animals is summarised, 'And God made the beast of the earth after his kind, and cattle after their kind, and everything that creepeth upon the earth after his kind: and God saw that it was good'. (Genesis 1:25.) Thus three groups of creatures are mentioned: the beast, the cattle and the creeping thing. While the last would include a large number of orders, the first two describe only mammals. It is important to note that the Lord

distinguishes between these, using the Hebrew word *behemah* for cattle and *chaiyah* for beast. The first word is used 52 times for 'cattle' and elsewhere 136 times for 'beast'. This suggests that from the beginning the creature to be closely associated with man for his use, was marked out. So the experience of man through the centuries is in keeping with the Biblical descriptive differences. In Genesis 2:19 we read God brought every beast (*chaiyah*) to Adam to see what he would call them, and 'Adam gave names to all cattle (*behemah*) and to the fowl of the air and to every beast (*chaiyah*) of the field.' Thus the first farmer recognised which were to be his closer associates in the animal kingdom. And this took place before the Fall, at which the natural

world became less hospitable to man, with the beasts more wild.

Since this time man's efforts in the animal kingdom have been to recover from his loss, seeking security and the supply of his desires. His experiments outside the few long-domesticated animals have been largely failures. Strictly within the domestic species he has been able and allowed by God to improve breeds and yields by selective breeding. This is because he has been given dominion over the works of God's hands (Psalm 8:6) and that within limits. For himself, as the Lord said, he is unable 'by taking thought to add one cubit to his stature' (Matthew 6:27), that is to evolve himself.

ON THE ORIGIN OF DOMESTICATED PLANTS AND ANIMALS

RANDALL R. HEDTKE*

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Let us assume, from the limited description provided in Genesis 2 and 3, that Adam and Eve were living in a completely natural, nontechnological condition. Genesis 2:15 indicates that they were to "till", "cultivate" or "dress" the garden of Eden, while verse 16 indicates that food was abundant. Possibly verse 15 should not be interpreted to mean that Adam and Eve were practicing an agricultural technology, i.e. attempting, against the laws of nature, to grow one species of plant within a specified plot of ground. One seldom, if ever, observes a single species of plant growing within a natural habitat of any significant size. Even a grassland which appears to be quite uniform is actually composed of several species of grasses and broad leaf plants.

An agricultural technology, as described in Genesis 3:17-18, came into existence after the Fall. Genesis 3:23 states that Adam was sent forth "from the garden of Eden, to till the ground from whence he was taken." The first instance of a technological practice seems to be the making of clothing from fig leaves immediately after the Fall. Later, (Genesis 3:21) God Himself makes more substantial clothes for Adam and Eve out of skins.

Possibly Genesis 3:18 should not be interpreted to mean that thorns and thistles were specially created

after the original creation and after the Fall to plague and thwart man in his agricultural endeavors. I prefer to think that thorns and thistles and other plants that are considered noxious were part of the original creation. Whether or not a plant is noxious is relative as to whether or not an agricultural technology is being practiced. In that sense, then, Genesis 3:18 may be interpreted to mean that, with the entrance of sin into the world, the perfection of the earth had been lost and it would now be necessary to practice agriculture. And man's efforts would be made difficult by the good seed dispersal and rapid germination of those plants that can take advantage of the disturbed areas caused by agriculture. Of course, for the preservation of soil it is beneficial to have plants that will voluntarily cover exposed areas.

Agriculture requires a large input of human, animal or mechanical energy. The food energy received for our labor was made more lucrative when our Lord God created some kinds of plants and animals whose genetic make-up lent itself to the technology of artificial selection, resulting in higher yields. It only remained, then, for enterprising plant and animal breeders throughout history to discover the technology adaptive plants and animals.

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The Australopithecines and Alleged Early Man (Continued from page 25)

¹Leakey, Mary D., 1979. Footprints frozen in time. *National Geographic* 155 (4): 446-457.

²Brace, C. Loring, and James F. Metress (eds.) 1973. *Man in evolutionary perspective*. Wiley.

³Leakey, L.S.B., 1966. *Homo habilis*, *Homo erectus*, and the Australopithecines. *Nature* 209 (5030): 1279-1281.

⁴Weiner, J.S., 1973. *The natural history of man*. Doubleday.

⁵In his book, *Man's first million years*. This book seems to be out of print, presumably having been superseded by *Man: his first two million years*.

⁶In the first edition of *Human evolution*. This edition has presumably been superseded by the second edition, Reference 3.

PLACEMENT SERVICE

Do you know of academic vacancies to which creationists might be directed? The Creation Research Society would like to be in the position to inform creationist scientists of such vacancies. If you know of such positions will you please inform Dr. John W. Klotz, 5 Seminary Terrace North, St. Louis, MO 63105 describing the position, the academic requirements and training required and any other information that might be available. You will be helping provide students with information on the position which you yourself share.

MAIZE IN ASIA AND ELSEWHERE†

GEORGE F. CARTER*

... The finding of maize pollen in India has frequently been reported. It set off quite a controversy over the distinction of maize pollen that was finally resolved in favor of those that thought that maize pollen was identifiable. The pollen men that did this work confidently state the pollen levels are pre-Columbian in age. See bibliography and notes on Jeffreys.

In China maize was being used to pay taxes within 60 years of the discovery of America. The maize was said to have entered China from India, probably, and to be well established. One has to be a believer in miracles to have such instant adoption and development to a major crop. The general figure for the spread of such a trait overland is one mile per year—not thousands. Jeffreys discusses this at length.

Maize in Europe is an interesting question and ... (there is) ... the question of maize in Africa and its importation into Portugal before 1492. This is a lengthy controversy that centers around M.W.D. Jeffreys. I followed this controversy for some time. In the end, the case swung Jeffreys' way. Maize was indeed known in Portugal before Columbus' voyage, and it was known under a west African name.

... Jeffreys, Sauer, and I have all looked into the maize-in-Europe situation and Edgar Anderson directed Finan's study of Maize in the *Great Herbals*. Finan showed that maize is described as being introduced into Europe via the Turks prior to 1500; and to most Europeans it was Turkish wheat. (Only belatedly was it called maize.) The Turkish maize is a mid-latitude flint. Hence, the botany and history say separate sources, with the Turkish maize earlier.

In Asia both Jeffreys and Sauer showed that maize was already established in the Philippines when Magellan arrived there. The notion that the Portuguese carried maize to Asia very early, as a result of their contact with Brazil on their way to the Indies is ingenious but has no foundation in fact. It stems from Merrill, late of Harvard. He invented hundreds of Portuguese contacts with Brazil to suit his needs for a vehicle to get maize to southeast Asia very early. There is no documentation to support this thesis.

Then, there is the matter of context; something on which I am growing increasingly adamant. Is maize the only thing in question? How about *Hibiscus rosa sinenses*, now probably an American plant and in Asia by the time of Christ? What about peanuts, according to our best reporter on Chinese archeology, already present in China in Lungshanoid's time (ca 2000 or 3000 B.C.). And that date fits the appearance of Asiatic pottery on the Ecuador coast. Then, there is the coconut in America. Winds and currents cannot carry that to

America—a conclusion now buttressed with computer drift data. Then, there is Chinese art and mythology, and mathematics, and so forth in America. Also Hindu art, mythology, etc. See the bibliography for some almost random samples of the literature. How in the name of good scholarship can one discuss maize so restrictively??

For a broad and careful statement on the whole transoceanic diffusion problem with a useful bibliography see; Stephen Jett, "PreColumbian Transoceanic Contacts", pp 593-650 in Jesse Jennings, *Ancient Native Americans*, W. H. Freeman and Company, San Francisco, 1978.

I cannot resist a quotation on the introduction of a new grain ... (and the notion) ... that a grain such as maize would be immediately adopted. In the reign of the King of Bhatgaon (1617-1633) "—some Indian corn (maize) was by chance brought from the east mixed up among a quantity of mas or urd dal (a kind of pulse). The clever of the country were immediately assembled, and decided that this new grain would cause a famine so that it was thought best to send it back whence it had come and destroy all the ill luck it might have left behind." From the problem of the introduction of primitive maize into Southeast Asia, Part II, *Folia Orientalia*, Vol. XIX, 1978, Tomas Marszewski. The first Spaniards in the Pacific had a similar experience. They sowed American grains on a Polynesian Island, expecting the people to take up the new foods. They didn't!

It is now clearly established that there were extensive and meaningful contacts between America and Asia very long before Columbus. Amongst the exchanged material there were plants and animals. The chicken being the most notable in the animal category, and for this discussion it is notable that in part of South America the chicken was known by a Hindu name. If maize was so valuable a plant ... then one would expect it to be carried and it seemingly was. As Anderson and others have pointed out, the maize in Inner Asia is a primitive maize, the kind of thing that would be expected to be carried from America at some early time. The maize on the coast of Asia is advanced maize, just the thing one would expect in post-Columbian time ...

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†This is abstracted from an item with the same title, by Dr. Carter, in *The Stonehenge Viewpoint*, no. 32, pp. 26 & 27, November-December 1979, where it was one item in a series of discussions. It is used here by permission. The postscript is from p.2 of the same issue of the *Viewpoint*. Clearly, in investigating the origin of domesticated plants, it is important to know where in fact they did grow.

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1964a. The possible Chinese origin of Teotihuacan cylindrical tripod pottery and certain related traits. *Congresso Internacional de Americanistas Actas y Memorias* 35 (1): 25-39. (Ekholm's many papers document southeast Asian influences in America including very specific art forms from India.)

Heine-Geldren, Robert, 1946. Traces of Indian and southeastern Asiatic Hindu-Buddhist influences in Mesoamerica. *Congresso Internacional de Americanistas Actas y Memorias* 35 (1): 47-54.

Jeffreys, M.D.W., 1971. PreColumbian maize in Asia (in) *Man across the sea*, ed. Carroll Riley et al., University of Texas Press, Austin, 376-400. Cites Vishnu-Mittre (1966) "the evidence for maize in India is not in any case later than 1435 A.D." Cites Vishnu-Mittre and Gupta (1966) "maize cultivation in Kashmir began in the thirteenth-fourteenth century". These last two papers are based on pollen analysis, carbonized food grains, and their impressions on pottery. Jeffreys' lengthy discussion of maize in China carries it back to about 1250 A.D. More conservative estimates cited by Jeffreys point to 1555 for well-established maize in western China, with Ping-ti-Ho's guess at an introduction from farther west around 1525, an impossibly early date for a diffusion from Spain after 1492.

This was one of Jeffreys' last papers on the subject of maize in the Old World and is well worth careful study.

Kirchoff, Paul, 1964. The diffusion of a great religious system from India to Mexico. *Congresso Internacional de Americanistas Actas y Memorias* 35 (1): 73-100.

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Vishnu-Mittre, and H.P. Gupta, 1966. Pollen Morphological Studies of some primitive varieties of maize (*Zea Mays* L.) with remarks on the history of maize in India. *The Paleobotanist* (Lucknow) 15: 176-185.

Postscript

... On beans and peas ... There is the usual confusion in common names. The European bean was *Vicia faba*. It was the size of a large lima, was wooden-hard, was nearly poisonous—... The pea and the lentil were the good European pulses.

In Asia it gets more confusing. They had several genera of beans; e.g., the soy bean. But they also had *Phaseolus* beans, but the species are different in the two areas. The American beans are *P. vulgaris* (common bean); *P. lunatus*, the lima bean; *P. acutifolius*, the tepary bean; *P. cocineus*, the scarlet runner bean.

I wrote a major article on the origin of agriculture and in it I called attention to the mimicking in America of Old World domestics. For example, Americans have *Phaseolus* beans, as does Asia. America has potatoes and tomatoes—and these are the same genera as the Asiatic egg plant—all of these are *Solanum* sp.

The earliest grain cultivated in America is the same as in China (*Setaria*), and the American pumpkins and squash are *Curbitacae*—relatives of the cucumbers, cantalopes, etc., of the Old World. There are more. I consider the parallels a bit much. Others consider them just obvious.

THE AUSTRALOPITHECINES AND (ALLEGED) EARLY MAN

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The Australopithecines, recently touted as the evolutionary ancestors of man, are now seen to be nothing of the sort. For they were much more ape-like than man-like; moreover, they lived at a time when man had already appeared, according to the evolutionists themselves. The true origin of man is recorded in Scripture; attempts to find it in some half-ape-like creature are doomed to failure.

In this article the evolutionary claims that the ape-like creatures known as *Australopithecus* were on the dividing line between early apes and early man are examined. Many fossils of these creatures have been found, dating from about 4 million years ago until they became extinct about one million years ago. (While I believe in a fairly recent Creation of the Earth some seven or eight thousand years ago, I shall not argue against these quoted dates in this article.)

There are about as many conflicting and differing views on Australopithecines as there are scientists. Numerous skulls, jaws, teeth, and various body bones have been found, all in Africa at various sites including Sterkfontein, Swartkrans, Koobi Fora, Olduvai, Hadar, and Omo River. The Australopithecines, like modern apes, had a wide range of varieties. This fact has caused paleontologists and anthropologists no end of difficulties in trying to decide on the taxonomic status of

the various finds. In this discussion I shall concentrate on the main finds, omitting some of the more insignificant fragments which are too small to serve as an adequate basis for any judgement. The conclusion, after an examination of the various theories, is that the evolutionists' identification of these creatures as a missing link between apes and man is refuted.

There are several opposing viewpoints on the Australopithecines, the main ones being:

(a) There was only one species of *Australopithecus*, which encompassed all the range and variety within the group.

(b) There were two species: *Australopithecus africanus* and the larger *Australopithecus robustus*.

(c) The *A. robustus* and *A. africanus* were merely the male and female representatives of the same species, *A. africanus* being the smaller female.

(d) There were several species, such as *A. tellanthropus*, *A. meganthropus*, *A. habilis*, *A. africanus*, etc., etc.,

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(e) *Australopithecus* does not belong in the genus of that name at all, but was in fact a primitive form of man, and should be included in the genus *Homo*. Some extremists in the scientific world go so far as to hold this view.

There are moreover many intermediate views, the disagreement going to show up the confusion which exists among evolutionists.

Zuckermann, Lehrmann, Oxnard, and some others believe that *Australopithecus* was simply a type of ape, now extinct, and has nothing to do with man.

According to Dr. Bernard Wood, a leading evolutionary authority on Australopithecines, the earliest known fossils of any real significance are those found by Dr. Donald Johanson at Hadar, Ethiopia, in 1975.¹ This fairly complete skeleton, nicknamed "Lucy", dates from over 3 million years BP, and according to Johanson² had massive V-shaped ape-like jaws. Her arms were long, and her legs fairly short. As Johanson says: "What is she? An *Australopithecus*, no doubt. Lucy is far from the genus *Homo*".

Analysis of the pelvis and leg and hip bones indicate that Lucy may have walked nearly upright—some of the time. She does not appear to have been a gracile *africanus* but more likely a coarse, massive-jawed *robustus*. Dr. Owen Lovejoy, Richard Leakey's anatomist associate, stated in 1979 at a public lecture in the U.S.A. that a multivariate analysis of Lucy's knee joints showed that they were characteristic of apes, not of man. He went on, however, to say that certain manipulative tests showed that she walked upright. In all likelihood Lucy could walk upright in somewhat the same way as orang-utans do—awkwardly and clumsily and only for short periods. That is the judgement of Charles Oxnard. Likewise, Richard Leakey himself is of the opinion that all *Australopithecini* were not habitual upright walkers.

In any event, Lucy, the robustus *Australopithecus*, was without doubt an ape from the neck up. Her ancestors are entirely unknown. The only possible candidate is something called *Ramapithecus*, which lived allegedly 12 million years ago, and is classified by some evolutionists as an ape.³ But there is much guesswork concerning *Ramapithecus*, for only a few teeth and some bits of jawbone have been found. Claims that *Ramapithecus* is the ancestor of the genera *Homo* or *Australopithecus* are nothing more than 'speculation'.

Other *A. robustus* remains have been found at Omo River (2.5 million years BP), Swartkrans (2 million years BP), Koobi Fora and Kromdraai (1.5 million years BP), and Olduvai (Zinjanthropus, 1.5 million years BP).

A. robustus was clearly not an evolutionary ancestor of man. He was more ape-like in all features than the gracile *africanus*; and, as Dr. Wood pointed out in his book, on page 56, : "The *robustus* femurs from Swartkrans were so unlike those of modern humans". Dr. Wood also admits that, contrary to expectations, *robustus* "appears to have been moving away from man". (In comparison with the supposedly earlier gracile *africanus*, who in some minds was the ancestor of *robustus*.)

This brings us to the supposedly earlier, more gracile *africanus*, some of which had skulls more rounded than

those of any modern apes. One widely-held notion is that *africanus*, having appeared on the scene first, gave rise to two new creatures:

- (a) *A. robustus*
- (b) Early *Homo* (man).

Even this view has severe, indeed fatal, problems. It is hard to imagine that the earlier Australopithecines were more advanced than the later ones (*robustus*). If that were true, *africanus* went in two opposing directions:

- (a) Became more primitive and evolved into the coarser *A. robustus*.
- (b) Became more advanced and evolved into man.

Even stronger evidence against this notion is seen when one studies the known facts about *africanus*, *robustus*, and *homo*. In the fossil record, as far as significant finds are concerned, *Homo* appears first!! Mary Leakey has found at Laetolil, in Africa, footprints which are considered to date from nearly 4 million years ago, and are identical with the footprints of modern humans except that they are somewhat smaller.⁴ They might, in fact, be identical with the footprints of a modern female, of age in the teens. Moreover, Mary Leakey and Dr. Johanson have found teeth and jawbones which, except that they are again a little smaller, are of virtually identical appearance with those of modern humans. These remains, found at Laetolil and Hadar, date from about 3.75 million years ago. Johanson found also at Hadar the bones of a hand, 'uncannily like our own' dated to about 3.5 million years ago.

For convenience, information about these fossils, and the ages assigned to them, are collected in Table 1. It can be seen at a glance that *Homo* appears on the scene first at Laetolil, followed by *robustus* and *Homo* contemporaneously at the same site—Hadar. Finally *africanus* appears at Hadar slightly later.

Most evolutionists would maintain—or admit—that if different creatures lived contemporaneously, especially in the same area, they can hardly have evolved the one into the other. As Table 1 shows, *Homo*, *africanus*, and *robustus* did live contemporaneously over a period of about 3 million years; and sometimes that was at the same site: e.g. Hadar, Koobi Fora, Omo. That means

all ancestors unknown			
Million years BP	<i>africanus</i>	<i>robustus</i>	<i>Homo</i>
4			Laetolil
3.5		Hadar	
3	Hadar		Hadar Omo Koobi Fora
2.5	Makapansgat Sterkfontein		
2	Omo Taung (infant)	Omo Swartkrans	
1.5	Koobi Fora	Koobi Fora Kromdraai Olduvai	Koobi Fora (<i>H. erectus</i>)
1	Taung		
Present	extinct	extinct	world-wide

Table 1. The various African fossils are here set into a time-scale. it is seen that many of them were contemporaneous, and continued unchanged for long times.

that no derivation of stock the one from the other could have occurred. So Richard Leakey is certainly correct in saying that man and the primitive *Australopithecus* lived side by side as long ago as 4 million years BP. (Remember, I am quoting these ages stated without arguing; that does not mean that I believe them.)

With allowance for variety in species and kinds, (which is very common) *Homo* of 4 million years ago is much the same as *Homo* of today. *A. africanus* was virtually unchanged from about 3 million years ago to when it became extinct. Neither did *robustus* change over a period of about 2 million years. In short, no evolution can be shown to have occurred in any of these three groups.

The sizes of brain of the *Homo* finds range from 800 cc's (Hadar) to 900 cc's (Koobi Fora); while the average *africanus* brain capacity was around 450 cc's and that of *robustus* a little over 500. When all the modern features of Skull 1470 are examined, along with the quite modern features of the Hadar and Laetolil *Homo*s, the contrast between ancient *Homo* and ancient *Australopithecus* becomes striking and definite.

We have therefore the situation that no proven ancestor is known for any early *Australopithecus* nor for any early *Homo*.

Now *Homo* (?) *habilis* must be considered.

In the 1960's, Dr. Louis Leakey found at Oduvai some teeth, and fragments of jaws and skulls, dating from about 1.8 million years BP. He thought that the late owner fell within the genus *Homo*. However, many other experts, such as Brace and Metress⁵ clearly demonstrated that *habilis* was nothing more than a large-brained *Australopithecus*, having a brain size of about 660 cc's. (Nowadays, of course, *habilis* would not be even considered as an early man, for the larger and more modern-looking Skull 1470 dates from about 3 million years BP.) The appearance of the teeth, jaws, and forehead of *habilis* are quite similar to those of *A. robustus*. The evolutionist Dr. E.L. Simons published a detailed study of *habilis* in 1972 and announced quite definitely that the designation of *habilis* as a *Homo* was 'totally indefensible'. His conclusion was quite clear: *habilis* was nothing more than a large *Australopithecine*. Even the discoverer himself, Dr. Louis Leakey, stated quite definitely that *habilis* could not possibly have been a transitional form between *Australopithecus* and later so-called *Homo erectus*.⁶ Dr. Leakey further stated emphatically that he had never 'been able to accept the view that *Australopithecus* represented a direct ancestral stage leading to *Homo erectus*'. He was, of course shown to be correct by discoveries by Richard Leakey, Mary Leakey, and Johanson, which prove conclusively that *Homo* was already in existence at a time at least as old as that of the *Australopithecines*.

We return now to the gracile *africanus*, as found at e.g. Taung and Sterkfontein. Another great problem immediately confronts the evolutionist: these very old fossils show a more rounded skull case than does *robustus*; but they have also very prognathous (ape-like) faces. How is it possible that the earlier *africanus* do not show the massive brow ridges and flattened foreheads of their alleged ape ancestors? The main reason, as Professor Keith once pointed out, (especially in the case of

the Taung child) is that these finds are certainly skulls of very young *Australopithecines*, whose ape-like features did not develop until the semi-adult stage. That is what happens to modern infant apes. An ape at birth has a brain capacity about two thirds of that of an adult ape. Now the capacity of both the Taung and Sterkfontein skulls is around 430 cc's. So an adult would have reached around 550-600 cc's, which is a typical range for *Australopithecus*. Other gracile *africanus* adult fossils do in fact show typical ape-like features.

There is more. Late in 1978, Dr. Donald Johanson claimed that a new find from Afar was the missing ape-man link. However, the skull of this small-brained creature is plainly that of an *Australopithecus*; and it is reported that virtually all other U.S. anthropologists dismiss Afar Man as nothing but another *Australopithecine*. Indeed, at the time to which it is dated, about 3.5 million years BP, *Homo* (man), as has been seen, was already clearly in existence.

Finally, it may be noted that Dr. Charles Oxnard, of the University of Chicago, in 1974 carried out a detailed multivariate computer analysis on all the fossil parts of the *Australopithecus* finds. His conclusion, published in 1975, was that "*Australopithecus* was uniquely different from both man and modern ape. If anything, it tended toward the orang utan". Both Oxnard and Zuckerman strongly reject this particular ape-like creature as having anything to do with man.

Of the *Australopithecines* in general, Professor J.S. Weiner wrote: "The ape-like profile of *Australopithecus* is so pronounced that its outline can be superimposed on that of a female chimpanzee with a remarkable closeness of fit, and in this respect and others it stands in strong contrast to modern man".⁷ (And, I might add, in strong contrast to Skull 1470, which is 3 million years old!)

The confusion suffered by evolutionists in regard to *Australopithecus* is illustrated by the case of Professor Ashley Montagu, a leading U.S. anthropologist. In 1957 he wrote that such an extremely ape-like creature could not possibly have anything to do with man.⁸ In 1964, in a book written with Dr. C. Loring Brace,⁹ he changed his mind and placed the *Australopithecus* in the genus *Homo*. However, by 1977 he had reconsidered, and reclassified them back in the genus *Australopithecus* (southern ape).³

So evolutionists are left in the embarrassing position of being able to find evolutionary ancestors for neither *Australopithecus* nor for man.

The solution to the mystery of man's origin is to be found, not in the nonsensical theory of evolution, but in the words of Scripture. Like all other kinds of life, man was created, not by accidents over millions of years, but suddenly by divine power. All attempts to find his origin through evolution are doomed to failure.

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THE HUMAN LINEAGE: DEMURS AND DISARRAY

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Evolutionary anthropology is in a state of disarray. Recent fossil finds, biochemical studies and evolutionary models based on living primates are contradictory to one another and to older standard scenarios of human evolution.

A recent news item cited an anthropologist at the University of Pennsylvania, as saying that: "... we have a handle on human evolution at the moment".¹ I, however, upon considering recent developments, reach an opposite conclusion: that evolutionary anthropology is right now in its greatest state of disarray.

The disarray is evident in at least four areas:

(1) David Pilbeam has just about destroyed the status of *Ramapithecus* as the ancestor from which the human line is said to have evolved. He found an unexpected fossil.

(2) Donald Johanson and Mary Leakey have both announced the finding of hominid remains they claim were bipedal long before the existence of stone tools. This presents a serious challenge to the established view that tool use gave rise to bipedal locomotion.

(3) Vincent Sarich, Adrienne Zihlman and others have dealt another blow to *Ramapithecus* and the rest of the Miocene fossil record. They suggest that biochemical data indicate that man and apes split recently, probably only four to five million years ago. This is in direct conflict with the accepted view, represented by Pilbeam and others, based on the fossil record, that the split occurred probably in excess of 10 million years ago.

(4) Leslie Aiello is proposing a New World monkey as the model primate form from which apes and man diverged. Aiello's contender is thrown into the ring with Johanson's primitive australopithecine and Zihlman's pygmy chimpanzee.

(1) *Ramapithecus*. The status of this ape as the first member of the family of man has never been secure. The entire case since 1961 was based on a handful of fossil teeth and jaw fragments and an erroneous humanlike reconstruction of a palate that almost no one thought to question critically. The error has been exposed because now a complete mandible has been found. Here is David Pilbeam's recantation:

... this new specimen did not conform to our expectations; the mandible was V-shaped, not U-shaped or parabolic; the incisor teeth, judging from their sockets, were tiny; and in its proportions the jaw was unlike almost anything else known. This, together with other data, made it clear that the story of human origins needed rethinking.²

And elsewhere in the same article Pilbeam admits that the "jawbone ... shook the established view of human origins" and "radical new ideas about human origins and early evolution are now in the air."³

Elwyn Simons said that *Ramapithecus* was "ideally structured to be an ancestor of hominids. If he isn't, we

don't have anything else that is."⁴ With *Ramapithecus* out of the running for the ancestor of man there is an incredible gap in the fossil record of more than 10 million years!

(2) *Bipedalism earlier than expected*. Donald Carl Johanson recently put another australopithecine on the books of animals past. His claims make it a very ancient one: 2.9 to 3.8 million years. It is a primitive creature:

The overview of the Laetolil and Hadar remains ... indicates that these forms represent the most primitive group of demonstrable hominids yet recovered from the fossil record.⁵

Johanson has named his new finds *Australopithecus afarensis*. Originally he thought the material included two genera, *Homo* and *Australopithecus*. He published the view in 1976 that the small skeleton known as "Lucy" was an australopithecine, whereas the other material belonging to larger individuals was *Homo* (true man).⁶ Johanson has dropped the *Homo* designation, though Mary Leakey is inclined to argue the point. Mrs. Leakey believes her jaws from Laetolil are true human ancestors and are more closely related to *Homo habilis* than Johanson has suggested. She is, in fact, on record as assigning her material to *Homo*.⁷

One of the most important points in all this is that no stone tools have been found with any of the materials. As Mary Leakey puts it:

We have encountered one anomaly. Despite three years of painstaking search by Peter Jones, no stone tools have been found in the Laetolil Beds. With their hands free, one would have expected this species to have developed tools ... But ... we haven't found a single stone introduced into the beds.⁸

Johanson affirms the same thing. The *afarensis* remains are about twice as old as the oldest known tools. This presents a serious threat to the view, thoroughly worked out in 1960 by Sherwood Washburn, that stone tools worked to produce bipedal locomotion.⁹

(3) *The human-ape split*. A radical shortening of the time scale for the branching of apes and man from the supposed ancestral line has been proposed recently by Adrienne L. Zihlman, John E. Cronin, Douglas L. Cramer and Vincent M. Sarich.

The usually accepted scenario based on fossils and radiometric dating suggests that the dryopithecines gave rise to forest apes and hominids, the former splitting off some 15 to 20 million years ago, the latter emerging about 12 million years ago. But now the above mentioned researchers are reporting that biochemical similarities in living primates and man suggest that the splits occurred much more recently: gorillas, chimpanzees and hominids all separated from ancestral stock only about 4 million years ago!¹⁰ *Ramapithecus* in this scenario, say Zihlman and

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Lowenstein, "has faded until nothing is left but his smile."¹¹

Richard Leakey comments that "so gross a discrepancy in the apparent timing is more than a little disconcerting. The question still remains to be resolved."¹² The molecular anthropologists claim the best evidence is on their side since independent researchers come up with very similar results. They say the biochemical data can be tested whereas the fossil evidence is too subjective. In their recent article Adrienne Zihlman and Jerold Lowenstein take Pilbeam, Johanson and others to task because of their refusal to recognize the molecular data. They comment regarding Johanson's and White's *Australopithecus afarensis*:

(They) discuss the apelike features of the skull and teeth and—again, without mentioning the molecular evidence—state that this implies a relatively recent divergence of man from the African apes. One begins to detect a groundswell among anthropologists for reversing the molecular argument by claiming that the fossil finds now so strongly suggest a recent divergence that the despised biochemistry may turn out to be right after all.¹³

(4) *A New World connection*. Speculation is rife regarding what creature may serve to be the model for the recent ancestor from which man and ape are said to have diverged. Donald Johanson has proposed *Australopithecus afarensis*. Adrienne Zihlman has been pushing the pygmy chimpanzee (*Pan paniscus*) of Africa.¹⁴ And now Leslie Aiello, a British anthropologist, is suggesting that a new contender must be considered: the howler monkey, a New World primate.¹⁵

Johanson's position is based on fossils, and Zihlman's on molecular data, but Aiello argues from morphology: how body form and shape vary in similar animals of different sizes. Since she wanted a model that would allow for variation into the living apes and man she ruled out all of the living apes as possibilities. She points out that all living apes are too specialized in their limbs for a tree climbing life. The best candidate, she says, is the howler, which uses all four limbs for both walking and climbing. It was a primate, something like the howler, claims Aiello, that was the common ancestor.

Conclusion

For nearly eighteen years it was presented as fact that tool use produced the bipedal way of life which, in turn, produced the large brain. That "fact" is no more. It has been recognized for what it has always been: a not very workable hypothesis that must be discarded.

We believe that evolutionary theory will never be able to make sense of the fossil record. Consider two huge problems:

a) There is no ancestral line for australopithecines. With *Ramapithecus* gone there is a period of more than 10 million years for which there are no transitional fossils.

b) There is no ancestral line for modern apes. There are simply no fossils to trace more than 15 million years of supposed evolution. David Pilbeam has admitted this quite candidly: "the fossil record of pongids (modern

apes) is *nonexistent* (emphasis mine), making a glaring deficiency in the whole story."¹⁶

The traditional anthropologists talk about a split occurring between apes and man. But if there is no fossil record for either one how can you talk about a split?

The molecular anthropologists talk about "molecular clocks".

The proteins of closely related species, such as horse and donkey or dog and fox, are nearly identical, whereas species that diverged more than a hundred million years ago, such as shrew and opossum, have many sequence differences. These differences can be measured precisely, and their number is approximately proportional to the divergence time.¹⁷

But is this not based on an unproved and unprovable assumption that there is a "clock" running? No one has ever measured "divergence time" across any significant time span. Evolution is here assumed in order to prove itself.

The creation model can be profitably applied to the data of protein similarities. The resemblances are equally (and I think more equal) a workable hypothesis for creative design.

This writer believes that the numerous model offerings for the ancestral form for men and apes that are currently filling the literature are a direct indication of the poverty of the evolutionary position. Anyone may offer and argue and no one can say he's wrong. There are no data.

The current scene in paleontology is confused and fraught with contradictions.

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COMPUTER SIMULATION OF LARGE-SCALE WAVE MOTIONS ASSOCIATED WITH THE GENESIS FLOOD†

M. E. CLARK* AND H. D. VOSS*

The theory and numerical methodology is developed whereby the dynamic processes associated with large-scale wave motions in the context of a global flood can be delineated. After a brief review of wave mechanics,‡ the available analytical results are given in synopsis. The basic computer algorithm, SOLA-SURF, is then described and utilized to produce solutions to a series of problems considered to be germane to Genesis Flood explanations. The results of these simulations are presented in terms of the velocity fields and the temporal sequencing of the free-surface configurations. Interpretations of the results leads to inferences as to the development of sedimentary strata left by the passing of the wave motions.

1. Introduction and General Problem Description

A quantitative flood model is crucial to understanding the earth's geologic features from a nonuniformitarian point of view. Such a model should feature dynamic global flow processes and be capable of incorporating the sedimentary processes of erosion, transport and deposition. In the past, bold assertions that large-scale fluid motions were capable of producing large-scale geologic features might have been the only available response to the uniformitarian's equally bold assertions. Now, however, tools have become available by which the complex dynamic processes and mechanisms that were involved during the Genesis Flood can be simulated. It is, therefore, incumbent upon flood catastrophists to attempt to couple flood hydraulics and flood geology and to put them on a quantitative base. If a global flood capable of producing the majority of the earth's sedimentary rocks is fact, then rigorous investigations using the disciplines of hydrodynamics and sedimentology should lead to accurate predictions of extant geological structures and terrain.

In order to pursue these ends, a global flood model of the significant and fundamental processes must be made.¹ Certainly, large global mechanisms are required if one is to suggest that nearly all of the 4×10^8 km³ of sedimentary rock could have been laid down in the incredibly short span of one year. Such a strict catastrophic view is consistent with a literal interpretation of Scripture and is capable of explaining many of the apparent inconsistencies associated with uniformitarianism. Local lithologies could also be better interpreted in terms of such a model by incorporating not only the particularities of the local depositional environment but also the generalities of global occurrences.

Considerable success has been achieved during the past decade in solving practical free-surface transient-flow problems using computer codes based on finite difference (primitive variable) methods.² This paper reports on the first use of this type of code for global flood model calculations. The preliminary results of this paper are most important in establishing proce-

dures for depicting likely flow patterns encountered during the motion of large fluid masses. These numerical procedures are not limited to simple bottom boundaries as are the analytical methods. They allow considerable freedom in the choice of sloping and curved bottom boundaries. Changes in bottom surface configuration as a function of time, equivalent to tectonic activity, as well as injection of fluid from such sites of change, equivalent to the opening of the fountains of the deep, can be handled by modification of the boundary conditions. Future modifications to this basic program will allow detailed calculations to be made of erosion, transport, and deposition of a multiconstituent sediment as a function of time over a simulated continent.

It is the main purpose of this paper, then, quantitatively to examine the theory, procedure, and computer code necessary to describe the complex hydrodynamic processes of a global flood. A general background on wave mechanics is followed by a short discussion of the significant but limited analytical solutions for wave propagation characteristics that are available. This work naturally leads into the major portion of the paper which develops the more intricate theory and numerical methodology of flood actions. The basic computer algorithm is first tested by showing that it reproduces problem solutions already in the literature. The algorithm is then modified to simulate some practical flood problems in preliminary fashion. A single wave propagating up a continental incline is first simulated; the case where the same wave propagates over the sequence of a submerged continental incline, mountain region, and mid-continent basin is then analyzed. The final simulations involve two subaqueous activities: the first depicts the flow patterns developed by the rapid injection of water into an ocean basin from an opening in the bottom boundary; the second shows the patterns resulting from a sudden uplift of a portion of an ocean basin. Discussion of these results and relevant conclusions are made in the final selection.

2. Background and Basic Wave Mechanic Relations

Many conditions associated with a global flood can be simulated if certain rational assumptions are made about its nature (e.g., the amount of water present, the bottom surface relief, wave mechanisms generating

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‡The term "wave mechanics" is used in this Report to mean the mechanics of waves on water. It has nothing to do with Schrodinger, or with quantum theory.

dynamic motion of the water) and if a method is employed which insures the proper application of the governing laws in the processes that take place in every element of the model. Since analytical solutions for such complex flow fields cannot be generated, the analyst must develop solutions using numerical methods in conjunction with large digital computers. Only recently have computers become large and fast enough to produce realistic results. These computer solutions could, for example, predict the details of the fluid motion in every region of a simulated ocean basin by producing the velocity vector fields, the pressure and shear fields, as well as the history of the changes in the free-surface configuration. This information could then be coupled with the known laws of sedimentology to postulate information regarding the make-up of sedimentary rock in a given region and the manner in which it was laid down to form the earth's crust. The general features of large inland basins (like cyclothems, other layered sequences, or persistent facies) could thus be explained on the basis of the cyclic action associated with global waves.

In this paper, wave motions on both large (global) and small (local) scales are deemed to be the significant mechanisms responsible for the development of the sedimentary geologic column. Although wave motions are omnipresent in the natural world, their basic features are enigmatic to the casual observer. They are, in essence, disturbances which move through a given medium, but do not move it at anywhere near the same rate as they move. A cork, for example, bobbing on the surface as waves pass by, is seen to remain in essentially the same horizontal position.

All the different kinds of waves (water waves, stress waves, radio waves, light waves) obey the same fundamental laws and have similar characteristics. The most significant of these for a water wave are: amplitude A (height of rise of the wave above the undisturbed free surface), wave length L (distance between successive

wave crests in a wave train), frequency of occurrence f or period T , and the speed of travel c . The wave speed is related as follows to the wave length, frequency, and/or period:

$$c = L/T \text{ or } c = Lf \quad (1)$$

Waves are greatly affected by changes in the characteristics of the medium. As long as a channel maintains constant cross-section and depth, a given surface wave will travel with constant speed. Should the depth or cross-section change, the wave characteristics change accordingly. Changes in channel cross-section or the interaction of waves with boundaries result in the generation of reflections. The incident and reflected waves interfere to form a resultant wave with modified characteristics.

Oscillatory and translatory waves are the main two types of water waves. In the former, the net mass transport is nil; in the latter, there is a definite amount of fluid advancement in the wave direction. Water waves are also categorized by the relative values of wave length L and depth d . In Fig. 1 three ranges of the d/L ratio for oscillatory waves define as many different situations regarding the manner in which the water reacts to the passing of the disturbance. When the depth of the water is greater than half the wave length, the deep-water condition is present and surface motion (in the form of circular particle orbits) decays exponentially with depth resulting in little or no bottom motion or influence. When the depth is small compared to wave length (d/L less than 0.05), shallow water waves disturb all of the fluid (orbits are horizontal back-and-forth displacements of particles). At intermediate d/L ratios, surface effects are again felt throughout the flow depth (ellipses degenerating to a straight line at the bottom). In Fig. 1, the length is scaled with respect to depth for the assumed d/L values. The particle orbits are also scaled with respect to the wave amplitude; however, since the relations used to calculate the proper propor-

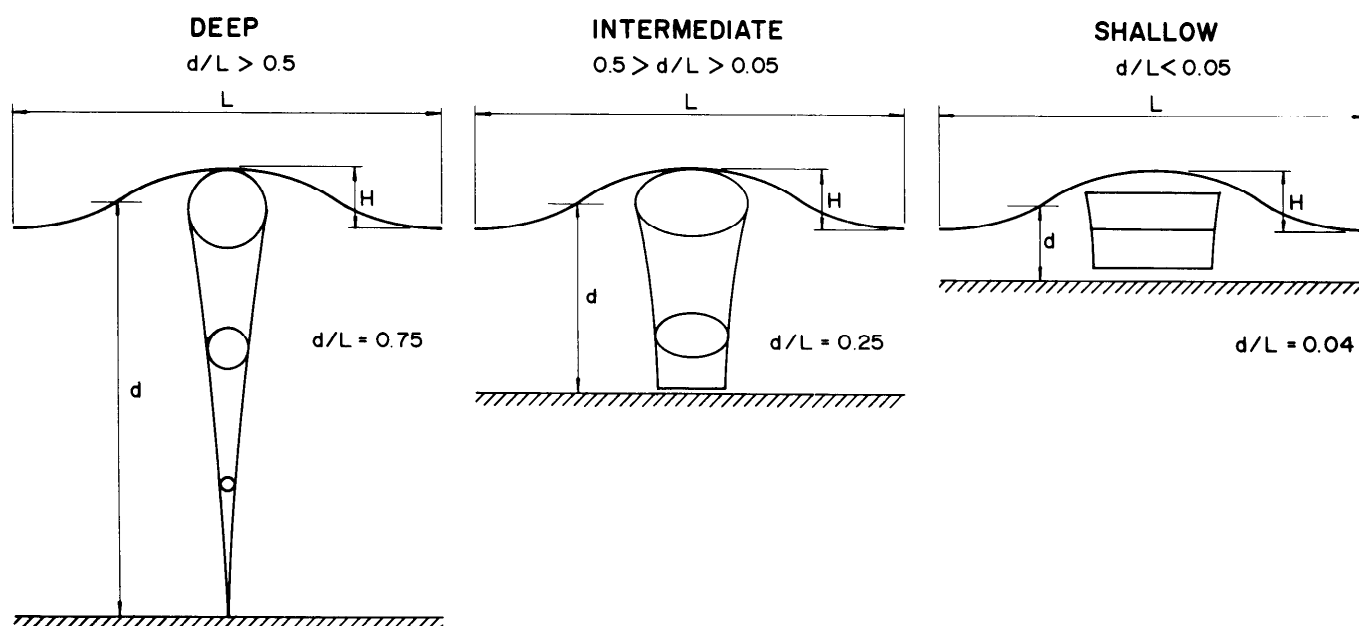


Figure 1. The three categories of water wave characteristics.

tions are based on small-amplitude theory, it is necessary for clarity to exaggerate the amplitude.

Translatory waves are usually characterized by a solitary wave of long length and finite amplitude, and are treated as shallow-water waves. As such, they would manifest the same type of fluid motion beneath the surface as periodic waves. Translatory waves can be generated by subaquatic tectonic activity or by true tidal forces.

3. Analytical Solutions for Wave Propagation Characteristics

Before describing the numerical studies based on the general Navier-Stokes governing equations, consideration is here given to some of the results of analytical solutions based on the simpler inviscid Bernoulli governing equations. For horizontal and ramp bottom boundaries, these descriptions of flow can be associated with large global motions and lead to valuable insights into flood dynamics which, in turn, aid in understanding geomorphology. In particular, the description of the velocity field in the vicinity of the bottom boundary is most useful when trying to understand the flow environment associated with the production of sedimentary formations. The analytical methods break down, however, for more complex geometrical boundary configurations and for large-amplitude waves—areas where the numerical methods can still be used.

Stokes, in 1880, developed the theory for progressive periodic waves of small but finite amplitude in a medium of constant depth using expressions for the velocity potential up to the third order (the first order being so-called linear theory). For the first or second order, the speed of wave propagation c is given by

$$c = \left[\frac{gL}{2\pi} \tanh \frac{2\pi d}{L} \right]^{0.5} \quad (2)$$

where g is the gravitational constant, L the wave length, and d the depth of the water. For deep water waves ($d/L > 0.5$), $\tanh (2\pi d/L) \rightarrow 1$ and $c = [gL/2\pi]^{0.5}$. For shallow water waves ($d/L < 0.05$), $\tanh (2\pi d/L) \rightarrow 2\pi d/L$ and $c = [gd]^{0.5}$. Using these relations and adopting some reasonable lengths for a global ocean wave, corresponding wave speeds can be calculated. A wave 100 km long would move at a rate of 915 km/hr in an ocean 7 km deep ($d/L = 0.07$) but only 178 km/hr where the depth was 0.25 km ($d/L = 0.0025$). Neither rate is small; but an observer on a ship (or ark) would not be aware of these large speeds since he would merely bob vertically according to the wave amplitude.

The wave amplitude given by Stokes is

$$A = \frac{a}{c} \sinh \left(\frac{2\pi d}{L} \right) = \frac{a \sinh (2\pi d/L)}{[(gd/2\pi) \tanh (2\pi d/L)]^{0.5}} \quad (3)$$

where a is the generator strength. The variation in wave amplitude with depth is difficult to assess using Eq. 3. In 1911, Rayleigh developed a method for use on uniform periodic waves as they entered shoaling waters. Constancy of wave energy assumed, the ratio of the wave amplitude H at any depth to the wave amplitude H' in deep water (i.e., water in which increases in depth no longer affect the wave characteristics) is

$$\frac{H}{H'} = \left[\frac{1}{2n} \frac{c_o}{c} \right]^{1/2} \quad (4)$$

where

$$n = \frac{1}{2} \left[1 + \frac{4\pi d/L}{\sinh 4\pi d/L} \right] \quad (5)$$

The wave speed in water of any depth c in ratio to that in deep water c_o is

$$\frac{c}{c_o} = \frac{L}{L_o} = \tanh \frac{2\pi d}{L} \quad (6)$$

Tabulation of these quantities in terms of the d/L ratio are found in Wiegel.³ Continuing the foregoing example and using Rayleigh's method, the 100 km wave moving at 915 km/hr with amplitude H in 7 km of water would have a height of $0.88H$ in deep water. Its wave length and speed in deep water would be 241 km and 2211 km/hr, respectively. According to the Rayleigh method, when this wave shoaled to a water depth of 0.25 km, the wave would increase its amplitude to $2.2H$ while decreasing its length to 19.5 km and its speed to 278 km/hr. These results are shown in Fig. 2.

The velocity field associated with first order (linear) theory is given by the horizontal (u) and vertical (v) component velocities as follows:

$$u = \frac{H}{2} k \frac{\cosh m(d+z)}{\sinh md} \sin(kt - mx) \quad (7)$$

$$v = \frac{H}{2} k \frac{\sinh m(d+z)}{\sinh md} \cos(kt - mx) \quad (8)$$

where x and z are the horizontal and vertical coordinate directions, respectively, m is $2\pi/L$, and k is given by

$$k^2 = mg \tanh md \quad (9)$$

Of particular interest is the motion parallel to the bottom surface: When $z = -d$, $\cosh m(d+z) \rightarrow \cosh(0) = 1$ and Eq. 7 reduces to

$$u = \frac{Hk}{2} \frac{\sin(kt - mx)}{\sinh md} \quad (10)$$

Thus, at the bottom surface beneath a periodic wave, there exists a temporal (periodic) pulsation of velocity. The presence of such a phenomenon could hold great significance in the context of a global flood in explaining the production of local sequences of sedimentary deposits.

It is also of interest to note that, in the higher order theories, there is a net mass-transport associated with traveling waves. Stokes' expression for this transport is of the form

$$\bar{U} = \frac{1}{2} \frac{\pi^2 H^2}{TL} \frac{\cosh \frac{4\pi}{L} (y_o + d)}{\sinh^2 2\pi d/L} \quad (11)$$

where y_o is the vertical distance between the still water position and the $\bar{U}$ vector.

When these fluid velocity fields are present in sediment-laden waters, the many different mechanisms that are present produce a wide variety of depositional patterns. The bedding and lamination characteristics

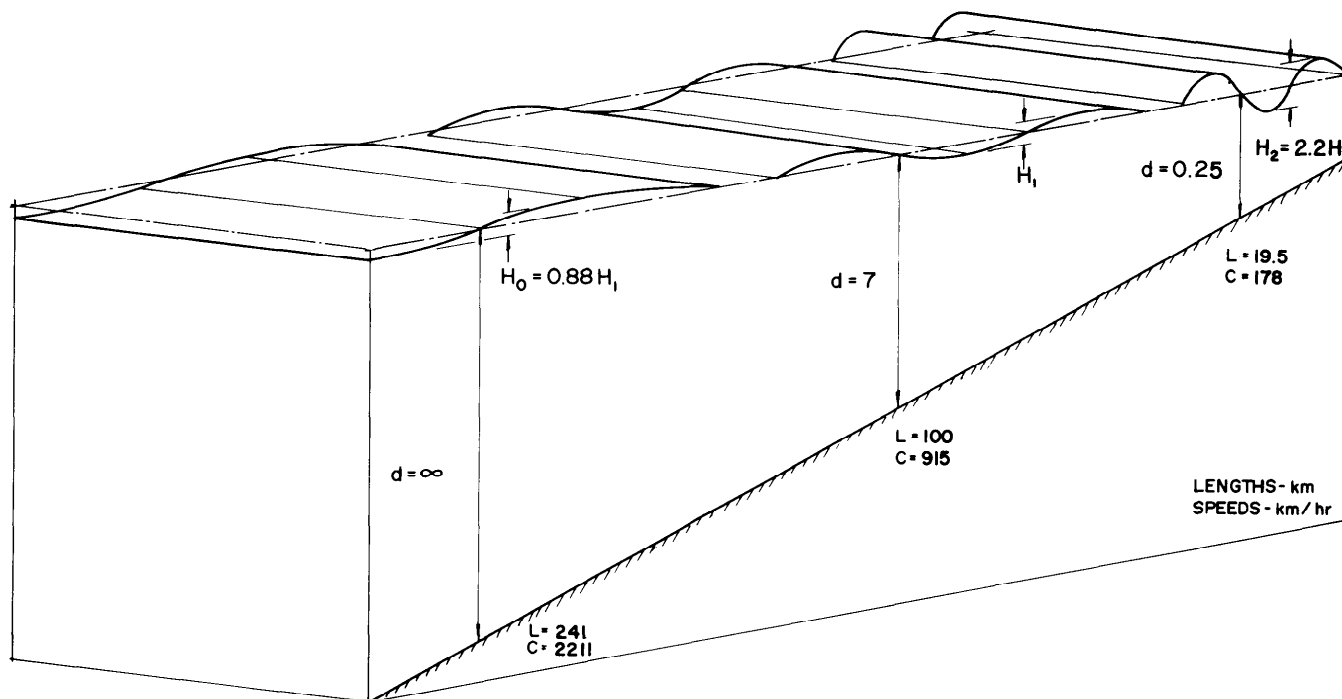


Figure 2. Large-scale periodic waves in waters of various depths. Note that the vertical scale is exaggerated.

observable in the sedimentary rocks result from dune and ripple migration, rolling, sorting, scour, traction, avalanching, and pulsations. The analytical relations of this section give the general characteristics of large scale fluid motions in uniform depth waterways or for special shoaling conditions. When more realistic boundary configurations are to be studied, it is necessary to use numerical analyses to solve for the same types of characteristics.

4. Relevant Theory and Numerical Methodology

All fluid mechanic behavior can be described by the Navier-Stokes (NS) and continuity equations when accompanied by the appropriate initial and boundary conditions. These equations take the form of partial differential equations applicable to each and every differential element in the flow field. Since the lateral motion is not of consequence in the motions to be studied, the two-dimensional versions of these governing equations are sufficient and appear as follows in incompressible flow form:

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0 \text{ (Continuity)} \quad (12)$$

$$\frac{\partial u}{\partial t} + \frac{\partial u^2}{\partial x} + \frac{\partial uv}{\partial y} = -\frac{\partial p}{\partial x} + g_x + \nu \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right) \quad (13)$$

(longitudinal (horizontal) NS equation)

$$\frac{\partial v}{\partial t} + \frac{\partial uv}{\partial x} + \frac{\partial v^2}{\partial y} = -\frac{\partial p}{\partial y} + g_y + \nu \left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} \right) \quad (14)$$

(normal (vertical) NS equation)

where u, v are the velocity components in the x, y coordinate directions, respectively, t is time, and ν is the kinematic viscosity. The motion is forced by the terms involving p , the ratio of pressure to fluid density, and g , the body acceleration, or by boundary conditions.

Considerable success has been achieved in solving practical, free-surface, transient-flow problems by the Los Alamos Scientific Laboratory of the University of California using the finite-difference, primitive-variable scheme. Starting in the mid-sixties with the Marker and Cell (MAC) method and progressing through various modifications like SMAC and ZUNI in the early seventies, this laboratory issued the SOLA-SURF code in 1975.² This code is straight-forward and relatively inexpensive to run, yet is capable of generating solutions to a wide variety of free-surface problems with only minor constraints on the geometrical configuration of the field boundaries. Accordingly, it has been chosen as the vehicle by which the flood simulations will be produced.

By definition, the partial space derivative $\partial u / \partial x$ (where the velocity component u is a function of both independent variables x, y as well as t) is given by

$$\frac{\partial u}{\partial x} = \lim_{\Delta x \rightarrow 0} \frac{\Delta u}{\Delta x} \quad (15)$$

As indicated in Fig. 3, the slope of the curve of such a function at a given point can be closely approximated by taking Δx as a small quantity ϵ without going to the limit of zero as required by the mathematical definition. Therefore, Eq. (15) can be written

$$\frac{\partial u}{\partial x} \approx \lim_{(x_2 - x_1) \rightarrow \epsilon} \frac{u_2 - u_1}{x_2 - x_1} \approx \frac{u_{i,j}^n - u_{i-1,j}^n}{\Delta x} \quad (16)$$

where ϵ is a small quantity, subscripts i, j are indices in a space grid, and superscript n is a time index ($t = n\Delta t$).

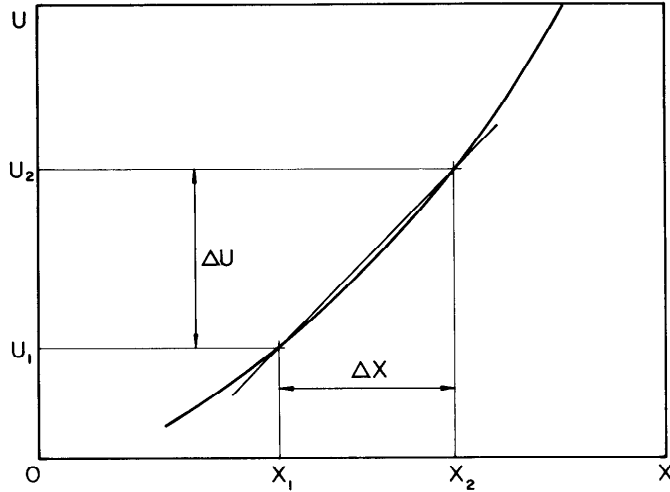


Figure 3. Graphical definition of the partial derivative of u with respect to x .

Progressing in a similar manner throughout the individual terms of Eq. (12-14), the governing differential equations can be converted to difference equations. In difference form, the continuity or conservation of mass equation is

$$\frac{1}{\Delta x} (u_{i,j}^{n+1} - u_{i-1,j}^{n+1}) + \frac{1}{\Delta y} (v_{i,j}^{n+1} - v_{i,j-1}^{n+1}) = 0 \quad (17)$$

The NS equations take the following form when solved for the advanced time velocity components

$$u_{i,j}^{n+1} = u_{i,j}^n + \Delta t \left[\frac{1}{\Delta x} (p_{i,j}^n - p_{i+1,j}^n) + g_x - \text{FLUX} - \text{FLUY} + \text{VISX} \right] \quad (18)$$

$$v_{i,j}^{n+1} = v_{i,j}^n + \Delta t \left[\frac{1}{\Delta y} (p_{i,j}^n - p_{i,j+1}^n) + g_y - \text{FLVX} - \text{FLVY} + \text{VISY} \right] \quad (19)$$

where a typical convective flux is

$$\text{FLUX} = \frac{1}{4\Delta x} [u_{i,j} + u_{i+1,j}]^2 + \alpha |u_{i,j} + u_{i+1,j}| (u_{i,j} - u_{i+1,j}) - (u_{i-1,j} + u_{i,j})^2 - \alpha |u_{i-1,j} + u_{i,j}| (u_{i-1,j} - u_{i,j}) \quad (20)$$

and a typical viscous flux is

$$\text{VISX} = \nu \left[\frac{1}{\Delta x^2} (u_{i+1,j} - 2u_{i,j} + u_{i-1,j}) + \frac{1}{\Delta y^2} \cdot (u_{i,j+1} - 2u_{i,j} + u_{i,j-1}) \right] \quad (21)$$

The term α is a coefficient used to provide various amounts of upwind differencing. If $\alpha = 0$, centered space differencing is obtained. If appropriately small values of Δx , Δy , and Δt are selected for use in these equations, they have been shown to yield valid solutions to time-dependent, free-surface problems of practical importance.

5. Computer Model

The specification of small spatial and temporal in-

crements of the independent variables requires multitudinous and repetitious application of the governing equations. The digital computer is well suited for such applications provided a systematized code can efficiently range over both the spatial field and temporal period of interest. The general arrangement of spatial meshes is shown in Fig. 4 where rectangular cells of width Δx and height Δy can be individually selected by the I, J indexing system. The actual fluid region is surrounded by a single layer of fictitious cells to aid in the definition of the boundary conditions. Observation of a typical cell (shaded in Fig. 4) shows the exact locations at which the dependent variables u , v and p are defined.

The same governing equations apply to all flow problems. A given problem is made distinct from the rest by the imposition of the boundary conditions and the forcing function on the specific geometric configuration that describes the field. SOLA-SURF has internal provisions for imposing four different boundary conditions: 1) the free-slip rigid wall for simulating inviscid fluid flows, 2) the no-slip rigid wall for viscous flows, 3) the continuative boundary condition for passing fluid out of the field at a boundary so as to avoid reflective upstream interference, and 4) periodic boundary conditions used to impose a forcing function at a boundary that repeats itself with time. The first two conditions are shown in Fig. 4. The free-slip condition is generated on a horizontal boundary by imposing a u -component velocity in the fictitious cell equal in magnitude and sign to the u -component in the cell adjacent to the boundary. The average of these two values produces a slip velocity component of u at the wall. Since the v -component is defined at the wall, it can easily be set to zero to complete the free-slip condition. The no-slip condition requires that both u and v be zero at the boundary. The u -component is made zero by imposing in the fictitious cell a u -component equal in magnitude but opposite in sign to that which occurs in the cell adjacent to the boundary. For vertical boundaries, the roles of the u and v components would be interchanged since the u -component is now defined at the boundary while the v -component is defined a half mesh away. When the boundaries are curved or slanted, a modification of these definitions is required.²

The positions of the free surface, denoted by H, and the bottom surface, denoted by HB, are indexed by JT and JB, respectively, as well as updated during the period of interest by the kinematic equation

$$\frac{\partial H}{\partial t} + u \frac{\partial H}{\partial x} = v \quad (22)$$

At the free surface, the pressure must be zero or a constant value p_s . The pressure in the cell containing the free surface is chosen so that a linear interpolation between it and the pressure in the cell adjacent below produces a zero value (or p_s) at the surface. In equation form,

$$p_{i,JT} = (1 - \eta) p_{i,JT-1} + \eta p_s \quad (23)$$

where $\eta = \Delta y / [H_i - (JT - 2.5)\Delta y]$

The updated velocity components calculated by Eq. (18) and (19) will not in general, satisfy the continuity condition of Eq. (17). If, for example, there is a net flow of mass into a cell, the cell pressure can be increased to

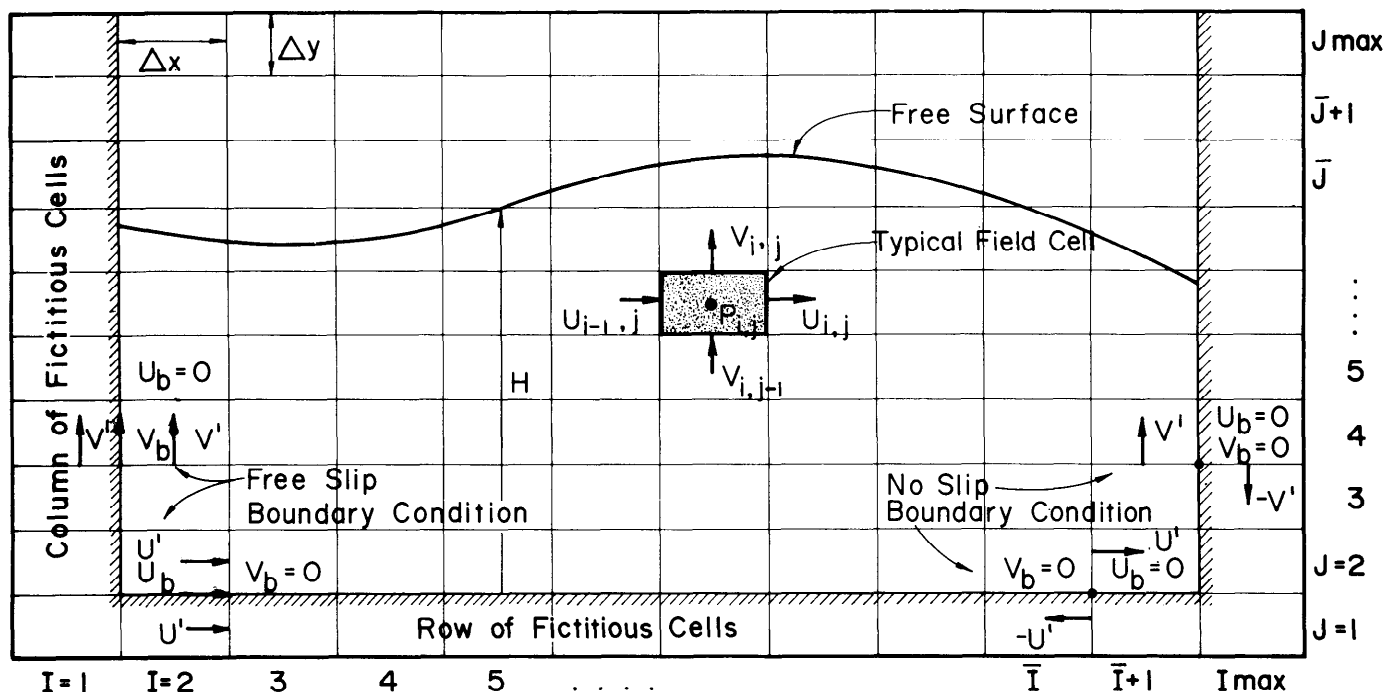


Figure 4. General mesh arrangement showing a typical cell and boundary condition definitions.

decrease the inflow. Contrariwise, when the net flow is out of the cell, the pressure can be reduced to decrease the outflow. The amount of pressure change is given in SOLA by the relation

$$p = -D / \left[\Delta t \left(\frac{1}{\Delta x^2} + \frac{1}{\Delta y^2} \right) \right] \quad (24)$$

where D is the divergence obtained when Eq. (17) is calculated (i.e., the amount by which the right hand side deviates from zero). The new cell pressure is then

$$p_{i,j} = p_{i,j} + \Delta p \quad (25)$$

and the velocity components are adjusted to reflect this change,

$$\begin{aligned} u_{i,j} &= u_{i,j} + \frac{\Delta p \Delta t}{\Delta x} \\ u_{i-1,j} &= u_{i-1,j} - \frac{\Delta p \Delta t}{\Delta x} \\ v_{i,j} &= v_{i,j} + \frac{\Delta p \Delta t}{\Delta y} \\ v_{i,j-1} &= v_{i,j-1} - \frac{\Delta p \Delta t}{\Delta y} \end{aligned} \quad (26)$$

These pressure and velocity adjustments must be performed iteratively since the adjustments in one cell affects adjacent cell values. The flow diagram for initiating the calculations and then advancing them temporally through a period of motion is given in SOLA. The temporal advance is governed by the explicit solution of the Navier-Stokes equations for the velocity field once for each cell and for each time step Δt . The adjustment of both velocity and pressure fields is made iteratively using the continuity equation. Iteration is

stopped when a preset allowable divergence is reached; this allowable value being of the order of 10^{-3} .

6. Initial Results

In order to gain familiarity with and to test the SOLA-SURF code, a sample problem was run for which a set of correct output values has been established.² (See their addendum.) This problem (an undular hydraulic bore) is generated by moving a body of inviscid fluid in a rectangular channel at a uniform velocity into the right-hand rigid boundary. When the fluid interacts with and reflects from the boundary, a wave or bore develops which travels to the left with a characteristic wave form and wave speed. In the test run, the channel was 12 units long (20 meshes at $\Delta x = 0.6$) and 1.6 units high (8 meshes at $\Delta y = 0.2$). Initially, the fluid height was set at $H = 1.0$ units or 5 meshes. The time step used was $t = 0.2$. The bore was maintained with fluid by setting a continuative inflow boundary at the left end of the channel. All other boundaries were given the free-slip condition. The results of the run were in accord with the established output values over a calculation period from $t = 0$ to $t = 10$. See the supplementary illustration.

7. Results of Practical Flood Problems

Solitary Wave on Ramp. Problems which can be considered germane to Genesis Flood explanations must involve the action of waves or wave trains in regions whose irregular bottom surfaces resemble antediluvial terrain. To initiate the simulations, a single solitary wave (one whose water particles move only in the direction of wave advance) was placed at the beginning of a two-dimensional flow field (10 units high, 27 units long) whose bottom took on an upward slope of $1/5$ at a



Supplementary illustration. A tidal bore on the Petitcodiac River, near Moncton, New Brunswick, Canada. The calculation of a sort of bore was one of the jobs on which the methods described in this article were tested. The bore shown here is just interesting, not destructive; but one can believe that during the Flood much greater bores may have caused very extensive geological effects.

This picture was supplied by the Department of Tourism of New Brunswick, Fredricton, New Brunswick, Canada, and is used here by permission.

Note the undisturbed water at the right, where the bore has not yet reached, the solitary wave moving to the right, and the disturbed water behind it.

distance of 18 units from the left rigid vertical wall. The right boundary was also rigid and vertical. The solitary wave description given by Laitone^{4,5} was used: The surface wave profile in a horizontal channel of constant depth is

$$y_s = d + H \operatorname{sech}^2 (A \omega x - c t) - \frac{3}{4} H \left(\frac{H}{d} \right) \operatorname{sech}^2 (A \omega x - c t) \cdot [1 - \operatorname{sech}^2 (A \omega x - c t)] \quad (27)$$

where

$$A \omega x = \frac{x}{d} \left[\frac{3}{4} \frac{H}{d} \right]^{1/2} \left[1 - \frac{5}{8} \frac{H}{d} \right] \quad (28)$$

and the wave speed

$$c = 1 + \frac{H}{2d} - \frac{3}{20} \left(\frac{H}{d} \right)^2 + \dots \quad (29)$$

The dimensionless velocity field (water particle velocity components normalized by the shallow water wave speed) in a constant-depth channel is given by

$$\frac{u}{(gd)^{1/2}} = \frac{H}{d} \left[1 + \frac{1}{4} \frac{H}{d} - \frac{3}{2} \frac{H}{d} \frac{y^2}{d^2} \right] \cdot \operatorname{sech}^2 (A \omega x - c t) + \frac{H^2}{d^2} \left[-1 + \frac{9}{4} \frac{y^2}{d^2} \right] \cdot \operatorname{sech}^4 (A \omega x - c t) \quad (30)$$

$$\frac{v}{(gd)^{1/2}} = 3^{1/2} \left(\frac{H}{d} \right)^{3/2} \frac{y}{d} \operatorname{sech}^2 (A \omega x - c t) \cdot$$

$$\tanh (A \omega x - c t) \cdot \left[1 - \frac{3}{8} \frac{H}{d} - \frac{1}{2} \frac{H}{d} \frac{y^2}{d^2} + \frac{H}{d} \left(-2 + \frac{3}{2} \frac{y^2}{d^2} \right) \cdot \operatorname{sech}^2 (A \omega x - c t) \right] \quad (31)$$

The solitary wave selected had a length of 18 units with its center at 9 units from the left end of the field and a maximum height of 1.25 units in a basin whose undisturbed depth was 1.0 units. Since the solitary wave is self-propagating, the flow solution was obtained by imposing the velocity field generated by Eq. (30) and (31) as the initial conditions and the allowing the program to run for a reasonable time. The results of the solution are presented in Fig. 5 in a temporal sequence of surface profiles where a HIDE plot⁶ indicates successive traces of the configuration of the free surface as time proceeds. Although the amplitude of the solitary wave increases as it moves up the slope, no secondary waves appear to be generated by the ramp. As the wave reflects from both the right and left boundaries, the amplitude is seen to nearly double. In reflecting, a secondary wave is generated which trails after the main wave, as seen in the rear view representation of Fig. 5, and interferes with it upon reflection off the left end. Although this solution appears to be reasonable, there is no corroborating evidence from the literature to confirm its validity.

Solitary Wave Moving Towards a Submerged "Continent". In an effort to simulate a more realistic Flood situation, the solitary wave was next imposed on a field which simulated a continental incline followed, after a maximum rise simulating a coastal mountain range, by an inland basin, all of which were submerged. A somewhat truncated solitary wave (15 units long, center at 4.7 units, height 1.25 units) was placed at the beginning of a 35.4 unit long basin. The first quarter length of the basin bottom was flat, the next quarter had a slope of 1/5, while the last half was described by one wave length of a sine wave which peaked at one-quarter of its length (i.e., at a distance of 21.4 units from the left boundary). The transition from ramp to sine wave was fairly smooth.

The configuration of the free surface is presented in Fig. 6 as a function of time. The movement of the wave up the ramp is without notable incident in the free surface but, as it passes onto the sine wave and over its zenith, a series of secondary waves are generated as seen in the rear view picture. The original wave reflects strongly from the right boundary and considerable interference is observed thereafter as the reflected wave moves back over the inland basin. The generation of the secondary waves is in accord with occurrences in similar calculations. For example, Kim and Lee⁷ have shown the transformation of a solitary wave into a series of waves as motion was calculated up a ramp and into a channel half the original height. The generation of these extra waves could hold added meaning in the explanation of sedimentary layering due to wave action.

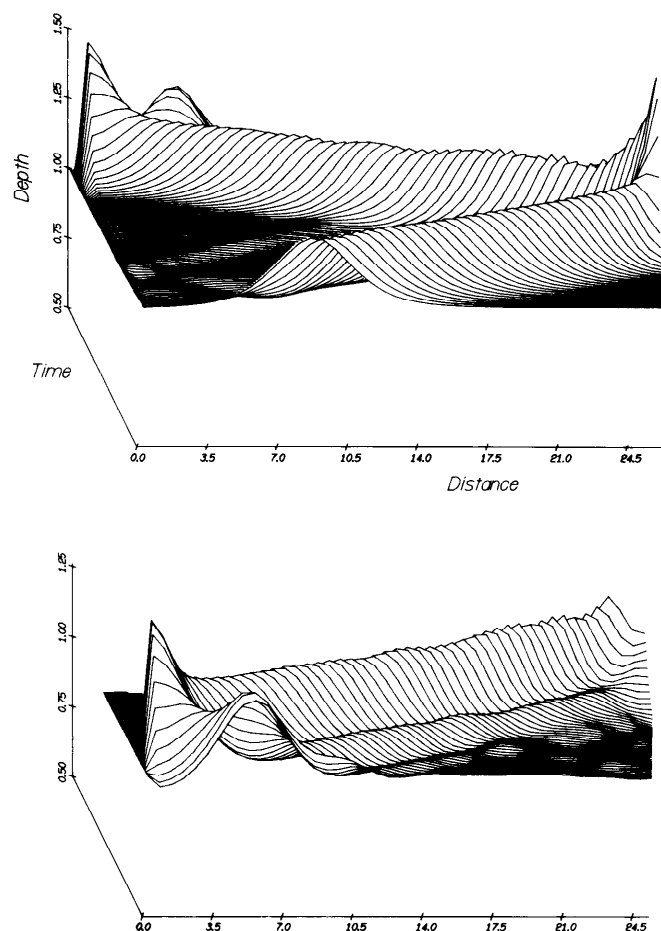


Figure 5. Temporal sequence of free-surface configurations as a solitary wave moves up a ramp. Upper part, front view; lower, rear view. This calculation was made for zero viscosity.

Additional information regarding the water action connected with the passage of the solitary wave can be obtained from examination of the velocity fields at various times during the course of the motion. In Fig. 7 is shown a temporal sequence of velocity vector plots for this "continent" configuration. The u and v component velocities as calculated were averaged in such a way as to redefine the velocity components at the center of each cell. They were then added vectorially and plotted to an appropriate scale. Since the calculations were made for a fluid with zero viscosity and for the free slip boundary conditions, the vector plots reflect these stipulations. Some of the features noted in Fig. 6 can be observed in this type of plot as well, the most striking being the transformation of the solitary wave into a series of waves once the zenith of the bottom boundary's sine wave is encountered. The classic velocity field of the solitary wave at the beginning of the sequence is seen to undergo dramatic changes on the ramp and sinusoid. Worthy of note is the observation that the secondary waves move at a greatly reduced wave speed.

This set of calculations was made with an undisturbed free surface height of 1.0 units and a sinusoid amplitude of 0.4. This combination provided a reasonable amount of water on top of the zenith of the sinusoid as well as a flooded inland basin. On another

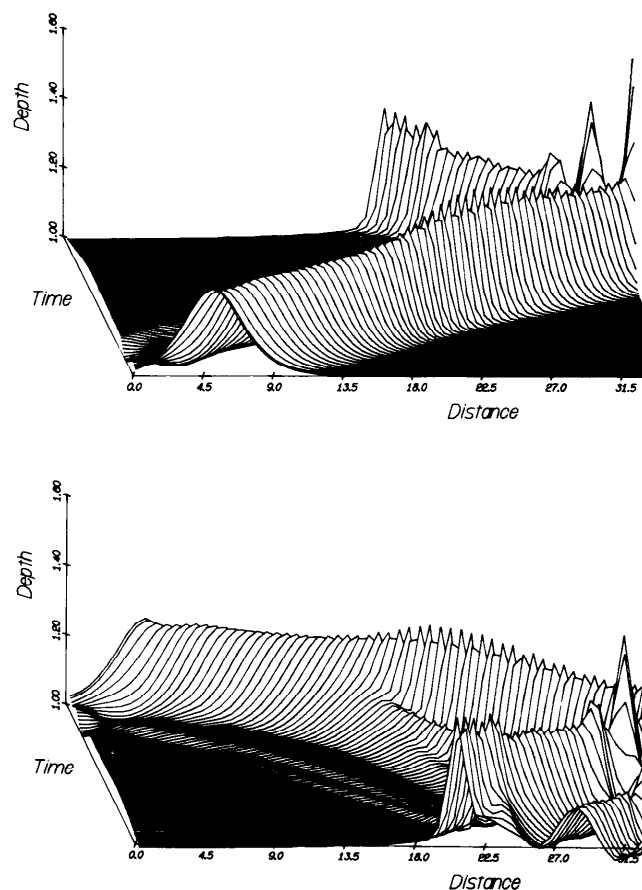


Figure 6. Temporal sequence of free-surface configurations as a solitary wave moves toward a submerged "continent". Upper part, front view; lower, rear view. This calculation was made for zero viscosity.

trial, the sinusoid amplitude was set at 0.2 which made the undisturbed free surface just intersect the zenith of the sinusoid for an undisturbed depth of 1.0 units. For the most part, the results of these calculations paralleled those shown in Fig. 7. However, the SOLA-SURF code could not resolve the difficulty encountered with the inadequate amount of fluid at the zenith of the sinusoid. Further study of this type of situation is needed and quite possibly a stronger code will be required to handle this special boundary condition.

Subaquatic Activity—Water Injection Through the Bottom Boundary. The final two attempts at mimicking flood situations in this initial study were aimed at investigating the fluid dynamic events associated with the welling-up of fluids from beneath the free surface as could be produced by a subaquatic earth movement with or without subsequent issuance of water through the disturbed bottom boundary. The idea for this simulation arises from a consideration of Gen. 7:11 where it states that in the 600th year, the second month, and 17th day of Noah's life "the fountains of the great deep" were broken up. In any valid analysis of the Genesis Flood, it must be realized that a considerable percentage of the water could have come from such a source. Questions arise as to the consequences of such

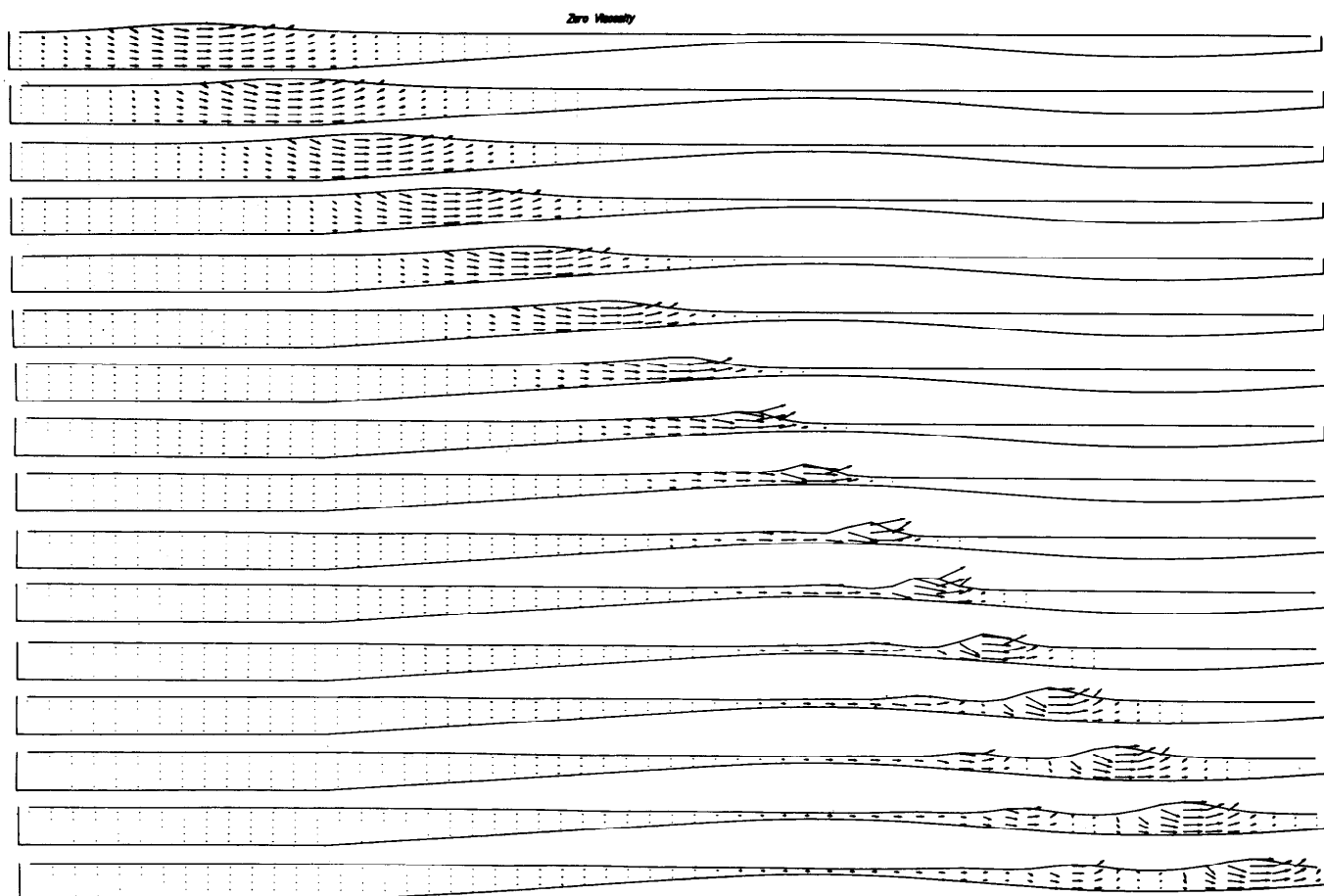


Figure 7. Temporal sequence of velocity vector field plots as a solitary wave moves toward a submerged "continent". This calculation was made for zero viscosity. The sequence reads from the top down.

events: how are such occurrences manifested on the surface? are wave motions developed? what velocity fields are produced in the vicinity? etc. A simplified representation of a "fountain" can be developed by using a portion of the bottom boundary of the basin as a "source" region where fluid is allowed to enter the field. As can be seen in the right half of Fig. 8, a rectangular field 12 units long, initially filled with quiescent fluid, was subjected to an upward (v component only) velocity at the boundary between 3 and 6 units. This upward flow was continued for a period of 6 seconds after which the "fountain" was turned off. This action activated the whole flow field as can be seen in Frames 2-4 in Fig. 8. The first manifestation on the surface was the welling-up of the fluid directly over the site of the bottom opening with fluid being given lateral motion on both sides of the source. The complexity of the fluid action was increased by the reflection of these waves off from both left and right rigid vertical walls. Once the incident waves were reflected, they in turn interacted and interfered with each other as the motion continued to develop. This sequence, calculated with no slip boundaries and a water viscosity, differs only in details from a second sequence (not shown) in which free slip and zero viscosity were stipulated.

Another variant of this type of calculation is shown in the left half of Fig. 8 where the length of time during

which the "fountain" was issuing fluid was increased to coincide with the total time of program run. The action in the field and at the surface is similar to the short opening time but is somewhat more dominated by the presence of the "fountain". The total volume of fluid increases considerably by the end of the sequence as well.

The configuration of the free surface as a function of time for both the short and long openings for the viscous cases are presented in Fig. 9. The interaction of the incident and reflected waves generated by the subaquatic source is dramatically illustrated.

Subaquatic Activity—Upheaval of the Bottom Boundary. The welling-up of water in a localized region could also be accomplished by an upward movement of the bottom boundary itself. If this movement took place rapidly, the fluid would be carried upward congruently with the boundary. In the simulation shown in Fig. 10, a field length of 18 units was used in which that section of the bottom boundary between 4 and 10 units was given an upward velocity corresponding to the temporal versine displacement generated by the following equation:

$$HB(I) = \frac{\epsilon_0}{2} \cdot \sin \left(\frac{2\pi T}{\sigma} \right) \left(1 - \cos \left(\frac{2\pi X(I)}{L} \right) \right) \quad (32)$$

where $HB(I)$ is the local displacement of the bottom at

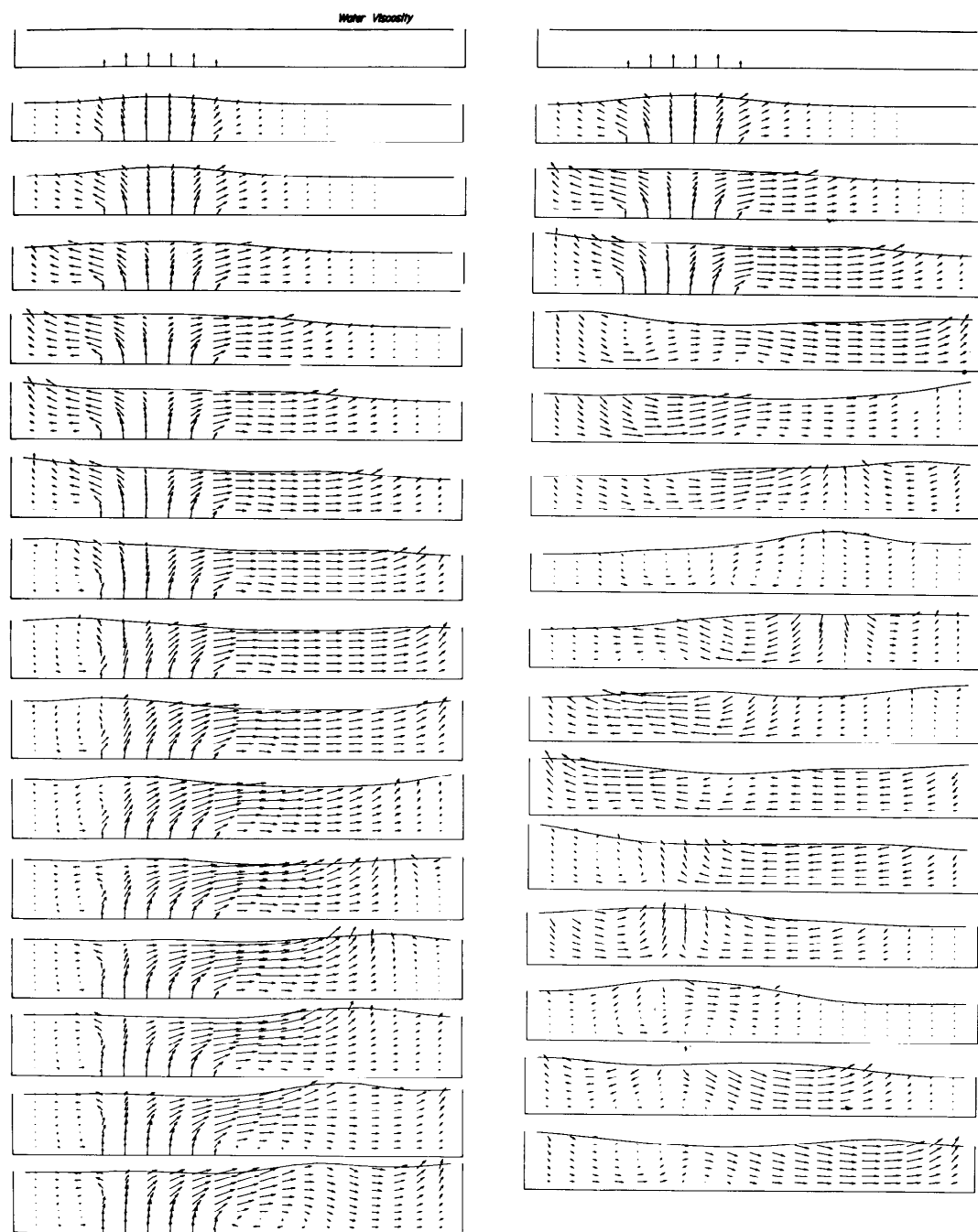


Figure 8. Temporal sequence of velocity vector field plots for a basin with water injection through the bottom boundary. Left, long opening; right, short opening. Water viscosity was used in the calculation. The sequence reads from the top down.

the i th section of the channel, ϵ_0 is the maximum upward displacement of the bottom boundary, σ is a parameter governing the period of the boundary motion, and L is the length of the 6-unit versine section. A series of σ -values were used to explore the phenomenon; the $\sigma=10$ value used in the display in Fig. 10 and 11 moved the bottom boundary suddenly enough to carry the water upward without running off during the process. During the quarter period of motion generated, the bottom was raised to its maximum amplitude of 0.5 units corresponding to the 10th time frame in Fig. 10.

After reaching this position, the motion of the boundary was stopped.

As can be seen from this sequence of velocity vector fields, the water then begins to flow down from this rise in the bottom boundary. In so doing, two rather large waves develop at the ends of the versine which in due time begin to propagate away from the rise. After several reflections from the rigid vertical walls at both left and right ends of the basin, the motion eventually dies down and the free surface adopts a nearly horizontal position in Frame 84. With additional computer

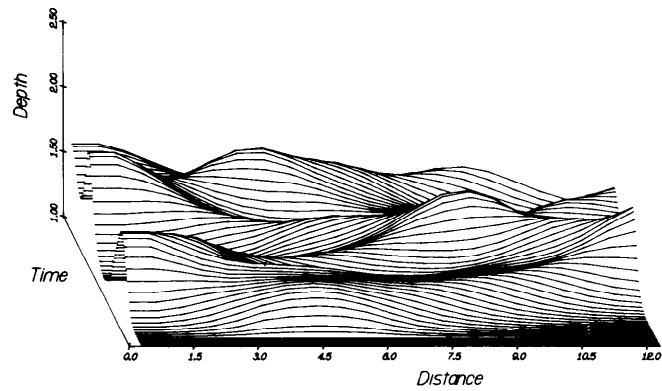
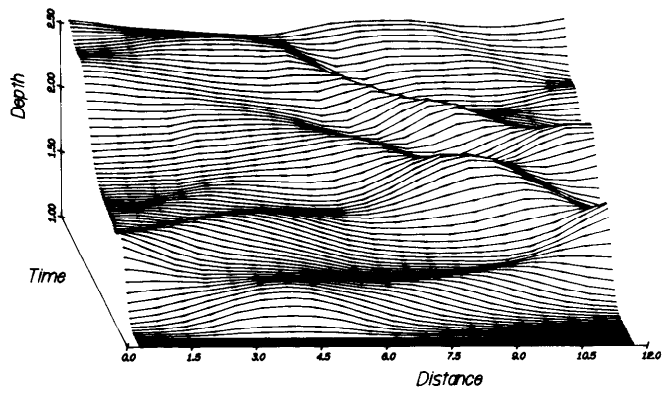


Figure 9. Temporal sequence of free-surface configurations for bottom boundary water injection. Above, long opening, front view; below, short opening, front view. Water viscosity was used in the calculation

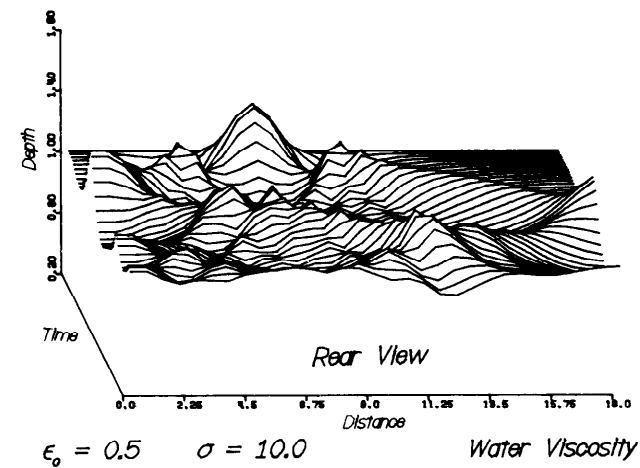
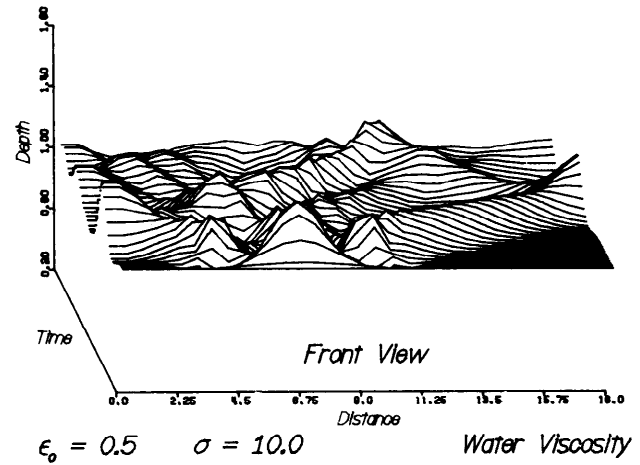


Figure 11. Temporal sequence of free-surface configurations for bottom boundary upheaval. Water viscosity was used in the calculations.

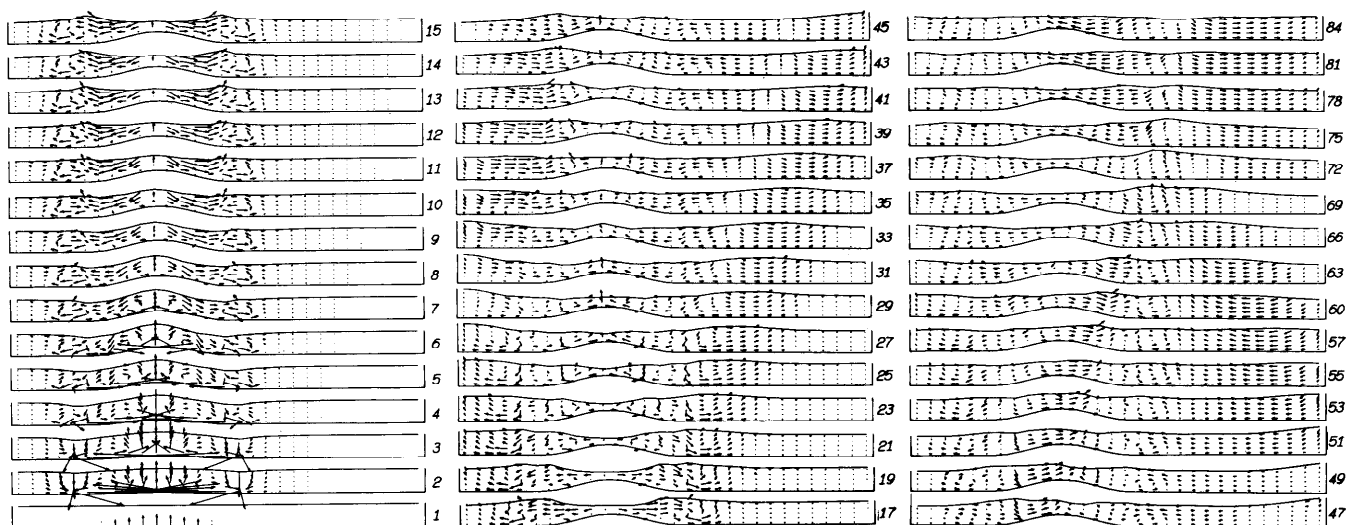


Figure 10. Temporal sequence of velocity vector field plots for a basin with upheaval of the bottom boundary. The sequence is shown by the numbers.

running time, the fluid motion still present in Frame 84 would be stopped by the viscous action and the free surface would be horizontal over the quiescent basin of water.

Of particular note is the considerable amount of fluid activity that occurs throughout the time sequence but particularly during the boundary motion. The large vortices, developed at the ends of the versine, decay slowly. The waves mentioned before have similar characteristics to the solitary waves imposed by equations in Fig. 5 and 6. The initial development of the free surface during uplift as well as subsequent propagation, reflection, and interference effects are clearly delineated by the temporal sequence of free-surface configurations shown in Fig. 11.

8. Discussion and Conclusions

The hypothesis adopted in this study reveals the authors' beliefs that the Genesis Flood was a dynamic year-long historical event that shaped the character of the earth's crust into the form we now see. These beliefs originated at the level of a literal interpretation of Scripture and have been augmented and confirmed by various subsequent studies including the one presented herein. The large water mass that prevailed during that period of history was anything but tranquil due to the variety of spatially- and temporally-varying forces that were brought to bear upon it. During the early stages, these forcing functions, which included large tectonic movements, the releasing of the "fountains of the deep", and large-scale hydro-thermal activity, were continuous although erratic and caused wave motions which were subsequently amplified by wave reflections and interference. The persistence of these perturbations during that period of the flood when the earth was completely covered with water led to enhanced cyclic activity since the wave motions were not readily damped because of the spherical geometry of the ocean system.

Yet to be quantitatively considered in all this dynamic activity is the contribution due to the gravitational forces caused by the earth-moon and earth-sun attraction. The frequency of the resulting semi-diurnal tide (12 hr.) is known to be close to the natural frequency of a global ocean for some modes of oscillation.⁸ It is reasonable to assume that the normally-small present-day tidal effects could be greatly amplified due to resonance. The reasonableness of assuming that the tidal effects during the flood year were greatly augmented is increased when it is realized that the governing parameters associated with tidal resonance effects would be quite different from present-day values. Hendershott says "This proximity to semi-diurnal resonance should not be surprising in view of the rich spectrum of free oscillations possible in even a regular flat-bottom ocean of global extent. —Variable bottom relief introduces additional free oscillations".

Also adopted in this study is the concept that the sedimentary structures which exist in the geologic record show cyclic characteristics as well as persistence over vast continental regions. These observations are in keeping with the aforementioned global and continental wave motions. Coupled with these observations are the uniform depositional characteristics of the sedimen-

tary layers without erosional channels and cuts to indicate intermediate passage of time. If the slow motions of local flood waters involving many millenia were responsible for the deposition of the geologic column, as is specified in uniformitarian geology, no two sedimentary strata should be seen in complete conformity. Rather, the sequence should show the evidence of continual interruptions in the layering process and a general lack of strata conformity.

Furthermore, there is Scripture support for the dynamic nature of the flood. Gen. 7: 18-19 states that "the waters prevailed and were increased greatly upon the earth—and the waters prevailed exceedingly upon the earth." Since the concepts of strength, vehemence, and insolence are involved in the words "prevailed exceedingly (*gahar meod*)", it can be inferred that dynamism rather than tranquillity was extant. After the 40 initial flood days in which both the "windows of heaven" and "fountains of the deep" were active, there were 150 days in which "the waters returned from off the earth continually" (Gen. 8: 3). Nelson⁹, instead of rendering "*halak*" as "continually", finds evidence for a more literal translation of "to and fro." He discusses this interpretation and gives other Scriptural support for a flood characterized by large motions and strong forces. New Testament writers (Mt. 24:39, Lk. 17: 27, 2 Pet. 2: 5, 3: 6), when referring to this historic event consistently use a unique word (*kataklusmos*) for the flood. It is the word translated in the Greek (and English) as "cataclysm." Again, it is easy to infer the dynamic character of the flood as opposed to a tranquil one.

In depicting the flow fields associated with several practical Genesis Flood situations, it has been shown that it is possible using numerical analysis to simulate the motions of large bodies of water having irregular boundary geometries and complex initial and boundary conditions. Considerable free surface activity has been demonstrated but, equally as important, significant temporal and spacial velocity distributions have been shown to occur in close proximity to the bottom boundary. These distributions are essential if these flows are to be capable of developing bed forms similar to the many sedimentary layers and cycles of rock units found throughout the world. For the large number of sedimentary layers to be deposited during the flood year instead of during the countless millenia available according to uniformitarian notions, there would need to be daily occurrences of mechanisms capable of producing large waves. Resonating tidal waves (i.e., tidal waves that have large amplitudes) could twice daily produce large moving masses of fluid capable of bringing bed loads into position for deposition once the wave passed. Interference effects associated with these waves would multiply the number of deposits that could be laid down per day. Since subaquatic mechanisms of the types investigated herein could have been frequently imposed during the early stages of the flood year, these too could have contributed greatly to the wave activity and the concomitant sedimentary environment. The difficulty and computer effort of the modeling would increase many fold if the particulate matter were included. Although attempts at such modeling are contemplated, the alternative of physically modeling the sedimentary

process is already in progress.¹ The coupling between the computer modeling and the physical modeling should increase the likelihood of arriving at a plausible physical explanation of geological features in accord with Scriptural accounts of the Genesis Flood.

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THE WARM EARTH FALLACY

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An analysis of the assumptions which must be made when ancient climate is inferred from the fossil record reveals that one must accept the Principle of Uniformitarianism and quite possibly the Theory of Evolution in order to determine the climate. Under the assumption that the earth has undergone a worldwide flood of a year's duration, it is impossible to determine what the pre-flood climate was like. The implications of this are that all current flood models which attempt to satisfy the warm earth criteria may be satisfying a situation which never existed.

For over fifty years one of the most firmly accepted creationist doctrines has been that the earth before the flood had a uniformly mild climate. Whitcomb and Morris have no less than eight quotations from three authorities attesting to the universal warmth of various ancient geologic periods.¹ Smith presents evidence in favor of the warm earth theory.² Rehwinkel³ as well as Whitcomb and Morris cites coal as evidence of the warmth of the prediluvial world. In fact Whitcomb and Morris state that,

"A universal warm, moist climate alone explains the evidence."⁴

Dillow cites limestone deposits in the higher latitudes, palm trees in Alaska, crocodiles in New Jersey, and frozen ripe fruit found in the New Siberian Islands as evidence of this mild climate. In fact he makes a temperature estimate of the pre-flood world based upon the fossils found at various latitudes.⁵

Other examples are easily brought to mind. Fossil tropical breadfruit found, along with magnolias, laurels, ferns, and sequoias, 300 miles north of the Arctic Circle.⁶ The Byrd expedition discovered fossil ferns at latitude 87° S.⁷ Obviously, such facts strongly compel a researcher to accept the idea that the polar regions were considerably warmer in the past than they are presently. There just seems to be no way any such animals and plants could have lived in these regions under present climatic regimes.

However, an analysis of the assumptions which one must make to determine the pre-flood climate shows that they are totally incompatible with the assumption

of a worldwide flood. The reason for this is that in order to infer climate from the fossil record one must implicitly accept the Principle of Uniformitarianism.

Two assumptions must be made before climatic information can be deduced. First, it must be assumed that the habitats of the fossil species being studied are of the same kind as can be observed to be inhabited by the living representatives today. In other words, the habitat has not changed. This is the first form of this assumption. When the case occurs that there are no living representatives in a fossil assemblage, it must be assumed that the habitat is similar to that of the nearest living "relatives". This is the second form of the first assumption. Few creationists would have problems accepting it in its first form; but they should feel uncomfortable with its second form. In accepting it in its second form as stated, one is implicitly accepting evolution; because only in the theory of evolution are there any relatives! One could escape this by assuming that God created similar forms to occupy similar environments, but he must be careful in making this assumption. With the wide climatic tolerances observed within various genera, this assumption is shaky at best.

It is only by using this second form that any climatic inferences can be made, e.g. from dinosaurs. There are no living representatives; but the reptiles, being structurally similar to these ancient creatures (although this has been questioned) are used as the models. Thus it is concluded that the dinosaurs must have been cold-blooded and lived in more temperate climes. By this reasoning, then, the dinosaur footprints on Svalbard means that the area was once warm.⁸ Accepting this conclusion is uncomfortably close to accepting evolution also.

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The second assumption which must be made before it is possible for climate to be deduced is that a species lived in close proximity to the place where it is buried. That this assumption is necessary is obvious; but in making it one automatically excludes the possibility that a worldwide flood mixed up the plants and animals before their burial. This second assumption is actually a corollary of the Principle of Uniformitarianism. Thus the creationist who accepts the climatic conclusions of uniformitarianists is implicitly accepting uniformity and in danger of unwittingly accepting evolution—the two ideas most contradictory to everything creationists believe.

It is quite possible, moreover, that in accepting the idea of a warm pre-flood climate, we are throwing away some very good evidence for the flood itself. First, it is obvious that these plants and animals could not possibly have lived under Arctic conditions; and so they need explaining. The flood is a perfect explanation for these fossils; because during a worldwide flood the plant material, especially since it can float, could have been widely dispersed over the entire world. Just how far this dispersal could have been is seen when it is realized that a floating island of vegetation, given open sea-room, could completely circumnavigate the present earth in a year with a velocity of only three miles per hour.

The fact that vegetation was carried during the flood in precisely this manner is implied very strongly in Genesis 8:11. The bird brought back a freshly picked leaf which quite obviously had not been carried on the ark. Is it possible that the reason that the flora assemblages for many of the geologic ages are so uniform from pole to pole is due to this type of dispersal?^{9,10} Any animals which obtained temporary safety upon any of the many floating islands of vegetation which had enough strength to support them would also be subject to this widespread dispersal.

Thus, by rejecting the idea that the world before the flood must have been universally warm, we gain a greater evidence in favor of the deluge.

This inconsistency in creationist thought appears quite often whenever coal deposits are discussed. Generally coal is considered evidence of a uniformly warm climate because of its wide latitudinal occurrence and the supposed tropical conditions for its formation. How-

ever, if coal is to be used as a climatic "thermometer" the plants would have to have grown near where the deposit is located. After coal is used to prove the warmth of the climate, author after author will then argue that the material which formed the coal was washed into its present location. These two arguments concerning coal are based upon mutually exclusive ideas of coal formation.

Implications and Conclusions

The first implication of this analysis is that creationist thought may have been sidetracked for over fifty years attempting to form flood models which satisfy a warm pre-diluvial climate when no such satisfaction was necessary. It was largely due to the warm earth fallacy that the Tilted Earth Axis and Vapor Canopy models were advanced. The second implication of the analysis is that if we need not satisfy the warm earth conditions other flood models can be investigated with the hope that one will be found which will answer more of our questions about the flood.

These results obviously do not prove that the earth was not universally warm. It may or may not have been. What they do show is that under the assumption of a worldwide flood we will never be able to determine the pre-flood climate with any certainty.

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Belief—and More

(Continued from page 56)

think that we do understand. But works of God which are not to be seen now, for instance creation of a new type of animal, become focal points of doubt. For a wise person, knowledge of the world imparts appreciation of the One who made the world.

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QUOTABLE QUOTE

"There is one point connected with Mr. Darwin's explanation of the bright colours of flowers which I have never seen referred to. The assumed attractiveness of bright colours to insects would appear to involve the supposition that the colour-vision of insects is approximately the same as our own. Surely this is a good deal to take for granted, when it is known that even among ourselves colour-vision varies greatly, and that no inconsiderable number of persons exist to whom, for example, the red of the scarlet geranium is no bright colour at all, but almost a match with the leaves."

Lord Rayleigh, in a letter in *Nature*, 1874

NEW PROTON AND NEUTRON MODELS

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This article extends the concepts developed in previous papers, alternatives to special theory of relativity, to generate magnetic forces of sufficient magnitude to replace the conventional concepts of the strong forces in nuclear physics.

The proton model consists of a spinning sphere of extremely small radius and extremely high perimeter speed, speed exceeding the speed of light. This speed is shown to be permissible in a sphere with constant rate of rotation. The result is a large magnetic flux and an intense magnetic field. This field provides binding force attraction between protons.

The proton's magnetic flux induces a spin in an electron deforming the electron into a rotating ring. The rotating electron ring encircles the spinning proton to form a neutron. The magnetic force keeps the plus and minus charges apart.

This paper makes use of published values of spin angular momentum, magnetic moments, and beta decay energy. It also uses the classical laws of conservation of angular momentum and energy and the equivalence of mass and energy.

1. Nuclear Forces

One of the unsolved problems in physics is the nuclear force, the force that holds the nucleus together. The nuclear force has been considered to be different from the electric, magnetic, and gravitational forces. The nuclear force is the strongest of these forces. The nuclear force is a short range force that is strongly attractive between two neutrons, two protons, or a neutron and a proton when these pairs of particles almost touch. This paper introduces new concepts that provide the conditions for stronger electromagnetic forces. The nuclear force is then developed in terms of strong electromagnetic forces.

2. A Magnetic Stabilizing Force

Earnshaw's theorem states that there is no stable electrostatic configuration. Like charges repel each other and unlike charges attract. These charges will move apart or come together, as the case may be, unless some counter force acts on them. Some nonelectrostatic forces must be added to achieve a stable state. This paper introduces a magnetic force to achieve a stable configuration of charges. In conventional theory the problem with the particle stability has been that the electric force is stronger than the magnetic force. It is only when moving with the speed of light that the magnetic force between two charges equals the electric force. According to special relativity charges can not move with speeds greater than the speed of light. If that were indeed so the magnetic force between the two charges could not exceed the electric force.

If, however, it can be shown that a rotating charged body can have speeds in excess of the speed of light a greater magnetic force is possible. This can account for the requisite forces to hold charges in a stable state. It will be shown that speeds in excess of light speed are feasible under certain conditions.

3. Rotational Speeds Exceeding the Speed of Light

A previous paper developed an alternative to special theory of relativity.¹ An adaptation of that theory shows that there can be a rotating speed of a charged body

that exceeds the speed of light c . The limitation of velocity to the speed of light c , according to that theory, resulted from the feedback effect on a finite charged particle in motion. As a finite particle moves along it causes a rate of change $\dot{\mathbf{B}}$ in the magnetic field at a fixed point in the medium. This $\dot{\mathbf{B}}$ in that region of the ambient medium generates an electric field that is fed back. This feedback enhances both the electric field $\mathbf{E}$ and magnetic induction $\mathbf{B}$ of the moving charge. This feedback enhancement causes the $\mathbf{E}$ and $\mathbf{B}$ fields to approach infinite magnitude, putting a limit on the translation speed of a charged particle.

If there is no fluctuation in the $\mathbf{B}$ field, as for example in uniform rotational motion of a charged particle, there is no feedback. With no-feedback there is no increase in the electric field, only the nonrelativistic increase in the magnetic field. Under this no-feedback condition it is possible to exceed the speed c and to achieve an increase in the ratio of magnetic to electric field.

The increase in the magnetic field $\mathbf{H}$ is brought about by the fundamental relation

$$\mathbf{H} = \mathbf{v} \times \mathbf{D} \quad (1)$$

From that equation and the relation $\mathbf{B} = \mu\mathbf{H}$, and the Maxwell equation for the speed of light, $c = (\mu\epsilon)^{-1/2}$, one may deduce the equation

$$\mathbf{B} = \frac{\mathbf{v} \times \mathbf{E}}{c^2} \quad (2)$$

In the right angle case and where a second charge q_0 is moving with speed v_0 with respect to this $\mathbf{B}$ field, the magnitude of the force on that charge is

$$F = \frac{q_0 v_0 v E}{c^2} \quad (3)$$

In the case of a positively charged sphere spinning with uniform angular speed there is no rate of change of $\mathbf{B}$, no $\dot{\mathbf{B}}$. The rotational speed v of its rim can exceed the speed of light c . Equation (2) still applies to the $\mathbf{B}$ field. When v exceeds c there is a greater increase in the ratio of $\mathbf{B}$ to $\mathbf{E}$ than would be possible in the feedback case. Now consider a negative charge moving with speed v_0 through this stronger magnetic field. It is possible for the magnetic force to exceed the electric force on that charge, repelling it instead of attracting it. That relative increase of magnetic to electric force is, of course, also a

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function of the speed v_0 . The greater v_0 the greater that ratio of magnetic to electric force. Here then is a possible mechanism to achieve a large enough magnetic field to hold apart a spinning proton and a revolving electron.

4. The Proton Model

A proton is assumed to consist of a small spinning sphere with a positive charge. From published values of the magnetic moment of a proton and its radius (approximately 10^{-15} meter) one can compute the magnetic field. It is not large enough to meet the required nuclear force magnitude. The need for a very strong magnetic field around the proton is met in the following way. Having fixed the value of the magnetic moment of the proton one looks for a means of increasing its magnetic field strength in the region near the proton. That can be done by assuming that the radius of the proton is much smaller than the afore-mentioned value which is usually assigned to it.

If one makes the radius of the proton small enough while keeping the magnetic moment fixed, the required magnetic field strength can be achieved. This does require the outer portion of the spherical proton to move faster than the speed of light.

The proton is assumed to be a spinning sphere with its charge uniformly distributed over the surface of this sphere. Denoting its radius as a_p , charge as q , and angular velocity as ω it can be shown that its magnetic moment is

$$M = \frac{qa_p^2\omega}{3} \quad (4)$$

The value of the magnetic moment of the proton is taken from the literature, as $M = 1.4106 \times 10^{-26}$ ampere meter². The two unknowns in Eq. (4) are the proton radius a_p and angular velocity ω . A means of determining an appropriate value of the radius was considered next. After making some preliminary computations on the magnetic flux needed from the proton it was seen that the proton radius must be very small, of the order of magnitude of 10^{-18} meter. That is much smaller than conventional 10^{-15} meter value for the proton radius. However the following means of computing the proton radius adds some credence to this very small value employed in this proton model.

In another previous paper the following equation was derived for the rest mass of the electron.²

$$m = \frac{q^2}{6\pi\epsilon ac^2} \quad (5)$$

A large percentage of that mass was due to the electric field surrounding the electron. If the same theory is extended to the proton one can then compute the proton radius from the known mass of the proton. Substituting the proton mass $m = 1.67626 \times 10^{-27}$ kg into Eq. (5) yields the proton radius $a_p = 1.023 \times 10^{-18}$ meter. Substituting that value of a_p into Eq. (4) yields a proton angular spin velocity $\omega = 2.52 \times 10^{29}$ rad/sec and the rim speed $v = 2.58 \times 10^{11}$ meter/sec. This is 861 times the speed of light. That high speed rotation produces an exceedingly strong magnetic field near the proton, a mag-

netic barrier that the rotating electron can not penetrate.

5. A Ring Electron

The concept of a deformable electron was included in a previous paper.³ That concept is now extended to include deformation from a spherical electron to a ring electron. The electron has the spherical shape in its free non-rotating state and the ring shape in its rapidly rotating state. The mechanism for deforming an electron into a ring is the centrifugal force associated with the magnetically induced spin of the electron as it moves into the magnetic field of a spinning proton.

The rotating ring electron is used here in connection with the spinning proton to develop a model of the *neutron*. The ring electron is also employed in a companion paper to develop a model of the hydrogen atom. The ring electron has an advantage over the Bohr orbital electron in that the steady rotation of a ring electron does not radiate energy. Whereas the Bohr orbital electron has that fundamental defect of either violating the radiation law or allowing the hydrogen atom to die from loss of energy.

6. Magnetic Boundary Force

The positive charge of the proton attracts the electron but the proton's magnetic field exerts a repulsion force on the rotating ring electron. As an illustration of the barrier provided by the strong magnetic field of the spinning proton consider the magnetic force dF_m on an elementary charge dq of the ring electron near the rim of the proton. Assume that the electron ring has the same speed as the speed of the Bohr electron. That is an electron rim speed of $v_0 = 2.19 \times 10^8$ meter/sec.

Substituting the differential element notation into Eq. (3) the magnetic repulsion force on that small adjacent portion of the ring

$$dF_m = \frac{dqv_0vE}{c^2} \quad (6)$$

The associated Coulomb attraction force is

$$dF_e = dq E \quad (7)$$

Substituting for the proton rim speed $v = 861 c$ and the electron ring rim speed $v_0 = 2.19 \times 10^8$ one has the ratio of magnetic repulsion to electric attraction on this incremental charge element

$$dF_m/dF_e = 6.3 \quad (8)$$

This indicates that at least for that portion of the ring the electron will not penetrate into the proton if it is moving, in the same direction as the proton rim. The positive and negative charges will remain separated.

7. Proton-Proton Magnetic Attraction

One of the mysteries of nuclear forces has been how two positive protons can be held together in the nucleus of an atom. The electro-static repulsion between those charges is very large. That problem is solved in this new model of the proton by the extremely large magnetic attraction between the protons.

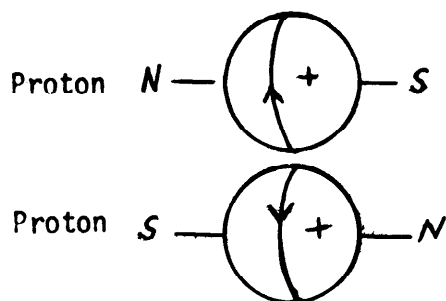


Figure 1. Spin directions for two magnetically bound protons.

Consider two adjacent protons spinning as shown in Fig. 1 with their magnetic moments parallel but in opposite directions. The magnetic attraction force between these two protons will be computed for the idealized case of two magnetic dipoles, each with magnetic moment M .

The attraction force⁴ on one proton of the magnetic moment M is

$$F_m = \frac{\partial B}{\partial r} M \quad (9)$$

where the B field⁵ due to the other proton is

$$B = \frac{\mu M}{4\pi r^3} \quad (10)$$

yielding attraction force

$$F_m = \frac{3\mu M^2}{4\pi r^4} \quad (11)$$

Using the value for magnetic moment of the proton $M = 1.41 \times 10^{-26}$ ampere meter² and the distance r between their centers equal to twice the proton radius, namely $r = 2.046 \times 10^{-15}$ meter, yields the attraction force $F_m = 3.404 \times 10^{13}$ newton. This is a much larger force than the electric repulsion force F_e . That force is easily shown from Coulomb's law to have the value $F_e = 5.52 \times 10^7$ newton.

Hence in this illustration the protons are held together by a *magnetic attraction force* that can be as large as 62 thousand times the electric repulsion force. For the balance condition between the electric and magnetic force the protons would be spaced further apart. This shows the plausibility of interpreting the so-called nuclear forces as electromagnetic forces, removing some of the mystery about nuclear forces.

A more stable configuration of the proton-proton combination is shown in Fig. 2. This is an in-line arrangement with both protons spinning about the same axis, in the same direction, and with their magnetic moments adding.

The same equations for the magnetic attraction and electric repulsion are applicable. But the expression for B is twice as large in the polar position. The net result is that in this configuration the ratio of the magnetic attraction to the electric repulsion is twice as large, a very strong binding force.

8. Strong Forces, Electromagnetic Forces, and Weak Forces

Modern physics classifies four types of forces: strong forces, electromagnetic forces, weak forces, and gravi-

tational forces. The strength of these forces is rated in the same sequential order, the strong forces being about 137 times as strong as the electromagnetic forces. The forces in the nucleus are the strong forces. Under the conditions set forth in this paper it has been shown that electromagnetic forces associated with the proton and neutron combinations can be as large as the so-called strong forces. Hence it appears that the strong forces are not so mysterious.

No claim is being made in this paper for a complete theory of the nucleus of the atom. The figures simply illustrate the reasonableness of stronger electromagnetic binding forces in the nucleus than previous theories have considered possible. The forces in the pair combinations were illustrations of extremely strong electromagnetic binding forces. In the actual nucleus of an atom it is unlikely that these pairs would have this same configuration because one never has just two protons or two neutrons in a nucleus. Except for hydrogen there would always be more than two of these particles in the nucleus and hence a more complex arrangement than with just a pair. Nevertheless the plausibility of sufficiently strong electromagnetic binding forces in the nucleus has been made possible by these concepts of the proton and neutron, the components of the nuclei of atoms.

It also appears that one could make a case for the weak force as being of the electromagnetic type between the electron ring and proton sphere in the new model of the neutron. The weak forces are associated with the type of decay that exists in the neutron when it is outside the nucleus of an atom. It appears then that both the strong forces and the weak forces may be only electromagnetic forces associated with the electromagnetic configurations of the proton and electron ring phenomena.

9. Neutron Model

The concept of an electron ring is based on the assumption that the electron spin is strong enough in the vicinity of a proton to deform the electron into a ring. If a free spherical electron falls into the magnetic field of a proton, the electron will certainly have a spin induced into it. With the new concept of an extremely strong magnetic field of a proton there should be sufficient magnetic flux linkage with this nearby electron to produce sufficient spin to deform the electron into a ring.

In the aforementioned companion paper the author has proposed a rotating ring electron to meet the non-radiating condition for a classical model of the hydrogen atom. As previously mentioned this is superior to the orbital electron model in the Bohr atom, the defect in the orbital model being loss of energy through radia-

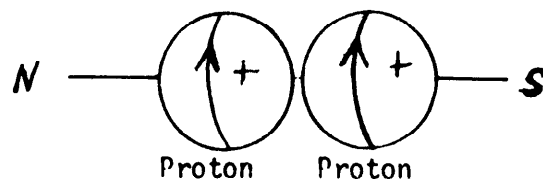


Figure 2. A more stable configuration of two magnetically bound protons.

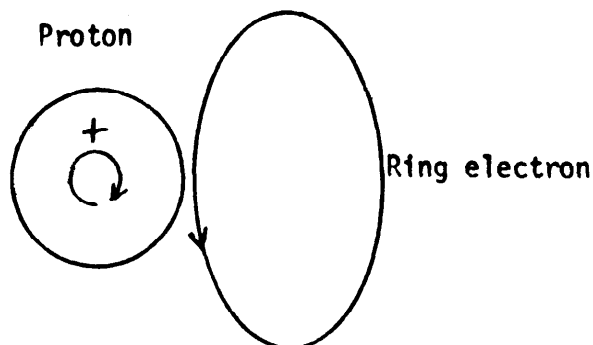


Figure 3. Hydrogen atom components. An electron ring and a proton spinning in the directions shown have the positive and negative charges held apart, despite their mutual attraction, by the magnetic repulsive force.

tion. In the hydrogen atom a stable state is achieved when the magnetic moments of the adjacent spinning proton and rotating ring electron are parallel, pointing in the same direction as shown in Fig. 3. The actual configuration of the electron is more complex than shown in Fig. 3 but the orientation of the magnetic moments is as shown in that figure.

The interest in this present paper is in an application of the electron ring and the associated proton sphere to the new model of the neutron. Even though the neutron has no net charge it has a magnetic moment. That implies a rotation of charges. Hence it is logical to assume that it does not contain an electron and proton in some type of rotational motion. The electron and proton must be held apart, not discharged together.

Assume that the electron ring in Fig. 3 is forceably flipped over 180 degrees so as to be concentric with the proton as shown in Fig. 4. The direction of rotation is the same for the electron ring and the proton. Because one charge is plus and the other minus their magnetic moments have opposite directions. The electrostatic attraction would shrink the electron ring size down somewhat but it would achieve a balance condition still larger than the proton radius. The adjacent portions of the electron and proton currents have opposite directions, providing a strong magnetic repulsion to prevent the merging of the plus and the minus charges.

The non-radiating condition would also hold for the electron ring in the stable neutron within the atom. This

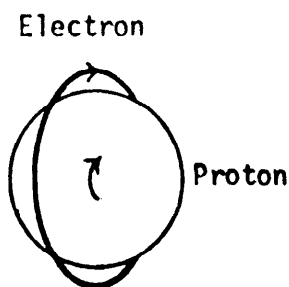


Figure 4. A neutron, its electron ring and proton spinning in the directions shown. The magnetic repulsive force holds the positive and negative charges apart.

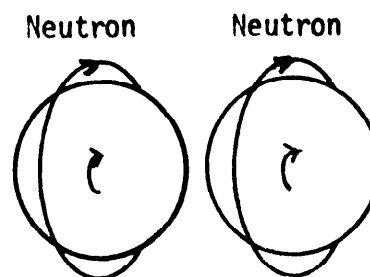


Figure 5. Neutron-neutron bound together by the net magnetic moments of each neutron.

combination of electron and proton satisfies the following requirements for a neutron: 1) no net charge, 2) extremely small size, 3) has a magnetic moment, 4) has less stability in the free state than the stability of an electron and proton in the hydrogen atom, and 5) releases energy when the neutron decays into an electron and proton.

10. Attraction Between Other Nuclear Combinations

The magnetic force can hold other nuclear pairs together. Fig. 5 illustrates an orientation of a neutron-neutron pair that can be held together by the magnetic force. The neutrons are in-line and their charge components spin about the common axis. The magnetic moments provide the basis for the net electromagnetic force being a magnetic attraction. Although there is no net charge the distribution is such that there will be some electric repulsion in the near field, but there is sufficient magnetic attraction to provide the required binding force.

Fig. 6 illustrates the orientation of a neutron-proton pair. There is a strong enough magnetic force in this combination also to bind the proton and neutron.

11. Momentum and Magnetic Moment Considerations

One of the most basic laws of physics is the conservation of angular momentum. The total angular momentum of an isolated system is constant. For the neutron the total angular momentum, the spin, $S_n = \hbar/2$ where $\hbar$ is Planck's constant divided by 2π .

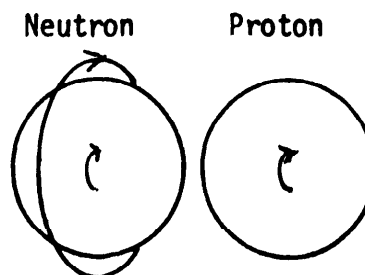


Figure 6. Neutron-proton bound together by the net magnetic moments of each.

The angular momentum equation for this neutron model is

$$m_e a_e^2 \omega_e + \frac{2}{5} m_p a_p^2 \omega_p = \hbar/2 \quad (12)$$

The first term on the left side of the equation is the angular momentum of the circular electron ring of mass m_e , radius a_e , and angular velocity ω_e . The second term is the angular momentum of the spherical proton of mass m_p , radius a_p , and angular velocity ω_p . Because the electron and proton spin in the same direction these angular momenta add up to give the total angular momentum $\hbar/2$ of the neutron.

The magnetic moment M_n of the neutron is known. The magnetic moment equation for this neutron model is

$$\frac{-q a_e^2 \omega_e}{2} + \frac{q a_p^2 \omega_p}{3} = -M_n \quad (13)$$

in which q is the numeric value of the electric charge. The first term on the left is the magnetic moment of the rotating ring electron and the second is the magnetic moment of the spinning proton. The minus signs in Eq. (13) indicate magnetic moments that have the opposite direction from the spin direction. Since the net value of the neutron's magnetic moment is negative it means that the rotating electron ring's contribution to the magnetic moment is greater than that of the proton.

12. Beta Decay of the Neutron

Outside the atom the neutron is unstable. This instability is consistent with the electron-proton configuration in this model. That configuration is one of unstable equilibrium. A displacement along the axis would, through the action of the magnetic repulsion, eject the electron from the neutron. That decay is an example of beta decay. The neutron has a half life of 960 second and beta decay energy⁶ of 1.2536×10^{-13} joule.

One may use that value of beta decay energy to compute the radius of the electron ring in the neutron. Consider the neutron as having been formed by bringing the electron in from its free state to its position in the neutron at distance a_e from the center of the proton. The potential energy delivered to the electron to accomplish this is

$$P.E. = \frac{q^2}{4\pi\epsilon a_e} \quad (14)$$

The beta decay is just the reverse process. Hence the beta decay energy is equal to that value of potential energy. Substituting the value of beta decay energy into Eq. (14) in place of the P.E. one obtains for the radius of the electron ring $a_e = 1.8404 \times 10^{-15}$ meter.

13. Angular Velocities

Solving simultaneous Eqs. (12) and (13) for the electron and proton angular velocities:

$$\omega_e = \frac{5q \hbar + 12m_p M_n}{(10m_e + 6m_p) q a_e^2} \quad (15)$$

$$\omega_p = \frac{15q \hbar - 60 m_e M_n}{(20m_e + 12m_p) q a_p^2} \quad (16)$$

Table 1.

q	$= 1.602191 \times 10^{-19}$ coul
$\hbar$	$= 1.0545919 \times 10^{-34}$ Js
M_n	$= 9.66318 \times 10^{-27}$ amp m ²
a_e	$= 1.8404 \times 10^{-15}$ m
a_p	$= 1.02316 \times 10^{-18}$ m
m_p	$= 1.672614 \times 10^{-27}$ kg
m_e	$= 9.109558 \times 10^{-31}$ kg
m_n	$= 1.674920 \times 10^{-27}$ kg

The angular velocities may be computed by aid of the values in Table 1. There is, however, a problem with the masses. The mass of the neutron exceeds the sum of the proton and electron mass by 1.39504×10^{-30} kg. Converting this to energy equivalent mc^2 one sees that this is the same as the beta decay energy, and likewise the potential energy given up by the electron in "forming" the neutron. Hence it appears that this mass 1.39504×10^{-30} kg., should be added to the electron mass when it is in the neutron, yielding the value $m'_e = 2.306 \times 10^{-30}$ kg. Using that value for the mass of the electron and the other values from Table 1 in Eqs. (15) and (16) yields angular velocities: $\omega_e = 5.091 \times 10^{22}$ radian/sec, and $\omega_p = 7.473 \times 10^{28}$ radian/sec. In accordance with conservation of angular momentum if the electron is ejected to its free state (no spin) the total angular momentum would then reside in the proton. The free state proton has the angular momentum $S_p = \hbar/2$, which is in agreement with conventional theory. The proton's free state angular velocity can be computed from

$$\frac{2}{5} m_p \omega_p a_p^2 = \hbar/2 \quad (17)$$

yielding $\omega_p = 3.0114 \times 10^{29}$ rad/sec. Using that angular velocity and $M_p = (q a_p^2 \omega_p)/3$, the proton's free state magnetic moment is $M_p = 1.6836 \times 10^{-26}$ amp m².

14. Refinements of the Model

The electron ring would have some radial depth, its inner radius being smaller than a_e and outer radius larger. This width of the charge in the ring would also have an effect on the magnetic flux distribution, increasing the magnetic repulsion force over and above the magnetic dipole field effect.

The force balance equation on the ring includes the coulomb attraction between the unlike charges, the magnetic repulsion, the tension in the ring, and the centripetal force.

The mean radius can be computed from the beta decay energy in precisely the same way as the idealized ring electron. The equivalent radius for the electrostatic force equation must take into account the inverse square effect.

If the beta decay is to yield a free electron with non-zero kinetic energy, that can be achieved in the neutron model by increasing the magnetic induction. It would require additional energy in forming the neutron from a free electron and a free proton, over and above the aforementioned potential energy transition. The decay

would then include a stronger repulsion force and yield kinetic energy in the separated electron, in an amount equal to that excess energy introduced in the formation of the neutron.

The present paper simply introduces the basic concepts. Some of the computed values will perhaps have to be altered somewhat as more information is obtained on the electron ring configuration.

15. Problems with Experimental Verification

Modern physics has developed a very complex hierarchy of particles and anti-particles to "explain" almost every type of phenomenon associated with particle physics. A tremendous number of experiments have been made to discover and confirm these particles. Had it not been for the past experimental work the numerical values in Table 1 would not have been available for the development of this present paper.

It is, however, still the business of physicists to look for new approaches in the hope of generalizing the base. It would take something quite different from the present approach in modern physics to ever achieve a more generalized base for consolidating the concepts. It is believed that the concepts developed in this paper, which also go back to the alternative to special relativity developed in previous papers, have some promise of reducing the number of basic forces from four to two.

There is always the problem of trying to determine whether or not the theory is consistent with experiment. That is not a simple problem because no one really is familiar with all of the experiments. Textbooks never give all of the details of the experiments. Neither do they give all of the pertinent experiments. So a lot of this hierarchy of particle physics rests on the confidence that our inheritance of experimental and theoretical development has been dependable. But the basic problem really is the possibility of alternate interpretation of any and every experiment.

16. Summary

Some quite new concepts have been incorporated into the proton and neutron models. The modern physics assumption of equal fixed intrinsic spin angular momentum of $\hbar/2$ for the electron, proton, and neutron have been abandoned. It is believed that the spin will indeed be altered by magnetic induction when these elementary particles move into or out of a magnetic field. A recent paper gives evidence that the proton's spin may not be constant.⁷ The reasoning is that: "the energy associated with a proton's spin is constant, and so it becomes more violent.—Only in the past few years have experimental techniques been devised for testing this assumption. It has turned out to be quite wrong. The influence of spin does not diminish as the energy of a collision increases; on the contrary, spin seems to become more important as the collision becomes more violent." This effect seems to be consistent with the angular momentum concepts employed in the new models of the proton and neutron.

Acknowledgment

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THE TRIPLETS' PARADOX

JEFFREY LEE*

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Relativity is more than adequately acquainted with the "Clock Paradox" or "Twins Paradox". In this familiar argument one of the two twins boards a rocket and journeys to a distant star at a velocity near that of light, c , only to find that upon returning his "stay at home" twin is much older than he. While years passed for the twin on Earth, only days or weeks passed for the twin who journeyed in the rocket.

The cause for this is the relativistic time dilation effect brought about by the moving twin's velocity with respect to the Earth's still frame of reference. The para-

dox which arises leads to several questions: Who actually moved? Who will actually experience the time dilation? Will a clock riding along with the twin in the rocket actually slow down and our astronaut twin physically age less? Will clocks on the Earth slow down from the viewpoint of the still frame of our astronaut twin and the "stay at home" twin age less? Or will both clocks of both observers slow down symmetrically?

A variety of explanations and answers to all these questions are explored at length by numerous articles, books and scientific papers. While some authorities say that the time dilation effect is symmetrical others bring in the Doppler Effect; and still others use reasoning

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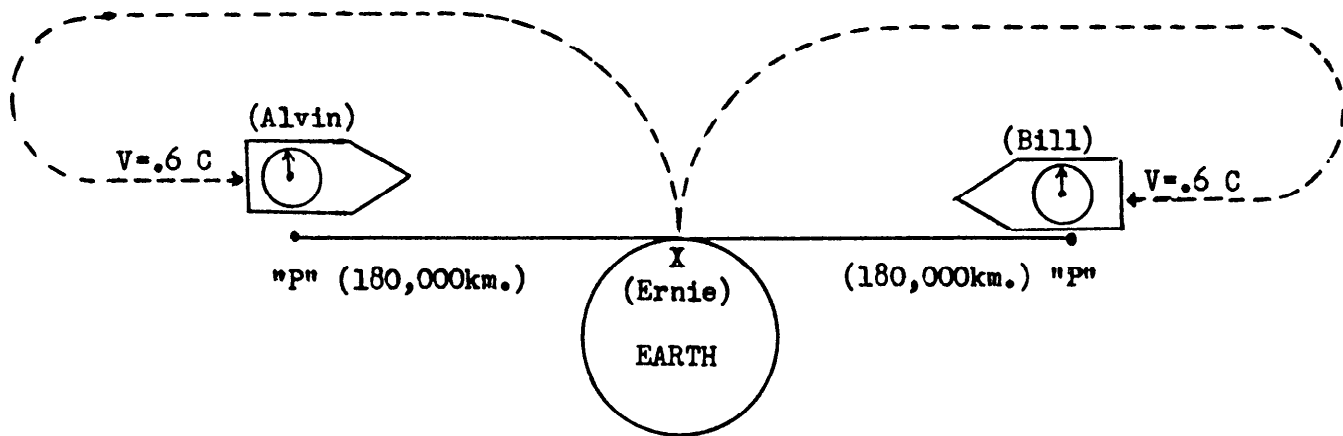


Figure 1. Here two of the triplets approach the Earth, on which the third is stationed, at a high speed.

which has nothing at all to do with the basic laws of Relativity as Einstein wrote them. A new system of reasoning containing no paradox is surely possible and will eventually be found; but what of the present? Does the presently existing Theory of Relativity furnish us with a complete and practically adequate description of the real universe, or is it simply a "good mathematical approximation" as was Newton's Classical Physics some years earlier? The fact that the "Twins Paradox" is still with us today is ample proof that new reasoning is needed concerning the situation.

Further illustration of the point can be made by constructing a simple hypothetical situation involving three instead of two observers: Alvin, Bill and Ernie. While Ernie remains earthbound, Alvin and Bill board rockets capable of velocity near that of light and proceed in opposite directions out into space. When far enough apart both rockets reverse direction and head directly back towards Earth. They accelerate to and retain a uniform velocity of $0.6c$ or $180,000 \text{ km./sec.}$ Both carry identical clocks set at zero which activate at the instant that the rockets pass point "P" (located at the end of rigid measuring rods extending in opposite directions $180,000$ kilometers from a point on the surface of the Earth), as shown in Fig. 1.

Alvin and Bill both reach point "P" at the same instant, and then they have no acceleration, only a velocity of $0.6c$ relative to the still frame of the Earth. Thus, according to the Theory of Relativity, the Lorentz Transformations (describing time dilation and the equation for the addition of velocities) will hold true for this situation.

Ernie, from his still frame on Earth, sees both rockets approaching at the same velocity of $0.6c$ from opposite directions, and will observe, by using the Lorentz Transformation, that both Alvin and Bill's clock will run slow at exactly the same rate. By plugging the velocity of $0.6c$ into the Lorentz Equation we find that both Alvin and Bill will, in their moving frames of reference, experience a time dilation of 0.8 relative to Ernie's still frame on Earth, i.e., the amount of time passing for Alvin and Bill in their moving frames of reference as they travel the $180,000$ kilometer distance in one second of Ernie's time passing in Ernie's still frame is $1 \times [1 - v^2/c^2]^{1/2} = 1 \times [1 - (0.6c)^2/c^2]^{1/2} = 0.8$ second. Er-

nie is positioned, with a camera, atop a mountain on Earth waiting for Alvin and Bill to pass him at a very close proximity. At the instant they both pass in front of him he snaps a photograph of the two clocks. Obviously we can see that, relativistically speaking, this should prove to be a most interesting picture.

From Ernie's Earth viewpoint, as the still frame of reference, both Alvin and Bill's clock would run slow by the exact same rate and show 0.8 seconds elapsed. This, of course, is due to the fact that both have the same $0.6c$ velocity relative to Ernie. Therefore, since their velocities are the same relative to Ernie's still frame then their time dilation relative to Ernie should also be the same. Consequently, from Ernie's viewpoint the photograph would show both Alvin's clock and Bill's clock to read the exact same time of 0.8 second.

Relativity, however, is built upon the assumption that any point of mass in the universe not experiencing an acceleration can claim itself to be the "still" frame of reference. Hence, according to the Theory of Relativity, both Alvin and Bill (since their clocks have experienced no acceleration, only a velocity in this situation) can also claim to be the still frame of reference. Therefore, from either Alvin or Bill's viewpoint as the still frame of reference Ernie's picture of things is entirely incorrect.

Alvin, from his own still frame, would observe Ernie and the Earth to be approaching him at a uniform velocity of $0.6c$ and find that Bill (using the formula provided by the Relativity Theory for addition of velocities) is approaching his still position at $0.88c$, since Alvin and Bill's relative velocity is given by:

$$\frac{v_A + v_B}{1 + \frac{v_A v_B}{c^2}} = \frac{0.6c + 0.6c}{1 + \frac{(0.6c)(0.6c)}{c^2}} = 0.88c$$

Here v_A and v_B represent Alvin's and Bill's velocities respectively. Thus we find that Bill's clock will experience a time dilation of 0.47 relative to Alvin's still position, i.e., the amount of time passing on Bill's clock as Alvin's still frame passes through one second of time is given by $1 \times [1 - v^2/c^2]^{1/2} = 1 \times [1 - (0.88c)^2/c^2]^{1/2} = 0.47$ second. So according to Alvin's viewpoint, as the still frame of reference, the photograph would show his clock to read one second and Bill's to read 0.47 second.

Likewise Bill, according to the Theory of Relativity, must disagree with Alvin and Ernie in saying that from his still frame it is Ernie and Alvin who are in motion towards him. Accordingly, from Bill's viewpoint as the still frame of reference, the photograph would show that it is his clock that reads one second pass as Alvin's shows only 0.47 second.

In Fig. 2 is shown how Alvin, Bill and Ernie would each describe the photograph of the two clocks (according to Relativity).

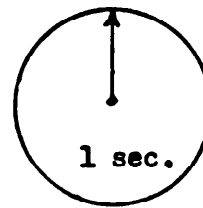
It is obvious that one clock cannot have three different readings at the same instant. A clock's hand can only register one position at a time. According to the laws of Relativity in this situation three different observers must obtain, at the exact same instant, entirely different readings on the same clock(s). This proves the inability of Relativity accurately to define an exact reference system concerning the physical laws of the universe. In this paradox of Relativity two different clocks (as viewed from three different inertial frames of reference) are used to illustrate the fact that the basic assumption of Relativity (that any point of mass in the universe not experiencing an acceleration can claim to be the still frame of reference) is inconsistent with the natural laws of the universe. Thus, we see that Relativity, although it may indeed be a very good mathematical description of the relationship of motion to space-time, is not the final solution.

We have here a simple but clear paradox for which Relativity has no solution. Therefore, the question we wish to ask Relativity is: What will the photograph show?

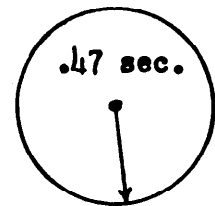
Reference

¹Lee, Jeffrey, 1978. *Ether, the speed of time through space*. Published privately. Pp. 76-86.

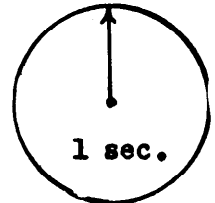
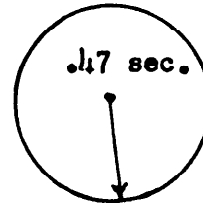
**Alvin's clock
should read:**



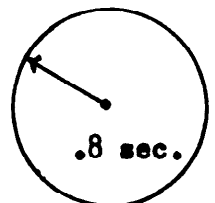
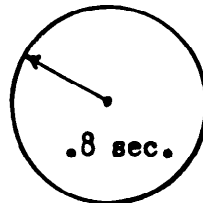
**Bill's clock
should read:**



A



B



E

Figure 2. This shows the three incompatible photographic records of clocks which, according to the theory, the triplets would obtain. A: Alvin's description of the photograph from his still frame; B: Bill's description of the photograph from his still frame; E: Ernie's description of the photograph from his still frame. The clocks are all supposed to take one second for one revolution of the hand.

ALTERNATIVES TO EVOLUTIONISM†

G. H. HARPER*

Introduction

In an earlier article¹ it was argued that our current teaching of Darwinism is indoctrinatory, partly because of inadequate or non-existent presentation of alternative theories to allow pupils a choice. One of the principal criticisms directed at that article was the failure to discuss alternatives, and this article is an attempt to remedy the deficiency. A number of theories are mentioned, but most attention is given to the one which I consider the most suitable partner for Darwinism in O- and A-level courses.

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Perhaps the debate about evolution has gone on without a break since 1859. Recently, however, there seems to have been a resurgence; the case of David Watson, the creationist teacher sacked from Rickmansworth School in 1976-7, attracted considerable attention, with strong views expressed on both sides. Since then, debate has flared up in the pages of the *Daily Telegraph*, the *School Science Review*, and the *Biologist*. By and large, few new ideas have appeared, but it is hoped that one at least will be contributed by this article—the steady state theory of species.

Alternative Theories

There are at least five theories contributing explanations or accounts of the history of life. Some can be applied in conjunction, while others are mutually exclu-

sive. The aim in this section of the article is to characterize them briefly and add a few comments on their usefulness in the context of modern education.

Evolutionism is the best known, for some reason. The term "evolution" tends nowadays to have an excessively wide application, and in this article it will refer only to the origin of species by gradual modification from other species. This excludes two senses in which the term is often used: the first is the minor kinds of change in a population's gene pool which forms the subject matter of most modern natural selection research. This is not evolution because it does not involve the production of new species, though Darwinists claim that such changes can accumulate to result in evolution. This claim however is contentious, and is disputed particularly by special creationists and steady state theorists.

The second sense excluded here concerns the speed of modification. A theory which postulates the origin of species from other species by non-gradual modification is *saltationism* and not evolutionism. The distinction between the two theories rests on a somewhat arbitrary separation of "gradual" from "non-gradual", but a sudden jump across the taxonomic gap separating two closely related species gives a rough idea of the minimum discontinuity for a case of saltation. In the late eighteenth and early nineteenth centuries, several writers thought in terms of saltation rather than evolution, especially where the mechanism they had in mind involved aberrant embryological development leading to offspring markedly different from the parents. Even within Darwin's circle the question of discontinuity in the origin of species caused some difference of opinion, as when T. H. Huxley criticized Darwin for sticking too rigidly to the axiom *natura non facit saltus*.

Both theories are able to play a useful role in modern biology teaching. Evolutionism can be presented in various forms according to the mechanism envisaged (inheritance of acquired characters, natural selection, genetic drift, selectively neutral mutation, etc.), and saltation is frequently exemplified in the cases of *Spartina townsendii*, the wheats, *Primula kewensis*, and *Galeopsis tetrahit*. It may not be too far-fetched to suggest that there is a good deal more evidence for saltationism than there is for evolutionism. It is a pity that the distinction between the two theories is not made clear at school level, especially since natural selection plays little or no role in the supposed saltationist origin of the species mentioned above.

Where a theory antagonistic to evolutionism is offered to pupils, it is generally *special creationism*, which postulates the direct creation of species by a supernatural act of God, who thus intervenes in the otherwise law-regulated processes of nature. The theory is usually dismissed by science teachers on the grounds that it is not scientific or that it involves supernatural causes. However, I don't think anyone would seriously argue that it can be shown to be false. Even if metaphysical it might be true. The usual reason for its dismissal is that it conflicts with the outlook which supposes that all phenomena are the result of solely natural causes. But this view is not itself scientific (it certainly is not testable); at the least it is a methodological assumption,

and very often it is also a belief. The conflict between evolutionism and special creationism usually boils down to the conflict between rival metaphysical beliefs, and at least in this respect evolutionism and special creationism are of comparable status. While it may be pointless trying to decide between the two theories by reference to scientific observations, comparison of the two in school courses could very usefully lead to a realization of the metaphysical component in the scientific picture of the world. A good basis for such a discussion might be Gosse's *Omphalos*, which ingeniously reconciled the fossil record with special creationism.²

A theory sometimes confused with special creationism is *spontaneous creationism*, according to which species arise from non-living matter rather than from other species, and by natural causes rather than supernaturally. Recently this has become respectable as an account of the origin of the first forms of life, but occasionally in the nineteenth century biologists postulated this as the sole mechanism for the appearance of new species of all kinds, after geological catastrophes, for instance.

It will be immediately obvious that the four theories mentioned so far are merely versions of one theory—that species originate. This postulate is, however, open to question, and the *steady state theory of species* simply asserts that species do not originate. All they do is remain in existence or become extinct. There have been surprisingly few attempts to establish a steady state theory of species, though elements of it can be found in the works of Charles Lyell in the early nineteenth century. Most of the rest of this article is devoted to an explanation of the concept.

The Problem of the Earth's Origin

It is widely believed that the earth was once in a state which life on its surface could not tolerate, and also that it did not exist as a planet at all. If this is true, one can adhere to the steady state theory of species, if one assumes that all known species arrived from other regions of the universe. However, most people would regard this suggestion as absurd.

Alternatively, one can assume a steady state theory of the earth, according to which it has always been able to support life and in fact has always been much the same as we know it today. Most people would also regard this suggestion as absurd. An attempt will be made to argue, however, that it is not absurd, by considering the determination of the age of the earth.

The age of the earth has, of course, been the subject of speculation and estimate for several centuries, and just a few of these estimates may be quoted. For long after the mid-seventeenth century, the famous date of 4004 B.C. was the accepted answer. A late nineteenth-century estimate that was widely publicized was Lord Kelvin's of 20-400 m.y. (million years). A fairly recent figure is 4600 m.y., though there does seem to be some "uncertainty regarding the physical nature of the event being dated . . ."³

While this small selection gives a highly simplified picture of the history of geochronology, it serves to illustrate that different methods of estimation (and the ex-

amples are derived from Bible analysis, cooling rates of a molten earth, and lead isotope decay) give wildly different answers. Moreover, the general trend is for later estimates to give the earth a greater age. This trend is also seen in the related area of estimation of the age of the oldest rocks in the earth's crust; for instance, between the first (1969) and second (1972) editions of a modern book on earth sciences,⁴ this age increased by 12 per cent from 3400 m.y. to 3800 m.y. As a historian viewing this trend, I see no reason for supposing it will not continue; and it leads me to think that geochronologists might one day seriously entertain a theory postulating an infinite age for the earth—i.e. no origin.

Another point arising from geochronology is that our confidence in an estimate is presumably related to our confidence in the method of estimation. Few people now have confidence in the analysis of Biblical genealogies, and it is recognized that Kelvin's estimates were wide of the mark, if only because he made what are now regarded as erroneous assumptions about the source of the earth's heat. Pity he didn't "know about" radioactive decay, we might say, but again from a historical point of view it would be naive in the extreme to believe firmly that modern science has the final solution. Modern methods involve assumptions about the behavior of decaying radioactive minerals, and other assumptions about the state of the elements at the "origin of the earth", upon which the estimates are based. For a biologist or anyone else to accept the most recent geochronological results as "fact" would strike me as uncritical credulity.

One might argue against this cautious attitude that one has, after all, another check on the truth of modern estimates—in the comparison of results from independent methods of dating. I agree that it is a useful check, so long as the methods really are independent and don't share a common false assumption. But there is a salutary example from the nineteenth century. Kelvin's estimate of 98 m.y. (the broad limits of 20 and 400 m.y. were mentioned above) was based on physical assumptions; a geologist, Professor Phillips, used an entirely different method—assessing the total thickness of sedimentary strata and working out how long they had taken to accumulate—and had arrived at a figure of 96 m.y.⁵ This agreement was felt to be satisfactory—but now we would not think it showed the reliability of the estimates.

The uncertainty of modern opinions on the age of the earth—and also on how it originated, though this has not been discussed here—seems to me sufficient for the biologist to adopt the following position. The simple form of the steady state theory of species, asserting that they have never originated, can be advocated in the knowledge that there are no observations or indisputable conclusions from geochronology or geophysics which contradict the supposition of the earth, in more or less its present state, existing already for an infinite duration.

Alternatively and preferably, we can be more cautious and consider that as biologists we are under no obligation to theorize seriously about periods of time for which we have no biological evidence. We would be foolish if we allowed the views of geophysicists to dic-

tate our biological theories about the history of life; it is surely a sound position to keep an open mind about life before the start of the fossil record, and to regard it as simply beyond our scientific reach. With this approach, then, the steady state theory is generally applied only to the period since the start of the fossil record.

Fossils

As has recently been remarked by an evolutionist, "The only tangible evidence that evolution has occurred in the past is provided by the fossil record."⁶ It therefore seems appropriate to deal with palaeontology first and in greatest detail. Evolutionists interpret the fossil record as a picture of evolutionary history in so far as the facts fit conveniently into plausible phylogenetic reconstructions. Since, however, there are so few fossil sequences showing an unambiguous link between an ancestor and a descendant species, evolutionism has a rich supply of devices for coping with the situation, mostly relating to the supposed incompleteness of the fossil record. It is curious that the antiprogressionist and antievolutionist Charles Lyell in the 1830s, and the progressionist and evolutionist Charles Darwin in the 1850s, both emphasized the incompleteness of the fossil record, the one to save his antiprogressionism and the other to save his evolutionism.

A common methodological assumption of evolutionism is that presence of a fossil indicates existence of the species, while absence of fossil indicates extinction or that the species has not yet come into existence. However, this sometimes does not lead to acceptable reconstructions, for instance, where there is a large gap within the fossil record of a species. Things went very badly wrong, of course, in the case of the crossopterygian fishes. From the fossil evidence, they were for long assumed to be extinct since the end of the Mesozoic, but discovery of living specimens of *Latimeria* (a coelacanth and crossopterygian) off the coast of Africa naturally led to a revision of this view. There is no difficulty in thinking up reasons for the absence of fossils; surviving forms may have lived at low population densities, or their bodies may always have been destroyed before fossilization could occur, or they inhabited environments where rock formation was not occurring, or rocks containing their fossils have by chance not been found, or such rocks have been eroded away, and so on.

So the evolutionist thinks first and foremost in terms of evolutionary history when he tries to explain palaeontological observations; he will often resort to explanations in terms of the ecological relation of the organism to sites of fossilization only when a phylogenetic interpretation appears unsatisfactory. The steady state theorist, however, relies principally on palaeoecology to construct his explanations. If a fossil species appears in a given horizon for the first time, such as the horse *Eohippus* in the Eocene, it is assumed that the species always existed, and the steady state theorist will try to account for the fossil's appearance in terms of population increase, migration, habitat change, and so on.

It should be clear at this stage that one cannot demonstrate the origin of a species from the fossil record. One invokes an explanation in terms of origin merely because evolutionism dictates this. Equally, it is im-

possible from the fossil record alone to demonstrate the extinction of a species. We can only say with justification that a species is extinct if we are confident that our knowledge of the earth's surface makes negligible the chance of it being found alive today. It is only a combination of palaeontology and neontology (the study of living species), or neontology on its own, which allows us to demonstrate extinction. Thus we can conclude that mammoths and dodos are extinct; but we cannot with the same confidence say that trilobites are extinct, despite the absence of their fossils from the Mesozoic and later rocks. If large fish, like coelacanths, can remain undetected for so long, it seems possible that a trilobite may some day be caught from some little known part of the sea. All palaeontological observations are therefore compatible with the supposition that all species have existed at all times before the present or before the date of their extinction.

The palaeoecological approach of the steady state theory may be illustrated by the conventions of pollen analysis. It is a common technique in palaeontology to summarize the change of abundance with time in different taxa by the diagrams given in Figure 1. In all cases, the time axis extends upward, while the horizontal axis merely separates taxa or it may crudely indicate taxonomic distance. Figure 1(a) indicates taxonomic distance, and is an evolutionist interpretation of the data. Figure 1(b) is a less theory-laden presentation of the same data. Figure 1(c) uses a time scale within the Quaternary, and shows relative abundance of different types of tree pollen in peat deposits. For the pollen diagram, the analyst assumes fixity of species, and that each species has the same climatic and general ecological preferences as it has today. The data are then used to reconstruct the climate and vegetational history of the area from which the samples were obtained. The steady state theorist would interpret Figure 1(b) in a similar way. He might consider the Carboniferous and suggest that, at least in the areas where organisms were being fossilized, ecological conditions generally resembled those parts of the present surface of the earth where cartilaginous fish, bony fish, and amphibians tend to abound or occupy a large proportion of the local fauna and flora—e.g. swamps, badly drained tropical rain forest, and so on. This would be quite compatible with the contemporary existence of all other species we know living today, since they could be supposed to be rare, or living in areas and habitats away from the regions of rock formation—in all cases implying a low chance of being fossilized. If one considers at any point in time how small an area of the world's surface is actually a site of fossilization, the conception seems not to stretch the imagination too far. For instance, in Europe today, fossilization is probably occurring in only a few percent at most of the land area, and it is unlikely that the animals and plants being fossilized are representative, as regards numbers of species or of individuals, of the living populations of animals and plants.

At this point, it is instructive to go into a little more detail about evolutionists' attitudes to the fossil record. There are two rival models of evolutionary change as seen in the fossil record, known as the phyletic gradualist model, and the punctuated equilibrium model.

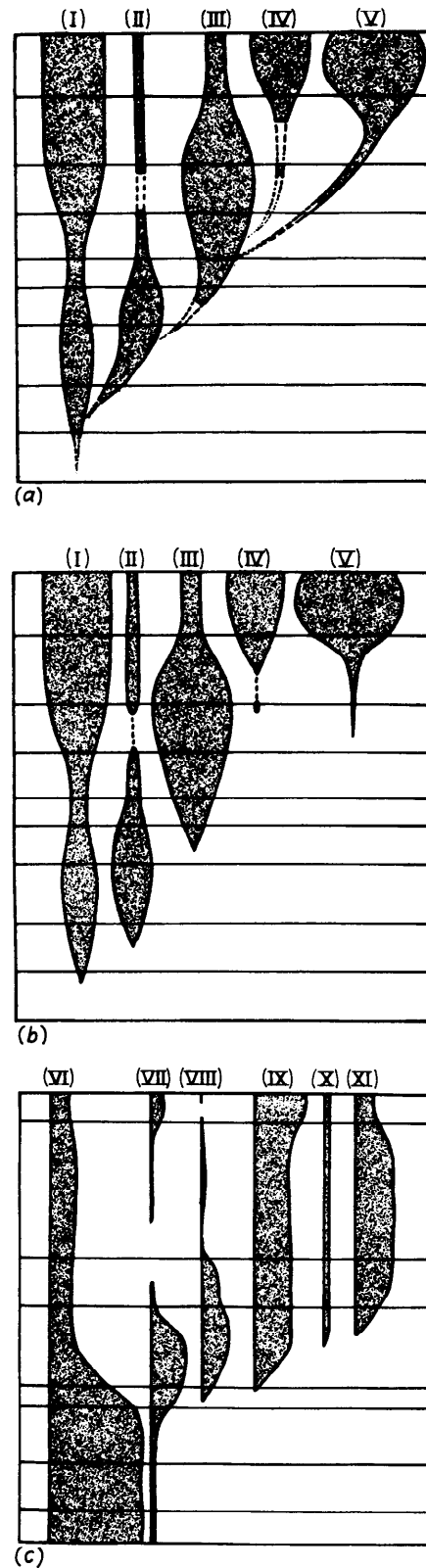


Figure 1. Three methods of displaying palaeontological data: (a) and (b) show abundance of major groups of chordates in the post-Ordovician fossil record, (c) shows relative abundances of tree pollen through the post-Glacial. The vertical axes show time, with the present at the top. (I) osteichthyes, (II) amphibia, (III) reptiles, (IV) birds, (V) mammals, (VI) birch, (VII) pine, (VIII) elm, (IX) oak, (X) lime, (XI) alder.

For long after palaeontologists started interpreting fossils in evolutionary terms, the pattern of fossils held to demonstrate a case of evolution consisted in a long series in which gradual and sustained change was observed. A. E. Trueman reported finding several such changes in a series of fossil oysters in the Lower Lias in South Wales; similarly, A. W. Rowe had earlier traced gradual changes in heart urchins of the genus *Micraster* in successive horizons of the chalk. This mode of evolution is known as phyletic gradualism, and exponents of the model would maintain that it is the major or only mode of evolution, and moreover can be demonstrated in the fossil record with numerous examples.

Phyletic gradualism has recently come under attack, however, notably by N. Eldredge and S. J. Gould in a paper of 1972. One criticism of gradualism is that if the accepted examples indicate typical rates of evolution, then the process is simply far too slow to account for the evolution and diversification of known species in an acceptable span of time. It is also pointed out that acceptable examples of phyletic gradualism have hardly ever been demonstrated. It is not sufficient, for instance, to show a sequence of species, each varying from the previous one in a consistent trend of change; phyletic gradualism supposes a consistent gradual modification *within* a species in addition, so that one species merges into the next with perhaps only an arbitrary distinction between them. The fact is, it seems, that this has hardly ever been found.

Further criticism of phyletic gradualism includes the observation that practical stratigraphy successfully assumes and makes use of the static nature of fossil species, and this does not fit well with an evolutionary palaeontology which emphasizes gradual change. Moreover, the idea of a large widespread population, very gradually changing throughout its range from one species to a descendant species, simply does not accord with neontological evolutionary theory (i.e. theory based on the observation of living organisms) which stresses speciation occurring in populations isolated in environments different from that of the main population.

The doctrine, or model, of punctuated equilibrium admits that occasional cases of phyletic gradualism may occur, and be detected, but proposes that for the most part new species arise quite differently. A new species is most likely to arise by a relatively quick process (in palaeontological terms, more or less instantaneously) in a small population on the edge of the range of the ancestor species. Once originated by this local and sudden speciation, the species remains static in form in most respects, though there may be minor non-directional fluctuation, or minor directional change, through the life of the species—neither related obviously to the direction of change in descendant species. The chance of finding a speciation event recorded in a fossil sequence is more or less ruled out by the small size of the population it occurs in, the speed of the speciation, the restricted locality, and the location of the event away from the main range of the ancestor species. Thus one expects to find, in fossil sequences, merely a break with a fairly sudden replacement of ancestor by descendant. The break may represent the

extinction or emigration of the ancestor, and the immigration of the successful descendant which had evolved elsewhere.⁷

The punctuated equilibrium model has been mentioned for the following reason. Evolutionists will, of course, see both models as variants of evolutionism. However, it will not have escaped the notice of anyone with an open mind on evolutionism that the punctuated equilibrium model leads one to expect palaeontological observations of the same kind as those expected by steady state theorists. There is no palaeontological way of distinguishing between the following two situations: (a) a species appears in the fossil record as a result of spread or population increase following speciation elsewhere; (b) a species appears in the fossil record as a result of spread or population increase following environmental change which gives it a new advantage over competitors. So, punctuated equilibrists have kindly provided a non-evolutionist approach to the fossil record; steady state theorists can feel grateful and should encourage them in the good work.

Other Applications

School textbooks usually support Darwinism not only with fossil data, but also by reference to such areas as (a) taxonomy, (b) comparative anatomy, physiology and embryology, (c) distribution, and (d) natural selection research. Space allows only a brief treatment of these in relation to the steady state theory.

All of the topics mentioned except for distribution and natural selection research can be handled in terms of one principle; this is the principle of the limited number of organic structures which are physico-chemically feasible and able to support life. This can be illustrated with a set of engines. An attempt has been made to arrange them in a natural and hierarchical classification in Figure 2. The principle of the limited number of physico-chemically feasible structures simply asserts, in this case, that only some designs of engine will work. There are different degrees of feasibility, ranging from the design that could not be made to work even for five minutes under ideal circumstances, to the engine that might reach the stage of commercial production but then succumb to competition from other designs because it is too noisy or its fuel is too expensive to make it attractive to consumers. The engines can be arranged in a natural classification because each taxon represents the limited number of designs possible using the structure common to the group. There is a taxonomic gap between, for instance, the oscillating group and the rotary group because either it is not feasible to build an engine of some intermediate structure, or because if such an engine were built it would be less commercially viable than ordinary oscillating or rotary engines.

Returning to biology, then, one interprets the structure of classifications according to the steady state theory as a map of the physico-chemically feasible structures capable of supporting life. Some of the taxonomic gaps may represent totally unfeasible forms. Others, though, may be of relatively recent date—i.e. the taxonomic space might once have been occupied by organisms which were viable in a given environment

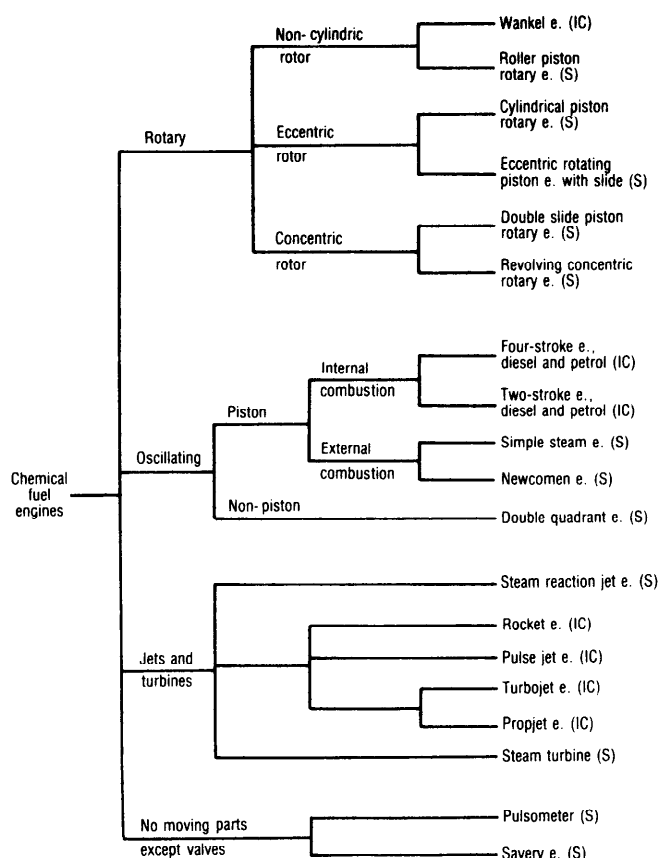


Figure 2. Natural classification of some chemical fuel engines. (IC) = internal combustion, (S) = steam, e. = engine.

but succumbed to competition in a changing environment; dinosaurs and dodos are examples.

In the steady state theory, the common embryological sequence (where there is one) leading to the various adult forms in a natural group merely represents the most efficient ontogenetic route to the structure which unites the members of the group. If we take the chordate body plan as one of the physico-chemically feasible structures able to support life, it is unlikely that there would be numerous different ways in which a single cell can convert itself into the adult chordate form. Even if there were numerous feasible ways, it is unlikely that all would be equally reliable or efficient, and in the competition between species the less reliable or efficient would be likely to succumb. So, the steady state theorist does not view the notochord or gill pouches as an indication of ancestry, but as a necessary part of the most efficient ontogenetic route to the adult structure in question. The facts of comparative anatomy, physiology and biochemistry usually quoted in support of evolutionism are all aspects of the same idea. For instance, the common pattern of pentadactyl limbs is to be interpreted as the product of the most efficient ontogenetic way of making a jointed limb with prehensile terminal appendages in a vertebrate body; and the detection of a given chemical only in members of one particular natural group of species leads one to expect that it is necessary to the function of the physico-chemical structure which the species share.

There is little to remark under the heading of distribution since most explanations already rely mainly on ecological and geographical assumptions, which are quite acceptable to steady state theorists, and the origin of species does not usually form an essential part of the explanation. The restriction of most marsupials to Australia is a case in point. Finally, natural selection research is quite acceptable to steady state theorists, in so far as the effects studied are no greater than intra-specific changes. The steady state theory denies, of course, that natural selection (or any other natural process) produces new species.

Cautionary Note on "Grandiose" Doctrines

A feature of Darwinism is its "grandiosity", by which I mean its wide coverage and the claim of many of its adherents that it is necessary for full understanding in taxonomy, palaeontology, comparative anatomy, biochemistry, embryology, study of distribution, ethology—in fact most areas of biology. In addition to this, there can be a strong hold on the imagination, so that many evolutionists simply cannot imagine any alternative way of thinking in these areas of biology. One school textbook puts it thus: "It is impossible . . . without doing violence to the evidence, to do otherwise than accept the *fact* of evolution."⁸ A non-evolutionist trying to imagine the state of mind in the author of that sentence may be excused for thinking that evolutionism can certainly get a tight grip on people.

If a comparably grandiose doctrine is needed in opposition to Darwinism, then either special creationism or the steady state theory is available. At this point, however, I wish to point out some dangers in dealing with grandiose doctrines in A-level teaching. It could be argued that the strength of the Darwinist orthodoxy is in part due to the theory's grandiosity. Quite apart from the stranglehold on the imagination—and I know from personal experience that even when intellectually prepared to consider alternative ideas, a person may find that a blocked imagination can be the greatest obstacle—the student is faced with a supposed "mass of evidence" in support of Darwinism. Even if the student queries the "evidence" from one class of phenomena, and thinks it is unconvincing, he is unlikely to feel free to cast off the whole theory because of the mass of evidence he thinks still resides in other areas of biology. It is surely up to us as teachers to prevent pupils and students getting into this situation; and in the present context, perhaps some "positive discrimination" is needed to counteract the mass of indoctrinatory school textbooks, exam syllabi, children's readers, encyclopedias, television programmes, etc. to which we shall still be subjected for some years at least.

The danger in making too much use of Darwinism and a comprehensive alternative to it may arise if students subconsciously come to believe that they have to think in terms of grandiose conceptions at school science level. If they are only presented with, say, two in biology (e.g. Darwinism and the steady state theory), they may feel that they have to choose between the ones they learn about. This would not be necessary, and would be a misleading approach to scientific method.

Far better, surely, for them to start off learning to hypothesize freely in relation to small sets of data, and to learn how to discriminate between small-scale hypotheses by the prediction and collection of observations. If grandiose doctrines are introduced, it should be made clear to students that, while free to believe in one if they wish, they are under no obligation to make such a commitment, now or later. It could also be suggested to them that very general theories may not correspond with the hypothetico-deductive model in the same way as small-scale hypotheses often do.

It is frequently claimed that Darwinism is central to modern biology;⁹ on the contrary, if all references to Darwinism suddenly disappeared, biology would remain substantially unchanged. It would merely have lost a little color. Grandiose doctrines in science are like some occupants of high office; they sound very important but have in fact been promoted to a position of ineffectuality.

Conclusion

The steady state theory is introduced in this article mainly as a sparring partner for Darwinism in teaching. However, the theory also merits serious consideration by those not engaged in teaching, quite simply because it might be true; and pursuit of the truth is thought by most people to be one of the main aims of science. We have no guarantee from any authoritative source that a theory to be true must be dramatic, entertaining, or fit in with our current conception of the structure and development of human society. So the simplicity of this theory is no guide to its truth or falsity. Nor is its degree of plausibility, where this psychological criterion may be largely determined by the theories we have been brought up to believe during childhood.

Perhaps we can hope that soon there will be no new school textbooks appearing whose authors consider Darwinism to be the only theory of the history of life to which pupils should be exposed.

Acknowledgements

I am grateful to Dr. Jeremy Greenwood, Department of Biological Sciences, Dundee University, and Mark Ridley, Zoology Department, Oxford University, for exercising their critical faculties on an earlier draft of this article. They are in no way responsible for the views expressed.

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(Editor's note.) While many readers of the *Quarterly* will disagree with the steady state theory, they will likely find some common ground, and thus find the theory of interest.

BELIEF—AND MORE

WILLIAM J. TINKLE*

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The scene is El Paso, where I was writing on our textbook on Biology. We are in a large room of the University of Texas, filled to its extent with people. At the invitation of students, Professor Harold Slusher is speaking on the Second Law of Thermodynamics. The attention and order are good but a professor attracts attention when he abruptly leaves the room.

In the question period at the close a student objects. "That's your belief; is it any better than ours?"

"Certainly it's better; it agrees with the Second Law of Thermodynamics." A question that might have made me stumble but Slusher made a strong point. We creationists do not choose a belief that sounds good to our

ears, but go along with the observed facts of the universe. The two laws of thermodynamics have been found to be true wherever they have been tested. Some might say that evolution is a basic law but in many cases it cannot be put to a test; no one has observed the first beginning of a plant or animal.

Many persons start their education with a belief that all life started very simple and developed very gradually; they study biology to understand how this growth took place. Thus evolution is basic in their minds and hard to displace even if not explained by any real evidence.

Mental Effect

Often the casting off of a true belief about the nature of the world has a damaging effect upon a person's

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character. Once I visited Prof. Slusher at his office and he told me about a student who could not logically keep his faith in God along with his science. I was glad he had come to the proper person for help, and later learned that his doubts had been allayed.

We face the following belief which is widespread: "The replacement of 'Will' by 'Chance' as mediator of biological change has transformed our view of man's relation to the rest of the universe."¹ Unfortunately this is the case in the minds of many people.

We need not give here a complete definition of science; but two prevalent attitudes should be noted. A: Science is founded upon observation or the results of experiment. B: Science is whatever a famous scientist says. It is easy to see that view A is much the more reliable; but even if we ourselves do the experimenting and observing, it simply becomes impossible to do it all. What is the surface of Mars like? What was the structure of the first animal in the world? We must rely upon our reasoning ability and our comparison of authorities for many of our ideas.

Belief Needed

Evolutionists charge that we overlook facts and rely upon faith; but in fact they depend upon faith fully as much as we do. We have faith buttressed by observation, the two working together in logic. A person with no faith is timid, unwilling to trust anybody. Read the writing of our opponents closely and you will see that they have an uncanny faith in both chance and time. The changes which we observe are various, they say, but more often work for good than for ill; and, given aeons of time, they work outstanding, improved developments. Marvelous faith! But the fact is, that without intelligent planning and loyal supervision, the tendency is in the opposite direction; it still takes planning and energy to make water flow uphill. This is the summary of the message of the Second Law of Thermodynamics.

No big, sturdy house is built without an architect, and he makes a clear plan before he starts; so it is with the world also. Let doubters cast their spears at teleology as much as they will, true science has nothing against it. The best research says that a gene is made up as a code of genetic matter, a different arrangement for each trait of a plant or animal; can you explain how this code was built up gradually by chance and natural selection? If this be the true method, increase our faith! Observing research indicates planning but evolution tells us this.

A Basis For Belief?

Another experience. As a young man I was working toward a degree in a university. The many students in beginning zoology were divided into classes of 35, each with an instructor and an assistant. I was one of the last position, having no teaching to do but helping with materials. The professor taught one class and met with instructors and assistants occasionally; not a bad organization.

At one such meeting the professor was giving instructions on teaching evolution. Caring more for logic than most professors, he said, "Don't teach evolution on a certain basis, that is founded on an assumption;" and he

ruled out one basis after another until one instructor asked, "Dr. B---. Why do you believe in evolution?" In an awesome silence Dr. B--- answered, "So that I won't have to believe in anything supernatural."

If we had closed the meeting at that moment, I doubt if I could have walked out of that room. Believe what you *want* to believe? Scientists are to believe what the *truth* forces them to believe and that is why we urge young people to study science. Am I spending so much time and money here to learn to believe my own preferences? Ah! but science is more than that.

When the instructor whom I assisted started on the evolution lessons she changed her method. No longer did she present types of success in nature and students form conclusions. Each tiny variation was a step in the universal change from a simple, accidental animal to the complex, successful types of today. Each tiny little thing different from the average was a proof that evolution did occur, even if it was not a helpful change.

Plan Needed

"One can only understand the essence of things when one knows their origin and development."²

Most people agree with this necessity of knowledge but there is still much disagreement as to what the origin was. At one time this disagreement was between theologians and scientists; now it is between two groups of scientists. After almost 17 years of the Creation Research Society we can see much progress and now a number of other groups have arisen with similar aims. It is easy to see progress since the following quotation was written: "The German Fuhrer . . . has consciously sought to make the practice of Germany conform to the theory of evolution."³ And the textbook which we wrote (mentioned at the beginning) is still much in demand. A third edition is being prepared.

Our Solution

In our teaching we do not say, "Evolution is a naughty word; we will avoid any mention of it." Actually, that word has caused such effect in the world that students should have historical knowledge of it. We teach both sides of the controversy and the student apprehends which side the instructor believes. Our experience has shown that those who observe the facts of nature and believe the logical reasoning associated with them are rewarded with strong and helpful characters.

When we ponder upon the intricate structure of living things and the unique mental power of man, then reflect upon the structure of the earth, how that earth is formed in such a way as to facilitate and nourish the activity of living things we can agree that the Being who made and is maintaining the world is evidently a Manager of magnificent wisdom and power. But we are inclined to say that we cannot understand how it is done; and then sometimes we say we don't believe what we don't understand; then it is time to stop and reflect.

We do believe many things that we do not understand; even how our food is digested and built into our bodies; lifeless matter into living protoplasm. However, if we see a process often we cease to question it and

(Continued on page 41)

THE SHRINKING SUN: A CREATIONIST'S PREDICTION, ITS VERIFICATION, AND THE RESULTING IMPLICATIONS FOR THEORIES OF ORIGINS

HILTON HINDERLITER*

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It is shown that the question: whence comes solar energy, has a connection, which might not be suspected at first, with the question of origins: did things evolve or were they created? In view of this, the fact, noticed only recently, that the sun appears to be contracting at a measurable rate, could prove to be a major scientific embarrassment for evolutionism.

Introduction

On January 25, 1977, I wrote to the editor of this journal, suggesting that (and giving reasons why) gravitational contraction of the sun was "something for creationists to look into".¹

On June 13, 1979, a paper was presented at the meeting of the American Astronomical Society, in which the authors—John A. Eddy (visiting scientist at the Harvard-Smithsonian Center for Astrophysics) and Aram A. Boornazian (mathematician with S. Ross & Co.)—concluded that:

"the Sun has been shrinking for a hundred years, and perhaps at least as long as 400 years", and, "The implication is that the Sun, and presumably other similar stars, could now be deriving a significant part of their energy from gravitational contraction".^{2,3}

Scientific understanding of the physical universe relies heavily upon the process of studying information gained from the natural world, constructing a theoretical framework from that information, and making predictions (based on the resulting theory) that can be tested by their comparison with data to be accumulated in the future. It is by the success or failure of such comparisons that hypotheses are validated or falsified. And the recently-discovered contraction of the sun allows for just such a comparison. In this case the competing theories are seen to be evolutionism vs. creationism, which predict quite different scenarios for the history of the cosmos. These, in turn, imply totally-different constraints on the sun's composition and behavior. But to understand the connection between solar contraction and the two different models of origins, we first need a little solar history.

History

With the realization, in recent centuries, of the magnitudes of the sun's size and radiant output, natural philosophers began asking the question, "By what means could the sun produce such a vast amount of energy?" Clearly the fireplace model (picturing the sun as a huge lump of coal) would not do; recorded history is of greater duration than would have been the glowing embers. So another explanation was sought. With the advent of Newtonian mechanics, the gravitational force made its debut. And close on its heels followed the concept of potential energy due to gravitation. Along with

conservation of energy, these formulations led to some new hypotheses:

One was that meteor-type material being gravitationally attracted to the sun supplied the requisite energy. The problem here, however, was that such a process would add to the total mass of the sun. Though this would amount to an imperceptible increase in the visual appearance of Old Sol, it would cause a measurable change in the length of the year (one which is not observed).

But around the year 1850, another theory based on gravitation was proposed: gravitational contraction (the sun shrinking, under its own weight)—suggested by Hermann von Helmholtz. His calculations (which involved assumptions about the solar system's origin which contemporary creationists would reject, by the way) showed that, if contraction had supplied the sun with energy, which was radiated at the present rate, the sun itself could be no more than tens of millions of years old.

Now it so happened that, at that time in history, many of those who had gained prominence in certain fields (especially geology and biology) were of the opinion that the earth was orders of magnitude older than any such figure; hence, down the drain went gravitational contraction (solely on the basis of a supposed age of the earth in billions of years)! This made for an obvious void, leaving no explanation for the sun's energy—until, about the turn of the century, radioactivity stepped onto the stage. Nuclear reactions are said to permit mass to be converted into energy (according to the famous $E=mc^2$). Though this, too, would require a change in the sun's mass, the amount of change would be so small as to cause only one-second's worth of increase in the length of the year in 15 million years (too small to be detected).

As the years went by, specific reactions were written out, whereby it was said that hydrogen in the sun fuses to become helium (the carbon and proton-proton cycles). Strong in the memory of my undergraduate days looms the content of a course I had on the subject of solar physics. The nuclear-fusion model had by then become so refined that astrophysicists claimed to understand in considerable detail just what was going on in the solar interior. That was, until last but certainly not least, entered the neutrino!

There is Nothing ν (Nu) Under the Sun!

To attempt to ascertain the conditions and reactions characterizing the solar interior in any direct way

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seemed next to impossible, since our knowledge was based solely on radiations emanating from the opaque surface of the sun (the photosphere). According to accepted models, energy from deep inside requires millions of years just to reach the surface. (From there, in contrast, electromagnetic radiations—including light—travel all the way to the earth in about 8 minutes.) But this seemingly-insurmountable hindrance to our acquisition of direct data from inside the sun was shattered by the discovery of a new particle.

The backbone of physics has been the conservation laws, of which energy, linear momentum, and angular momentum are notable varieties. Well, a certain type of radioactive disintegration, beta decay (β),⁴ seemed, about 1930, to defy all three of these conservation laws. (An example of beta decay is that by which the unstable nucleus of ^{14}C changes into ^{14}N , an electron being emitted. This reaction is the one involved in carbon dating.) These observations demanded a choice: either the most basic of the conservation laws were violated by beta decay, or else an additional particle was being emitted—one with just the right properties to balance the equations. These properties included a net electrical charge of zero, and a rest mass also essentially zero (but energy and momentum not zero). For this reason, the new particle was dubbed “neutrino” (ν), which means “little neutral one”. (Do not confuse this with the neutron, which, though also electrically neutral, is one of the massive components of nuclei.) An extensive theory developed for the neutrino, from which it was calculated that this particle was nearly beyond hopes of detection. For example, a neutrino has a 50-50 chance of passing through one-light-year’s thickness (6 trillion miles) of lead, without reacting! Or, considering passage all the way through the earth, only one neutrino in 10 billion would fail to make it; the rest wouldn’t even know the earth was there!

Such results led people to wonder whether neutrinos might forever elude efforts aimed at their detection. Detection is a formidable task, to be sure; but this worry was eliminated by 1956, when the existence of neutrino-type particles was experimentally demonstrated. In fact, it has by now been concluded that there are various types in the neutrino family, not just a singular “breed”.

To get back to the question of what’s happening inside the sun, neutrinos are the heroes of the plot, because the great majority of them barge right out unaffected. That they should be produced inside the sun was a requirement of the nuclear-fusion theory (which involved β -decay). So scientists constructed neutrino counters, with the expectation of chiseling in stone (i.e. proving once and for all) the validity of the nuclear fusion model, which had become by this time the universally-accepted explanation for solar energy.

Before ushering in the punch line, I should take the reader on a side excursion to deep, abandoned mines—for the sake of anyone who has read the literature, and wondered why in the world neutrino detectors should be located in such places. Given the great unlikelihood of neutrinos reacting with any detecting material (even 100,000 gallons of it), it is apparent that the number of neutrino events recorded will be very small. This means

that stray background interference (such as that due to cosmic rays) would be a serious cause of error in counting neutrinos from the sun. That is, unless one’s counter were shielded from these other radiations. And what better shield than a mile or more of earth? Remember that the neutrinos themselves pass through the earth like a mouse through a cat-family reunion—without stopping to say hello—so the encounter with terra firma leaves their numbers, for all practical purposes, undiminished.

The Experimental Results

So we are now caught up to the late 1960’s, sitting in an underground mine, along with 600 tons of cleaning fluid for a neutrino net; and the crucial question is, “How many are we snagging?” Ah (GULP), not nearly enough!⁵ A number of about 4 per month (which is barely above the limit of uncertainty for the experiment) sounds scanty; but, since we expected very few reactions in the first place, the telling tale is the comparison of this rate with that predicted from the accepted model of the sun. Even so, the number falls far short (at most, 1/10 the expected number). And these could as well be coming from other cosmic sources (The counter can’t be “aimed” to determine the direction of origin.). So we have facing us the experimental fact that hardly any neutrinos at all appear to be coming from the sun.

What does a scientist do when confronted by such a dilemma? First he double-checks every detail of the theory—the assumptions made, the parameters inserted—to see if something was overlooked. For more than a decade, now, the formulas have been turned upside-down (with even some attempts at bending them—as in the postulation of an unknown energy level in ^6Be), but still the paradox of the “missing neutrinos” remains.⁶

Call in the Shrink

What does all of this have to do with the shrinkage of the sun, anyway? To be blunt, solar contraction is the refreshing breeze that simply blows away the foggy dilemma. For, if a major part of the sun’s energy does after all derive from gravitational contraction, then there need be no appreciable amount of nuclear fusions taking place within the blazing orb—hence not nearly so many neutrinos (if any at all) would be expected to come from it. That so many of the “experts” were blinded to this simple solution is itself a paradox—one which betrays a bias to be dealt with shortly. But even after a decade of confrontations with the neutrino puzzle (all of which ended in failure), solar theorists still clung to the fusion model. For example, in April, 1978, Melvin Freedman of Argonne National Laboratory stated that, “The Sun is a main-sequence star that almost certainly derives its energy from the fusion of hydrogen to produce helium and energy”.⁷ The rationale which Dr. Freedman gave for this conclusion (namely, the age of the sun) leads us to the heart of this discussion, which involves the report of how I, personally, came to “tune in” to the neutrino mystery.

When I first ran across a report of the missing neutrinos (shortly after Davis’s discovery), the subject immediately attracted my attention—because of the con-

tradition it posed to the detailed, and supposedly-accurate story I had been told (in the solar physics course) about the sun. Then, in the spring of 1976, I became aware of something that I had been exposed to years before, but to which I had never quite paid attention. At the time I wasn't in search of ideas about the sun; I was just filling in the minutes between sessions of a faculty workshop at Argonne Lab, by browsing through a periodical published by their staff. It happened to contain an article about the neutrino paradox, which itself contained a brief history of theories of solar energy. And just a few words—words that I had read before, words that appear in most every basic text on astronomy—those few words in that article nearly sent me jumping out of my chair! “If gravitational contraction were the power source, the sun could only last about 50 million years: the sun's age is over 100 times that.”⁷ I thought to myself, “Hogwash! Is that the *only* reason why they discounted gravitational contraction??” For by this time I had done considerable study on the scientific evidence bearing on the age of the earth, solar system, etc.; and I had come to realize that the compelling force for the acceptance of vast ages was merely a faith in evolutionism, which itself has no evidential leg to stand on. (I assume that the readers of this journal are not so naive as to think that radiometric dating proves the earth to be billions of years old.⁸⁻¹¹) To me, the answer to the paradox was obvious: The scientific measurements discredited the nuclear-fusion model of the sun; but that was no problem, because its predecessor had been scrapped because of a scientifically-unsupportable predisposition to believe in what I call the “billion-year myth”. As far as data are concerned, gravitational contraction has been alive and well since the time of Helmholtz. And it was that conclusion which I communicated to Professor Armstrong in January, 1977.

At the time, I had no hopes at all of any contraction being measured directly. I supposed that the amount of shrinkage would be too small to be detectable during, say, an entire human lifetime. But I did wonder whether some indirect link might be found that could decide whether contraction might be the key to the sun's energy after all. Needless to say, my reading (in the summer of 1979) of Dr. Eddy's data and conclusions set me to talking to myself (in elated bewilderment) for an entire afternoon.

Defence Against Thermodynamics Disproved

(Continued from page 73)

Thus even the receipt of energy in the form of heat, and its subsequent giving out, cause no change in entropy, provided they be done reversibly. And, in particular, they certainly cause no decrease. Thus any appeal to open systems, as a way around the second law, is clearly useless.

References

- ⁸*Ibid.* pp. 210 and 211. The name “heat pump” is not used there; but the principle involved is stated: that of heating by refrigeration.
¹¹*Ibid.*, pp. 141-143.

Summary

There are still other surprises to be told about the sun; but in conclusion of this article, an important point must not be passed over. First of all, theories of origins, by their very nature, cannot be labelled as “scientific”;¹² but conclusions drawn from them can be tested against scientific data. Thus the credibility of a theory of origins depends crucially upon the success or failure of the predictions which derive from it. In the case at hand, evolutionism demanded a vast age for the sun, which in turn caused gravitational contraction to be ruled out as a major source of the sun's energy. On the other hand, creationism had no commitment to vast ages, hence it posed no objection to gravitational contraction. As it turns out, the contraction has actually been *observed* (the amount and character of same will be a future topic of discussion)—so, although it is a certainty that this measured contraction will be interpreted, molded, and generally tailored to fit into the vast-ages scenario (after the fact), it is clear that we have witnessed a *major scientific defeat for evolutionism*—as we have seen its vital organ (the billion-year myth) persuading astrophysicists to reject the possibility of solar contraction, even after scientific measurements (namely the neutrino count) suggested that the nuclear-fusion route was a blind alley. To sum it up: this is just one more situation in which the belief in evolutionism has proved a mental roadblock to true scientific progress!

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¹²Morris, *op. cit.*, p. 4.

ELECTION RESULTS

In the annual election, held earlier this year, the following persons were elected to the Board of Directors for a term of three years, 1980-1982.

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

SOLAR NEUTRINOS AND A YOUNG SUN

PAUL M. STEIDL*

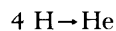
Received 18 October, 1979

The failure to find solar neutrinos which should be a result of hydrogen fusion reactions in the sun indicates that the sun is young. Further, the solar global oscillations preclude the existence of fusion at all. The only viable alternative, gravitational contraction, which has a comparatively short time span, is indicated by actual observations of a decreasing solar diameter.

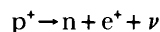
The well-known solar neutrino problem has been with us since 1968 and shows no signs of going away. Though many dozens of explanations have appeared, none has been satisfactory. The reason is that all scientists have approached the problem with uniformitarian presuppositions. When the problem is examined more objectively, it becomes obvious that the lack of solar neutrinos is almost irrefutable evidence for a recently created sun.

The single most important assumption in all of astrophysics is that the source of energy in stars is nuclear fusion, primarily the conversion of hydrogen into helium. All of stellar evolution theory depends entirely upon this assumption, and with it, most of the rest of astrophysics. Yet the actual occurrence of nuclear fusion in stars has never been verified. It has become accepted as dogma simply because it is the only conceivable process which could provide energy for the billions of years which stars are believed to have existed. Simple chemical burning would last for only about 5,000 years, and gravitational contraction can provide energy at the present solar luminosity for a mere 20,000,000 years. But nuclear fusion, because of the high mass defect of helium (about 0.7%) has the potential of providing immense amounts of energy, about 6.4×10^{18} erg/gram. This is adequate, if the entire mass of the sun were converted into helium, to keep it burning at the present luminosity for about 100 billion years. But because conditions for fusion are believed to exist only in the inner 10% of the mass of the sun, its main sequence lifetime would be limited to 10 billion years.

The basic reaction is believed to be



where only the nuclei are considered. Since the hydrogen nucleus is a single proton and the helium nucleus, or alpha particle, consists of two protons and two neutrons, it is necessary for two of the hydrogen nuclei to be converted, via beta decay, into neutrons. Charge conservation requires that a positron be produced to carry away the proton's positive charge, while lepton conservation requires the production of a neutrino.



The sun is extremely opaque to all forms of electromagnetic radiation which might arise in the interior due to nuclear reactions. Harwit says, "The overall structure and appearance of the star can therefore give no clue about whether nuclear reactions indeed are responsible for stellar luminosities."¹ Neutrinos, on the

other hand, being neutral and massless, have an extremely small cross section for interaction with matter, and should escape freely from even the center of the sun if they are being produced there. If such neutrinos could be detected on Earth, it would be a strong indication that nuclear fusion is indeed taking place in the sun.

The Search for Solar Neutrinos

In the 1960's Raymond Davis undertook an experiment to detect these solar neutrinos. Though the cross section for interaction with matter is small, the neutrinos ought to be produced in such copious numbers that a measurable fraction should be detectable. Years before Davis began his experiment, Cl^{37} was suggested as a target for detecting neutrinos. In the rare instance when a neutrino interacts with a Cl^{37} nucleus, it is transformed into an Ar^{37} nucleus. This isotope of argon is radioactive with a half-life of 35 days.² The neutrino energy threshold to initiate the reaction is 0.814 MeV, so any solar neutrinos must have at least this energy to be detected.³

To learn what neutrino energies and fluxes are expected, we have to examine the proposed energy mechanisms in the sun as assumed in current solar models. The total number of neutrinos which the sun should be producing is easily calculated from the known solar luminosity, $L_{\odot}$, and the mass defect of the helium atom (equivalent to the total energy released for each helium atom, and thus for each two neutrinos, produced). So there should be $2L_{\odot}/26.2 \text{ MeV} = 19.0 \times 10^{37}$ neutrinos/sec. Here $L_{\odot}$ is 4×10^{33} erg/sec and 26.2 MeV are released per helium atom.⁴ At the Earth's distance from the sun, 1 AU, this is $19.0 \times 10^{37} \nu/\text{sec} / (4\pi (1 \text{ AU})^2) = 6.7 \times 10^{10} \nu/\text{sec} \cdot \text{cm}^2$. A convenient unit has been established for expressing the neutrino capture rate. This is the Solar Neutrino Unit, or SNU, and is equal to 10^{-36} neutrino absorptions per target atom per second.

However besides the flux of neutrinos, we need to know their energy distribution, because not all neutrinos will be able to initiate the detection reaction. The energy distribution of neutrinos depends upon the process which produces them. A number of variations of the simple hydrogen to helium fusion reaction are known and it is believed that all play a role in solar energy generation to a greater or lesser extent. The amount of participation of each branch, or variation, depends sensitively upon temperature and chemical composition. The reactions are summarized in Table 1. The two major classes of fusion reaction are the CNO bi-cycle and the proton-proton chain. The CNO bi-cycle is thought to require higher temperatures than exist in

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the solar core; and therefore it proceeds only slowly. Each variation, however, produces neutrinos of sufficient energy to be detected, more so, in fact, than the proton-proton chain which is expected to predominate in the sun. Therefore a high neutrino capture rate would be expected if the CNO cycle were at all important in the solar energy scheme. The low detection limits, which we shall examine presently, definitely eliminate this cycle from being an important energy source in the sun.

The proton-proton chain, because it may occur at lower temperatures, is thought to be the dominant fusion reaction in the sun, where the central temperature is thought to be 15 million degrees Kelvin.⁵ Table 1 shows all three branches of the proton-proton chain. All have the first stages in common—fusion of two hydrogen nuclei into a deuterium (heavy hydrogen) nucleus via beta decay; and further fusion with a third hydrogen nucleus to produce He³. Here they diverge, and the divergence is extremely important. Either two light helium nuclei will fuse into an alpha particle (normal helium nucleus) or a He³ nucleus will fuse with an He⁴ nucleus. In the former case, the reaction is over, since a new He⁴ has been produced with the accompanying release of two of the original hydrogen nuclei. In the latter case the two helium nuclei fuse into beryllium which proceeds to take one of the other two possible branches.

Table 1. This shows the various reactions by which the fusion of hydrogen is believed to take place in the Sun

Process	% taking this branch	Neutrino Energy (MeV)
Proton-proton Chain		
$H^1 + H^1 \rightarrow H^2 + e^+ + \nu$ OR $H^1 + H^1 + e^- \rightarrow H^2 + \nu$	99.75	0.42 1.44
$H^2 + H^1 \rightarrow He^3 + \gamma$ I. $He^3 + He^4 \rightarrow He^4 + 2 H^1 + 6$ II. $He^3 + He^4 \rightarrow Be^7 + \gamma$ $Be^7 + e^- \rightarrow Li^7 + \nu$ $Li^7 + H^1 \rightarrow 2He^4$	14	0.861 (90%) 0.383 (10%)
III. $He^3 + He^4 \rightarrow Be^7 + \gamma$ $Be^7 + H^1 \rightarrow B^8 + \gamma$ $B^8 \rightarrow Be^{8*} + e^+ + \nu$ $Be^{8*} \rightarrow 2He^4$ CNO bi-cycle	0.02	14.06
$H^1 + C^{12} \rightarrow N^{13} + \gamma$ $N^{13} \rightarrow C^{13} + e^+ + \nu$		0.71
$H^1 + C^{13} \rightarrow N^{14} + \gamma$ $H^1 + N^{14} \rightarrow O^{15} + \gamma$ $O^{15} \rightarrow N^{15} + e^+ + \nu$		1.00
$H^1 + N^{15} \rightarrow C^{12} + He^4$ OR $H^1 + N^{15} \rightarrow O^{16} + \gamma$ $H^1 + O^{16} \rightarrow F^{17} + \gamma$ $F^{17} \rightarrow O^{17} + e^+ + \nu$		0.94
$H^1 + O^{17} \rightarrow N^{14} + He^4$		

Table 2. This shows the fluxes, and rates of capture, of solar neutrinos due to the various processes. These data are as in Reference 2, p. 40.

Neutrino Sources and Energies (MeV)	Flux on Earth ($cm^{-2} sec^{-1}$)	Capture Rates in Cl ³⁷ in SNU's
$H + H \rightarrow D + e^+ + \nu$ (0 - 0.42 MeV)	6.1×10^{10}	0
$H + H + e^- \rightarrow D + \nu$ (1.44 MeV)	1.8×10^8	0.26
Be ⁷ decay (0.86 MeV)	3.4×10^9	0.99
Be ⁸ decay (0- 14 MeV)	3.2×10^6	4.32
O ¹⁵ decay (0- 1.74 MeV)	1.8×10^8	0.14
N ¹³ decay (0- 1.19 MeV)	2.6×10^8	0.05
	Total	5.8 SNU's

This is dependent upon the existence of helium-4 already in the solar core. The first branch, the fusion of two He³ nuclei, does not produce any neutrinos and is taken by 86% of all fusion reactions. The second branch, taken by almost all the remaining reactions, produces neutrinos with marginally detectable energies. The third branch, though taken by only 0.02 of the fusion reactions, produces highly energetic neutrinos and makes the largest contribution to the neutrino flux which should be detectable with chlorine atom detectors.⁶ The contributions of the various branches to the total flux at the Earth as well as the actual expected capture rate are shown in Table 2.

As a detector Davis chose the common cleaning fluid perchloroethylene, C₂Cl₄. This has the advantages that it is cheap, available, and contains a high proportion of chlorine atoms. To get enough of this in one place and then to isolate it from background radiation whose effects could swamp the minute effect of the solar neutrinos is a formidable problem. Davis filled a tank with 100,000 gallons of this fluid and put it at the bottom of the Homestake gold mine in Lead, South Dakota, 4850 feet underground. The great depth isolates his target from most of the secondary cosmic rays which could also cause the chlorine to argon reaction and confuse the results. Even at this great depth, however, the lower limit of Davis' detector is 0.4 SNU's because of the cosmic rays which penetrate nearly a mile of rock.⁷ Natural radiation from the rock walls of the cavity where the tank is placed can also initiate the reaction. This can be nearly eliminated, however, by flooding the chamber with water.

The chlorine atoms, when converted to argon, are released into the liquid as a dissolved gas. They are recovered by bubbling helium gas through the tank. The helium picks up the argon atoms. They are later separated by cooling the gas in charcoal cooled to liquid nitrogen temperatures. The argon atoms are absorbed onto the charcoal and the helium is returned to

the tank. After the argon is removed from the tank, the argon atom decays are counted for at least 150 days. The counts are quite low, typically 5 to 10 counts above background during a 70 day period.⁸

The first solar model formulated with the intent to predict the expected number of solar neutrinos was that of Sears in 1964. His parameters included an assumed age of 4.5×10^9 years and predicted a neutrino flux of 36 SNU's.⁹ Further improvements in solar models continually lowered the expected flux to 22 SNU's in 1968. In the same year Davis' experiment set an upper limit to the solar neutrino flux of 3 SNU's.¹⁰ The discrepancy is large, and despite constant revisions to solar models, persists to this day. Davis presents an expected flux of 5.8 SNU's,¹¹ while Bahcall has a model with 4.7 SNU's.¹² Meanwhile, Davis has improved his upper limit. His signal amounts to 0.24 ± 0.09 Ar³⁷ atoms per day which amounts to 1.3 ± 0.4 SNU's. However he states, "We do not regard this result as a measurement of the solar neutrino flux because of uncertainties in various background effects."¹³ Thus we can conclude that no signal at all has been conclusively detected from fusion processes occurring in the sun.

Proposed Explanations of the Lack of Solar Neutrinos

Besides possible experimental problems, which we shall discuss shortly, there are two possible explanations: 1) no nuclear reactions are taking place in the sun; or 2) the third branch only of the proton-proton reaction is not occurring as expected. Possibility number one, that no nuclear reactions at all are occurring in the sun, is the explanation which I shall present as the correct one later. However let us first examine the ramifications of the second possibility. From Table 1 it can be seen that the occurrence of the third branch of the proton-proton chain is dependent upon the presence of He⁴ already in the solar core. If this amount is really different (i.e. lower) than anticipated, then the energetic neutrino flux should be lower. Thus the assumed amount of He⁴ in the solar core is critical in determining the expected neutrino flux.

Scientists assume that the He⁴ in the sun has come from two sources. The first is primordial helium, created, supposedly, in the big bang. This is mixed with hydrogen throughout the universe in the approximately constant proportion of about 30% by mass. Besides this is the end product of the nuclear fusion itself. If hydrogen has been burning into helium for 4.5 billion years, the helium should have been building up in the core for that length of time. If the sun is younger, there will be less helium than allowed in the current solar models, and consequently a lower neutrino flux.¹⁴ Bahcall and Sears¹⁵ present a formula illustrating the dependence of neutrino flux upon a variety of parameters. The age dependence is

$$\phi \text{ (flux)} \propto \left[\frac{\text{Age}}{4.7 \times 10^9 \text{ yr}} \right]^{+1.4}$$

Using Davis' measurement of 1.3 SNU's, this formula implies an upper limit for the age of the sun of 1.6×10^9 years.

Of course there are other factors in Bahcall and Sears' formula, including luminosity, metal abundances and various reaction cross sections. However most of these are constrained by direct measurements to values which cannot allow the neutrino flux to decrease adequately to explain the lack of neutrinos. Age is also considered well known and to be within a few percent of 4.5×10^9 years. This in turn is based upon a number of uniformitarian assumptions which have been dealt with in numerous other articles in this journal. The absence of solar neutrinos in the anticipated numbers is strong evidence for the youth of the sun.

Alternate explanations are not lacking, however. Since simply varying the relevant parameters cannot reduce the expected neutrino flux adequately, more exotic changes are often proposed. There are also those who maintain that the experiment is at fault. This seems unlikely, since the experimental apparatus is subject to direct testing. Argon recovery is not at fault since small amounts of argon were introduced into the tank and successfully recovered. Also, the conversion of chlorine to argon was induced by placing a neutron source inside the tank and all expected argon was efficiently recovered.¹⁶ Cross sections for the neutrino interactions have been checked and rechecked, both experimentally and theoretically, and there is little likelihood that they are incorrect.¹⁷

Possible verification of the ability of the apparatus to detect neutrino-induced argon is found in one run, number 27, where an anomalously large (compared to other runs) number of argon atoms were produced. In fact this single run contributes significantly to the 1.3 SNU average presented earlier. Davis attributes this to statistical variations,¹⁸ but John Bahcall presents an intriguing speculation. He suggests that this run may have actually detected neutrinos from the collapse of a star which was not detected optically. If true, this indicates both that the experiment functions correctly, and that neutrinos are stable over long time periods, eliminating the suggestion that Davis' negative results could be attributed to the decay of solar neutrinos en route to the Earth.¹⁹ Of course this idea may be incorrect.

It is considered more likely that the problem lies within the sun. Some of the many suggestions are:

1. The initial helium abundance Y was less than 0.16-0.20²⁰
2. Unexpected large errors exist in one or more of the relevant nuclear cross sections²¹
3. One or more of the neutrino absorption cross sections has been significantly overestimated²²
4. The sun was initially inhomogeneous and remained so²³
5. Significant mixing of the solar interior has occurred during the nuclear burning phase²⁴
6. Strong, large-scale magnetic fields of up to 10^9 gauss exist in the solar interior²⁵
7. The gravitational constant, G, increases with time²⁶
8. The interior opacity may be lower than expected²⁷
9. The core is in a transient state and is not currently producing neutrinos²⁸

10. A black hole at the center of the sun with a mass of 10^{-5} of the solar mass, $M_{\odot}$, could produce half the sun's luminosity²⁹
11. The sun could have formed in two phases, the inner half having a high metal abundance and the outer layers having a low metal abundance³⁰
12. There is a departure from the Maxwellian velocity distribution at high energies³¹
13. There is a critical temperature below which hydrogen and helium are immiscible³²
14. The sun has substantial amounts of He^3 so that the principle energy source is He^3 (He^3 , $2p$) He^4 ³³
15. There are competing nuclear reactions which tend to reduce the amount of B^8 produced³⁴
16. There is a variation in the strength of the weak interaction with increasing gravity³⁵

Obviously, many of these suggestions are quite fanciful, and none is entirely satisfactory. Perhaps the most popular one, though one of the most general, is number 9, which simply says that for one reason or another, the sun is temporarily turned off. There is no need to discuss these suggestions one by one. It is sufficient to note that none is considered adequate, there is little independent evidence for any, and the problem persists.

Maybe there is no Fusion in the Sun

Thus the near absence of solar neutrinos alone is enough to indicate that the sun is considerably younger than usually assumed. But, as I mentioned earlier, I plan to take an even more radical position and will argue that there is no nuclear fusion occurring in the sun at all. If this is true, the age of the sun will be limited to the maximum time provided by an alternate energy source, necessarily very much less time than would be provided by nuclear fusion.

Davis' average solar neutrino flux is 1.3 ± 0.4 , including run #27. If this is excluded, using Davis' data,³⁶ the value is 1.0 ± 0.4 . From Table 2 the expected neutrino flux from fusion processes *other* than branch three of the proton-proton chain is 1.48 SNU's. Thus the observed flux is so low as to eliminate not only the Be^8 reactions, but others as well. When this is added to Davis' statement that he does not regard the 1.3 SNU's as measurement of the solar neutrino flux, there is little reason to believe that nuclear fusion of any kind is taking place in the sun. Certainly nuclear fusion would be as good a source of solar energy as any other; any source that could provide energy for more than about 10,000 years would be satisfactory within the creationist time frame. But the evidence is against fusion, and this is in our favor, for no other energy source could provide energy as long as 4.5 billion years. The sun is surely younger than its accepted (uniformitarian) age.

But there are other reasons as well for thinking that the sun's energy source is other than nuclear fusion. One is the relatively recently discovered global oscillations of the sun. Henry Hill and his associates were attempting to measure the oblateness of the sun in an attempt to distinguish between different versions of the general theory of relativity. They did not measure the

oblateness, but they did detect that the sun is oscillating or ringing like a bell in several different modes.³⁷ The numerous periods range from 5 to 300 minutes. There are two reasons why this observation is relevant to the solar neutrino problem. The first has to do with energy transport. The temperature gradient in the sun is computed on the basis of energy transport by radiation. High energy photons produced by fusion reactions are absorbed and reemitted countless times as they diffuse towards the surface. It is said that energy transported in this way would take 30 million years to reach the surface, the sun is so opaque.³⁸ Because of this extremely high opacity, the temperature gradient in the sun is high, causing the sun's center to be at 15 million degrees, if the current models are correct. If, however, the acoustic waves are real, they also could transport energy and very rapidly. The effective opacity to energy transport is much reduced and therefore so is the temperature gradient. This allows a lower central temperature in the sun. Since the rate of nuclear reactions is so extremely temperature-sensitive, the decrease in temperature would be enough to reduce the third branch of the proton-proton chain enough to make its neutrinos below the threshold of detection.

This may sound like a point in favor of the evolutionists, for is the neutrino problem not solved by this discovery? Hardly. While it is true that under the right conditions the lack of solar neutrinos could be solved by the acoustic waves, the waves bring up a problem which is just as bad, which brings me to the second reason for mentioning the solar oscillations. The 2 hour 40 minute oscillations are too long to be ascribed to the surface layers of the sun. The best explanation is that they are radial pulsations involving the entire sun, and the period is consistent with the sun's being a homogeneous sphere!³⁹ This leads to a central temperature so low that nuclear fusion is almost nonexistent.⁴⁰ Thus solar oscillations solve the solar neutrino problem by not only reducing the temperature so that fewer neutrinos are produced, but to such an extent that nuclear fusion itself is effectively eliminated. Severny *et al.* estimate that the luminosity due to nuclear fusion would be about 2.5×10^{29} erg/second⁴¹ or only 6.25×10^{-5} of the observed luminosity.

If not Fusion, then What?

What, then, is the energy source of the sun? Before the arrival of the nuclear fusion theory, several mechanisms were advanced, most of which were incorrect for obvious reasons. The most successful was that of Hermann von Helmholtz. He postulated that the contraction of the sun was sufficient to supply its entire luminosity, the energy being derived from its gravitational field. This process would keep the sun shining for about 20 million years into the past if the sun were assumed to have started from a cloud with infinite radius.⁴² Certainly this is more than enough for creationists. Ley objects to this mechanism, in addition to the limited time period, by pointing out that solar contraction should be measurable.⁴³ The approximate magnitude of this change is easily calculated. Using Novotny's formula for the energy release of the sun as it shrinks from R to R_0 ⁴⁴

$$E = -GM^2 \left(\frac{1}{R_0} - \frac{1}{R} \right)$$

setting E equal to 4×10^{33} ergs (the energy released by the sun per second), and solving for R gives a shrinkage of 2.9×10^{-4} centimeters per second, or about 10,000 cm per year. At the sun's distance this amounts to 1.4×10^{-4} seconds of arc per year, or 0.014 seconds per century, definitely too small to be measurable.

But we have by no means reached the end of this possibility. In a paper presented to the American Astronomical Society in June, 1979, John A. Eddy and Aram A. Boornazian announced that the sun is shrinking at a rate of 2 seconds of arc per century.⁴⁵ This is considerably more than the amount required to produce all the sun's luminosity. Since this is so much larger than the requisite amount, it implies that the whole sun is not shrinking uniformly, but more likely, it is only the outer layers which are involved. This amounts to about 5 feet per hour in the horizontal direction and about half that vertically. The announcement was the result of solar diameter measurements recorded over the last 143 years, and they speculate that it may have been going on longer. Of course they do not allow the possibility that it has been going on for more than a few hundred years, since this would totally dethrone stellar evolution. Rather, they consider it a temporary phase.

However, they admit that the energy produced by this contraction is adequate to make up for the amount which apparently is not being produced by fusion; and, as we saw, this is nearly 100%. Thus it is not unreasonable to suppose that this contraction is responsible for the entire solar luminosity, and has been from the time of creation. In the last 10,000 years, the entire shrinkage of the sun would amount to 1.3×10^5 kilometers, or a little less than 10% of the sun's present diameter.

Another study shows a somewhat smaller rate of decrease. Sofia *et al* gives a shrinkage value of 0.2 arc seconds per century,⁴⁶ a factor of ten smaller than Eddy's measurements, but still a factor of 10 larger than the amount necessary to supply the sun's entire luminosity. The difference appears to be due to the way in which the data were selected. Nevertheless, both agree that the sun is shrinking, just as would be expected from the Helmholtz model.

There is one final consideration. What if Eddy is right in saying that the shrinkage is only temporary, and that in the long run nuclear fusion is the real solar energy source? Is there any way to tell? Yes. At the NATO Advanced Study Institute on The Origin of the Solar System, A. G. W. Cameron presented a paper in which he calculated that if the sun had contracted from a gas cloud, and material fell inward to form a core with the present density, the temperature would have only reached one million degrees Kelvin! This is far too low for any nuclear reactions to take place.⁴⁷ Thus if the sun had formed according to an evolutionary process, nuclear burning could never have been initiated.

Conclusion

The evidence is clear. If the sun had formed as is assumed by most scientists today, nuclear fusion could

never have become its energy source. Evidence from the solar neutrino experiment, global solar oscillations, and measured solar shrinkage all are strong evidence against the existence of nuclear fusion in the sun. Any alternate energy source necessarily means a shorter maximum lifetime, 20 million years at most for contraction, and apparently less at the present high contraction rate. Therefore, as the Biblical creation account tells us, the sun is a young object.

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THE CANOPY IN WORLD MYTHOLOGY

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For many years creationists have seen in the numerous ancient legends of a global deluge evidence of a circumstantial nature for the flood of Genesis. It has not heretofore been pointed out, however, that similar testimony exists for a "water heaven" such as that described in Genesis 1:6-8. This suggests another line of confirmation of the vapor canopy theory. In this article an attempt is made to summarize this anthropological evidence for the vapor canopy from various legends all over the world.

The science of cultural anthropology has added some possible evidence for the existence of the pre-flood celestial ocean. In nearly every culture there is an account of a great flood which inundated the earth and destroyed all mankind. In these stories a man or a family or a couple, etc., were saved by a canoe, an ark, or by climbing a mountain. In many of these accounts there are references to a climatic regime and even to a water heaven that offers striking parallels to the Genesis record. Evidence of this kind must be handled with care, and not too much can be made of it. However, where once the trend in these kinds of studies used to be to write it all off as primitive myth, now there is growing recognition of a possible historical basis that gave rise to these myths. Opinions differ and nothing can be said with certainty, but the evidence found in these myths is so widespread and so similar to Genesis that it seems appropriate to give it brief comment. It must be remembered, however, that this evidence is not the basis for belief in the pre-flood canopy or in the fact of the global deluge. That evidence rests primarily on the Biblical statements. These myths can be viewed as offering a possible supplementary confirmation.

Assuming the reliability of the Biblical account, one can give a quite plausible explanation of the origin of these stories. Obviously, in the years following the flood, Noah and his sons would have shared the events of that fateful year of the deluge many times with their children. They would have often drawn attention to the differences between conditions that existed in the pre-flood world and those of their generation. The decreasing longevity would have caused alarm and comment. When their children asked, "What was it like before the flood", their answers would have been remembered, and in time taken worldwide by successive generations. In the process, the stories would have been mythologized, distorted, exaggerated, added to, modified, etc., until the original became only a faint memory. In the following pages, some of these "cultural memories" of an antediluvian water heaven will be analyzed. These do not represent eyewitness accounts, but reports passed on through Shem, Ham and Japheth to their posterity.

The most comprehensive compilation of global flood stories is that by Sir James George Frazer in his three-volume *Folk-Lore in the Old Testament*.¹ He cites evidence of flood accounts from the Indians in North America to the Indians of India. Hawaii, Alaska, Indonesia, Europe, Asia, Australia, and Mesopotamia all have flood accounts. Needless to say, as the tribes

migrated farther and farther from Ararat, the stories became more and more distorted. In fact, this point has been carefully documented by John Montgomery.² This impressive evidence would seem to substantiate the view that these stories *do* have a common origin and are not exaggerated tales of local catastrophes, as some have maintained.³

The Canopy in Ancient Mythology

After an analysis of numerous mythological accounts of the ancient earth, Kellogg concludes that many of them tell of a visible water heaven, scintillating with light.⁴ This heaven was the home of the gods, and it obstructed the power of the sun god. One day this water heaven was banished, and the sun came riding through as the conqueror of heaven and master of the wind and rain. One who believes the Biblical account of primeval vapor canopy is tempted to see ancient allusions to the new burst of "sun power" that was undoubtedly unleashed when the canopy condensed during the rainfall of Noah's flood. The ancients took this as the victory of the sun god over the watery heaven. Isaac Vail noted a similar theme in many myths:

We will find the ancient heaven represented as a screen. We will find the sun concealed—a slave or subaltern to an overmastering power; you will find the sun finally exalted through elemental conflict with Titan and Giant vapor, or tempest enemies, into immortality.⁵

It is interesting that many of the words for "heaven" in ancient manuscripts in some cases seem to have an etymology that suggests the idea of a celestial ocean. For example, in Akkadian and Arabic, the cognate words for "heaven" are used by metonymy to mean "rain". In this mythology it refers to the upper part of the cosmic ocean which enveloped the earth and is made of water.⁶ The Greek word for "heaven", *ouranos*, is probably derived from *ou*, "there", and *raino*, "to sprinkle"; hence, the "there waters".⁷ Interestingly, it was located above the ether, or upper, air.⁸ Thus, it parallels the Hebrew idea of waters *above* the expanse and not *in* them. The phrase is often found in the Orphic writing of the cosmic egg which bursts open. The upper shell became the envelope of the world.⁹ In Homer, a brazen, iron, starry heaven, resting on pillars, served as the habitation of heavenly beings.¹⁰ In the Magic Papyri, too, the term *ouranos* is common: as the firmament which includes the heavenly ocean.¹¹ Some have seen the etymology of the Hebrew word, *Shamayim*, as coming from *sham*, "there", and *mayim*, "waters". Hence, like the Greek *ouranos*, we have again

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the "there waters".¹² Others feel this Hebrew etymology is erroneous.¹³

Eastern Asia

Numerous accounts of a flood and of a celestial vault are reported from this area. The Karen of Burma, for example, believe that the water of the great flood came down from the "celestial vault".¹⁴ This seems to be an idea similar to the celestial ocean held up by a metallic dome found in other myths.

Babylon

In the Babylonian creation account, *Enuma elish*, there are a number of references to a celestial ocean. As the story goes, Marduk went to war against the Babylonian chaos monster, Tiamat, the salt water ocean. In this account, there are three types of water. Apsu represents the sweet water ocean, Tiamat the salt water ocean, and Mummu the fog, the mist and the clouds which rose from Apsu and Tiamat and hovered over them. Thus Tiamat was considered the primeval ocean which surrounded the universe, while Apsu is the subterranean waters that fed the springs and rivers.¹⁵ Possibly Apsu is paralleled by the waters of the deep in Genesis 7:11 that supplied most of the water for the flood. When Marduk overcame Tiamat, he cut her body in half vertically. With one half of her body he formed the earth and with the other half he formed the sky (*Enuma Elish*, IV:138). Thus, half of the primeval ocean is now up in the sky! This seems to parallel the "waters above the firmament" motif of Genesis. After this water was placed in the sky, a crossbar was fixed and guards were posted and commanded to prevent the celestial waters from escaping (IV:139; see IV:128-145, the "windows of heaven" of Genesis 7:11?). Marduk used these waters to construct the sky. They had to be prevented from falling back to earth.¹⁶ The text reads:

He cleft her (Tiamat) like a fish, in two halves;

From the one half he made and covered the heaven.¹⁷

In Babylonian parallel to the Biblical flood account, *The Gilgamesh Epic*, there are a number of references which, when viewed in the light of the Genesis record, have some interesting implications. Genesis speaks of the flood being caused by the break-up of the fountains of the deep and by torrential rains. In *The Gilgamesh Epic*, "the land he broke like a pot" (the break-up of the fountains of the deep?)¹⁸ Furthermore, torrential rains and destructive winds (the "great wind" of Genesis 8:1?) accompanied by lightning and thunder are the cause of the flood (XI: 96-131). Dikes, canals, and reservoirs burst open (XI: 90-131).

A Buddhist Account

The Buddhist account of creation involves a vague and confusing reference to a "creative cloud" from which poured the waters which began to rotate in a "water circle". Out of this came the earth.¹⁹ This creative cloud began to pour out gold, water, precious stones, iron, etc., onto the earth. Thus, they seemed to have conceived the early earth as covered by some kind

of vaporous cloud canopy. It is not difficult to conceive of a vague memory of the "waters" above narrated by Noah's sons.

Egypt

In ancient Egypt, the heaven was regarded as an ocean parallel with that on earth.²⁰ The sun god traveled in a barge through this ocean which "surrounds the world".²¹ This watery heaven was the god *Canopus*. His symbols were a water vase and the serpent. His very name is a memorial to the vapor canopy.²² According to the legend, in the beginning only ocean existed upon which appeared an egg, out of which issued the sun god. From himself he begot four children: Shu, Tefnut, Geb, and Nut.²³ Nut was the sky goddess. In primordial times, she was embraced by the earth god, Geb, until Shu, the god of the atmosphere, separated them by elevating Nut high above the earth and placing himself beneath her.²⁴ In a modified version, Re, the sun god, sprang from the union of Geb and Nut. He travels by day across the celestial ocean in a boat.²⁵ When night comes, he transfers to another boat, descends to the netherworld and continues his voyage. In the account of Shu and Tefnut, the atmosphere, thrusting themselves between Geb and Nut and raising Nut into the heavens, we have an obvious reference to the separation of the waters below the expanse from the waters above the expanse of Genesis. The Egyptians received the story from Noah's sons through many generations and recounted the reference to a literal liquid water ocean above the atmosphere.

Greece

The myths of Hellas have captivated the imaginations of men for centuries. Perhaps none of them is more moving than the majestic epic poetry of Hesiod. Born in 846 B.C., this farmer-turned-poet composed many poems, among which his *Theogony* is most famous. In it he gives the readers a "Genealogy of the Gods".²⁶ In the beginning, Hesiod says, was Chaos, and the *Theogony* traces the development from chaos to cosmos just as the Biblical account in Genesis does.²⁷ From Chaos was born Erebus ("misty", "black Night"); and from the black Night (Erebus) came Aether and Day. Aether is the "bright, untainted upper atmosphere, as distinguished from Aer, the lower atmosphere of the earth".²⁸ Above the Aether was Ouranos (Heaven). As pointed out above, this heaven may be etymologically derived from "there waters". At any rate, in the Magic Papyri the term *ouranos* is common for the firmament which includes the heavenly ocean.²⁹ Ouranos or Uranus,³⁰ mated with the earth and she bore the Titans, one of which was Cronos.³¹ Cronos is *not* the god of time as is popularly conceived.³² His precise nature is unclear, but he prevents his father, Ouranos (the "water heaven") from ever mating with his mother again by castrating him. Uranus is no longer mentioned in Greek mythology as a god to whom worship is ascribed.³³ This enforced separation between Ouranos and the Earth seems to parallel the battle between Marduk and Tiamat. The castration would suggest the conquest of Tiamat, her being cut in two, and her restraint up

above the firmament. Thus, when Cronos comes to the throne, the water heaven has already been restrained.

During the reign of Cronos, a golden age prevailed. Men lived without sorrow, were free from toil and grief, and also enjoyed long life.³⁴ Interestingly, there were two suns—Hyperion and Helios. While Cronos reigned and men enjoyed the golden age, Hyperion was the sun that shone on this planet.³⁵ Hyperion was the son of Gaia (earth) and Uranus (the sky, or “water heaven”).³⁶ In a later age, under Zeus, Hyperion is displaced by his son, Helios, and a new sun takes over.

The fall of Cronos and the golden age came about by the rise of Zeus, the son of Cronos. The myths present Zeus as the weather god. He was particularly responsible for rain, hail, snow, and thunder. Thunderbolts were his constant and infallible weapons, and one of his most common Homeric epithets was “Gatherer of Clouds”.³⁷

It is easy to see how this bizarre cosmogony could reflect a distorted version of the true situation described by the sons of Noah to their descendants. Under the canopy, the earth would have enjoyed a “golden age” such as Hesiod describes. Furthermore, a gathering of clouds, rain, and thunder must have marked the end of that “golden age” in the Bible with the collapse of the canopy and the Deluge. Thus, Zeus, the cloud gatherer, may reflect the cloud canopy from which the rain of the Deluge fell. He was the god of weather and rain, and it was rain that ended the “golden age”.

Under a canopy a dimmer sun would have been observable in the antediluvian heavens. Could not the Greek myth reflect this in the transfer of power to the new sun, Helios, when Hyperion lost power as the golden age ended? Table 1 illustrates some possible parallels with the Biblical account. Admittedly, the parallel is not as precise as the table indicates. Zeus, for example, did not end the “golden age” with a Deluge (although his name is associated with a plot to destroy the human race by flood).³⁸ Also, the Greeks continued to believe in the existence of the water heaven and the solid dome until at least the third century B.C. However, the parallels are close enough to suggest a common source. Perhaps both Genesis and the Greek myth go back to a report passed on through Noah.

India

Indian religious literature is full of references to a water heaven that could possibly be interpreted as the

Table 1. Parallels between Greek and Hebrew possible references to the canopy.

	<i>In the Beginning</i>	<i>Conquest of Chaos</i>	<i>Canopy Era</i>	<i>Deluge</i>	<i>Post-flood</i>
GREEK	Chaos	Ouranos & Gaia separated	Longevity Golden Age Ouranos Hyperion	Zeus, god of weather	Silver, bronze & iron age, New Sun, Helios
HEBREW	The Deep	Division of waters	Longevity “it was good” “waters above”	“windows of heaven”	Longevity declines

liquid ocean of the Hebrew records. In the *Vedas* and in the *Avesta*, the idea of an upper or heavenly sea is frequent.³⁹ Originally, the upper waters were ruled by Varuna, the guardian of the “sea of heaven” from which he sent rain.⁴⁰ He acquired his position as “lord of the waters” after the great god Indra conquered the Chaos monster, Vritra, who, like Tiamat in Babylon, restrained the release of creative forces until conquered by Marduk. When Vritra was defeated by Indra, her belly was slit open and the cosmic waters were driven to their place in the atmospheric ocean where Varuna was instated as their ruler.⁴¹ Subsequently (the chronology is ambiguous) Varuna was ousted from her position as the guardian of the atmospheric waters and made guardian of the terrestrial waters.⁴² Indra took over as god of the atmosphere. Varuna now resides in the netherworld at the roots of the world tree and near to (or in) the subterranean cosmic waters.⁴³ Today, Indra is the god of Nature, a kind of Hercules with the characteristics of Zeus. He rules the sky, and when he thunders, he lets loose the rain. He is called “lord of heaven”, or “rider of the clouds”, or “the thunderer”.⁴⁴

There is also an interesting myth related to the sun. During the rein of Varuna, the water heaven, the sun was Ahura-Mazda. Varuna ruled and the divinity of light, Mithras, was subordinate to him. During his reign, Mithras was not the sun—he simply was the god of the upper air.⁴⁵ “But somehow, somewhere, he became the central deity in an almost new religion”.⁴⁶ In the new religion, Mithras, the new sun, was born from a rock, i.e., the sun rising above the mountains. Mithras was a kind of ally with Ahura-Mazda. Apparently, there was a problem with darkness, so Ahura-Mazda instructed Mithras to solve the difficulty. Mithras promptly killed the wild bull that was responsible, and light reigned. In other stories, the darkness tried to destroy the human race by a flood, and Mithras, the new sun, rescued mankind.⁴⁷

The similarity of these myths to the Hebrew account is striking. Both begin with a situation of chaos which is overcome by the conquering god. The waters of the chaos monster are ruled in a heavenly ocean by Varuna, the sea of heaven. While Varuna reigns, Ahura-Mazda is the sun. With Varuna’s ouster (the condensation of the canopy?), a new sun is instated, Mithras (a former subordinate of Varuna’s), and darkness has been overcome. Certainly, just prior to the flood, the world was enveloped in semi-darkness due to the clouds. When the canopy condensed, a “new sun” with greater brightness and slightly differing optical appearance would have appeared in the post-diluvian heavens.⁴⁸ The god who overcame this darkness, ousted the water heaven, was the god of the storm, weather, rain, and clouds, Indra. In some of the stories, the birth of the new sun is connected with his saving of the world from the global deluge, precisely the parallel predicted by the collapse of the Genesis canopy and subsequent flood. The nature of these parallels with the Hebrew account can be easily seen in Table 2.

Persia

In the Persian sacred book, the *Zend-Avesta*, a deluge legend is told.⁴⁹ For 900 winters the sage Yima (the first

Table 2. Parallels between the Indian and Hebrew references to the water heaven.

	Beginning	Conquest of Chaos	Restraint of Chaos	Release of Water Heaven
INDIA	Chaos "Vritra"	Indra slits Vritra's belly and drives the waters into the atmospheric ocean	Rule of Varuna, the water heaven Old Sun	Varuna ousted Indra, the storm god, supreme New sun, Mithras Flood (in some stories)
HEBREW	Chaos "The Deep"	The division of the waters	Canopy	"The windows of heaven were opened" Flood

mortal with whom the creator conversed) reigned over the world under the divine superintendence. And during all that time, there was neither cold wind nor hot wind (i.e., a temperature equilibrium such as would be produced by a vapor canopy greenhouse effect), neither disease nor death (longevity?). Because of the favorable climatic conditions, mankind and animals apparently increased at such an alarming rate that the earth had to be enlarged three times to accommodate them. The creator decided that a flood was the answer to overpopulation and proceeded to destroy them all. He informed Yima that upon the material world the fatal winters are going to fall, and that he would bring a fierce, foul frost. Such a situation would be expected with the collapse of the vapor canopy. A new climatic regime would be introduced. There would be a sudden deep freeze in many parts of the world, even in presently tropical regions.⁵⁰

Polynesia

The islands of the South Pacific are rich in traditions which speak of a flood and possibly of a concept of a water heaven. Among the Ifugoo, in the Philippines, for example, it is said that the sky used to be so close to the earth that it interfered with the sharpening of one's spear!⁵¹ Apparently, the Manobo of Mindanao say that the sky was once very close to the earth, and that while a woman was pounding with her pestle, she accidentally hit it, causing the heavens to ascend to a great height.⁵² In Borneo, six suns reigned in succession while the sky hung low. With the advent of the seventh sun, the sky retreated to its present position. Similar tales are found in many of the islands.⁵³

Again, the theme of a new sun as would be predicted by the collapse of the Genesis canopy is found. The seventh sun is the most intense because the obstructing heavenly waters have been removed.

A Maori legend describes a division of the waters in a way similar to the Genesis account.

And now a great light prevailed
lo then looked to the waters, which composed him
about,
And spake a fourth time saying:
"Ye waters of Tai-kam, be ye separate, heaven
must be formed."

Rome

Then the sky became suspended.⁵⁴
Note that the division of the waters here occurred after the creation of light, just as in Genesis.

The famous Roman poet, Ovid (43 B.C. to A.D. 18) compiled many ancient Roman myths in his magnum opus, *Metamorphoses*. These fifteen "books" published in A.D. 7 recounted in engaging hexameters the renowned transformations of inanimate objects, animals, mortals, and gods. Since almost everything in Greek and Roman legend changed its form, the scheme permitted Ovid to range through the whole realm of classical mythology from the creation of the world to the deification of Caesar.⁵⁵ One of his themes involves the four ages of the world. Here he traces the traditions of ancient Roman mythology which depict the earlier stages of the ancient earth. The first age was the GOLDEN AGE:

The earth itself, too, in freedom, untouched by the harrow and wounded by no ploughshares, *of its own accord produced everything*; and men, contented with the food created under no compulsion, gathered the fruit of the arbute-tree, and the strawberries of the mountain, and cornels, and blackberries adhering to the prickly bramble-bushes, and acorns which had fallen from the wide-spreading tree of Jove. Then it was *eternal spring*; and the gentle Zephyrs, with their soothing breezes, cherished the flowers produced without any seed. Soon, too, the Earth unploughed yielded crops of grain, and the land, without being renewed, was whitened with the heavy ears of corn. Then, rivers of milk, then rivers of nectar were flowing, and the yellow honey was distilled from the green holm oak.⁵⁶

Here is an interesting mythological description of a time in which the earth brought forth abundant crops; there were no seasons, only an "eternal spring," or uniformly sub-tropical temperature regime. This seems to parallel closely the conditions predicted from Genesis, i.e., the greenhouse effect of earth's ancient water heaven.

During the golden age, Saturn reigned. Saturn was an ancient rustic god equated with the Greek Cronos.⁵⁷ During the reign of Saturn, life was easy and happy. He taught men to farm and how to enjoy the gifts of civilization. His name is derived either from *satur*, "stuffed, gorged," or *sator*, "a sower." If *sator* is the root of the name, then it would indicate his connection with the abundance of the golden age.⁵⁸ Saturn took over the rule from Coelus, Rome's most ancient diety. Coelus is roughly equivalent to the Greek Uranus or water heaven.⁵⁹ When Saturn took over, the water heaven was under his control and a golden age prevailed. It is not difficult to see here the subjugation of the waters theme from Greece where the waters of chaos are restrained as in the Genesis record. Saturn was deposed by Jupiter just as Cronos of Greece was deposed by Zeus. Jupiter is related to Zeus and was thought to be responsible for weather of all kinds, especially lightning and rain.⁶⁰

The next Age, according to Ovid, was the Silver Age. Jupiter shortened the duration of the former spring,

and divided the year into four periods by means of winters, and summers, and unsteady autumns, and short springs. Then for the first time, did the parched air glow with sultry heat, and the ice, bound up by the winds, was pendant.⁶¹

If, as the first chapters of this thesis have attempted to demonstrate, the earth was indeed once surrounded by a canopy of water or vapor, one would predict a relatively insignificant seasonal variation. Furthermore, such a lack of seasonal differences may be implied in Genesis 8:22. Thus, with the collapse of the canopy, drastic seasonal differences would have been introduced for the first time. This is the situation noted in the Roman myths.

Sumer

In ancient Sumer, the oldest known civilization, accounts of the water heaven are found. In the Sumerian creation Epic, the ancient theme of the separation of the water heaven from the earth is recounted:

After heaven had been moved away from earth,

After earth had been separated from heaven . . .⁶²
This separation was effected by the air god, Enlil.⁶³ The Sumerians believed that the waters above were maintained up there by a solid metal vault. The composition of that vault may have been, in their thinking, tin, in so far as the Sumerian term for tin is "metal of heaven."⁶⁴ Heaven and earth were originally created by Nammu, as a symbol for "sea."⁶⁵ Thus, the heavens were watery. According to the Sumerians, inside this upside-down vault the sun, the atmosphere, the stars and the planets were found.

Surrounding the "heaven-earth" on all sides, as well as top and bottom, was the boundless sea in which the universe somehow remained fixed and immovable.⁶⁶

Thus, in a garbled form, one can detect the Hebrew idea of the waters above being formed out of the waters of the primeval sea.

The Sumerian deluge story is also similar to the Hebrew.

All the windstorms, exceedingly powerful, attacked as one. The deluge raged over the surface of the earth seven days and seven nights. And the huge boat had been tossed about on the great waters.⁶⁷

An Analysis

Interpretation of these myths is a tricky business. There are so many unknowns as to what these people really believed that no certain statements about details are possible. Did they really believe, for example, in wooden sluice gates (Babylon); an air god separating heaven and earth (Sumer); a metallic dome for the heavens; or that rain came through the windows in Baal's house (Canaan)? Much of the confusion exists because the ancients viewed all of nature as personal. They did not seem to draw the subject-object distinction between human beings and nature itself. They did not personify nature, i.e., ascribe human characteristics to it, but they actually perceived nature as personal and of the same "stuff" as human beings. It was all united in one large unified being. Hence, to speak of sentries

posted at the heavenly sluice gates did not necessarily mean little men in uniform standing guard. The restraining forces, whatever they were, were personal and may have only been conceptualized as particular humans.⁶⁸

However, it seems to be felt by many that there may be some mechanistic basis for the myths. Guirand summarizes:

. . . some have interpreted the noisy quarrels of Zeus and Hera as a mythological translation of storms or the struggle of the meteors and atmospheric disturbances in revolt against the sky They were only translating the emotions they felt in the face of nature's great mysteries into gracious and poetic forms.⁶⁹

Frequently they are simply a romanticized form of natural phenomena; sometimes they are allegorized accounts of historical facts.

For these reasons, it is always dangerous to try to read too much into these stories. However, the parallels with the Genesis record of a water heaven are frequent, interesting, and very precise. This suggests either that one borrowed from the other, that they arose independently, or that both were derived from a common more ancient source.

How are the accounts of a flood to be explained? Cultures from Babylon to South America report flood legends that parallel closely the details of the Genesis record. Furthermore, as argued above, there are widespread accounts of an ancient water heaven. While this evidence could be explained in many ways, it is specifically predicted on the basis of a normal exegesis of the Genesis account and the assumption of its truthfulness. If there were a water heaven which condensed and resulted in a global deluge, one would expect to find universal flood and water heaven traditions—and this is exactly what one does find. This tends to supply circumstantial evidence for an anthropologically universal flood. Secular anthropologists today, of course, simply say that Genesis borrowed and slightly purified these grotesque myths. Thus, the existence of these legends (instead of being evidence for a global deluge) are reduced to evidence that Genesis borrowed from Babylon. Now suppose there were no such traditions; then what would the secular anthropologist say about the Genesis tradition? "Would they not use this very lack of circumstantial evidence as a weighty objection to the veracity of the Biblical account?"⁷⁰ Thus, the presence of the legends serves in these people's eyes, to condemn the Biblical account, and their absence would probably do the same. Obviously, such arguments prove nothing.

The use of these legends as evidence for an anthropologically universal flood (or water heaven) has, indeed, been severely questioned by modern scholars. Sir James George Frazer says:

Formerly, under the influence of the Biblical tradition, inquirers were disposed to identify legends of a great flood, wherever found, with the familiar Noachian deluge, and to suppose that in them we had more or less corrupt and apocryphal versions of that great catastrophe, of which the only true and authentic record is preserved in the Book of

Genesis. Such a view can hardly be maintained any longer.⁷¹

However, Frazer's conclusion is too hasty. One needs to examine the reasons he sets for rejecting the common source hypothesis. They are twofold.

First, he argues that many of the flood stories are too "diverse, often quaint, childish, or grotesque" to be copies of a single human original. Now Frazer may be right in his assertion that the flood stories do not come from a common source, but it is hard to see how his first objection to such a view can be taken with any seriousness. These kinds of distortions are exactly what would be expected if they did all descend from a common source. Frazer seems to think that simply making a statement that they cannot be copies of a distant original is proof of the statement.

Secondly, Frazer argues that modern research has "proved" that the supposed divine original in Genesis is not an original at all, but a comparatively late "purification" of a much older Babylonian or rather Sumerian version. Not only has modern science failed to prove this, however, but in fact it has proven exactly the opposite. Within fifteen years of the publication of Frazer's book (1918), archaeological investigations in the Near East totally overturned much of the testimony upon which his statement was made.⁷²

Also, recent excavations at Tell Mardikh (Ebla) in Syria have revealed a creation account dated hundreds of years before the Babylonian that is already "purified." It has none of the polytheistic absurdities of the *Epic of Atrahasis* or the *Enuma Elish*. Thus, the Hebrew account is more like this older version than the Babylonian.⁷³

But not only is Frazer's case not proven, he also apparently has set up a "straw man" in place of what the conservative evangelical position really is. No one today maintains that Genesis was the original account and that everything in ancient mythology was copied from it. What is asserted is that Genesis itself is an accurate representation of the ancient source while the pagan myths are distorted versions of the same source.⁷⁴ Whether Moses received this information about the flood by direct revelation, or through divinely preserved oral tradition, or through written records, is unknown. But unless one is assuming the impossibility of revelation, or at least the impossibility of its coming to Moses, Frazer's argument hardly carries any weight. And since ultimately that is the very point in question, there is no need to concede the validity of his point. His argument begs the question.

Having already rejected the notion that these flood stories could be authentic cultural memories of the account described in Genesis, Frazer is then left with the perplexing problem of explaining the origin of these stories. If they did not arise from the account of the flood passed on by Shem, Ham, and Japheth to their descendants, where did they come from? Frazer makes four points, or assumptions, in regard to this.⁷⁵

(1) His first point, or controlling assumption, is that the stories of global inundation must be false because modern geology says it is impossible. His certainty rests ultimately in the interpretations of the geological strata offered by the contemporary historical geologist. How-

ever, this interpretation is open to serious challenge. In fact, there seems to be rather convincing evidence that it is the modern geologist's interpretations of fossil strata that are "impossible," and not the fact of a global deluge. Convincing evidence is being presented by many creationist scientists that a global deluge may be the only way the geologic strata can be adequately explained.⁷⁶ But, more importantly, God has clearly revealed to us in His Word that just such a deluge took place, and such a direct revelation of past conditions must take precedence over the finite inductive science of the historical geologist!⁷⁷

(2) Since modern geology has "proven" that there cannot have been a global flood, these stories of such a global flood must represent local catastrophes which, in passing through the medium of popular tradition, have been magnified into worldwide catastrophes (unless, of course, these accounts are positive evidence for a global catastrophe!). Frazer then cites stories of violent floods in Holland and other places around the world as evidence of local catastrophes that could have been magnified in transmission into global flood stories. However, even though this could certainly have happened, and probably has, in none of the local catastrophes he cites does he say that they were ever so magnified. Thus, he has hardly proved his point! "Could be" is not "is".

Furthermore, the "magnified local affair" theory suffers from its inability to explain the numerous similarities. In many of the accounts that Frazer himself documents, such details as the sending forth of the dove, the salvation of eight people, an ark, two of every kind, etc., are present. John Bright has rejected Frazer's view for similar reasons.

... it is difficult to believe that so remarkable a coincidence of outline as exists between so many of these widely separated accounts can be accounted for in this way.⁷⁸

Frazer, of course, has a ready answer for these striking similarities. He says they are the result of the preaching of Christian missionaries!⁷⁹ Such an origin for many of these stories is, however, incredible. Byron Nelson has effectively refuted this thesis with several observations.⁸⁰

(1) There are no universal legends of other great miracles recorded in the Bible, such as the crossing of the Red Sea. Why were only the flood and "water heaven" legends dispersed?

(2) Secondly, why are there so many differences in detail and in emphases in all these legends if missionaries are the common source?

(3) Thirdly, as Whitcomb and Morris have observed, it seems highly unlikely that Christian missionaries would ever have reached all these tribes; and, if they did, they would hardly have given priority to describing the flood, but would have presented the Gospel.⁸¹ It would be a knowledge of Christ that would be found in these tribes if Christian missionaries had truly been there.

Frazer's third objection is, maybe, more substantial. He points out that the flood stories which come from islands in the sea or from sea-coast communities and tribes ascribe the flood to rising water and not to rain. This, he argues, would tend to suggest that the stories

were indeed of local catastrophes which were magnified. For in those island and sea coast communities, floods were generally caused by earthquakes at sea that sent a tidal wave roaring over the island. Since in the global flood stories of these communities only this kind of causative agent is described, it logically appears that they simply took a common local catastrophe and magnified it. Frazer's point here seems to have some force; however, there is another possibility. Frequently in the transmission of ancient stories and legends, the details will be modified to fit circumstances with which the local community is more familiar. An obvious example is the custom of Medieval artists of depicting Old Testament characters in Italian robes! Furthermore, it is common for local circumstances to get woven into any ancient story.⁸² This is particularly noticeable in the tendency to bring ancient heroes and gods into the primitive stories. The Egyptians' myths, for instance, are full of this tendency. As an original story from the city of Memphis is passed on to the city of Thebes, the local deity at Thebes takes the place of the deity at Memphis, or the theology is slightly modified to accommodate both. Thus, it could be that the island and sea-coast peoples lost or played down the notion of rain as a causative agent during the transmission of the story because they wanted to account for the flood, indeed, they thought of floods, in terms of the causative agent with which they were familiar—namely, rising tides produced by earthquakes at sea. Maybe they forgot how to conceive any other kind of flood.

Finally, Frazer argues that, since the earthquake at sea can explain the coastal flood stories, then why cannot heavy rains explain the inland flood stories? Could be? Maybe? Might have been? This argument obviously encounters the same difficulties as the preceding. Also, it is based on an unproved assumption: that flood stories among coastal people are due to tidal waves.

The simplest way to account for the universal testimony to a water heaven and a global flood is to grant that they represent a genuine cultural memory of a situation described by Noah's sons to their descendants. While the case for a pre-flood vapor canopy does not rest on this kind of data, it is certainly strikingly confirmed by it. The early invention of writing, the excellent memories of ancient peoples, and the tendency of kings and other individuals to preserve their records in writing have led many anthropologists to believe that behind all legends there is an element of historical truth.⁸³

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EVOLUTIONISTIC DEFENCE AGAINST THERMODYNAMICS DISPROVED

H. L. ARMSTRONG

(Continued from March, 1980)

Certainly the Earth receives energy from the Sun. It loses an equal amount, for the average temperature remains about constant. However, it is energy received as heat which is most important in the present discussion? It is true, of course, that the heating is incidentally necessary, in order to keep the temperature suitable for living things. But if this were the only point, the open system would have little to do with the matter. If only temperature mattered, a closed system, at the appropriate temperature, should be just as suitable for the origin and development of life. So from that viewpoint, it would be irrelevant whether or not the system was open.

But in fact, is it the receipt of heat which is most essential? By considering photosynthesis, one might decide that rather it is the receipt of radiant energy; certainly in photosynthesis just heat would seem to be no substitute for the proper radiant energy.

Now the receipt of radiant energy corresponds to work done on the system; it is more like mechanical work—shaft work, engineers say—done on the system, than like the receipt of heat. It is more as if the radiation were received by a solar cell, which then, by electrical means, did work on the system. So, since matters were being considered in terms of a change of entropy, consider the effect of such work on a system in which everything happens reversibly.

In the system shown schematically in Figure 2, let work, or amount W , be done on the system. There it is

shown as being done by turning a shaft from outside.

How is that work to be used up in the system? (Which is now considered as a thermodynamic system, not necessarily something living.) The first thought is to dissipate it by friction. That is what is done in a brake test on a motor, for instance. But it was desired to have reversible processes; and friction is not reversible.

So proceed as follows. Have the shaft work used to drive a heat pump,⁶ incorporated into the system. Let the pump take in an amount q of heat from a reservoir of heat at an absolute temperature t , and give out a larger amount Q to another reservoir at a higher temperature T , as shown. In principle, t might be only infinitesimally more than absolute zero.

In appropriate units, the net amount of heat given out, $Q-q$, will be equal to the work W . And if t is infinitesimal, as suggested, so is q .

Also, since the heat pump is reversible, Carnot's theorem⁷ will apply, so that $Q/T = q/t$. Now, due to the heat taken in, there would be an increase of entropy of amount q/t . But due to that given out, there would be a simultaneous decrease of amount Q/T . But the amounts are equal; so the entropy does not change. In particular, then, the entropy of the system is not made to decrease by doing work on the system.

Indeed, a similar conclusion follows even if the action of the Sun be considered as merely supplying heat, provided things be done reversibly. Consider, for instance, the system shown in Figure 3.

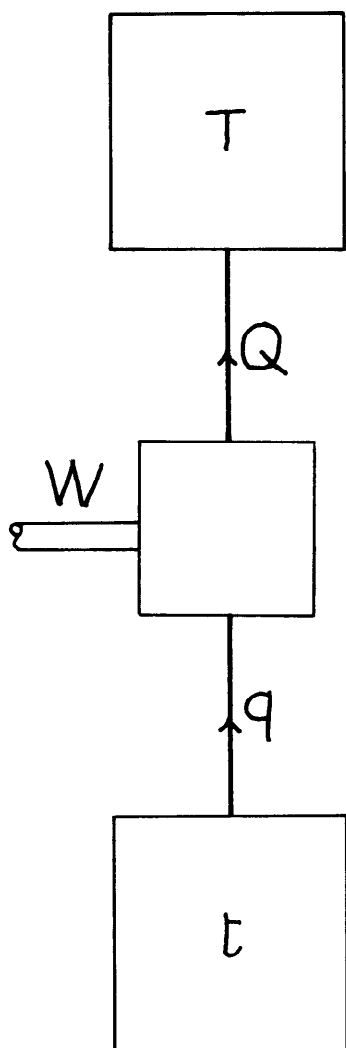


Figure 2. This illustrates a way in which work, shown here as shaft work for definiteness, could be dissipated reversibly. The work drives a heat pump, as described in the text; and the difference between the heat out and the heat in corresponds to the work. The temperature t need, in principle, be only infinitesimally more than the absolute zero; and in that case the amount of work q would likewise be infinitesimally small.

Let heat, of amount Q , be taken in a temperature T , as shown. Let heat be rejected—given out—at a lower temperature t . How is this to be managed?

It will not do just to let the heat flow through something, such as a bar of metal. For the processes were to be reversible; but such a conduction of heat is irreversible.

The following arrangement is suggested.

Let the heat Q which comes in be applied to drive a reversible heat engine, and a smaller amount of heat q be rejected to some reservoir—a heat sink—at a temperature t . Again, by Carnot's theorem, $Q/T = q/t$. But this would not give what was wanted; for it was desired that, ultimately, the same amount Q of heat be given out.

Solve the problem as follows. Let there be incorporated into the system a reversible heat pump, driven by the engine and using the work of amount $Q - q$. Let that heat pump take heat of amount q' from a reser-

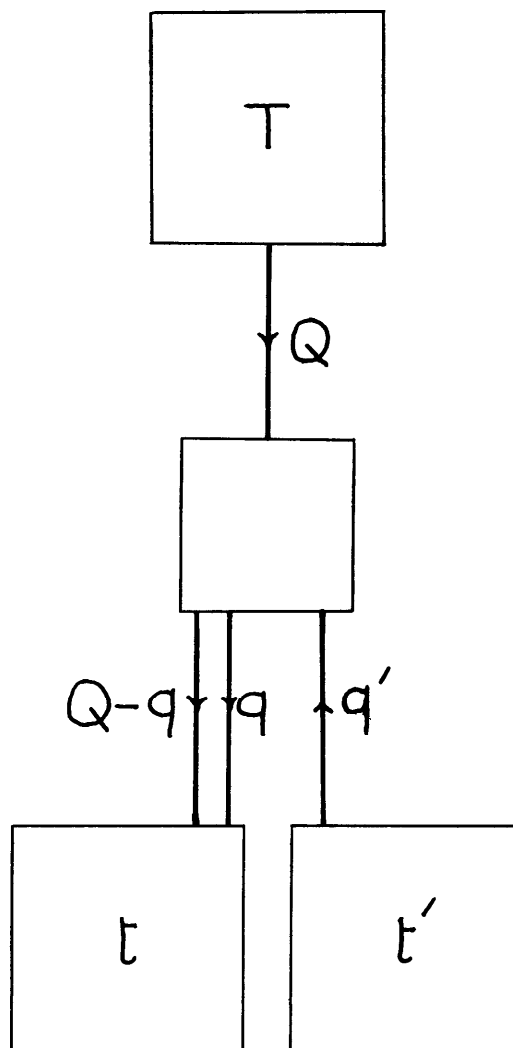


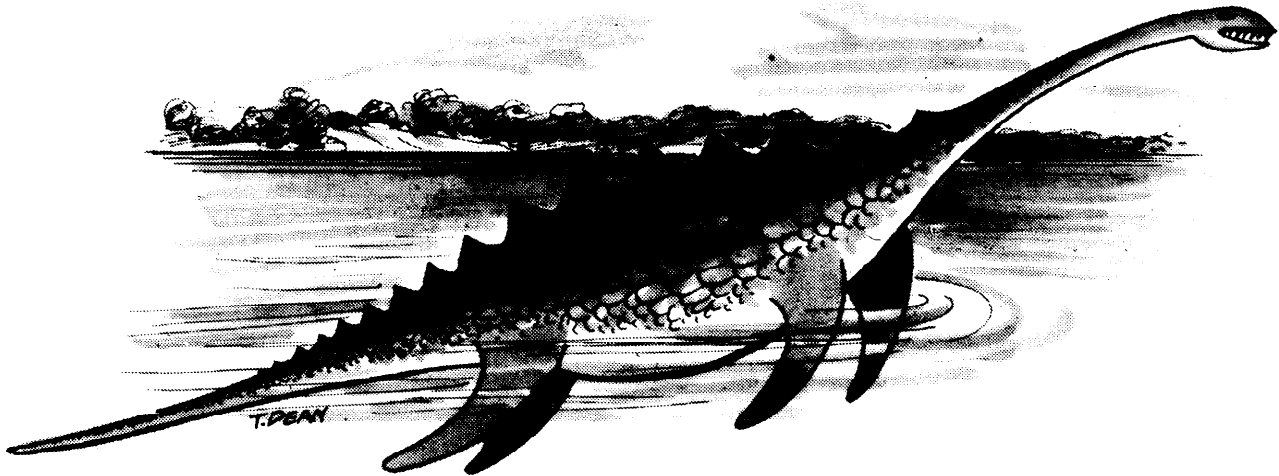
Figure 3. In this system heat is taken in at a certain temperature, and in the same amount rejected at a lower temperature, with the help of an auxiliary reservoir of heat, at a temperature only infinitesimally above the absolute zero. All the processes involved here are reversible.

voir—a source—at a temperature t' , only infinitesimally above the absolute zero, and deliver an amount $Q - q$ (for under these conditions the amount of heat delivered would differ only negligibly from the work done to deliver it) to the system at temperature t . That amount would immediately be rejected, at temperature t . So the amount of heat rejected would be $q + (Q - q) = Q$, as desired.

Moreover, again by Carnot's theorem $q'/t' = (Q - q)/t$. So the amount of heat taken in at temperature t' causes an increase of entropy of amount $q'/t' = (Q - q)/t$. That taken in at temperature T causes an increase of entropy of amount $Q/T = q/t$, as already noted. The heat given out, at temperature t , causes, considered altogether, a decrease in entropy of amount Q/t . Now $[(Q - q)/t] + [q/t] = [Q/t]$. So the increase and decrease just balance; there is no net change of entropy.

(Continued on page 59)

PANORAMA OF SCIENCE



More Plesiosaurs?

Another report of a sighting of what may be a plesiosaur, which is supposed to have been extinct for millions of years, has appeared.¹ Mr. Burge Brown reports that he has seen, at Bynoe Harbor, near Darwin, Australia, up to three of the creatures at once, at intervals over about seven years. Several other people, including a sergeant of police, have seen them.

The illustration shows an artist's impression of the creature drawn from Mr. Brown's description. The picture is from the *Northern Territory News*, Darwin, Northern Territory, Australia, and is used here by permission.

It will be recalled that an apparently similar animal was fished up, already dead, off New Zealand about

three years ago.² And Australia and New Zealand are in the same part of the world.

It would, of course, be desirable to have more corroboration of the existence of such animals. But a Creationist would not be surprised to find them. For he knows that they were living before the Flood, only a few thousand years ago. And it would seem that marine animals would have a good chance of living through the Flood, even if their terrestrial counterparts perished.

—Contributed by Mr. Andrew Snelling.

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SEMINARY ADOPTS POSITION STATEMENT

We are informed that on 6 July, 1979, the faculty of Grace Theological Seminary, Winona Lake, Indiana, adopted a statement of position which makes clear their commitment to Creationism. The position taken is outlined as follows:

1. Scriptural revelation provides the only framework within which natural revelation can be rightly understood (Ps. 36:9).
2. The earth did not evolve from a chaos of gas and dust. Neither did it cool down from a molten mass of rock and metal. It was created by purely supernatural means during six literal days with no gaps before or between the days (Ex. 20: 11).
3. On the first day of creation, the earth was brought into existence in an unformed and uninhabited condition, and God formed and filled it in the succeeding actions of that first week (Gen. 1: 1-2).
4. Present forms of plants and animals are not the result of evolutionary processes. On the third through the sixth day of creation, God completely furnished the earth with all the

basic kinds of living things that have ever existed, including man (Gen. 1: 11-31).

5. Along with all created things and beings, Satan was created as a holy angel within the creation week (Col. 1: 16, Ex. 20: 11).

6. The fall of Satan and of "his angels" (Mt. 25: 41) occurred sometime after the end of the creation week—at which time all was "exceedingly good" (Gen. 1: 31).

7. The worldwide flood of Noah's day provides an adequate explanation for the great number of fossils and all major geological strata (Gen. 6-8).

Copies of the whole statement (from which the above is an excerpt) can be obtained from Grace Theological Seminary, Winona Lake, Indiana 46590. Due to heavy demand, it is necessary to charge 5¢ per copy for bulk orders of 50 or more.

It is good to see a seminary come out with so clear a statement of where it stands, and is to be hoped that many other similar institutions will likewise stand up and be counted for Creationism.

BOOK REVIEWS

Teaching About the Creation/Evolution Controversy by Jerry Bergman, Ph.D., 1979. Bloomington, Indiana: Phi Delta Kappa Educational Foundation (Eighth and Union, Box 789) Paperback Booklet, 45 pp. Single copy, 75 cents (Quantity discounts available).

Reviewed by John N. Moore.*

This booklet is a part of a long series of booklets (labelled "fastbacks") and monographs sponsored by the national professional education fraternity, Phi Delta Kappa, and written "in nontechnical language so that beginning teachers and the general public may gain a better understanding of educational problems".

Concerning the problem of teaching about the creation/evolution controversy, Jerry Bergman begins the Introduction with the important fact that active *student* groups "have been formed at universities throughout the country researching the question of origins". Then he offers two main sections: "Evolution and Creationism as Different Belief Structures" and "Explanation and Critique of the Theory of Evolution".

In his consideration of evolution and creationism Bergman helps the reader understand that there are several types of beliefs involved. After explaining the main ideas of evolutionists he carefully shows that creationists offer criticisms on a number of grounds; yet, he also includes challenges put forth by evolutionists.

Before giving attention to educational issues involved in the controversy, the author wisely discusses the important question of validity of any field of knowledge, i.e., "How do we know what we know?" He enumerates authority, tradition, faith, intuition, experience, and the scientific method as ways of knowing. Of necessity Bergman shows the importance of circumstantial evidence and of assumptions that must be accepted.

According to the author, "If schools are truly to be places of inquiry, we must not inhibit investigations in any single area, but look at all sides of all issues, even issues some people label 'religious'". Bergman mentions and gives references to legal opinions. He also shows that *both* creationism and evolutionism cannot be proven by observation or experimentation.

The last main section before a short Summary is entitled, "Should We Teach Both Creation and Evolution in the Schools?". After giving some of the views published by leaders of educational organisations the author asserts, "Probably the strongest pedagogical argument for teaching both theories is that it permits comparison and contrasts". In the following several pages Bergman presents support for the two-model approach, and quotes explicitly from a recent high school textbook (published by Allyn and Bacon) and from a college textbook (published by Macmillan) to show that authors are already endeavoring to include a more balanced version of the creation/evolution controversy. In fact he could have quoted from another college textbook published by McGraw-Hill in 1974, wherein the authors discuss at some length major arguments put forth by creationist scientists.

The author's clear, even-tempered, quite balanced support for teaching about the creation/evolution controversy is highly recommended. This booklet can be read quickly because of the condensed format of the "fastback" series. However an excellent Bibliography of up-to-date references mostly from the late 1970's is provided. This is an excellent guidebook to this timely subject which many observers expect to be a part of the scientific scene for years to come. (See *BioScience* 29 (9), September 1979).

The Mammoth in Ice and Snow? (Cold-Adaptation of Woolly Mammoth: Fact or Fiction?), by Hans Krause, 1978. Self-Published: Kameralamtsstrasse 22, 7000 Stuttgart 40, West Germany. 108 pgs. Paperback. \$8.80 (shipping cost included).

Reviewed by John N. Moore

Writing as a non-paleontologist the author explains in the Introduction that he could not find a "clearly arranged and written" report of scientific research on the cold-adaptation of the woolly mammoth. Therefore, he set about compiling such material, and this self-published book is the result of his search.

Krause has used primary sources whenever possible and numerous university scientists and national museum scientists have read his material and provided critical advice. This book, however, is written for both the scientist and interested non-specialist who will find the style of "questions, dialogues, definitions, and repetitions" helpful aspects of the author's format.

The chapter, "What Is Actually There?", first of 13 chapters, starts with mention of a July 21, 1977 report, including a clear picture, of a new discovery of a mammoth calf. Then Krause writes about the Beresovka-Mammoth find in 1900 with regard to where it was found, how it has been explained, and what scientists believe today. He refers to both the Ice-Age Theory and the Flood account of the Bible.

Krause discusses methods of research used and asks whether a woolly mammoth could live in northeastern Siberia and on the islands of the Arctic Sea. He holds, ... we can find out by examining the following points:

1. The physical characteristics, said to prove its adaptation to the arctic cold.
2. The animals, found together with the mammoth, and whose descendants are still living today.
3. The plant remains, found in the stomach of the mammoth.
4. The reasons as to why its carcass was preserved in the frozen ground of Siberia until the present day. (page 13)

The author restricts the content of his book to a study of eight physical characteristics that can be examined, pro- and con-, relevant to the presumed cold-adaptation of the woolly mammoth. He develops his arguments about small ears; long, curved tusks; short legs; long hair and thick skin; short, goatlike tail; anal flap; fat hump; and thick layer of fat beneath the skin in separate Chapters 2 through 9.

These chapters are prepared in clear style and orderly

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format for a wide range of readership. Since scientists include the fox, the hare, and the living elephant in their discussions of the currently adopted adaptation theory, Krause also examines these animals.

After his meticulous examination of the eight physical characteristics in separate chapters that contain excellent, objective treatment of data, Krause cites his results or findings:

Not a single one of those eight pieces of evidence is valid. The woolly mammoth (*Elephas primigenius*) was *not* adapted to the Arctic cold. It could *not* have lived in ice and snow. It could *not* have lived in a climate, as we find it today in northeastern Siberia and on the islands of the Arctic Sea. It would have frozen to death. The cold-adaptation of the woolly mammoth is only science fiction. (page 95)

A Summary chapter of the main points of his investigation is provided in four closing pages containing a total of 44 itemized statements correlated with each of the eight main chapters of his book.

Very properly the author asks, "What should be examined next?" Since publishing his book, he has corresponded with Dr. Joseph Dillow who has written on the mammoths.¹

This book is an excellent addition to the literature associated with the creation/evolution controversy. In an important "Epilog" written jointly, three German scientists make clear that Krause accomplished his purpose, as they express it, "to arouse justified doubt in the orthodox Lyellian opinion . . .".

Reference

¹Dillow, Jody, 1977. The catastrophic deep-freeze of the Beresovka mammoth. *Creation Research Society Quarterly* 14 (1): 5-13.

How to Think about Evolution (and Other Bible Science Controversies), by L. Duane Thurman, 1978. Downers Grove, Illinois: Inter-Varsity Press. 144 pgs. Paperback, \$3.50.

Reviewed by John N. Moore

This book is most appropriately dedicated, "To all who are interested in a broad understanding and peaceful discussion of controversial issues." L. Duane Thurman (Ph.D. in Botany from the University of California at Berkeley) has succeeded very well in such a dedication in this book "intended to furnish high school and college students with a balanced approach to the origin of life which is missing from most introductory biology, anthropology, evolution and geology texts." (p. 11, Preface). He seems to write to each young reader personally.

Thurman has admirably avoided indoctrination and also confusion of dogmatism. Quite often I wanted to declare, "So true.", in response to statements, such as:

"After all, this controversy is mainly the product of people's interpretations, not scientific evidence or biblical texts." (p. 12)

"Darwin never demonstrated the formation of two or more species from a common source." (p. 39)

"Any date is derived by deductions, assumptions and inference added to the text." (p. 116)

The author begins his seven chapters with attention to "The Renewed Controversy" and moves quickly over

conflicts prior to Darwin and the Scopes Trial (so-called). Thurman concentrates on the 1969 "California Textbook Controversy" and responses by scientists and analyses of such responses. In doing so he ignores the fact that very extensive analyses of high school science textbooks were begun actually in Texas in 1960 by the M. F. Gablers, interested and concerned parents, who have subsequently founded Educational Research Analysts in Longview, Texas.

Chapter 2, "Acquiring Tools to Sharpen Your Thinking", and Chapter 3, "Science and Its Methods", are clear expositions to aid young people in struggling with science, pseudoscience and nonscience. Problems of interpretation of evidence, limits and sources of knowledge plus relationship of logic, faith and science are brought out admirably well.

The main answers to "how to think about evolution" are found in the next chapters: "The Factual Side: Microevolution", "The Theoretical Side: Macroevolution", and "Creation". The first contains definitions about change in living things. Origin of the universe, life, groups above the species level, and the human race are discussed under "Macroevolution". Then six different versions of creation are discussed and grouped under two interpretations of time: A. Creation in Six Twenty-four Hour Days, and B. Creation in Geologic Time.

The last chapter, "Your Approach to Controversy", is well done with primary sub-divisions of "Science, Evolution and Origins" and "Scripture, Creation and Origins". Thurman concludes his book with nine guidelines offered to help the young reader "cut through the confusion surrounding difficult controversies and help you learn how to make up your own mind about the issues". (p. 134)

There are numerous good points about this book. I liked his tables and figures, especially the chart of "Comparison of two common philosophical perspectives used in interpreting the world and its origins" (p. 54), and Figure 7, "Three Interpretations of Evidence of Origins" (monophyletic and polyphyletic based on spontaneous generation plus polyphyletic based on creation by God, p. 113) as well as Figure 8, "The Relationships between Versions of Creation and Evolution" (including six creation models and five macroevolution models, p. 130). Particularly useful are the six criteria of a good theory (p. 67) and his attention to definition of "species" (p. 90).

I do have some questions or reservations about style which, of course, reflect judgements of the publication editors. For instance a rather long quotation without any indentation begins on p. 44 and is not clearly seen as continued throughout p. 45 before conclusion on p. 46. And the use of numbered steps of the scientific method (pp. 60-63) and also numbered identification of the different kinds of evidence (pp. 64 and 65) would have been helpful, as was practiced to aid the reader in identifying special guidelines (pp. 117f and pp. 134f).

A very disappointing aspect of this book is the absence of an Index. An index is most important for full functional use of any book in my estimation. And another missing feature in the Notes section is citation of actual chapter titles which always facilitate quick

use of references provided. In the notes for Chapters 4, 5, 6, and 7 several references were included that had been cited initially in previous chapters. Reader "follow-up" is significantly hampered because of the required search in previous notes for complete bibliographic information.

Regrettably some further serious shortcomings should be mentioned, which should be considered carefully for modification in the next edition. An easy means of reference to these trouble spots is the following itemization by page numbers:

p. 57: "God . . . makes fewer errors than man does (presumably none)." I would hold that the author should acknowledge that God makes *no* mistakes.

p. 68: "Some theories . . . become laws." Here a confusion of scientific terminology is perpetrated. The author should read "The Laws-Are-Mature-Theories-Fable" by J. K. Horner and P. A. Rubba, *The Science Teacher*, February 1979 (p. 31). These authors show very properly that "laws" are only limited, though well-substantiated, descriptive statements; whereas, "theories" are much broader in scope and are the frame of reference by which laws are explained.

p. 89: Whereas the author relates, "Linnaeus omitted this strict definition from the last edition of his monumental book, *Systema Naturae*", a careful reading of *Stages in the Evolution of Plant Species* (Cornell University Press, 1951, pp. 4-5) by Jens Clausen brings out that actually Linnaeus changed his mind to the point of believing that God might have created "natural orders" from which existing species originated by mixing genera. Thus Linnaeus turned away from believing in "fixity of species".

p. 94: The author missed a "golden opportunity" to make clear to the reader that *no new* kinds of living things come into existence as a result of mutational changes. Rather only modifications of already existing genes occur and hence only *variations* of existing physical traits can be demonstrated empirically.

p. 98: At the top of the page the author refers to cosmologists who believe the Big Bang concept. He should have used the term "cosmogonists" instead as he did quite correctly near the bottom of the same page.

p. 101: I regret the easy acceptance of the expression "fossil record" by the author. Actually geologists participate in a type of semantic deception since the term "record" commonly refers to notations made by some human being. Yet no such notational record is available to the geologists who merely find rock layers as the only empirical data, and then they proceed to interpret their findings according to their preconceived ideas about megaevolution. (See *Growth of a Prehistoric Time Scale (Based on Organic Evolution)* by William B. Berry. 1968. San Francisco: W. H. Freeman and Company).

p. 108: When the author writes, "Phylogeny refers to the development . . ." (and on p. 124 he uses: "developed"), he becomes involved in possible confusion between the terms "evolution" and "embryological development". This is unfortunate and can be avoided by carefully limiting the use of "development" to stages within the lifetime of *one* organism.

p. 116: A more complete consideration of the pro-

blem of time for both creationists and evolutionists is needed in this book.

p. 119: The author's intent to help young readers with regard to calculation of the date of creation would be enhanced by reference to the way textbook authors utilize quotations, such as is provided by Edward E. Daub, "Demythologizing White's Warfare of Science with Theology", *The American Biology Teacher*, 40 (9): 553-556, December 1978.

However, notwithstanding these nine specific points and previous more general questions or reservations, this is a fine book. Thurman's example of a balanced approach is most commendable. I recommend the book for all who want help in making up their own minds about "evolution" and other Bible-science issues.

The Einstein Myth and the Ives Papers, edited by Dean Turner and Richard Hazelett, 1979. The Devin-Adair Co., Old Greenwich, Conn. 06870. 448 pages, \$22.50.

Reviewed by Thomas G. Barnes.*

This book is one more in a growing list of books and technical papers that expose serious fallacies in Einstein's theories of relativity, both his special and general theory of relativity. It contains a rather comprehensive exposure of the problems in Einstein's relativity, with an exceptional amount of reproduced reference articles to support that position. It adheres to an absolute space and time, rejecting the non-Euclidean geometry and fourth dimension of relativity, but holds to a form of *clock-slowness* and *meterstick contraction*.

The hero in this book is the noted Bell Telephone scientist Herbert Ives (1882-1953). There is no question but that Ives is a scientist of the first magnitude. That is amply documented in this book. A large number of his related scientific papers are reproduced in the book as evidence against Einstein's relativity and in support of an alternative theory that Ives developed to replace Einstein's relativity.

The book is a rather large one, 445 double-column pages. It is not a continuous treatment, but is a compilation of a wide range of material. It is not very well laid out. The numbering of the pages is not consistent. However it contains interesting information and comments that one could not find elsewhere. For example here are two excerpts from letters in the book:

In a letter from Ives to Dr. Elmore E. Butterfield:

Apropos of your characterization of Einstein, I think of him as the great paradox swallower; e.g., the velocity of light is independent of the velocity of the source, and also shares the velocity of the source; light is waves and also is particles. His technique for solving a problem is always to say that both of two contradictory explanations are true.

In a letter from Butterfield to Dr. John A. Steffens:

On more than one occasion, Vannevar Bush has emphasized the fact that our system of education is not producing fundamental thinkers of the caliber of J. Willard Gibbs, H. Helmholtz, H. A. Lorentz or H.

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Poincaré. It is difficult to see how we can produce fundamental thinkers when our teachers cannot detect the fallacies in Einstein's theories, paradoxes and postulates, but instead rush to climb aboard the Einstein bandwagon where further straight thinking becomes impossible.

The book is divided into five parts. The first part carries the heading *The Einstein Myth* and the subheading *A Presentation of Evidences for the Reality of Absolute Space and Time*. It is written by Dean Turner and gives a non-mathematical discussion of the whole subject included in the book. That portion is well organized and readable like a booklet on that subject. All of the pertinent points are taken up in that part. This includes a review of the history of the development of relativity and the part various ones played in it and the discrepancies that were woven into it. It also includes a treatment of the experiments that the author thinks most important, those conventionally associated with the Einstein interpretation and those in opposition to his view.

Part two of the book is designated as The Ives Papers. It consists of thirty reproduced technical papers published by Ives in the *Journal of the Optical Society of America* and other journals plus one paper that had not previously been published. This monumental work of Ives refutes Einstein's special and general theories of relativity and presents an alternative. A lament is made in the book that the work of Ives which refutes relativity has not received the acclaim to which it is entitled.

Part three of the book is designated "Ives on the Demise of the Photon". It is based on the Rumford Medal Lecture delivered by Herbert Ives in 1951, which is reproduced in the book. That lecture is entitled *Adventures With Standing Waves*. The most profound impact of the lecture is its attack on the photon, the particle concept of light. This is a blow to the concept of a photon employed by Einstein in his famous paper on the photoelectric effect, work for which he was awarded the Nobel Prize. Ives strongly contends that the particle concept, the photon concept, of the incoming light is wrong. He supports his argument by standing light wave phenomena previously studied by Weiner and more extensively by Ives himself, with improved techniques.

Ives' arguments against the photon, the quantum of light, is of such importance that this reviewer is including the following lengthy quotations from pages 216 and 217 of the book.

"The last experiment showed how minutely the photoelectric emission followed the predictions made from the wave nature of light. Yet it is from this very photoelectric effect that the wave theory has received its most serious challenge. Philip Lenard, over fifty years ago, in studying the photoelectric effect, found that the energies of the ejected electrons were quite independent of the intensity of the exciting light. Einstein, in 1905, proposed that the energies associated with the photoelectrons be identified with the quantum of energy discovered by Planck, proportional to the frequency of the light. This identification has been abundantly confirmed, notably by the experiments of Millikan. In addition to the idea that a photoelectron carries the energy $h\nu$ Einstein also

proposed, as a 'heuristic' view, that this amount of energy was also discrete in the radiation before it encountered the electron. This is equivalent to the assumption that light travels in bundles—now called 'photons'.

But however attractive from some standpoints the photon appears, it has not been acceptable to those of wide acquaintance with the intricate phenomena of optics. The case was well stated by H. A. Lorentz in an address in 1910, from which I quote the following extracts: 'Nevertheless the speaker holds the hypothesis of light quanta to be impossible, if the quanta are regarded as wholly incoherent, an assumption which is most natural and which is also made by Planck. The impossibility of incoherent quanta follows from a consideration of interference phenomena. Specifically Lummer and Gehrke have observed interference at a phase difference of two million wavelengths; for yellow light, that corresponds to a length of one meter. If each quantum by itself should be capable of giving sharp interference, then it must also itself extend over that length in the direction of propagation. But, the lateral area of the quantum must also be considerable, which follows from the diffraction theory of optical instruments. Should a light quantum cover only one square centimeter of area, then it would be obviously senseless to fabricate large telescope objectives, for only a small fraction of the area would be used by each quantum in the production of images; on the other hand it is well known that the clearness of images can be greatly enhanced by large objectives. Thus a light quantum would have to be as large as the largest telescope objectives, and, since it is unlikely that the volume of the quantum adjusts itself to our instruments, it would be necessary to conceive of it as considerably larger. But then, only fractions of quanta could get through a small opening such as the pupil of the eye. According to the hypothesis of absorption by the retina, only whole quanta can be taken up, so that fractions would have to recombine into whole quanta. Moreover, the consideration of the simplest interference phenomena, such as Newton's rings, shows that the quanta must be divisible, because in the process the ray is resolved by reflection into two parts which travel by different paths and finally come to interference.

To this expression of dissent is to be added that of Henri Poincaré, who in his only published reference to Einstein remarks that while Einstein would put the quantum in the incident light, he, Poincaré, would place it in the molecule; and he speaks elsewhere of finding the 'vestibule' by which the molecule admits or releases energy in quanta.

Ives then expresses his belief that wave mechanics is the way out. But he states: "that wave mechanics puts the h of quantum theory in the *atom* and not in the *radiation*. It provides in short that 'vestibule' that Poincaré demanded, in order to avoid the unacceptable idea of photons.

The other two parts of the book are entitled *Papers and Notes by Others* and J. J. Callahan: *Euclid or Einstein: A Proof of the Parallel Theory and a Critique of*

Metageometry. This last paper is in support of Euclidean geometry and a rejection of non-Euclidean geometry employed in relativity. The existence of absolute space is said to be demonstrated by Sagnac's rotating interferometer experiment, by Bradley's aberration of star light, and by the A. A. Michelson and H. G. Gale experiment. Other experiments are said to demonstrate that a moving clock runs slow and that there is an associated contraction in moving metersticks. The clock slowing is said to be related to velocity and that Einstein's clock slowing occurs during acceleration. Ives holds to absolute space and time in theory, but contends that the instruments are effected by motion so that one is not able to measure the drift through absolute space.

An experiment by Ives and C. R. Stilwell with canal rays (positively charged particles) is cited as evidence of the clock slowing. The book cites a number of more recent experiments. The well known muon experiment and the J. C. Hafele and R. E. Keating flight around the world of cesium atomic clocks are said to be proof of the slowing of moving clocks.

The reviewer does not agree that moving clocks run slow. He wishes to point out that the world's leading scientist on time measurements, the inventor of the cesium atomic clock, Dr. L. Essen, has shown that the Hafele and Keating experiment did not confirm the presumed clock slowing. It would have been helpful if the book had included Essen's article.¹ The reviewer also maintains that the famous muon experiment does not prove clock slowing, but rather should be investigated for evidence as to what causes the decay process, noting the muons are subjected to severe external conditions, by the filter, in that experiment.

The authors are to be commended for the scope and depth of material brought together in this book. It is an excellent source book. The book is one of real importance because it challenges the very foundations of modern physics and the philosophy that is prevalent in science today. The authors make it clear that a return to absolute space and time is needed for a wholesome philosophy in science. The book documents the philosophical degradation in those who adopt relativism. They point out the limitations of science and the need for God. Their point is well taken: "The ultimate strategic question of modern science is this: At what point should one acknowledge that scientific explanation has gone as far as it can go? That is, at what point ought a theistic philosophical explanation be accepted as a satisfactory one where no merely empirical one appears to be possible?"

Reference

¹Essen, L., 1977. Atomic clocks coming and going. *Creation Research Society Quarterly* 14 (1): 46.

Minerals, Metals, Glazing and Man, by John Dayton. 1978. Harrap, London. 496 pages, 32 color plates, 31 maps, over 400 figures. £40.00†

Reviewed by Peter J. James.*

... For its first two parts alone, John Dayton's *Minerals, Metals, Glazing and Man* (or "Who Was Sesostri I?") deserves to grace departmental libraries in

a number of fields, including archaeology, art history, geology, chemistry and metallurgy. Beautifully produced and copiously illustrated, it satisfies an urgent need—mainly on the part of archaeologists—for a comprehensive work of reference on a number of important and interrelated topics. Its main themes—the composition of ancient glazes and pigments, techniques of application, the provenance and geology of the metals (excluding iron) used in antiquity, mining, smelting and casting—are lucidly explained and illustrated with numerous maps, charts and tables of chemical analyses.

Part III, which discusses the archaeological evidence for the trading of minerals and metals and the spread of glazing and metallurgical skills, will probably cause the book to be promptly whisked off the departmental shelves, and ceremonially pulped before its heresies can contaminate unwitting students. Dayton, a mining engineer turned archaeologist, assesses the traditional structure of ancient Near Eastern history and European prehistory from a broad interdisciplinary standpoint, and pulls no punches in revealing its faults: "... Archaeology in the Near East has built up a card-house of interrelated "facts" by the stylistic comparison of artefacts from one area to the next, each system building upon the flimsy evidence of the past—often, indeed, on a single find of doubtful date and stratigraphy, as with the cylinder seal from Platanos of the Old Babylonian period. Unfortunately, the myths in this vast corpus are almost self-perpetuating while providing rich pastures for studies in minutiae. Few have had the courage or time, or for that matter the overall knowledge, with the "quasi-science" split into so many specialised compartments and tiny geographical areas, to question the very bases. The tombstones of those rash souls who have questioned the fundamentals lie scattered along the dusty by-ways of history, forgotten and unlamented." (p. 6)

With apparently little concern for his own safety, Dayton develops his work, "which started out as a simple study of the evolution of glazing technology", throughout the book into a massive and devastating attack on traditional chronology, concluding that the history of the Bronze Age is utterly wrong from start to finish. His scope is vast and his claims are sweeping and extraordinary. In challenging the accepted dates and synchronisms for the Early and Middle, as well as the Late Bronze Ages, his work is potentially more disrupting than *Ages in Chaos* itself; even for this reviewer, well-steeped in the concept of Velikovsky's revise chronology, some of Dayton's conclusions are positively frightening.

Most of Dayton's claims are based on the "hard" facts of chemistry and geology, and to make it perfectly plain what he is talking about he begins the book with a series of definitions, of glass, glaze, frit, faience and the other materials discussed in his study. Chapter two treats pigments and "Egyptian blue" (moulded objects of a

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†This is an excerpt from a somewhat longer review, by Mr. James, in the S.I.S. Review, III (4): 81-83. (Spring 1979). It is reprinted here especially in the thought that it may be helpful to readers who are interested in chronology, and is used by permission.

chalky blue material) or *kyanos* as he prefers to call it, since it is one of Dayton's conclusions (Appendix I) that its manufacture was probably a Mycenaean invention. The next chapters discuss the application of glaze to clay and non-clay objects, and Mesopotamian glazed ceramics. So far Dayton sticks to stating the plain facts of scientific analysis, but even in this simple exercise of establishing a reference guide he gleefully exposes several fallacies, such as the description "lead glaze" used for many Egyptian objects, when lead glazing was apparently not invented until Roman times.

Part II deals with non-ferrous metals, and stresses the links between glazing and metallurgy. Colouring in ancient glazes—until the middle of the second millennium BC—was dependent on metals, particularly copper, and analysis of glazes can show up traces of rare elements in the copper such as zinc and cobalt. Such complex ores in glaze can be used then, like the metals themselves in the form of weapons, tools, and jewellery, to monitor the technological capabilities and trading contacts of ancient peoples: "The development of polychrome glazing sprang from the use of new ores, which in turn tends to imply new patterns of trade coming into existence at certain periods of history."

To trace these trading patterns Dayton gives a full survey of the mineral deposits available to early man in Europe, Western Asia and North Africa, which clearly illustrates the meagreness of mineral resources in Egypt and Mesopotamia. He lists no fewer than 26 minerals used in the ancient Near East which hardly occur (if at all) in that area, must have been imported, and usually do occur in abundance in Europe. Dayton takes the logical and simple view that the technology required to work a material was most probably developed *in situ*, at the source's location, reversing the traditional picture of the civilised arts and sciences having developed in the valleys of the Nile, Tigris and Euphrates, and focussing instead on the important trading routes along the Rhine and Danube. In Dayton's opinion the geological and archaeological evidence points to the Hungarian/Bohemian basin as the ideal centre for the discovery of metallurgy, rather than Caucasia or the Near East. He carefully refuses to be dogmatic about this however, and names Cornwall and Spain as alternative sites with ideal geology for the discovery of metal-working.

Dayton's work on geology and metallurgy thus forms another line of evidence against the traditional picture, drawn by V. Gordon Childe and others in the early part of this century of a barbarian Europe dependent for all its skills on the expertise of the "older" civilisations of the Near East. Of course Dayton is not the first to challenge this view, the trend against the old arguments based on diffusion of culture from the Near East into Europe having been in full flood several years ago, highlighted in particular by Colin Renfrew's *Before Civilisation* (1973). While Renfrew's book had an enormous impact and represents something of a landmark in archaeological thinking, his work was marred by two serious difficulties, the questions of radiocarbon dating and diffusion. Renfrew's book tends to give the totally misleading impression that the case against the old diffusionist theories rests largely on the "second radiocarbon revolution", that which pushed back the C14 dates

of prehistoric Europe by recalibrating them according to the Suess Curve based on the tree-rings of the Californian Bristlecone Pine. This method—sought in the first place partly to help explain away the anomalously "low" C14 results obtained from Egyptian New Kingdom samples—is based on the false premise that the variations in C14 recorded by the Bristlecone tree-rings represent global fluctuations, and that the "correction" deduced from these American samples is equally applicable to Near Eastern and European materials. Preliminary work on building up a tree-ring sequence from Irish oaks has already resulted in a curve without the "wiggles" of the Suess calibration.

Dayton is well aware of such drawbacks in the use of the Bristlecone evidence, and in his very clear discussion of C14 dating (pp. 413-8) he completely rejects its application on a world-wide basis, preferring to stick to uncorrected C14 dates. Until tree-ring sequences for different areas of Europe and Western Asia have been developed, surely this is *the most honest approach to the problem*. Dayton, much to his credit, sees no good reason to tamper with and "correct" the "low" results from Egyptian samples, since they are only "low" when compared to the historical dates derived from the theory of Sothic dating, which he also wisely rejects (p. 190).

His map showing the *uncorrected* dates for the earliest occurrences of copper and tin bronzes in archaeological contexts stresses the obvious fact, obscured by Renfrew's enthusiasm for the "second radiocarbon revolution", that the dates for the metal-working Neolithic cultures of Europe are *still* earlier than those for the Near East. "We have the assumption that Carbon 14 dates are unaffected by local geographical variations in their uncorrected state for the area from the Indus to Cornwall, which is improbable. However, using the few dates available, an interesting picture does emerge of metallurgy being earlier in the regions where metals do in fact occur." (p.8)

Dayton's studies also constitute a welcome antidote to the rabid anti-diffusionism of Renfrew and his school. Having rejected the old idea that the civilised arts and sciences had diffused from the Near East and Aegean into barbarian Euaire, Renfrew took the new and extreme position that diffusion could be ignored as a "meaningful explanatory principle", and practically denied all contact between Europe and the Near East by his insistence on a chronological and cultural "fault line" between the two areas. Dayton's studies of the complex ores used in the latter area turn this artificial picture on its head, demonstrating that metallurgy and related arts probably originated in Europe and spread along trade routes into the Near East. The "types of metal artifacts of remarkably similar style and range" found throughout the early metal-working cultures, the geological evidence, and the C14 dates all support this new diffusionist picture.

There would, of course, have been reciprocal influences, sometimes accompanying large-scale movements of peoples throughout the civilised areas of the Old World. Dayton dislikes the "'static theory' of archaeology: that there never were any great invasions or movements of peoples or 'master-races', and, at the

most, only a little hand-to-hand trade between villages and tribes" (p. 400). He believes that there may be some historical reality behind the Herodotean story of the conqueror Sesostrius, whose Egyptian empire was supposed to have reached as far as Thrace, the Caucasus and India. On a more down to earth level, Dayton's extensive series of lead isotope analyses of manufactured objects and samples from available deposits reveal a number of interesting and often surprising clues to ancient trade patterns. Lead isotope analysis can be used to "blood group" ores, and determine their origin with a fair amount of confidence. Thus blue frit from the XIXth Dynasty levels of Philistine Fara "definitely fits the unique Sardinian lead pattern", providing the first hard evidence for the origin of the Shardana, a tribe associated with the Philistines in Egyptian inscriptions. A dagger from Beth Shan bearing the cartouche of Amenhotep III is made of Laurion copper, a result that might support Velikovsky's claim that the land of "Atika" from which Ramesses III imported ores (*hmt*, translated as copper by Breasted) was simply Attica in Greece.

A major theme of Dayton's work is the definition of new "technological horizons" as a means of correlating cultural phases. In particular he finds the advanced metallurgy and glazing of early Mesopotamian periods, such as Jemdet Nasr, out of step with the evolution of techniques in Palestine. The faience and other sophisticated products attributed to the 1st Dynasty of Egypt he also sees as anomalous, and he produces a welter of technological and archaeological comparisons, which, if they prove to be valid, would throw the usually accepted chronological pattern for the Early and Middle Bronze Ages into total chaos. From the reports of Petrie and others he dredges up a horrifying collection of anachronisms, including the seemingly incredible fact that the type of patterned ware associated with the Egyptian 1st Dynasty was, in Petrie's words, "identical with that of later Aegean or Mycenaean pottery" (p. 407). He adds a number of apparent *Second Intermediate Period* features from 1st Dynasty tombs that seem to defy explanation.

Dayton's conclusion that the 1st Dynasty of Egypt and the Jemdet Nasr Period are of *Middle Bronze* date raises unheard-of and abominable problems for Near Eastern archaeologists, and is almost impossible to assess without a massive study of Early and Middle Bronze Age chronology. Dayton himself, while the destructive potential of the anomalies he points to is not to be underestimated, seems reluctant to construct a revised model for this period in enough detail to be readily evaluated. Apart from the general conclusion that many of the earlier Egyptian dynasties were probably contemporary, Dayton gives little clue to exactly *how* he thinks Old and Middle Kingdom chronology should be revised, and his one crack at the "game on Manetho juggling" (p. 412) is rather vague. While this is rather exasperating, it was not really Dayton's task to penetrate the complex and confusing world of dynasties and king lists, rather to point out, from the technologist's point of view, what he sees as the inadequacies of the accepted archaeological chronologies.

... From Dayton's point of view, the supposed disappearance of skills during the nebulous "Dark Ages", c.

1200-800 BC, and their subsequent reappearance, make very little sense. For him, as for Velikovsky, this "Dark Age" is imaginary, a phantom produced by an incorrect chronology. His brief discussion of the site of Hissarlik (thought to be Troy), a classic "Dark Age" site with no remains for "four hundred years" makes many interesting observations, noting, for example, the close similarity of the *Buckelkeramik* that appeared in "12th century" Troy VIIB to Italian ware of the Hallstatt period from c. 900 BC onwards. A note on the "Italian Connection" between barbarian European and Mycenaean chronologies reveals similar gaps that pose serious problems for European prehistorians.

... Dayton is very conscious of the fact that his forays into chronology are only a beginning, and his conclusions are undogmatic and flexible, a few large swathes at the foundations of the "cardhouse". Part III begins with the admirable motto: "It is better to be roughly right than precisely wrong." His book offers invaluable reference studies and a mass of "hard" data on technology for the chronological researcher, plus plenty of material and ideas for further controversy. The reaction of the archaeological community will no doubt be "mixed", not to say hostile. One can only hope that this fascinating interdisciplinary work receives the attention it deserves.

Psychic Roulette by George Vandeman. Pacific Press Publishing Association, Mountain View, California. 160 pp., Paper, \$2.75.

Reviewed by H. L. Armstrong.*

This work, which was originally published several years ago, seems to have been re-issued recently. The thesis maintained is that the many expressions of occultism, of which one hears nowadays, are to be viewed as attempts by evil spiritual beings to entice people for their own purposes. Some of the occult matters mentioned, or ones considered occult for the purpose of the book, include spiritualism in its many forms, investigations about reincarnation, astrology, hypnosis, some of the experiments in biofeedback, and some others.

Among manifestations of the occult the author includes the outburst of unidentified flying objects, or some of them. No doubt some of the reports arise from hoaxes, or from mistakes. But there seem to be some which can not be explained away thus. Yet from the reports it is hard to believe that the flying saucers, and other such things reported, are really solid, physical objects.

The author suggests that such phenomena are examples of the latest way in which spiritual forces of evil are attempting to make contact with people, and eventually to bring them under their control. At one time, these forces impersonated the dead. Now, they change their tactics, in accordance with the different superstitions now current, and pretend to be extraterrestrial beings. But their ultimate aims have not changed at all.

Readers of this work may find some points of theology with which they can not agree. But they will find useful warnings against spiritual menaces which, while new in detail, are old in essence.

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LETTERS TO THE EDITOR

On the Hebrew for an Indefinite Period of Time

Having been a Creationist for several years, I have taken an active interest in both the Biblical and the scientific case for Creation. However, there is a Biblical argument for Creation which I have never seen fully stated.

It has been pointed out that if the writer of Genesis had wanted to say ages, instead of days, (to explain an evolutionary sequence of events) he could have used another word.¹ However, no one has ever suggested an alternative in the books on the subject which I have seen.

One possible alternative would seem to be the Hebrew word *olam*, which can mean an indefinite time.² For instance, Joshua, in Joshua 24: 2, said: "From ancient times your fathers lived beyond the River . . .". (NASV). In the Hebrew, "from ancient times" is the word *olam*.

The amount of time is not specified in this passage; but this very point is significant to the Creationist. If the alleged evolutionary sequence of events were the true one, God could have had Moses use *olam* to express indefinite periods of time, such as a thousand, a million, or ten billion years. On the intellectual level, it would not have been necessary for Moses to know the exact amount of time involved, just as Daniel did not understand all of the revelation which he wrote. (Daniel 12: 8-9). It was necessary, though, that Moses be accurate, for the accuracy of Scripture must be preserved. God could easily have had Moses use the word *olam* in the account of Creation. That would have left the passage open to an evolutionary interpretation without violating Moses' intelligence.

But, in fact, the Hebrew word which God had Moses use was *yom*, the ordinary word for day. Since an evolutionary sequence could have been expressed in Hebrew, but in fact that was not done, it must be concluded that the days of Genesis were ordinary days of 24 hours.

References

- ¹Morris, Henry, 1970. Biblical cosmology and modern science. Baker Book House, Grand Rapids. P. 59.
²Young, Robert. Analytical concordance to the Bible. Funk and Wagnalls Co, New York. P. 990.

Sincerely,
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Yes, Historical Accuracy!

I believe that Mr. Robb's question: "How about historical accuracy?"¹ is an important one. In Appendix D of my book, *The Great Brain Robbery*,² I have given some reasons for accepting the chronological interpretation of Genesis 5 and 11. Here are a few more:

1) It was God Who invented the calendar. (Gen. 1:14). Life could certainly have existed on this planet without any timekeeping devices; but the annual orbit of the

Earth through the signs of the zodiac was evidently designed by Him so that we should "number our days". Adam and his successors knew this well, and kept track of their birthdays. Ancient civilizations reveal an astonishing grasp of astronomy.

2) The Old Testament is packed with chronology, the word 'year(s)' appearing about 700 times. The length of the Israelites' sojourn in Egypt is specified, and the interval between the Exodus and Solomon's temple. Thereafter the length of every king's reign is noted until the Captivity, when Jewish chronology merges with Babylonian (Daniel 1:11; 2:1), and Persian. From Abraham's leaving Ur to Joseph's death there is an exact chronology built into the book of Genesis; the date of every important birth, marriage, and death is noted.

Incidentally, I am well aware of the problem about Cainan; but it is, I suggest, of minimal importance when set against the broad spectrum of 2,000 years between Adam and Abraham.

3) All of this leads us to infer that dates are an important part of God's revelation. Evidently the Jews thought so too; Stephen mentioned four in his historical recap (Acts, Ch. 7), and Paul two (Acts 13: 18 & 20). By the analogy of Scripture, we have good grounds for thinking that the chronological principle runs right back to Genesis 1-11.

4) I submit that the principle of postulating gaps in the Old Testament from acknowledged gaps in the genealogies in the New Testament is wholly erroneous. Equally, one could argue that idolatry is not sinful because Christ never mentioned it, or that the six days of Creation are unimportant because He is not recorded as having spoken of them. In fact, of course, He at all times assumed an acquaintance with the Scriptures (i.e., the Old Testament) in His hearers, just as Matthew assumed an acquaintance with the genealogies on the part of his readers.

Further, an evolutionist might argue:

"Luke 3: 23-38 gives a list of names in the genitive case. In order to reconcile the Bible with the theories of modern archaeology and anthropology you allow the possibility of names omitted. Why, then, do you not allow another gap between God and Adam—a gap large enough to contain thousands of ape-men? Perhaps "God made man in His own image" means: "God made man's-ancestors-with-the-capacity-of-evolving-into-His-image"!!

Conclusion

Once we abandon at any point the plain, obvious meaning of Scripture as it has been understood by scores of generations of Christians (including such men as Sir Isaac Newton) we entangle ourselves in a never-ending mesh of problems worse than those we seek to avoid. Is it not time for Creationists to stand up for the truth of Genesis 5 and 11, as we have stood for the truth of Genesis 1-3 and Exodus 20:11? To me it seems not at all improbable that archaeologists and anthropologists should be as hopelessly wrong in their dating of Man, Civilization, and the Flood, as geologists and biologists

have been in their dating of rocks and fossils.

In my opinion, then, there is no compelling need to concede uncertainties in the genealogical parts of Scripture; and statements such as: "Scripture does not reveal the exact date of Adam's creation:", or "Scripture does not provide data by which the date of the flood can be discovered" (*New Scofield Bible*) are unfortunate, unjustified, and untrue.

References

¹Robb, K.A., 1979. Historical accuracy too? *Creation Research Society Quarterly* 16 (3): 188.

²Watson, David C.C., 1976. The great brain robbery. Moody Press, Chicago.

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The Problem of Senescence

Senescence is defined as a deteriorative process which increases vulnerability and decreases viability for a given organism.¹ It is, alas, a function of all living systems. It might also be called that process "which leads ultimately toward death". The question is—why does it persist? It strikes me as odd, that, after so many eons of adaptation, it should remain such an overwhelming phenomenon in all species. That is, of course, assuming that all of these species *were*, in fact, constantly adapting themselves to the environment for that period of time. Does it not seem plausible to expect that at least a few species of creatures should have been able, prior to the onset of *Homo sapiens*' pollutants, to have achieved some form of, shall we say, "immortality"? The Galapagos and Giant Tortoises and their meager 150 year-plus lifespans are rather pitiful examples, I would say, for being exemplary among earth's creatures. After four billion plus years of evolution, I should think that we would be able to do better than that. Any amino acid capable of extricating itself from the primeval soup, developing an oxygen-sustaining system, and waking up several million years later to find out that it was a fish, should by now, after hundreds of millions of years of additional adaptation to Planet Earth, be able to grant us a shade longer existence than the measly three score and ten that most of us talking bipeds eke out! After all, let's be reasonable! Is that too much to ask?

It seems to me that if evolution can claim to bridge the gap between Non-life and Life with such self-evident ease, it should not be at such pains to explain to us why we do not observe at least the "birth-pangs" of immortality in some of the creatures around us, let alone ourselves. Apparently I am not the only person bothered by such a dilemma:

The theoretical difficulties of devising a system in which *short* life is selected as a character of fitness are considerable though not insuperable.²

Well, let's see such a system! It would seem that we, as Creationists, have quite a field here in which to play. The more time evolution requires for its schemes, the

less plausible death itself becomes. We know that senescence, and its ultimate outcome, death, are both the result of the Curse, and we look forward to that day when "The last enemy to be abolished will be death." (I Corinthians 15:26). It seems to me, however, that a great deal of work could be done in this area toward exposing this most fallacious aspect of evolutionary theory. Comments invited.

References

¹Comfort, Alex, 1956. The biology of senescence. Rinehart and Co., Inc., New York. P. 17.

²*Ibid.*, p. 38.

Yours sincerely,
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To John C. Whitcomb and Donald B. DeYoung

Thank you for your letter of November 20th, 1979. I certainly appreciate the autographed copy of your book *The Moon: Its Creation, Form, and Significance*. I have thoroughly enjoyed reading and meditating over this excellent work.

While I was on the moon my belief was in the theory of evolution. However, since that time I have put my faith in Jesus and the reality of the Holy Bible. I believe now with all my heart in God as the Creator and this book has been a tremendous inspiration to me to understand more fully the reality of God's creation.

May God's richest blessings be upon each of you and your families.

Sincerely yours,
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Mr. Duke was an Apollo 16 astronaut. This letter is reprinted here by permission.

CREATIONIST ARTICLE MADE AVAILABLE

We are informed that the article *An Analysis of Darwin's Natural Selection—Artificial Selection Analogy*, by Randall R. Hedtke, from the *Creation Research Society Quarterly* for September, 1979, has been made available in E.R.I.C., a national educational reference system, by the Minnesota Information Network for Educators, which is associated with the Minnesota State Department of Education at St. Paul.

It is good to see Creationist literature thus made available, and can be hoped that its message will have an influence in many schools.

CREATION RESEARCH SOCIETY

History The Creation Research Society was first organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a real need for an association devoted to research and publication in the field of scientific creationism, with a current membership of over 600 voting members (with graduate degrees in science) and over 1800 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is recognized as probably the outstanding publication in the field.

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

Membership Voting membership is limited to scientists having at least an earned graduate degree in a natural or applied science. Dues are \$12.00 (\$13.00 U.S. for overseas) per year and may be sent to Wilbert H. Rusch, Sr., Membership Secretary, 2717 Cranbrook Road, Ann Arbor, Michigan 48104. Sustaining membership for those who do not meet the criteria for voting membership, and yet who subscribe to the statement of belief, is available at \$12.00 (\$13.00 U.S. for overseas) per year and includes subscription to the Annual Issue and Quarterlies. All others interested in receiving copies of all these publications may do so at the rate of the subscription price for all issues for one year: \$15.00 (\$16.00 U.S. for overseas.)

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

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

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

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

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

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

Board of Directors *Biochemistry*: Duane T. Gish, Ph.D., Institute for Creation Research, 2716 Madison Avenue, San Diego, CA 92116. *Biological Sciences*: Wayne Frair, Ph.D., **Secretary**, The King's College, Briarcliff Manor, NY 10510; George F. Howe, Ph.D., **President**, Los Angeles Baptist College, Newhall, CA 91321; John R. Meyer, Ph.D., Los Angeles Baptist College, Newhall, CA 91321; Wilbert H. Rusch, Sr., M.S., LL.D., **Membership Secretary**, Professor of Science, Concordia College, Ann Arbor, MI 48105; E. Norbert Smith, Ph.D., Northeastern Oklahoma State University, Tahlequah, OK 74464; Paul A. Zimmerman, Ph.D. Concordia Junior College, Riverforest, IL; *Engineering*: D. R. Boylan, Ph.D., Professor of Engineering, Iowa State University, Ames, Iowa 50011; *Genetics*: John W. Klotz, Ph.D., Director of Graduate Studies, Concordia Seminary, St. Louis, MO 63105; *Geology*: Clifford L. Burdick, M.S., D.Sc., 924 N. 6th Avenue, Tucson, AZ 85705. *Geophysics*: Harold Slusher, M.S., D.Sc., University of Texas at El Paso, TX 79902. *Physical Sciences*: Harold Armstrong, M.S., **Publications Editor**, Queens University, Kingston, Ontario, Canada; Thomas G. Barnes, D.Sc., University of Texas at El Paso, TX 79902; Richard G. Korthals, M.S., **Treasurer**, P. O. Box 135, Arcadia, MI 49613; Henry M. Morris, Ph.D., Institute for Creation Research, 2716 Madison Avenue, San Diego, CA 92116, and President of Christian Heritage College, San Diego; George Mulfinger, M.S., Bob Jones University, Greenville, SC 29614; Emmett L. Williams, Jr., Ph.D., **Vice-President**, Bob Jones University, Greenville, SC 29614. *Science Education*: John N. Moore, M.S., Ed.D., 136 Brody Hall, Michigan State University, East Lansing, MI 48824.

ANTHOLOGY OF CREATIONIST WRITINGS AVAILABLE

Why not Creation, an anthology of selected articles from the *Creation Research Society Quarterly*, Volumes I-V, 1964-1969, is now available from the Society. Articles in it include:

Examining the Cosmogonies—a Historical Review
Entropy and the Solid State
Radiocarbon Confirms Biblical Creation
Cosmological Implications of Extinct Radioactivity from Pleochroic Halos
Sedimentation and the Fossil Record: a Study in Hydraulic Engineering
Prolegomena to a Study of Cataclysmal Sedimentation

Fossil Man in the Light of the Record in Genesis
Critique of Biochemical Evolution
Analysis of So-called Evidences of Evolution
The Galapagos Island Finches
Neo-Darwinism and Society

Why not Creation may be obtained from Creation Research Society Books, 5093 Williamsport Drive, Norcross, Georgia 30071, for \$4.95, postpaid and prepaid. Please make checks payable to Creation Research Society Books. Payments from outside the United States should be by a check drawn on a U.S. bank, or by international money order.