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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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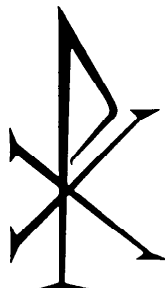
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COVER ILLUSTRATION

The boy, shown on the front cover, is very much interested in the conch shell; and who is there among us who does not find sea-shells fascinating, both for their beauty and for their intricacy?

It is suggested, in *Panorama of Science*, elsewhere in this issue of the *Quarterly*, that these shells may provide evidence for the goodness of the Creator. For here is a provision of beauty above and beyond any mere need, and goodness is revealed in the giving of more than is needed.

This picture was provided by the Florida Division of Tourism, Tallahassee, Florida, and is used here by permission.

TABLE OF CONTENTS

	Page
Studying the Human Brain.....	75
Kevin C. McLeod	
A Statistical Analysis of the Genesis Life-Spans.....	80
William L. Seaver	
Was the Pre-Flood Animal Kingdom Vegetarian?.....	88
Grant R. Lambert	
The Creation of the Earth's Magnetic Field.....	89
D. Russell Humphreys	
The Fossil Story.....	94
William J. Tinkle	
Panorama of Science.....	95
Some Implications of Variant Cranial Capacities for the Best-Preserved Australopithecine Skull Specimens.....	96
Gerald Duffett	
The Age of Lunar Craters.....	105
Glen R. Morton, Harold S. Slusher, and Richard E. Mandock	
Are the Bristle-Cone Pine Trees Really so Old?.....	108
Walter E. Lammerts	
What Bible-Scientists can Learn from Bible-Science.....	116
Barry Ferst	
Book Review (1).....	120
Letters to the Editor (4).....	121
Special Notice About Election, 1984.....	123
Report of the 1983 Board of Directors Meeting.....	124
Wayne Frair	
(Proposed) Amendment to the By-Laws.....	125
Creation Research Society Research Committee (RC) Activities: a Decade Review including Philosophy and Purpose.....	125



NOTICE TO AUTHORS

After 30 September 1983, articles, letters to the editor, and book reviews for the *Quarterly* should be sent to the editor-elect: Dr. Emmett L. Williams, 5093 Williamsport Drive, Norcross, Georgia 30071.

Items for *Panorama of Science* may continue to be sent to H. L. Armstrong, 4 Couper Street, Kingston, Ontario, Canada.

STUDYING THE HUMAN BRAIN

KEVIN C. McLEOD*

Received 6 January 1983

This study looks into the question, "why" the human brain is so large and complex. In the course of the investigation, the role of language in the fossil record is examined. The conclusion: that man and his brain are unique creations, will, it is hoped, encourage more insight into this most challenging area.

Few would deny that the three-pound human brain is the most complex structure in the universe. In fact, the human cranium really contains two brains in one, the *corpus callosum* that connects the two large hemispheres having over 20×10^6 connections. Epileptics whose *corpus callosum* was severed led nearly normal lives despite this obvious lack of intercommunication.¹

Consider the marvelous human brain—philosophers attempt to fathom it, science is still in an elementary stage of understanding it, and the computers cannot assimilate its myriad of functions. Neurological and other specialized scientists have calculated that a space of 1.5×10^6 cubic feet, 1×10^6 kilowatts of electrical power, 1×10^{21} wires, 1×10^{21} miniature tubes, and 2×10^{18} dollars in finances would be needed even crudely to simulate the human brain from the physiological view point.²

The case for design and a Designer seems paramount in considering the brain. Yet if evolution (the molecule to man theory) is true then this master jewel of its vast tireless struggle must assuredly proclaim also its creator — time, chance, mutation, natural selection, etc. The two views are discordant and if the reader is polarized between them and wonders 'is the debate of this issue truly important?' — consider this observation from Lassek in his book *The Human Brain*. "Circumstantial evidence, inference, and conjecture have been freely used in attempting to place together the story of mankind and his evolution, but scientific detective studies, during the past century, of remote and living savage and barbaric tribes have been helpful in crystallizing the overall picture. In all probability, the problem will continue to fascinate the minds of thinking men the world over whether they be theologians, philosophers, scientists or other specialists. It is doubtful whether it will ever be solved to the satisfaction of all because the human race can be traced back, with some degree of surety, only to about 5,000 B.C. Beyond this date, man's behavior is partially clothed with mystery. Any conclusions made in this field will always be of significance to man because *where he thinks he originated affects his everyday psychology*."³

Studies and Comparisons

The mind of man and the studies of its supreme complexity is more than curiosity but a contemplation into the very core of our human-ness. For what really holds man distinct from the animals is his brain — correct? Presented below are a few studies pertinent to this presentation.

1. Man's brain is not absolutely the largest, the average human brain weighs 1.5 kilograms while

that of the larger whales weighs 5 kilograms⁴ and in elephants 2.5 kilograms.

2. Brain weight compared to body weight does not have man at the pinnacle. In the whale its ratio is 1:8,500, in man 1:44, in the marmoset and capuchin monkey 1:27 and 1:17.5 respectively.
3. Man does have the substantial advantage in cortical surface area (due largely to the extensive fissurization that buries 72% of the cortex). Compared to the monkey, man has 2,579 cm²; monkey 109 cm².⁵
4. The amazing enlargement of the human brain continues rapidly after birth; the difference in capacity between human and pongo (chimpanzee) foetal skulls is not markedly divergent — being 120ml to 95ml respectively.⁶
5. Man's motor cortex is augmented 16.7 times over that of the monkey (being 80.18 cm³ to 4.79 cm³) which allows in part for the fine motor functions that humans display.⁷
6. The "hallmark" of man is his relatively large frontal lobes or association cortices; however when frontal lobe measurements are compared to the rest of the cortices, man is not unique — man 1:3.79 (25.4%)
—chimpanzee 1:3.61 (27.8%)
—and macaque 1:3.79 (26.4%).⁸
7. Man's brain is a leader but not a numerical champion in comparing the sum of neurons in the hemisphere
—man 6.9 billion
—chimpanzee 5.5 billion
—and macaque 2.5 billion.⁹

Why Is Man's Brain Different?

"Man's cortex is more finely differentiated cytoarchitectonically and therefore capable of unique and complex behaviors."¹⁰ Given then that man's large lobes are finely differentiated, the question pleads 'how this specific specialization arose?' Jerison proposes to offer an answer in his book *Paleoneurology of Language*. "This is actually an essay on why the human brain is so big. Language is clearly part of the answer, and it may be the whole answer."¹¹

Dr. Jerison, in studying localized brain lesions and their effects on language, estimates that 50% of the volume of human brains is involved in language — its transmission, reception, assimilation, comprehension and association. Evolutionists believe that the beginning of language had to have selective advantages. That possibly the perception and memory required to create cognitive maps of their hunting ranges supplied the hominids an environmental niche.¹²

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There arises in this author's mind a difficult decision — if language (other scientists believe that tool-making may either have preceded or paralleled the advent of language)¹³ was the new skill that necessitated man's brain to enlarge and if the larger hominid brain is what allowed him the use of language — then which came first? Remember that natural selection is a passive screen, then the creation of the delicate and intricate functions of man's brain (mind) relies upon the undirected chances of nature, i.e., that force that can only and ultimately produce biological change — genetic mutation.¹⁴ With this in mind consider the following illustration.

The computer has already been likened to our brain — then imagine if the critical operations of any large city bank (every bit as subjected to competition and pressures from within or without as the hominid ancestor) would be improved if by happenstance fashion connections were switched, pulled, added, or rearranged in the micro-chip-centered-hardware of its giant computer. Would you deposit your funds in an experimental bank of this order?

It has been estimated that 600 cm³ more 'brains' would be needed to channel a language-incompetent chimpanzee onto a level of competency.¹⁵ But is the addition of 'more' cerebral tissue really the answer to the advent of higher intelligence? "The fact that this expression (density) is valid from the smallest mammalian species to species with brains much larger than man is another indication that intelligence does not bear a simple relationship to neuron density and degree of axodendrite complexity in the cerebral cortex."¹⁶

Zamenhof conducted an interesting study in which he injected somatotrophin into pregnant rats increasing the neuronal mitotic activity in the fetus. He got increases of

- 70.4% in cortex volume,
- 30% in cerebral hemisphere weight,
- and 14.8-27.6% in cortical cell density at maturity.¹⁷

But on psychological performances these 'superbrain' rats acted only equal to controls. In fact, females, who seemed to have more changes in cortical structure, needed more trials than males in learning mazes. Zamenhof concludes, "Perhaps the behavioral evidence is best explained by the possibility that increased density actually lowered dendritic branchings and the level of task requirement."¹⁸

Some scientists are not satisfied that hominid language evolved as a response to selective pressure for improved communication. They point to the examples of birds who have subprimate encephalization and yet produce marvelously variable sounds, responding with selectivity to many specific songs and show plasticity in their productions inducing "racial variants on their calls."¹⁹ They suggest the rapidity of hominid encephalization during the past few million years (which no other mammalian species evidence) suggest a niche uncharacteristic of primates had been invaded and that was that of the social predator.²⁰

It is known that wolves, for instance, are highly successful social predators, displaying great daily range and navigation skills aided by sophisticated olfaction

and scent marking systems. Researchers theorize that since primates had a reduced sense of olfaction, the hominids evolved a vocal-acoustic "language" system in substitute.²¹ This theory has many problems aside from the point that nature in bypassing a 'simple' diminution of olfaction in early hominids certainly detoured an equivalent distance of light years in its blind quest to construct a superior and 'complex' achievement in man's brain. Where is the evidence for man's evolutionary record as a predator? Rose remarks candidly, "The fossil and other direct evidence for the evolution of human subsistence patterns is patchy and equivocal."²² Also, while the motor systems were developing to produce the complex sounds of human speech, the neuronal control had to be as highly integrated as any other cortically directed motor system (to have the plausibility of working effectively) and no motor system requires such sophisticated control as the voice box and associated organs of speech. This prerequisite bespeaks of pre-adaptions.²³ If you include pre-adaptions in your model, then it seems nature is no longer blind and working randomly. Nature then demonstrates the same forethought and provision as a Master Designer and theologically becomes equivalent to God.

Also, research into man's behavior, brain size, and brain complexity still affords more baffling questions. Holloway in his article for *Brain Research* states, "However, assuming for the moment that a relative increase in frontal association cortex did take place in the case of man, it still remains unclear as to how this would account for man's behavior in contrast to the apes."²⁴

As noted above in study number seven, man does have more neurons to work with but the question is asked, "What is the difference between $2^{6.9} \times 10^9$ and $2^{5.5} \times 10^9$?" Does this infinitesimal difference between two infinities decide the difference in behavior between the two forms (man and chimp)? . . . it is disappointing to find that man has but 1.25 more neurons in his cortex than his lowly cousin."²⁵

Holloway goes on to say "It is not clear how either 1.25 more neurons or additional maturation time would explain the differences of behavior between man and ape."²⁶ And in his conclusion he summarizes,

- (a) gross differences of the size in brains alone does not explain differences of behavior within the primate order
- (b) cytoarchitectural differentiation is not in line with current evidence of neurohistology
- (c) frontal lobe differences appear to be slight, if they exist at all, within much of the primate order and
- (d) simple addition of more neurons still leaves the difficulty of explaining the nature of the transformation.²⁷

See also Figure 1.

Singularity of Man

There is something fundamentally unique about man's brain because of what he 'can do' with it. He is the sole owner in the universe of this marvelous organ that enables him to be all that is meant by the encompassing word — human. With this brain (and its in-

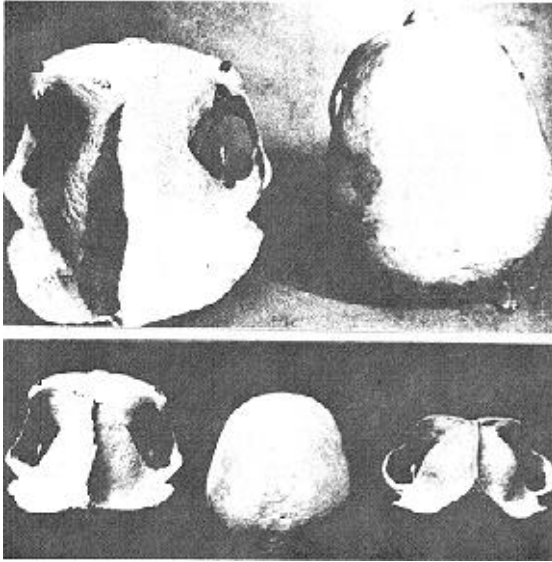


Figure 1. Upper: posterior view of gorilla (left) and human (right) skulls show the vast difference in exterior design. Lower: posterior views of skulls (left to right) of gorilla, orangutan ("man's closest cousins?"), and man. The vast differences in design are not only obvious in an external view, but also have their counterparts in differences in cranial capacity, size of brain, and intelligence.

These pictures are according to Reference 46, and are used here by permission.

herent mind) he is not just at the pinnacle of nature's creation — he is above nature because it appears that only man can truly manipulate nature itself.

Where did this power come from? Some would suggest that the terminus to this question is found in the beginning. Read Genesis 1:28-30.

To state that man is unique is an understatement. Consider these few examples. Man is the only creature who weeps, who creates new materials (even elements), who provides elaborate shelters and tools, who possess culture, tradition, and the means for transmission of experience (in language written and spoken). Only man buries the dead, reproduces works of art and music, decorates and adorns himself. He only enacts laws and governments to set rules for his behavior and he alone displays a moral conscience, the ethical knowledge of right and wrong. Only man is truly teachable with the ability to learn from experience and the witness of past generations and modify his environment accordingly. Man alone domesticates other animals, cares for his sick and injured with medicine, has science that fathoms the laws of the universe, and has compassion for fellow creatures (with means to save from extinction endangered species). And man is the only being who worships a higher being — who worships God.

And recent research is now disclosing that man's mind has demonstrated a higher level of consciousness than ever before acknowledged by science. French physicists have reported that school children by thought alone can alter the decay rate of radioactive emission.²⁸

Endocast

The physical evidence for hominid evolution and the theoretical evolution of man's brain depends heav-

ily on fossil remains. By fossil evidence it is hoped that traces of his ascent can be construed. When fragments of skulls are discovered, the pieces are analyzed and assembled and missing portions are supplied to form what is believed to be an approximate conformity of its living shape. By studying the interior conformation, dimensions, indentions, and modeling of the inner table of fossil bone a cast of the possible configuration of the organism's brain can be assumed.

Studying imprints of endocranial grooves is speculative business; and some researchers like Weidenreich confess: "comparatively speaking the number of grooves means nothing; and the whale steals the show in this respect. This marine mammal has without question the most intricate cerebral arrangement of all the different species."²⁹ This points out the fact that a study of endocranial groove imprints alone (which is all the evidence a fossil can give) in the case of the whale, would probably not lead to our understanding of the 'intricate cerebral arrangement' that we know exists.

In studying the sizes and shapes of skulls in early man Weidenreich in his paper for *American Anthropologist*³⁰ compares these variations to corresponding variations among breeds of dogs. He suggests that the vast differences in sizes exactly parallels alterations in sizes and shapes of what would be predicted from different varieties of man.

This entire area of attempting to uncover a lineage of man's supposed evolution through fossil findings coupled with neuropaleontological assumptions is laced with problems. Bennett summarizes one aspect of this search well, "There were also striking exceptions to the general relation — idiots with larger brains and geniuses with smaller brains. The hypothesis of an intrinsic relation between brain size and cerebral exercise or ability was therefore generally abandoned. The difficulty of working with such factors discouraged research, and the problem largely reverted to the speculative realm."³¹

Olson writing in the *Journal of Human Evolution* upon the graduations in hominid ascension notes: "The evolutionary and systematic fallacy inherent in morphological grades becomes increasingly evident as the paleontological record increases in its completeness and the morphological discontinuities caused by inadequate sampling are reduced."³² Elsewhere in this same journal Zindler states, "All other augments and elaborations assigned to mankind's lineage — such as a hominid augment to bridge the gap between the australopithecine and habiline (*homo habilis*) elaborations — are hypothetically inspired constructs in the absence of a tenable cranial fossil record."³³

Attempting to trace the theorized enlargement of man's brain through fossil skull and endocast analysis has other inherent hazards. It must be remembered as Jerison points out, "potential sources of error . . . if a pathological or immature fossil happens to be collected. If the only evidence on the fossil is the endocast, then the error is unavoidable and one must include it in estimating the risk of errors in wrong decisions."³⁴

Jerison is critical of the role endocasts attempt to assume in landmarking 'developing' language areas.

He states, "To argue that a particular depression in a natural endocast in a fossil hominid represents a posteriorly shifted lunette, and therefore, enlarged language area anterior to the lunette, seems to me futile and probably false."³⁵ He goes on: "Is there further evidence in the endocasts themselves for localized expansion of the language areas? In my view, aside from the evidence of asymmetry, the answer is no."³⁶ He finalizes his opinion of localized language areas in hominids by saying, "It is impossible to use evidence of fossil endocasts as part of the argument in its favor."³⁷

In fact, an interesting observation is made concerning the cortical relationship involved in brain structure and language. "If one works on the problem as a bit of design engineering it turns out to require moving structures into unusual positions."³⁸ This requirement from an engineer (designer standpoint) is just the exact design that presently functions in all normal human brains.

Finally this enlightening statement by Holloway should be appreciated by all interested in the theory of human evolution. "The study of primate endocasts, particularly in the great apes and hominids, gives exceedingly little information about evolutionary changes and permits little basis for suggesting hypotheses concerning the events of man's evolution . . . The extreme variability of cranial capacity is well appreciated, and its correlation with any sort of behavioral attributes is notoriously low. Brilliance may be exhibited by men whose cranial capacity differs as much as 1000-1100 ml, a magnitude which is as much or more than the known (supposed) increase in this pa-

rameter from say Australopithecis to modern Homo sapiens, i.e., the whole of hominid evolution."³⁹ Please note the graph illustrating these ranges: Figure 2.

Microcephaly

It is no supreme whim or fluke of nature that man's brain is so vastly complex — no matter what the size, as observations in microcephaly reveal. Microcephaly is a rare condition (1 out of 250,000 births) resulting in small craniums usually from premature closure of the skull sutures in the infant's early development. Reference to the graph shows microcephalics with cranial capacities in the 500 cm³ and one in the 300 cm³ ranges. Holloway states, ". . . the fact remains that very small brain size within pongid limits permits behavior patterns that in no sense can be viewed as pongid."⁴⁰ "These examples of microcephaly make salient the fact that something in the way of human specificity exists, even when the brain is deficient."⁴¹

Conclusion

One must assume that for man's brain to evolve as rapidly as it 'has' in the relatively short span of a few million years, then a dynamic and variability of structures must have arisen to pass the accrediting forces of selection. However, if we use the present as our key to the past — a different picture emerges.

Notice these two observations. One — by Bennet and Diamond writing in *Science*, "Whatever the cerebral residuals of experience are, it is unlikely that they will involve large changes of either gross anatomy or chemistry. It is characteristic of the brain that its variability is extremely low. Weight of the brain varies less from individual to individual of a species than the

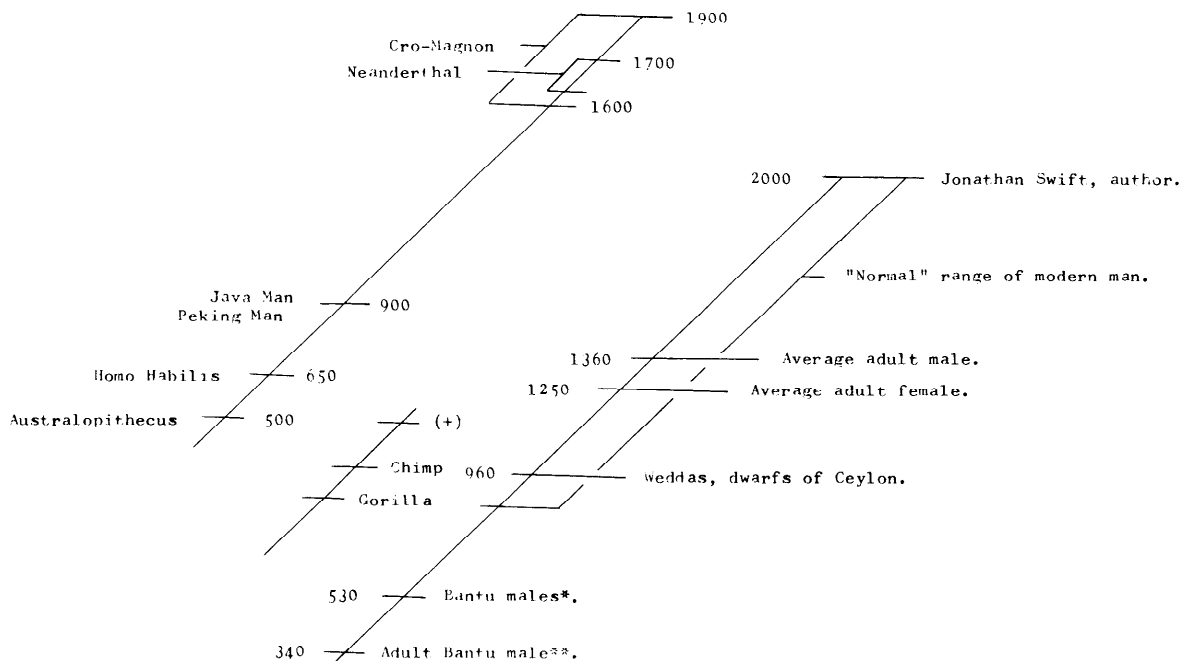


Figure 2. This shows brain capacities for some alleged evolutionary ancestors, the apes, and modern man. Unless specified, points represent a mean value. The scale is in milliliters.

*Average of three brothers with cranial capacities of 561, 511, and 517. They possessed speech capabilities.

**Institutional worker.

(+) One large brain case of a gorilla. Reference 8, p. 128.

weight of almost any other organ, and we have found the coefficients of variation for acetylcholinesterase activity to be almost as small as those for weight."⁴² And two — by Grassé in his book *Evolution of Living Organisms*, "For several millenia the Chinese have numbered hundreds of millions. The conditions of their physical and social environment have favored intensive selection. To what result? None. They simply remain Chinese. Within each population, men differ by their genotype, and yet the species *Homo sapiens* has not modified its plan or structure or functions. To the common base are added a variety of diversifying and personifying ornaments, totally lacking evolutionary value."⁴³

We have attempted, in short, to examine the issue of our large uniquely human brain, the role of language in its development, and the place of fossil studies (endocast) aiding our understanding. Some evolutionists predict a bleak future for us humans noting that the endocranial capacity of man has decreased since Neanderthal times.⁴⁴ Perhaps one intellectual was right — It's later than you think.

Finally, it is hoped that open-minded research will newly be channeled into this most fascinating area of the human brain. It is believed that a greater knowledge of the *design* and function of the brain can only return benefits to mankind at large. It is not just academia at work here but the use of this fund of information to cure mental diseases, mental illness, understand our development, aid learning, predict effects and causes, prevent mental retardation, strokes, cancers, dementias, epilepsy and hundreds more — all basically to better understand ourselves. To conclude, this last comment by Dr. Weider Penfield, a pioneer in the electrical treatment for epilepsy, seems most beneficial. "Do brain mechanisms account for the mind? [In] death the mind seems to vanish, as in sleep. I said "seems" . . . If, however, during life, when brain and mind are awake, direct communication is sometimes established with the minds of other men or with the mind of God, then it is clear that energy from without can reach a man's mind. In that case, it is not unreasonable for him to hope that after death the mind may awaken to another source of energy."⁴⁵

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A NEW JOURNAL OF PHYSICS

It is apparent from correspondence that many readers of the *Quarterly* are interested in the theory of relativity, and related matters. These people might like to know about the *Journal of Classical Physics*, which is apparently in its second year of publication, and of which we have heard recently.

The purpose of the journal seems to be to take up the line of approach to physical problems which was followed so successfully, by Maxwell, Lorentz, Heaviside, and others around the turn of the century and a little earlier, before it was abandoned — prematurely, some think — early in this century. Items which have been published include: Electron Structure; Similarities between Gravitational Force and the Force Between Electrostatic Dipoles; Modifications of Maxwell's Equations; and Astronomical Counterevidence to Relativity.

The address is: The Journal of Classical Physics, Box 492, New York, New York 10185.

A STATISTICAL ANALYSIS OF THE GENESIS LIFE-SPANS

WILLIAM L. SEAVER*

Received 24 December 1982

An extensive statistical analysis of the life-spans of the patriarchs, as given in Genesis Chapters 5 and 11, shows that statistically the life-span can be considered constant before the Flood, while after the Flood the data can be fitted by an asymptotic exponential decay curve. Also, it is concluded that as for the life-spans reported in Genesis Chapter 11, the data in the Masoretic text are the authentic ones; those in the Septuagint have been tampered with. Moreover, it is statistically unlikely that there are gaps in the genealogies in Genesis Chapter 11.

In his recent book, *The Waters Above: Earth's Pre-Flood Vapor Canopy*, Joseph Dillow has noted that for almost 75 years different theories about a water canopy have been proliferated in creationist (and other) literature.¹ This pre-Flood vapor canopy has been proposed to be the only scientific and Biblical explanation for the greatly extended lifespans of the post-Flood patriarchs. It has been contended by Morris and Whitcomb and others since that this vapor canopy shielded the pre-Flood patriarchs from radiation bombardment; and that with the collapse of the canopy increased radiation levels would result in decreased longevity.² On the other hand, Donald Patten has suggested that after the Flood there was a progressive decline in carbon dioxide (affecting the skin and the brain) resulting in a decline in oxygenation of brain cells, which is considered the cause of accelerated aging.³ However, it is not the intention of this author to debate what caused the decline in lifespans, but to analyze the decline both statistically and Biblically.

Graphic analysis of the life-spans delineated in Genesis 11 seems to indicate an exponential decay function after the Flood. Both Patten⁴ and Armstrong⁵ have investigated this functional possibility. Later, Strickling, using the data from the Septuagint and Masoretic texts, generated exponential decay functions for expressing the post-Flood life-spans for the purpose of establishing a correction factor for the Carbon 14 dating process.⁶ More recently, Dillow has used linear regression to derive the equation

$$y = 652e^{-.1355x} \quad (1)$$

where y = the age at death for the patriarch and x = the number of generations from Noah, with $x = 0$ at Noah's generation.⁷ Because there was a high correlation of .95 (perfect correlation is +1 or -1 and in no correlation the correlation coefficient $r = 0$) between the life-spans and the generations, Dillow concluded that the exponential decay curve was statistically valid.⁸ His model is a building stone and a step in the right direction; but is still not quite Biblically and statistically correct. A proper statistical analysis of the longevity data, using recently developed statistical model building reasoning, and the scriptures shall confirm another model to have the best fit. Furthermore, statistical analysis of the Genesis 5 and 11 age data shall confirm two recent conclusions: (a) one by Niessen that there was a deliberate and systematic tampering of the Septuagint ages⁹ (b) and another by Dillow that for there to be gaps in the genealogy "the

gaps would have to be systematic and specific, not random."¹⁰

Statistical Model Concepts

To develop a statistical model, whether by linear or nonlinear regression methods, the purpose of the model must be carefully considered. Statistical models can be used solely for data description as Dillow, Patten, and Armstrong have done, for parameter estimation, and for prediction and estimation as illustrated by Strickling in his analysis of the Genesis 11 data. The appropriate model for the post-Flood patriarch life-spans should not only be descriptive of the Genesis 11 data but beyond. Also, the parameters of the equation should have some meaning, and the predictions or estimates for later generations should be sensible. In addition, assumptions about the error terms ϵ_i for a simple linear model (if it were appropriate for the Genesis 11 life-spans)

$$\hat{Y}_i = \beta_0 + \beta_1 X_i + \epsilon_i \quad (2)$$

may be very important depending upon the use of the model.

The models that could be used in analyzing the Genesis longevity data are either linear or nonlinear. The statement that a model is linear or nonlinear refers to linearity or nonlinearity in the parameters, β_0 , β_1 , β_2 , etc. Y being the response variable and X representing the predictor variables. A linear model would be as follows:

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 X_i^2 + \dots + \beta_p X_i^p + \epsilon_i \quad (3)$$

On the other hand, the nonlinear model

$$y = \beta_0 \exp(-\beta_1 x + \epsilon) \quad (4)$$

used by Dillow can be transformed to a linear model by taking logarithms to the base e as shown below:

$$\ln y = \ln \beta_0 - \beta_1 x + \epsilon \quad (5)$$

However, sometimes a nonlinear model cannot be converted into a linear form.

If a linear model is chosen, say $Y = \beta_0 + \beta_1 X$, the unknown parameters (β_0 , β_1) for this simple linear model must be estimated, $\hat{y}_i = b_0 + b_1 x_i$, where b_0 = the y intercept and b_1 = the slope of the line. For linear regression, the method of least squares is to minimize the function,

$$Q = \sum_{i=1}^n (y_i - \hat{y}_i)^2 = \sum_{i=1}^n (y_i - b_0 - b_1 x_i)^2, \quad (6)$$

with respect to each estimated coefficient where y_i = the actual observation value and $\hat{y}_i$ = the fitted or predicted value corresponding to the associated x_i . The solution is unique.¹¹ For nonlinear regression, an iterative technique for obtaining the parameter estimates is

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necessary. There are three iterative methods: (1) the Taylor series or Gauss-Newton method, (2) the gradient or steepest descent method, and (3) the Marguardt compromise which is basically an interpolation between the other two methods so that the size and direction of the step of convergence can be determined simultaneously. A mathematical summary of these three methods is presented by Draper and Smith.¹² The Marguardt compromise is the nonlinear method used for the nonlinear regression model in this paper. It should be mentioned that all three iterative nonlinear estimation procedures require initial starting values for the parameters, and all available prior information should be used to make these starting values as reliable as possible. Poor starting values can lead to poor convergence or a wrong estimation. However, there is certain Biblical information that can be utilized to establish good starting values for the nonlinear model for the post-Flood data.

Once a feasible model is found that describes the data and estimates the parameters, the next phase of the model building is checking the adequacy of the model. Various questions on model adequacy are asked. Is the model reasonable for present and future observations? Do certain data points not fit the equation? Why do these unusual observations not conform? Must the original model be modified? These kinds of questions in building a statistical model, whether linear or nonlinear, lead to a repetitive process which goes from data to model, model to data, data to model, etc., until final adoption of a totally adequate model.

An easy way to check for adequacy is to compare the observed data values (y_i) to the fitted values of the model ($\hat{y}_i$). These differences between data and model fit, $y_i - \hat{y}_i$, are called residuals:

$$e_i = y_i - \hat{y}_i \quad (7)$$

There is a residual, e_i , for each data point. An extremely large residual might suggest that either model is inadequate as to fit or that the observation in question is suspicious. Unusual observations that are not due to an incorrect specification of the model are called outliers. For instance, with a one-dimensional or univariate data set, an outlier would be an observation that sticks out unusually far on the end of the data set. There are numerous outlier diagnostics for linear regression that have appeared in the last ten years: standardized residuals, studentized residuals, Cook's index, the elements of the hat matrix, changes in the model coefficients or the model fit as a result of omitting an observation, and others.¹³ Some of these outlier detecting methods can be extended to nonlinear regression. However, it is best only to mention the outlier diagnostics as they occur and their value for the situation at hand.

Pre-Flood Analysis

The Biblical evidence strongly supports the fact that there are no gaps in the Genesis 5 genealogy. As noted by Dillow, there is an absence of gaps in Genesis 4:25, 26 between Adam, Seth, and Enosh where a father-son, not a father-descendant, relationship is attested to by the first three generations.¹⁴ In addition, Jude 14 confirms that Enoch was the seventh generation from

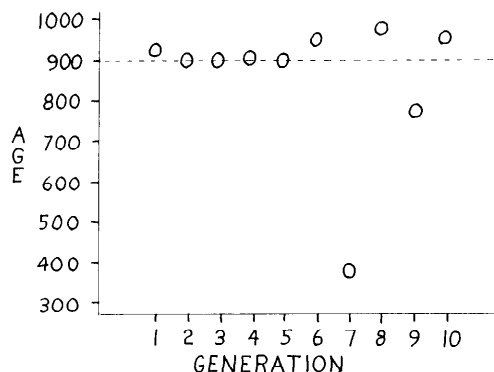


Figure 1. Pre-Flood data. "O" shows the observed, i.e. recorded, age of the patriarchs. The broken line shows the predictive equation for the median regression model.

Adam. Thus, the implications of these two passages are that there are no gaps between the remaining three generations. Niessen's recent work on a tight chronology for Genesis 5 and 11 exegetically and logically supports the belief that there are no gaps in the genealogies.¹⁵

Figure 1 gives a pictorial presentation of the prediluvian ages from Adam to Noah. Noah's inclusion in the Genesis 5 chronology even though he lived in the pre-Flood patriarchs is because of three reasons. First, as far as longevity, Noah is more like the pre-Flood patriarchs. Secondly, there is symmetry in the genealogies of Genesis 5 and 11 (ten generations in each) if Noah is included with the prediluvian patriarchs. And finally, if Noah is included in the post-Flood age, he is a statistical outlier that does not conform to the post-Flood model.

Examination of the data in Figure 1 suggests, to the statistician, that three models or model variations could fit the data of Genesis 5: a simple linear regression model, a median regression or robust regression model, or some arithmetic mean model. Using x for the number of generations away from Adam (with $x = 1$ at Adam) and y for the age-span, the following linear regression model can be fitted:

$$\hat{y} = 924.60 - 12.20x \quad (8)$$

$$(t = 7.19) (t = -.59)$$

The slope, -12.20 , suggests that ages declined 12.20 years for every generation prior to the Flood. However, a statistical test for the significance of this slope as being different from zero gives a t value of $-.59$, which means probability wise that there is about a 72 percent chance of finding a more significant slope. Furthermore, examination of the predicted values for this model and of the residuals in Table 1 shows that this model is inappropriate. The predicted values of the linear regression model are only relatively close to the actual age-spans for the first five generations. From Jared on, the residuals are large. Using the studentized residual (the residual divided by its unique standard deviation) or the studentized residual which examines the fit of the model on the remaining $n - 1$ data points when the i^{th} data point is omitted, it is obvious visually from Table 1 that Enoch is a statistical outlier. Statistical tests based upon the maximum studentized residual or the studentized residuals with

Table 1. Pre-Flood Analysis: Simple Linear Regression.

Name	Birth After Creation	Death After Creation	x Generation	y Age	y Predicted Age	e _i Residuals	Studentized Residuals	Studentized Residuals with i th Point Deleted
Adam	0	930	1	930	912.4	17.6	.12	.11
Seth	130	1042	2	905	900.2	11.8	.07	.07
Enosh	235	1140	3	905	888.0	17.0	.10	.09
Kenan	325	1235	4	910	875.8	34.2	.20	.18
Mahalalel	395	1290	5	895	863.8	31.4	.18	.17
Jared	460	1422	6	962	851.4	110.6	.62	.60
Enoch	622	987	7	365	839.2	-474.2	-2.70	-8.39
Methuselah	687	1656	8	969	827.0	142.0	.83	.81
Lamech	874	1651	9	777	814.8	-37.8	-.23	-.22
Noah	1056	2006	10	950	802.6	147.8	.97	.96
Flood	1656							

the i^{th} point deleted would show Enoch an outlier at a 1 percent or a 0.1 percent level of significance or smaller, respectively.¹⁶ For this model no other observation would statistically be proven an outlier. However, Lamech, who only lived 777 years and who died about 5 years before the flood, should have been a possible outlier, but the linear regression model casts more doubt on Methuselah and Noah than on Lamech. Thus, the outlier analysis of the residuals suggests that this regression model is inadequate.

A second model possibility for the Genesis 5 data is a robust regression model, such as median regression, which tends to be insensitive to outliers.¹⁷ Using a simple median regression model explained by Velleman and Hoaglin, the model is as follows:¹⁸

$$\hat{y}_i = 895.3752 + 4.75x_i \quad (9)$$

Table 2 shows that the predicted values for the ages are more in line with the actual values except for Enoch and Lamech, which is what we would expect Biblically. Enoch is definitely an outlier with a residual of -563.6 years away from an expected life span of 928.6 years. Genesis 5:22-24 and Hebrews 11:5 also confirm that he is an outlier because he pleased God with his walk. Thus, this median regression model provides a better statistical and Biblical fit to the Genesis 5 age-spans.

Since Enoch and possibly even Lamech may be statistical outliers, an accurate measurement of the association between generation and age can be analyzed with a nonparametric correlation, called the Spearman rank correlation coefficient, r_s .¹⁹ This correlation co-

efficient is insensitive to outliers since it uses the rank of the variables instead of the actual values. If $d_i = \text{rank}(x_i) - \text{rank}(y_i)$ or $d_i = \text{rank}(\text{generation}) - \text{rank}(\text{age})$, then

$$r_s = 1 - \frac{6\sum d_i^2}{n^3 - n} \quad \text{where } n = \text{sample size.}$$

Spearman's correlation coefficient for the pre-Flood data is .03 (remember that the minimum is zero and the maximum is +1 or -1), and the probability of finding a larger correlation value is 93 percent. The statistical conclusion of the pre-Flood analysis is that there is no relationship between generation and ages. The implication of this conclusion is that the best descriptive and predictive model for the pre-Flood age

is a line parallel to the x axis, such as $\hat{y} = \bar{y}$ the arithmetic mean (857.5 years) or better yet $\hat{y} = \text{the median age (911 years)}$. The scientific conclusion of this pre-Flood analysis is that there were extremely stable conditions, likely atmospheric, prior to the Flood; but this analysis itself does not say what caused the stability or the longevity of the pre-Flood patriarchs.

Post-Flood Analysis — Masoretic Text

As noted earlier, the Biblical evidence for a tight chronology for Genesis 5 with no gaps is difficult to refute. On the other hand, there is no such obvious Biblical support for no gaps in the Genesis 11 genealogy, except for the important hermeneutical concept of first reference whereby if there are no gaps in Genesis 5 it is expected that there are no gaps in Genesis 11. Niessen presented some excellent Biblical thinking on the question of no gaps in the Genesis 11 genealogy; but once the proper statistical model is chosen, the statistical evidence will also confirm that for gaps to exist there would have to be a systematic, mathematical, nonrandom spacing of these ages, which is extremely unlikely. Using the ages from the Hebrew Masoretic text, the proper biblical statistical model will be developed in this section.

Dillow's model for the post-Flood age considered the patriarchs from Noah to Jacob, and then Moses' contemporaries, according to Psalm 90:10. His original model did not include Joseph who lived to be 110 (Gen. 50:26).²⁰ Redoing Dillow's model with Joseph included, the model obtained through linear regression methods is little different:

Table 2. Pre-Flood Analysis: Median Regression.

Name	x Generation	y Age	y _i Predicted Age	e _i Residual
Adam	1	930	900.1	29.9
Seth	2	912	904.9	7.1
Enosh	3	905	909.6	-4.6
Kenan	4	910	914.4	-4.4
Mahalalel	5	895	919.1	-24.1
Jared	6	962	923.9	38.1
Enoch	7	365	928.6	-563.6
Methuselah	8	969	933.4	35.6
Lamech	9	777	938.1	-161.1
Noah	10	950	942.9	7.1

Table 3. Post-Flood Linear Regression Models.

Patriarch	Generation*	Dillow Model**			Modified Dillow Model***		
		Age	Predicted Age	Residual	Predicted Age	Residual	Studentized Residuals****
Noah		950	652.4	297.6			
Shem	0	600	569.7	30.0	517.2	82.8	.93
Arpachshad	1	438	497.5	-59.5	450.3	-18.3	-.25
Shelah	2	433	434.4	-1.4	402.5	30.5	.43
Eber	3	464	379.4	84.6	355.1	108.9	1.56
Peleg	4	239	331.3	-92.3	313.3	-74.3	-1.56
Reu	5	239	289.3	-50.3	276.4	-37.4	-.83
Serug	6	230	252.6	-22.6	243.8	-13.8	-.33
Nahor	7	148	220.6	-72.6	215.1	-67.1	-2.12
Terah	8	205	192.7	12.3	189.8	15.2	.44
Abraham	9	175	168.2	6.8	167.4	7.6	.25
Isaac	10	180	146.9	33.1	147.7	32.3	1.15
Jacob	11	147	128.3	18.7	130.3	16.7	.71
Joseph	12	110	112.0	-2.0	115.0	-5.0	-.27
Moses' Contemporaries	16	70	65.2	4.8	69.6	.4	.04
Selected Generation							
Away From Shem	19		43.4		47.8		
	29		11.2		13.7		
	39		2.9		3.9		
	99		0.0		0.0		

*For the original Dillow model where $x = 0$ starting with Noah, all of the values for generation would be increased by one.

**The mean square, the variance about the regression line for the transformed model $\ln y = \ln b_0 - b_1x$, is .048529.

***The mean square is only .033478 for the modified Dillow model.

****The studentized residuals were computed from the model, $\ln y = \ln b_0 - b_1x$.

$$\hat{y} = 653e^{-.1358x} \quad (10)$$

The predicted values and residuals for Dillow's exponential decay model are shown in Table 3. The model completely misses Noah by 297.7 years. He is definitely a statistical outlier for the post-Flood data but not the pre-Flood data. There are also large residuals for Peleg, Eber, and Nahor. Omitting Noah and letting Shem be the first semi-true post-Flood observation ($x = 0$ for his generation), the linear regression model is

$$\hat{y} = 517e^{-.1253x} \quad (11)$$

As seen in Table 3 for the modified Dillow model, Eber and Shem have the largest residuals, 108.9 and 82.8 respectively. However, using the maximum studentized residual whereby each residual is divided by its own standard deviation thus putting all the residuals on an equal footing, only Nahor is suspect; but he is not an outlier at a 10 percent level of significance.²¹ For the studentized residual with the i^{th} observation omitted, Nahor would again be flagged as suspicious; but other outlier tests confirm that he is a valid observation.²² While both Dillow's original model and the modified model yield a Spearman rank correlation coefficient of $-.9549$ between age and generation, the modified model has a lower mean square (variance about the regression line) and almost exactly predicts the age of 70 for Moses' contemporaries according to Psalm 90:12. However, if predictions are made for successive generations after Moses as done in Table 3, both of the models fall apart. For instance, 29 generations after Shem, the predicted ages are 11.2 years for the Dillow model and 13.7 years for the modified Dillow model. While the modified model is better, it is only good for descriptive purposes.

The models presented in Table 3 were derived with linear regression methods after the natural logarithm transformation was applied to the age. These models provide only a close approximation of the nonlinear model. If nonlinear regression with the Marquardt compromise is used to construct the exponential decay curve, the model is slightly different:

$$\hat{y} = 563e^{-.1416x} \quad (12)$$

The sum of squares (the sum of the square of the differences between the actual observations and the predicted values, $SS = \sum (y_i - \hat{y}_i)^2$) for the modified Dillow model is 33228 while it is considerably less for the exponential decay, nonlinear model at 28728.²³ Thus, the nonlinear form of the exponential decay curve fits the data better. Table 4 reveals that, by this model, Eber has the largest residual and the largest studentized residual but is not a likely outlier.²⁴ The predicted value for Moses' contemporaries is 58.5 years, and for 29 generations away from Shem it is 9.3 years. So again, while this form of the exponential decay model provides an even better description of the patriarch life-spans than the modified Dillow model, it still fails in prediction beyond the scope of the data. As visually evidenced in Figure 2, this descriptive model is still declining after Moses.

Using the Biblical information from Psalm 90:12 that man should live to be 70 or 80 years old if strong, the best model should incorporate this information along with the exponentially declining ages. The nonlinear model, an asymptotic exponential decay model, utilizes this information and would be of the following form:

$$y = \beta_0 + \beta_1 e^{-\beta_2 x} \quad (13)$$

Using 70 as a starting value for β_0 , the nonlinear re-

Table 4. Nonlinear Models.

Patriarch	Generation	Age	Exponential Decay Model			Asymptotic Exponential Decay Model**		
			Predicted Age	Residual	Studentized Residual	Predicted Age	Residual	Studentized Residual
Shem	0	600	563.6	36.4	1.03	583.1	16.9	.59
Arpachshad	1	438	489.2	-51.2	-1.22	492.9	-54.9	-1.31
Shelah	2	433	424.6	8.4	.19	418.5	14.5	.33
Eber	3	464	368.5	95.5	2.07	357.2	106.8	2.40
Peleg	4	239	319.8	-80.8	-1.74	306.5	-67.5	-1.52
Reu	5	239	277.6	-38.6	-.83	264.8	25.8	-.58
Serug	6	230	240.9	-10.9	-.24	230.4	-.4	-.01
Nahor	7	148	209.1	-61.1	-1.32	202.0	-54.0	-1.18
Terah	8	205	181.5	23.5	.51	178.6	26.4	.57
Abraham	9	175	157.5	17.5	.38	159.2	15.8	.34
Isaac	10	180	136.7	43.3	.94	143.3	36.7	.80
Jacob	11	147	118.7	28.3	.61	130.2	16.8	.38
Joseph	12	110	103.0	7.0	.15	119.3	-9.3	-.21
Moses' Contemporaries	16	70	58.5	11.5	.24	91.9	-21.9	-.60
Selected Generations								
Away From Shem	19		38.2			81.6		
	29		9.3			70.3		
	39		2.3			68.6		
	99		0.0			68.3		

* $y = 563 \exp(-0.1416x)$.

** $y = 68.34 + 514.8 \exp(-0.1927x)$.

gression model that fits the post-Flood data is as follows:

$$\hat{y} = 68.34 + 514.8e^{-.1927x} \quad (14)$$

This model has a smaller sum of squares, 26213 versus 28728, for the exponential decay model in equation (12); but the standard deviations about the regression lines are about the same, 2394 and 2383 respectively. However, the asymptotic exponential decay model not only describes the data well, but it also accurately predicts for future generations. Table 4 shows that the predictions for 19, 29, 39, and 99 future generations away from Shem are very close to what Psalm 90:12

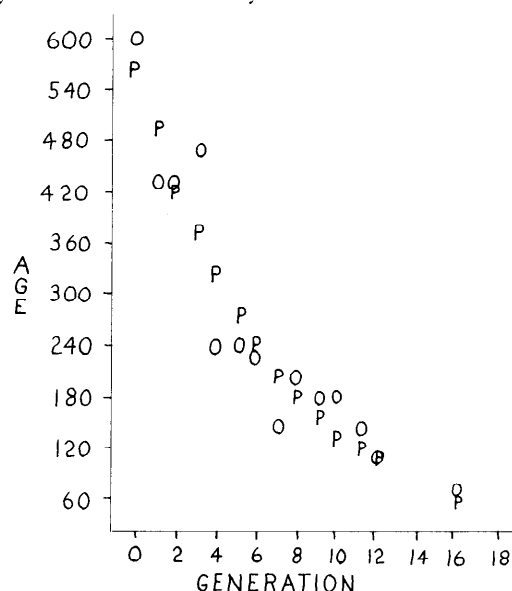


Figure 2. Post-Flood data: nonlinear exponential decay curve. "O" shows the observed age of the patriarchs, "P" the predicted age. A connection of the predicted points P would give the predictive curve.

says, 81.6, 70.3, 68.6, and 68.3 years old. Thus, there is a converging of the estimate of life-span to 68.3 years, which is very close to the male expectation of life at birth in 1980 at 69.8 years.²⁵ A graph of this model and the data is shown in Figure 3.

Examination of the residuals for the AED model shows that Eber again has the largest residual and largest studentized residual. At a 10 percent significance level, Eber would not be an outlier by the maximum studentized residual criterion.²⁶ Using the studentized residual with the i^{th} observation deleted from the model, Eber is very suspect at a 1 percent level of significance. Other outlier diagnostics discussed by Hoaglin and Welsch suggest that Shem and Moses' contemporaries could be outliers, but close examination of the changes in the coefficients with the i^{th} observation deleted and the change in overall model fit with the i^{th} observation deleted show these two observations to be consistent with the model and the rest of the data.²⁷ Thus, only Eber, whose life-span increased over his father's, rather than decreasing, is still possibly an outlier. It has recently been suggested by Peterson that Eber was a prophet who had been informed by God that the earth was going to be divided during his son's lifetime (since Peleg, Eber's son, means division in Hebrew) with the division of the people due to the confusion of tongues at the Tower of Babel and with the division of the land masses with water.²⁸ If Eber was such a prophet, then the extended life-span for him may have been an extension of his ministry during some difficult days. As a result then, Eber Biblically is a valid observation but with different circumstances surrounding his lifetime.

To evaluate the special impact that Eber has on the AED model, a nonlinear jackknife procedure was used whereby each observation was deleted from the post-Flood data set and the Marguardt nonlinear algorithm was rerun using the original least squares estimates as

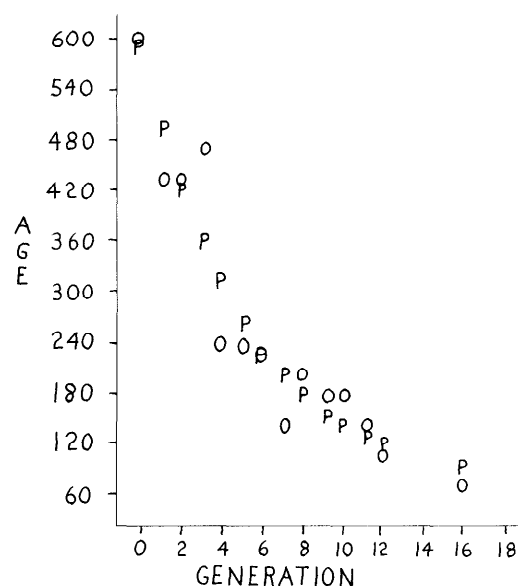


Figure 3. Post-Flood data: asymptotic exponential decay curve. "O" indicates the observed age of the patriarchs. "P" the predicted age. A connection of the predicted points P would give the predictive curve.

starting points.²⁹ These nonlinear least squares estimates of the AED model parameters are shown in Table 5. Only the coefficient estimates with Eber omitted are widely different from the other estimates. In fact, the average of these nonlinear estimates with a patriarch omitted is very close to the preferred AED model ($b_0 = 68.34$, $b_1 = 514.8$, $b_2 = .1927$). While this author has assumed consecutive generations for Genesis 11, even the omission of a generation, one at a time, does not change the equation of the model significantly.

In developing a jackknife estimate of the nonlinear coefficients which was distribution-free and rather insensitive to an outlier, Duncan and Fox have suggested the use of pseudo-values, which are

$$P_i = nb - (n - 1)b_{-i} \quad (15)$$

the difference between the nonlinear least squares es-

timates and the nonlinear estimate with the i^{th} data point deleted.³⁰ The average of these pseudo-values for each estimated parameter will give a jackknife estimate. These jackknife estimates are given in Table 5, and again they are little different from the original AED model except for b_0 , which is now estimated at 78.09 years instead of 68.34 years. An important aspect of these pseudo-values is their analogy to residuals in which case the pseudo-values for Eber are the most extreme.

In the final analysis, the AED fits the post-Flood data better than any other model, even with the one patriarch generation omitted. Secondly, even the fact that Eber lived longer than might have been expected during his day and so tended to be a statistical outlier (but not a Biblical outlier) did not invalidate the AED model. Thirdly, the fact that the original AED model converges to 68.3 years or the jackknife AED model converges to 78.1 years is further confirmation that this model is in line with what the Bible says. It is interesting to note that the 1980 preliminary expectation of life at birth was 73.6 for all residents of the United States, 69.8 for all male, and 77.5 for all females.³¹ The highest life expectancy according to the 1982 World Almanac and Book of Facts was 79.2 years for all females in Iceland.³² Thus, time and statistics again confirm the validity of the Bible, and the AED model fits the Genesis 11 data of the past plus the present day situation.

Post-Flood Analysis — Septuagint Text

The Septuagint (LXX) for Genesis 11 not only contains an extra name, Cainan, that does not appear in the Hebrew Masoretic text, but also an entirely different set of numbers for "begetting" ages and lifespans. The net result is that Genesis 11 contains an additional 880 years between the Flood and Abraham. Niessen concludes from historical evidence that the Septuagint records of Genesis 5 and 11 were tampered, that the second Cainan in Genesis 11 is spurious, and that the second Cainan was accidentally added to later copies of Luke.³³ Even a statistical analysis of the Septuagint lifespans versus generation leads to some suspicious

Table 5. Post-Flood Jackknife Analysis.

Patriarch	Nonlinear Coefficient Estimates With Patriarch Omitted			Pseudo-Values		
	b_0	b_1	b_2	P_0	P_1	P_2
Shem	49.57	502.36	.1164	312.35	676.50	.5346
Arpachshad	69.61	541.30	.2009	51.78	170.25	.0856
Shelah	71.24	508.90	.1954	30.67	591.50	.1568
Eber	99.69	481.46	.2424	-339.20	948.26	-.4543
Peleg	44.38	536.58	.1662	379.83	231.66	.5367
Reu	60.65	520.07	.1820	168.38	446.35	.3308
Serug	68.27	514.83	.1925	69.29	514.39	.1944
Nahor	61.92	515.34	.1785	151.86	507.83	.3774
Terah	67.77	517.62	.1964	75.81	478.17	.1447
Abraham	66.27	517.80	.1931	95.21	475.86	.1867
Isaac	59.24	524.94	.1896	186.62	382.95	.2331
Jacob	62.00	521.01	.1891	150.17	434.10	.2385
Joseph	73.10	510.51	.1960	6.43	570.62	.1497
Moses' Contemporaries	92.56	496.02	.2153	-246.55	759.01	-.1019
Average	67.59	514.91	.1931	78.09	513.39	.1867*

* $y = 78.09 + 513.39 \exp(-0.1867x)$ is the jackknife model.

results. The Septuagint data listed in Table 6 and plotted in Figure 4 reveals a directly inverse relationship between age and lifespan. The simple linear regression model

$$\hat{y} = 542.76 - 32.25x \quad (16)$$

fits the data very well. Both model coefficients are extremely statistically significant at a level of significance of 0.0001. The largest residuals and studentized residuals (shown in Table 6) are for the end points of the data set, Shem and Moses' contemporaries. Using the maximum studentized residual, the 70 year-old for Moses' contemporaries is a statistical outlier at a 10 percent level of significance.³⁴

However, using the studentized residual with the i^{th} observation deleted plus scaled measures of change in each parameter estimate with the i^{th} patriarch deleted, the lifespans of Shem and Moses' contemporaries are statistical outliers.³⁵ This is very surprising in light of the fact that the Pearson correlation coefficient is $-.976$ between age and generation while the Spearman correlation coefficient is $-.995$. If the observation for Moses' contemporaries is dropped from the post-Flood data set, the Pearson correlation coefficient jumps up to $-.986$ and there are no statistical outliers for this reduced data set. The high correlation with the full Septuagint data set with outliers and a higher correlation with the reduced data set with no outliers (and yet still having poor predictability for Moses' contemporaries) suggest that something is wrong either with the model or the data. The simple linear model does not fit the scientific expectation of a decay curve for the post-Flood era, and according to Dillow,

Such a decay is a common curve whenever a system in equilibrium is suddenly acted on in a way that results in pressure toward a new equilibrium. It can be seen in the discharge of a capacitor in the laboratory and in many other scientific experiments.³⁶

In particular, an AED curve would be the expectation. There is no doubt that Shem at 600 years and Moses'

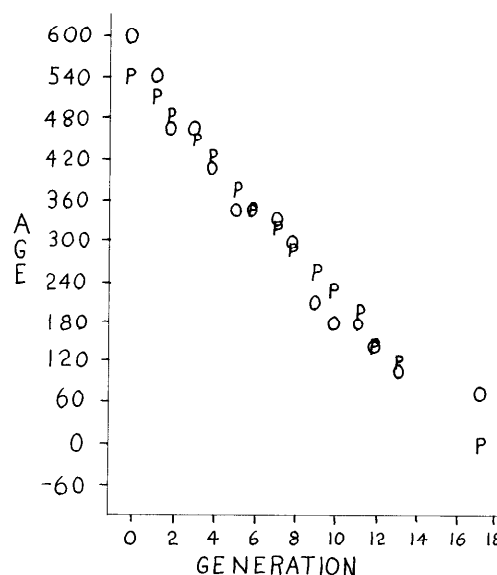


Figure 4. Post-Flood data as given in the Septuagint: simple linear regression model. "O" shows the observed (i.e., stated in the Septuagint) age of the patriarchs, "P" the predicted age. A connection of the predicted points P would give the predictive curve.

contemporaries at 70 years are valid Biblical points. Thus, the end points being valid and the simple linear model fitting the data but missing the end points and not being scientifically appropriate, there must have been a tampering with the Genesis 11 lifespans in the making of the Septuagint, as suggested by Niessen.³⁷ In fact, statistically it is very likely that the lifespans were adjusted up to force the data to fit a straightedge or simple linear model.

Even a nonlinear model of the AED form was fitted to the Septuagint Genesis 11 data; but it had poor predictability and the estimated coefficients were Biblically meaningless. Thus, the statistical analysis of the Septuagint post-Flood data reveals that the Septuagint data are invalid.

Table 6. Post-Flood: Simple Linear Regression Model with the Septuagint Data.

Patriarch	Generation	Age	Predicted Age	Residual	Studentized Residual	Studentized Residuals With i^{th} Point Deleted
Shem	0	600	542.8	57.2	1.78	1.97
Arpachshad	1	535	510.5	24.5	.74	.73
Cainan	2	460	478.3	-18.3	-.54	-.53
Shelah	3	460	446.0	14.0	.41	.40
Eber	4	404	413.7	-9.7	.28	-.27
Peleg	5	339	381.5	-42.5	-1.22	-1.24
Reu	6	339	349.2	-10.2	-.29	-.28
Serug	7	330	317.0	13.0	.37	.36
Nahor	8	304	284.7	19.3	.55	.53
Terah	9	205	252.5	-47.5	-1.36	-1.40
Abraham	10	175	220.2	-45.2	-1.30	-1.34
Isaac	11	180	188.0	-8.0	-.23	-.22
Jacob	12	147	155.7	-8.7	-.26	-.25
Joseph	13	110	123.5	-13.5	-.41	-.39
Moses' Contemporaries	17	70	-5.6	75.6	2.59	3.56

Conclusions

On the basis of the statistical analysis of the lifespans in Genesis 5 and 11, using linear and nonlinear models, some important conclusions need to be repeated. First off, for the genealogies in Genesis 5 for which the Biblical evidence indicates no gaps, the statistical model that best fits those lifespans is either a median or robust regression model with practically a zero slope. Such a model, which is not affected by the outlier Enoch, indicates that there were extremely stable conditions of life prior to the Flood, interpreted by many as stable atmospheric conditions. Secondly, the basic exponential decay curve is inadequate for the post-Flood era, but the asymptotic exponential decay curve on the Masoretic text lifespans provides the best fit. The AED model is best as far as description of the relationship between ages and generations, as far as prediction of future lifespans, as far as explainability, and as far as agreement with the Bible (in particular Psalm 90:12). Thirdly, the fact that the AED model provides estimates of today's longevity which are in agreement with the Bible confirms again that "the grass withers, the flower fades, but the Word of our God abides forever" (Isa. 40:8). Fourthly, the statistical analysis of the Septuagint lifespans in Genesis 11 supports Niessen's recent conclusion that there was a deliberate tampering of the ages. And finally, if there were gaps in the Genesis 11 genealogy, which is not likely in light of the excellent Biblical and statistical fit of the AED model, then the gaps would have to be systematic, specific, nonrandom, and of the AED model form.

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- The studentized residual with the i^{th} observation omitted is 2.57 for Nahor, but with only 12 degrees of freedom Nahor is only an outlier at a .025 level of significance and not at a .01 level of significance. Measures of change in overall model fit or in coefficients do not suggest that Nahor is an outlier. Hoaglin and Welsch, p. 20.
- The smaller this sum of squares the better the fit of the model is to the actual data.
- While Eber has the largest studentized residual of 2.07 which is not statistically significant at 10 percent and the largest studentized residual with the i^{th} patriarch omitted (2.47) which is significant at a 5 percent level of significance, the other outlier diagnostics such as Cook's index, change in overall fit, or change in coefficients with the i^{th} observation deleted reflect nothing unusual about Eber. In part, this last group of outlier diagnostics cast more doubt on Shem than Eber.
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WAS THE PRE-FLOOD ANIMAL KINGDOM VEGETARIAN?

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It is commonly assumed that much of the animal kingdom became carnivorous or at least omnivorous after the Fall, though no mention of such a change is recorded in Genesis 3. Here, a case is made from the scriptures for creatures being exclusively vegetarian before the flood.

First, relevant palaeontological evidence must be mentioned, however. Clear evidence for the existence of carnivores is found in most fossiliferous strata. This is not only inferred from the nature of individual skeletal remains, but from associations of organisms either locked in combat or in the process of capturing or digesting their prey at the time of their demise. Thus, if most of the fossil record were deposited in the flood,¹ these carnivores must have existed before the flood and the question is thereby answered without further ado. Recently, however, Morton has raised the serious possibility that the fossil record (at least from the Cambrian onwards) represents 'a partial capturing of the repopulation of the world following the flood.'² If this 'reproductive-repopulation' model is correct, there are no substantial pre-flood fossil deposits of eukaryotic organisms with which to answer the above question. Biblical evidence only can be adduced.

It is certain that in the original creation both man and animals were vegetarian, since God gave Adam and Eve permission to eat only every green plant yielding seed (Gen. 1:29) and permission to eat every green plant to other creatures also (Gen. 1:30). After the Fall, man remained a vegetarian (Gen. 3:18) (It is conceivable, however, that some men ate animal flesh before the flood as they disobeyed God in most other respects.) until shortly after the flood; God gave Noah and his sons 'every moving thing that lives' in addition to the green plants (Gen. 9:3).

In the case of other creatures, no such definitive decrees are recorded, though interesting polemics and cautious conclusions are possible. If carnivorous creatures came into being after the Fall, it is surprising that there is no mention of this, no provision or warning to Adam and Eve in Genesis 3. Exactly the kind of warning and provision one would expect is only made after the flood in Genesis 9. Here, God puts the fear and dread of man upon the animals, birds and fish (verse 2). It is significant that this occurs *immediately* after God has decreed that Noah and his sons be fruitful and multiply and fill the earth (v. 1). While aggressive carnivores might not seem formidable to humans reared in 20th century suburbia, the sons of Noah would have been hard pressed to survive let alone fill the earth in the absence of God's gracious

enabling provision. At this time, it is also commanded that any beast which kills a man must be put to death (v. 5).

Since the fear and dread of man is put upon the animal kingdom after the flood, it would seem reasonable to conclude that this was not the case beforehand. Thus, if the pre-flood world had carnivores, these had no fear of man and must have made human life extremely hazardous. That the early descendants of Adam not only survived, but multiplied and routinely attained to a 900 year life-span is remarkable.

Moreover, it would appear that the food eaten on the ark was vegetarian, and that man and animals ate from common food reserves (Gen. 6:21, 22). If the pre-flood world were vegetarian, the coexistence of these creatures with each other and with man during their gathering and year together in the ark does not require miraculous intervention by God. Rather it is symptomatic of a peaceful coexistence which had prevailed throughout the pre-flood period.

Considering the possibility of a pre-flood vegetarian world, a natural question is why the change to include carnivores and omnivores was decreed after the flood. Such a change would, of course, have profound effects on the entire earth ecosystem. A possible answer to this question is found in the comparative harshness of the post-flood world. Many have assumed that the pre-flood world had an equable climate and low mutation rates as a consequence of the water vapor canopy, while the post-flood world was harsher with climatic variation and higher mutation rates largely due to solar ray penetration to the earth's surface. This being the case, the tendency of organisms to degenerate genetically would be significantly greater after the flood (witness, for example, the decreased life-span of man (Gen. 11)). Therefore, there would be a greater need after the flood for differential elimination of unfit organisms which would otherwise survive, reproduce and lower genetic standards further. Such a rigorous differential elimination (natural selection) would be achieved by the introduction of carnivores at all levels of the biological hierarchy.

It is clear that there is insufficient Biblical data to establish a uniquely vegetarian pre-flood world directly and unequivocally. However, given the assumption that the bulk of the fossil record is post-flood, the Biblical data is at the very least consistent with this idea and it hence merits serious consideration.

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THE CREATION OF THE EARTH'S MAGNETIC FIELD

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God could have started the earth's magnetic field in a very simple way. He could have created the earth's original atoms with some of their nuclear magnetic moments pointing in the same direction. In one plausible scenario, this would produce a magnetic field of dipole character about eighteen times stronger than the earth's present field. The alignment of nuclei would disappear in a short time, but the field would preserve itself by inducing an electric current in the earth's interior. The field strength would gradually diminish due to resistive losses, as Barnes has calculated. If the field has always decayed at the present rate, it would take about 6,000 years to reach its present strength. In other words, the initial value for the field is consistent with the observed decay rate and the scriptural time scale. It is a striking confirmation of the Biblical creation account.

1. Introduction

The earth's magnetic field has intrigued scientists for nearly half a millenium. Everyone agrees that the source of the field must be a large electric current — billions of amperes — circulating in the core of the earth. But scientists disagree about what causes the current to flow.

Evolutionists believe that the magnetic field has existed for billions of years. So they conjecture that there is some physical process which has maintained the current for all that time, either continuously or in alternating cycles. They theorize that there is some motion of the electrically conductive fluid in the core which maintains the electric current as the fluid moves through the existing magnetic field. The core would resemble an electric generator which produces its own magnetic field. Supporters of such "dynamo" theories have assumed some very complex fluid motions to explain the existing magnetic field. But they have not yet made a firm mathematical connection between the motions and the field. More important, they have not shown that such fluid motions actually occur in the core:

The motions within the earth's core present a dynamical problem of surprising complexity that is *far from being resolved*. . . . Despite the unresolved complexity it is gratifying to understand how several reasonable *assumed* patterns of flow can exhibit dynamo action . . . [Italics mine].¹

On the other hand, creationists have a simple and mathematically rigorous theory of the earth's magnetic field. It explains the two most important features of the field observed today: its overall "dipole" shape (shown in Figure 1), and the steady decrease of its overall strength. The field has decayed by about seven percent over the last 150 years. The creationists say that there is nothing maintaining the core current except its own electromagnetic inertia. Dr. Thomas Barnes^{2, 3} showed that the electrical resistance of the core would slowly decrease the current, producing a slowly decaying dipole magnetic field. He showed that a reasonable value of electrical conductivity in the core would produce the observed decay rate.

Evolutionists object to Barnes' theory because of its implications about the earth's age.⁴ If there is no "dynamo" maintaining the electric current in the core, the current would only last about ten thousand years.

This would mean that the current — and presumably the earth — was started a lot more recently than the evolutionists would prefer. One of the questions they frequently ask is: How did the electric current get started? In this paper I am proposing one possible answer to that question.

2. Magnetic Fields of Nuclei

Many atomic nuclei have a small magnetic field due to their spins. Their magnetic dipole moments (which indicate the source strength) are roughly a thousand times smaller than the magnetic moments of the atomic electrons. In most substances, the magnetic moments of both the electrons and nuclei point in random directions, so that the net magnetic moment is about zero. About five years ago, I noticed that if a sizeable proportion of the earth's nuclei had magnetic moments and were oriented properly, their total magnetic field would be about the same as the earth's. Coincidences of this sort are not common in physics. Since the numbers involved range from infinitesimal to cosmic, a wild guess is usually many orders of magnitude off base. Consequently, I began to wonder if God started the earth's magnetic field by the simple expedient of creating many of its original nuclei in a lined-up state. Once started, the ordinary laws of electricity and magnetism would tend to preserve the field, allowing it to decay slowly to its present value as Barnes has calculated.

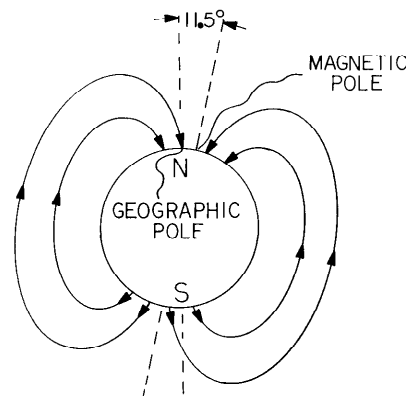


Figure 1. The earth's dipole magnetic field. It will be recalled that the Earth's north magnetic pole is a south-type pole, and vice versa.

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To estimate the strength of the original magnetic field, we need to know the answers to two questions:

- (1) What was the original composition of the earth?
- (2) What proportion of the nuclei did God align?

Fortunately, there is a Biblical answer to the first question, as section 3 will show. Section 4 will show a plausible physical answer to the second question.

3. Water: The First Matter

The Bible implies that the earth just after its creation was one hundred percent water. God, through the apostle Peter, says of the event:

For when they maintain this, it escapes their notice that by the word of God the heavens existed long ago and *the earth was formed out of water and by water* (2 Peter 3:5, NASB, italics mine).⁵

The most straightforward understanding of this verse seems to be that God first created the earth as a sphere of pure water. If this were so, He must have soon thereafter transformed many of the hydrogen and oxygen atoms into the silicon, iron, and other atoms of which the present earth consists. The Greek word translated as “formed” in this passage, *sunestosa*, comes from a verb whose primary meaning is “to place together, to set in the same place, to bring or band together.”⁶ The American Standard Version of 1901 well translates it as “compact.”⁷ The human author, Peter, may not have understood that such compaction would require the banding together of protons, neutrons, and electrons to make new atoms, i.e., nuclear and chemical transformations. However, God certainly knows how atoms and nuclei work, and He nowhere indicates in scripture that His human authors had fully to understand what He was saying through them. In fact, Peter himself points out that the prophets did not completely understand what “the Spirit of Christ within them was indicating as He predicted the sufferings of Christ and the glories to follow” (1 Peter 1:11, NASB). The scriptural teaching on inspiration⁸ requires that the true meaning must be within the bounds of the general meaning of the word in Peter’s time. But it does not demand that Peter or his hearers understand the full implications of the compaction process. To require such a restriction would be to filter the rich wisdom of God through the limitations of a single human mind. So we do not need to exclude the possibility that God may have used nuclear and other physical transformations during the creation week.

The second verse of Genesis also implies that the early earth was initially water:

And the earth was formless and void, and darkness was over the surface of the *deep*; and the Spirit of God was moving over the surface of the *waters* (Genesis 1:2, NASB, italics mine).

This view of a completely water planet might help us to understand in what way the earth at that time was “formless and void.” There are not many things more structureless or more devoid of inhabitants than a featureless ball of water. Proponents of the “gap” theory might not like this interpretation, since they want the phrase “formless and void” to imply the result of a catastrophic judgement. However, it should be a help to those who do not see a gap between the

first two verses of Genesis, because it explains how the earth would be formless at that time.

The reader might well ask: “Why would God make the earth all water and then transform it? Wouldn’t it be simpler to just create it in the final form?” A possible answer might be that He did it to provide a picture of some spiritual truths. The New Testament uses the old creation of earth as a picture of the new creation of spiritual life in a believer (2 Corinthians 5:17; 4:6). It also uses water as a picture of the word of God (Ephesians 5:26). Just as the word of God and the spirit of God were prominent in the birth of earth, so also they are essential in the new birth of a man (John 3:5-8, 1 Peter 1:23).

Thus, the concept of an all-water earth in the beginning seems to be the most straightforward interpretation, and it appears to help our understanding of scripture. It also gives a fairly neat answer for the initial value of the earth’s magnetic field, as sections 5 and 6 will show. The concept does not seem to contradict any scripture, as far as I am aware. (Creationists thus far do not seem to have given the idea much attention, although I mentioned it in an earlier paper⁹ before I began to follow up its application to the earth’s magnetic field.) So let us pursue the implications of the idea.

4. Aligning Nuclei

Water is not usually considered a magnetic substance. Figure 2 shows a water molecule. The ten electrons in the molecule line themselves up in pairs so that their magnetic moments cancel out.¹⁰ The eight protons and eight neutrons of the oxygen nucleus similarly cancel out their own magnetic moments so that the total magnetic moment of the nucleus is zero.¹¹ That leaves the two hydrogen nuclei, which are single spinning protons. Each proton has a magnetic moment of 1.41×10^{-26} Joules per Tesla.¹²

Figure 3 shows how the two proton spins (and magnetic moments) normally line up with an external magnetic field (even a very slight one) under the laws of quantum mechanics. Theoretically, there are four possible lineups or “states.”¹³ At normal (or high) temperatures, the number of molecules in each state is about equal.¹⁴ In other words, about 25 percent of the molecules line up in state (a) with their proton magnetic moments cancelling. A similar thing happens

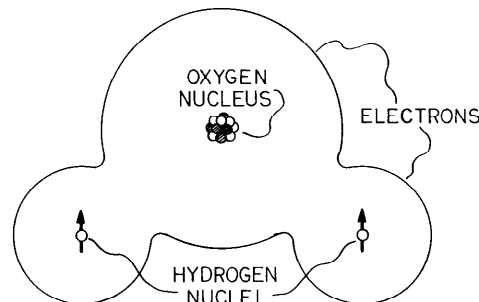


Figure 2. Water molecule. The electrons have no net magnetic moment, nor does the oxygen nucleus. The hydrogen nuclei, however, do have a magnetic moment.

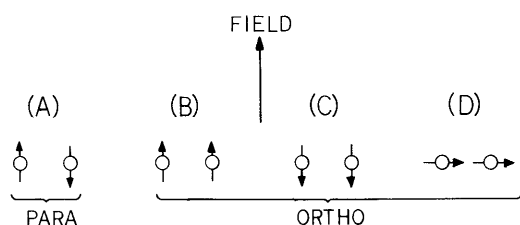


Figure 3. Normal alignment of the hydrogen nuclei in water subjected to a weak magnetic field. Twenty-five percent of the nuclei are in each of the four possible states.

in a hydrogen molecule; the corresponding state is called "parahydrogen."¹⁵ So we could call state (a) "parawater."

States (b), (c), and (d) have the spins of each pair lined up in a noncancelling way. The difference between these three "ortho" states (again borrowing from the hydrogen molecule names) is in how each pair lines up with the external magnetic field. In state (b), the pair is parallel to the field; in state (c), the pair is antiparallel to the field. The spins of state (d) are anywhere in the plane perpendicular to the field. About 25 percent of the molecules would be in each of these states of "orthowater." So there would be about three times more orthowater than parawater at ordinary (or high) temperatures.

The ortho-to-para ratio for hydrogen molecules has been measured and is indeed about three.¹⁶ I have not been able to find any mention of ortho and para forms of water in the literature. However, the theoretical reasoning appears to be exactly the same for any molecule with two similar nuclei.¹⁷ So we should expect water to have the same ratios as molecular hydrogen.

In water under normal conditions, molecules in state (a) have no net magnetic moment. Molecules in state (b) cancel out the effects of those in state (c). Molecules in state (d) have magnetic moments pointing in random directions in the plane perpendicular to the external field, thus cancelling one another. So water normally produces no net magnetic field.

Now let us consider what alignment God could have used to produce the earth's field. Since we have no better information, let us assume that God did it with a minimum of deviation from what was to be the ordinary alignment, and a maximum of orderliness. This would be in accordance with His principle, "Let all things be done properly and in an orderly manner" (1 Corinthians 14:40). Figure 4 shows two possibilities. Configuration one only requires that one-eighth of all the hydrogen nuclei have an unusual orientation. The second configuration affects more nuclei, but eliminates the somewhat disorderly state (d) of Figure 3. Either alignment generates 25 percent of the maximum possible field. God could easily have created any proportion of aligned nuclei He might have wanted, but these two possibilities seem more orderly to me. I admit that this is a subjective evaluation, but I know of no better way to make an estimate. So let us postulate this proportion, 25 percent, at least as a starting point.

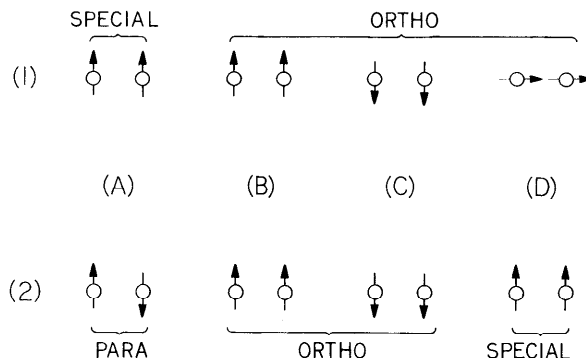


Figure 4. Two possible alignments of water protons at creation. Either configuration would produce 25 percent of the maximum possible magnetic field.

5. Initial Strength of the Field

With the information from sections 3 and 4, we can now estimate what the initial value of the earth's magnetic moment would have been if my water/nuclear magnetism hypothesis is true. The magnetic moment at creation would be:

$$M_c = kn\mu_w, \quad (1)$$

where μ_w is the magnetic moment of an orthowater molecule (both H nuclei parallel), n is the total number of water molecules available, and k is the fraction of water molecules contributing to the field.

From Section 4, we take k to be 0.25. The magnetic moment of an orthowater molecule should be twice the moment, μ_p , of a single proton:

$$\mu_w = 2\mu_p. \quad (2)$$

The number of water molecules is simply the total mass of the earth, m_e , divided by the mass of a single water molecule, m_w :

$$n = \frac{m_e}{m_w}. \quad (3)$$

Plugging equations (3) and (2) into equation (1) gives us:

$$M_c = 2k \frac{m_e}{m_w} \mu_p. \quad (4)$$

The mass of the earth is presently 5.976×10^{24} kg.¹⁸ The mass of a water molecule is about 18.02 atomic mass units, or 2.992×10^{-26} kg.¹⁹ Using these values plus the values for k and the proton magnetic moment mentioned earlier gives the earth's magnetic moment at creation:

$$M_c = 1.41 \times 10^{24} \text{ Joules/Tesla}. \quad (5)$$

This is about eighteen times stronger than the earth's present magnetic moment, 7.9×10^{22} J/T.²⁰ The next section will show how we can compare the theoretical result in equation (5) with another estimate derived from experiment. The field resulting from this alignment of protons would have a dipole shape,²¹ as does most of the earth's field today.

6. Decay of the Field

Once the magnetic field was established, thermal collisions of molecules would knock the nuclear orientations into the normal configuration shown in Figure 3. The time required for this "spin-lattice relaxation" in water at normal temperatures is between one and

ten seconds.²² But as protons began to lose their special orientation they would induce an electric current in the water. The current would tend to maintain the original magnetic field, according to Faraday's law of induction and Lenz's law.²³ Thus, the source of the field would quickly change from oriented protons to an electric current circulating in the watery earth. There would not be much loss of field, provided that the magnetic decay time, τ , of the earth at that time was greater than the thermal relaxation time. That is, we must have $\tau \gg 10$ seconds. The magnetic decay time²⁴ for a sphere of conductivity σ is:

$$\tau = \frac{\sigma \mu_0 R^2}{\pi^2} \quad (6)$$

Here R is a characteristic radius in the earth wherein the conductivity of the water is appreciable, and μ_0 is the magnetic permeability ($4\pi \times 10^{-7}$ henry per meter). Even pure water is a good electric conductor at the temperatures and pressures characteristic of the earth's interior. Above a pressure of 100 kilobars and a temperature of 500°C, the measured conductivity of water is greater than 10 mhos per meter.²⁵ Such conditions would be normal below a depth of a thousand kilometers in water.²⁶ So we can say that R was probably greater than 5000 km. Using these data in equation (6) gives us a magnetic decay constant of about one year for the earth of Genesis 1:1. This is much longer than the thermal relaxation time. So the electric current induced in the interior would preserve the magnetic field virtually intact.

As God transformed much of the water into other materials (Genesis 1:9) some parts of the earth would probably become less electrically conductive and others more conductive. But the same process of induction would tend to preserve the magnetic field, transferring current from less conductive parts (the crust and upper mantle) into more conductive portions (the lower mantle and fluid core). Since the magnetic decay time of the conductive parts would be longer than the six days of creation, the field would again be preserved efficiently.

After the creation week, the earth's magnetic moment would decay exponentially to its present value of roughly 7.9×10^{22} Joules per Tesla. Figure 5 shows how the measured values of the magnetic moment have steadily decreased over the past 150 years. It includes some new values measured recently. Table 1 shows the data and sources.^{27, 28} The scale of this graph is logarithmic so that an exponential decay would appear as a straight line on it. The straight line on the graph is the best least-squares fit to the data points shown. It corresponds to the following exponential decay for the magnetic moment M :

$$M = M_0 e^{-t/\tau}, \quad (7)$$

where t is the time in years A.D., τ is the present magnetic decay time, and M_0 is the value the magnetic field would have had in the year zero A.D. (= 1 B.C.) if the decay time has remained constant. The fitted values for M_0 and τ are:²⁹

$$\tau = (2049 \pm 79) \text{ years}, \quad (8)$$

$$M_0 = (2.088 \pm 0.204) \times 10^{23} \text{ J/T}. \quad (9)$$

If we assume that τ has been roughly constant since creation, we can extrapolate M back to the time of

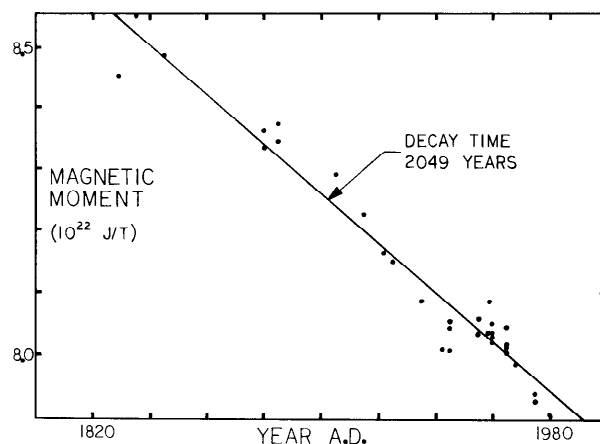


Figure 5. Observed values of the earth's dipole magnetic moment since 1829 A.D. The vertical scale is logarithmic, the horizontal scale is linear. A straight line on this graph implies an exponential decay. The straight line shown is the best (least-squares) fit to the data. Table 1 lists the data and sources.

Table 1. Observed Decay of the Earth's Magnetic Dipole Moment*

Number	Source	Year	Dipole Moment (Joules/Tesla $\times 10^{22}$)
1	Erman-Peterson	1829	8.454
2	Gauss	1835	8.558
3	Adams	1845	8.488
4	Adams	1880	8.363
5	Neumayer	1880	8.336
6	Fritsche	1885	8.347
7	Schmidt	1885	8.375
8	Vestine	1905	8.291
9	Vestine	1915	8.225
10	Dyson-Furner	1922	8.165
11	Vestine	1925	8.149
12	Vestine	1935	8.088
13	Jones-Melotte	1942.5	8.009
14	Vestine	1945	8.065
15	Afanasieva	1945	8.010
16	U.S.C. and G.S.	1945	8.066
17	Fanslau-Kautzleben	1945	8.090
18	U.S.C. and G. S.	1955	8.035
19	Finch-Leaton	1955	8.067
20	Nagata-Oguti	1958.5	8.038
21	Cain	1959	8.086
22	Fougere	1960	8.053
23	Adam	1960	8.037
24	Jensen-Cain	1960	8.025
25	Leaton	1965	8.013
26	Hurwitz	1965	8.017
27	Cain	1960	8.028
28	Cain	1960	8.022
29	Malin	1965	8.056
30	Barracough	1965	8.005
31	POGO	1968	7.985
32	IGS	1975	7.939
33	AWS	1975	7.927
34	Magsat	1980	7.906

*Sources 1-26 from reference 27. Sources 27-34 from reference 20. Includes eight new points since Barnes' paper (Ref. 2).

creation, as Figure 6 shows. Using a tight chronology from the Hebrew text of the Old Testament gives the time of creation as roughly 4000 B.C.³⁰ Using a value of -4000 years for t in equation (7) gives an estimate for the earth's magnetic moment at the time of creation:

$$M_c = (1.47 \pm \frac{1.28}{0.68}) \times 10^{24} \text{ J/T.} \quad (10)$$

This value is derived from experiment and the assumption of exponential decay at a constant rate. The large (one-sigma) error bounds come from extrapolating 150 years of data six millennia into the past.³¹

If the reader compares this experimentally-derived value of equation (10) with the theoretical value of equation (5), he will find that they agree to within 5 percent, well within the error bounds of the experimental value. I find such agreement remarkable and exciting.

7. Conclusion

The previous sections show that: (1) we can theoretically estimate the initial strength of the earth's magnetic field, and (2) present measurements of the earth's field and its decay are consistent with that value. This agreement provides supporting evidence for several concepts:

The field's exponential decay.

The short Biblical time scale.

An all-water original earth.

The scientific reliability of scripture.

If the field did not decay exponentially, the agreement would not exist. For example, a linear decay would predict a field less than one-fourth of the exponentially-derived starting value. If the time scale were much different from 6000 years, no agreement would be possible. That is, if the earth's age were stretched to 10,000 years, the initial value of magnetic moment would exceed the maximum value available from water (for $k = 1$). This not only supports young-earth views, but also the tight-chronology view of scripture.

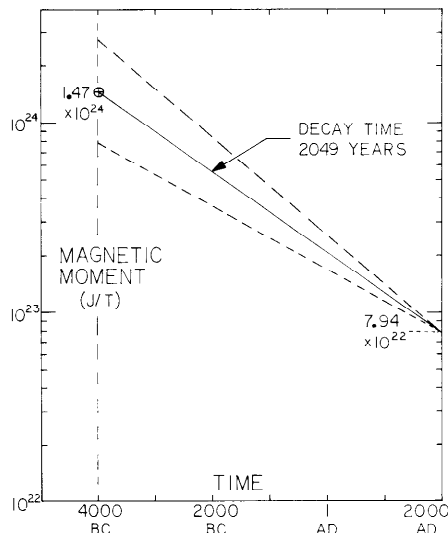


Figure 6. Extrapolation of the earth's dipole magnetic moment back to 4000 B.C. The vertical scale is logarithmic; the horizontal scale is linear. The error bands are statistical (1 - sigma) estimates of accuracy.

If the earth were originally created with the composition it now has instead of water, agreement would be impossible. Most of the earth's present nuclei, (such as silicon, oxygen, magnesium, calcium, and iron) have little or no magnetic moment. The fact that all of these factors—time, composition, exponential decay—must dovetail to produce agreement increases the likelihood that this is a correct explanation for the origin of the earth's field. I admit that my choice for the alignment fraction ($k = 0.25$) is not rigorous but merely plausible. However, even a k of 1.0 would extend the earth's age by only another 2000 years. The fact that agreement within 5 percent occurs with the tight-chronology age of 6000 years is quite significant.

This paper has moved into an area where creationists have been reluctant to apply the laws of ordinary science: the creation week itself. Much of what happened at that time is clearly miraculous, such as the direct creation of matter out of nothing. In order to tread on such holy ground, the creationist must be careful to use every bit of information available from scripture. He must also be very suspicious of his own speculations — as I am of mine. But at the very least this paper should refute a common charge which evolutionists make: that the Bible suppresses scientific thought by its assertion that God has intervened in this physical universe. Quite to the contrary, I find that scripture stimulates the imagination of any scientist willing to submit to his Creator — Jesus Christ.

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THE FOSSIL STORY

WILLIAM J. TINKLE*

When I was a boy I found in the garden something that had the appearance of a burdock root turned to stone; years later it was found to be a solitary coral, such as now are found living in the ocean. It was one of the animals whose presence caused the preserved life of northern Indiana to be called Silurian. The finding of a new type of life, whether living or fossil, gives a mild joy and sometimes leads to wrong conclusions as to what it reveals.

The most useful branch of geology is that which is called "urban" geology, although its value is wider than city industry. Tests are made to see if the substratum will uphold the foundation of a house; if a well in a certain spot will deliver enough water; if a house built on a certain hillside will slide downward with great loss. There is much information which geology gives more ably than the history of the earth.

What They Tell

Geology is depended on, however, to give such history, and largely through fossils. While relative ages in a small area may be learned by the order of the strata of rocks, if a stratum has different fossils in a part of its length, that part is said to be of a different age.

As we have seen, identification of the position of a bed is based on comparison of its fossil content with worldwide catalogs of fossils.¹

This statement by K. L. Currie gives the view of the majority of geologists; but there is an active minority who disagree. It is easily seen that this statement reposes much faith in the order in which the

fossils were laid down and that this order is claimed to be the same all over the world. It infers that each species came into being at the same time all over the world and lasted until another certain time, then became extinct at this time, being replaced by another species. As time went on it is claimed that each new species became more complex and that its added structure made it more successful.

Relative Vigor

Faith in this order of species is one of the chief supports of belief in evolution. But you see that Amoeba and all other very simple animals should have become extinct long ago, which they have not done; and we find that mosses and lichens, simple plants, cling to life in situations where sunflowers would not even make a start.

It has been stated that God writes in two manners, inspiring good books and arranging the order of the rocks; perhaps I have so stated at some time; but we are not justified in calling these acts of the same order. Listen to A. E. Wilder Smith:

How beautiful are the ripples in the sand. . . .
But if I see my name boldly written in the sand
or if I see "John loves Mary" an entirely different
reaction takes place within me.²

Let us beware that we do not claim God's intelligence in an assumption of our own. We have no reason to believe that God started each species at a different time rather than placing them together and it is still more presumptuous to credit some man with the knowledge of the time when each one started. Actually a few fossils were studied here and there by a

*Deceased, 1981.

few men and they decided the order which would best illustrate evolution. Are fossils speaking or men making estimates?

Fossils could be formed at present; a cliff could fall upon a stream, killing and preserving all of the stream's living things; but such action takes place very infrequently at present. Usually the animal is eaten; and if some bones are left they are not covered soon enough to preserve them. Perhaps you have observed dead fishes about a stream or more often a pond; and they are decaying, leaving no part to become a fossil; even the bones are broken into pieces as fine as sand. But in some places we find fossil fishes in great numbers. Some of them are not simply skeletons but the muscle layers also are preserved in the order found in a living fish; evidently they were covered quickly and deeply. The flood at the time of Noah was responsible for a great many of the fossils.

We should not pass by the fact that many fossils are found out of the order which some geologists have set down as correct. The author of this article has visited two of these famous places, the Franklin Mountains at El Paso and Glacier Park in Montana. In both places fossils called old are found higher than ones called recent. In neither place could I find evidence of strata having been lifted and pushed over others. The strata are not broken in pieces as the great pressure would have left them and no pulverized rock at the bedding plane between the layers of rock where the sliding is said to have occurred. At El Paso, even the bedding plane is hard to find, and all that is out of order is that simple fossils are found higher than complex ones. Anybody who has not studied geology would say that the fossils are in the correct order.

Summary

We may collect the principal ideas by a supposed conversation.

Creationist: On what ground do you say that fossils prove evolution?

Evolutionist: The simple fossils are deep and the compound ones are found higher.

Cre. Do you always find them so?

Evo. No, sometimes the simple ones are higher than the complex ones; but the correct order is as I first stated.

Cre. Why do you say that simple fossils should be lower than the complex ones?

Evo. This is the expected order in evolution: simple first, with complex upon them; this is the correct order.

Cre. Then you believe in this order because you believed in evolution to begin with. It was not the fossils who said it but some one who told the fossils where they should lie. You believe in evolution—because you believe in evolution; somebody started with the assumption that evolution was true and you agreed with him. Fossils are used as part of the discovered order of nature and then are employed as part of the reason for believing in that order. This circular reasoning has been pointed out previously.

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PANORAMA OF SCIENCE

Sea-Shells: Witnesses for the Creator's Goodness

Men as different as William Paley¹ and Sherlock Holmes² have pointed out that in the beauty in the world around us we have evidence of the Creator's goodness. As the latter put it: "... our powers, our desires, our food, are really necessary for our existence ... But this rose is an extra ... It is only goodness which gives extra ..."

Of course, in connection with evolution, attempts have been made to get around this evidence. It has been said, for instance, that the appearance of the flowers has a selective advantage in attracting insects to pollinate them.

It would be easy to point out weaknesses in that evolutionary dogma. Also, there are other examples of beauty which clearly have nothing to do with selection. Smith has pointed out that everyone agrees

that autumn leaves are beautiful; yet there is surely no evolutionary advantage there.³

Are sea-shells not another example? Everyone admires them; we recall, in the story *Treasure Island*, how the hero was surprised that the old pirate should have carried sea-shells in his seachest through all his wanderings. And surely there is no conceivable evolutionary advantage to this beauty. No, this is another bounty of the "goodness which gives extra."

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SOME IMPLICATIONS OF VARIANT CRANIAL CAPACITIES FOR THE BEST-PRESERVED AUSTRALOPITHECINE SKULL SPECIMENS

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The ten 'best-preserved' specimens of Australopithecine skulls were considered in this present study, which is a survey of the rise and fall in their measured/estimated cranial capacities.

The discovery of 'pre-Zinj' in 1960 probably triggered the change in trend that is detectable in the literature only after that date.

Discrepancies resulting from the basis of the same ten best specimens affect both the 'gracile' and 'robust' forms of *Australopithecus africanus* whose skulls probably demonstrate sexual dimorphism.

Whilst inadvertently establishing the gender of the Taung child by a mathematical method, the same method suggests that the specimen (Sts. 5) fits the plot of 'robust' results better than that of 'gracile.'

The revised cranial measurements might well imply the following:

- (1) Evolutionary morphometric studies are so variable as to be unreliable even when based upon the same fossil material.
- (2) The revised cranial capacities for australopithecines now lie well within the range of the great apes and so no more warrant the title of 'Near-men.'
- (3) If sexual dimorphism explains the presence/absence of the sagittal crest used to identify the 'robust' form as belonging to *robustus/boisei* species and the 'gracile' form as *africanus*, then any phylogeny which separates the latter from the former is invalid as it violates the 'facts of life' as well as one definition for the term species.
- (4) Discrepant results for cranial capacities such as those for *Australopithecus africanus* could well explain why phylogenies have recently sought to be established upon molecular studies instead of upon fossil specimens.

Plan of the Article

Preface

- 1 DATA SOURCES
 - 1.1 Poor presentation
 - 1.2 Taxonomic turmoil
 - 2 SPECIMENS DESCRIBED
 - 2.1 Catalogue numbers
 - 2.2 Species identification
 - 3 SEXUAL DIMORPHISM
 - 3.1 Sagittal crests
 - 3.2 Relative brain size
 - 4 DRASTIC SHRINKAGE
 - 4.1 Discrepancies revised
 - 4.2 Disturbing discovery
 - 5 DATA 'SPIN-OFFS'
 - 5.1 Singular discovery
 - 5.2 Doubtful specimen (Sts.5)
 - 6 DISTURBING SEQUELS
 - 6.1 Theoretical transference
 - 6.2 'Near-men' misnamed
 - 6.3 Futile phylogenies
 - 6.4 Shifting support
- Bibliography (References)
Appendix

Preface

This present study resulted from an excursion into the so-called 'Near-men' whilst researching background material for a tape-slide sequence on the topic of the alleged 'Ape-men.' When delving into details to do with actual specimens, I began to realize something that surely deserves much greater recognition than it has hitherto received. It was that a quiet revolution has taken place regarding the calculation/estimation of *Australopithecus* brain volumes based upon the same ten 'best-preserved' skull specimens. There-

fore, an alternative title could well have read *The Rise & Fall of the Australopithecines*. Certainly it proves the influence of the theory of evolution to bring pressure upon measurements resulting from the same specimens. How else can anyone account for the discrepancies uncovered herein?

Now it must surely follow that if such variation can exist within the scientific literature for the results of studying the best available specimens, then think what twaddle must fill popular books and broadcast programmes when scientists make pronouncements upon very scant fragments of fossil material often found scattered rather than abundant, whole and articulated.

Compared with the specimens of skulls that form the basis of this present study, the remains of 'Lucy' are pathetic. Stuck in a showcase at the British Museum (Natural History) like some holy relic, 'Lucy's' lower jaw seems to be having the laugh on any who believe that they are gazing upon the earliest known human ancestor. People who observe the few pieces of its shattered skull will appreciate that there is insufficient to compare its cranial capacity with that of either an ape or a man. So only on an average of ignorance is 'Lucy' (alias *Australopithecus afarensis*) an 'Ape-man' (or 'Ape-woman'). To my mind, 'Lucy' being an australopithecine is A LINK TOO FAR-FETCHED!

1 SOURCES OF DATA

The data about cranial capacities of the best-preserved specimens of Australopithecine skulls are contained in the table on page 48 of *Primate Evolution: an Introduction to Man's Place in Nature*, by Simons. The sources used by Simons are given in an Appendix to this article.

1.1 Poor Presentation

Unfortunately, the significance of the table of data collated by Simons is likely to be overlooked for the following reasons:

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- (1) There are no lines to guide the reader's eyes across several blank spaces; and so it is easy to jump or slip a line when scanning each row.
- (2) Two of the eight columns have different dates coupled together; and this makes it difficult to plot specimens with their year of published research on a graph.
- (3) There was no strict adherence to chronological order and so trends over a period of time were less obvious to detect.
- (4) Some data took the form of results whose range varied from 2 c.c. to 100 c.c. per entry whilst other data were declared to be estimates mostly without any margin of variation.
- (5) No attempt was made to identify the species and sex of each specimen.

On that last point further amplification is necessary and appropriate to this present study. The relevance of correctly identifying the species and sex of each specimen of *Australopithecus* will be very evident in sections 3 and 5.

1.2 Taxonomic Turmoil

Any attempt to give a name to a particular specimen of *Australopithecus* is fraught with setbacks. One main reason is that each new discovery of an Australopithecine prior to 1960 was hailed as being closer than ever before to the proverbial 'ape-man' and so owing to "discoverer's bias" it was given a brand new name—not simply a new specific epithet, but in many cases a new generic name. Therefore, the following genera exist in scientific periodicals and books¹ as synonyms for the present-day genus named *Australopithecus*:

- (1) ?*Africanthropus*
- (2) *Hemantropus*
- (3) *Megantropus*
- (4) *Paranthropus*
- (5) *Paraustralopithecus*
- (6) *Plesianthropus*
- (7) *Praanthropus*
- (8) ?*Tchadanthropus*
- (9) *Zinjanthropus*

Even the species known now as *Australopithecus africanus* consists of specimens that used to be named² as follows:

- (1) *Australopithecus robustus*
- (2) *Homo africanus*
- (3) *Homo habilis*
- (4) *Homo modjokertensis*
- (5) *Homo transvaalensis*
- (6) *Megantropus africanus*
- (7) *Megantropus palaeojavanicus*
- (8) *Paranthropus crassidens*
- (9) *Paranthropus robustus*
- (10) *Plesianthropus prometheus*³
- (11) *Plesianthropus transvaalensis*
- (12) *Telanthropus capensis*

Perhaps by now the astute reader will already be wondering why the two genera *Homo* and *Telanthropus* in the last list were not also included in the preceding list of genera synonymous with *Australopithecus*. The reason for their omission is that Wood discounts both. He considers:⁴

an anagenetic evolutionary progression from *Australopithecus africanus*, through the 'robust' form, and then on to the later *Homo* is most unlikely.

and also:

During excavation at Swartkrans in 1949 two mandibular fragments, a maxilla, some lower teeth and part of a forearm bone were recovered from what appeared to be a secondarily filled cavity in the main breccia. The shape and size of the mandibular body and the size of the teeth prompted Broom and Robinson to exclude the material from *Paranthropus* and place it in a new taxon *Telanthropus capensis*.⁵

Twenty years later, R. J. Clarke⁶ noticed that the maxilla, SK 80, fitted with two cranial fragments, SK 846 and 847; they made up what is known as the "composite" cranium. Features of the nose, frontal region and the palate prompted its allocation to *Telanthropus*, which Robinson had by now formally sunk into *Homo*.

TABLE 1 SORTED DATA ON BEST AUSTRALOPITHECUS SKULLS

SPECIMENS			CRANIAL CAPACITY shown in cubic centimetres (ave./a=average & est./e=estimated). % differences (if any) are in <i>italics</i> . Pub.yr. in brackets.									
My ref.	Mus. cat no.	Species of <i>Australopithecus</i>	(1926)	(1946)	(1947)	(1948)	(1950)	(1961)	(1962)	(1965)	(1967)	(1970)
1	Taung child	<i>africanus</i>	ave.510 0	ave.510 0	ave.510 0							407 -20.2
2	Taung adult	<i>africanus</i>			ave.597½ 0					562 -5.9		440 -26.4
3	Sts60	<i>africanus</i>		435 0			450 +3.4	415 -4.6				
4	Sts5	<i>africanus</i>		480 0			ave.481 +0.2	480 0				485 +1.0
5	Sts71	<i>africanus</i>		ave.500 0			ave.500 0					est.428 -14.4
6	Sts 19/58	<i>africanus</i>				530 0	560 +5.7	e.a.410 -22.6				est.436 -17.7
7	MLD 37/38	<i>africanus</i>						est.480 0	480 0			est.435 -9.4
8	OH 5	<i>boisei</i>									530 0	530 0
9	SK1585	<i>robustus</i>										530 0
10	SK 48	<i>robustus</i>				750 0		500 -33.3				
11	SK46	<i>robustus</i>				800 0		500 -37.5				

*est. based on 1. Sts = Sterkfontein site; MLD = Makapansgat; OH = Olduvai Gorge; & SK = Swartkrans.

2 SPECIMENS DESCRIBED

The data for the cranial capacities shown in Table 1 are based upon 'the ten best preserved brain cases of *Australopithecus*.' As that table contains eleven sets of results, then some explanation is necessary.

2.1 Catalogue Numbers

The first specimen was found by Dart in 1924 and I think that it was never given a museum catalogue number. Certainly none is cited on page 104 of the British Museum (Natural History) *Man's Place in Evolution* published in 1980 by the museum and the Press Syndicate of the University of Cambridge.

The second specimen is really an estimation of the cranial capacity of the adult stage if the first specimen had managed to not die as it is reckoned to have at the age of six years. It is the inclusion of this row in the data that brings the total to eleven in this present study.

The catalogue numbers are shown in the second column of Table 1 for specimens which I have referred to as 3 to 11, inclusively. However, specimen three also bears the reference T.M. 1511 to do with the Transvaal Museum and specimen six is supported by Sts 25.

2.2 Species Identification

Although the main purpose of this present study is to show the variation that can exist even when different workers use the same specimens — in this case the ten best-preserved ones — doubtless to identify to which species a particular specimen belongs will add to its value. Therefore the third column of Table 1 cites which specific epithet accompanies each *Australopithecus* individual.

Of course, strictly speaking, even *robustus* is nowadays considered as being within the *africanus* species of *Australopithecus*. That point was made at the top of the second list in section 1.2 of this present study.

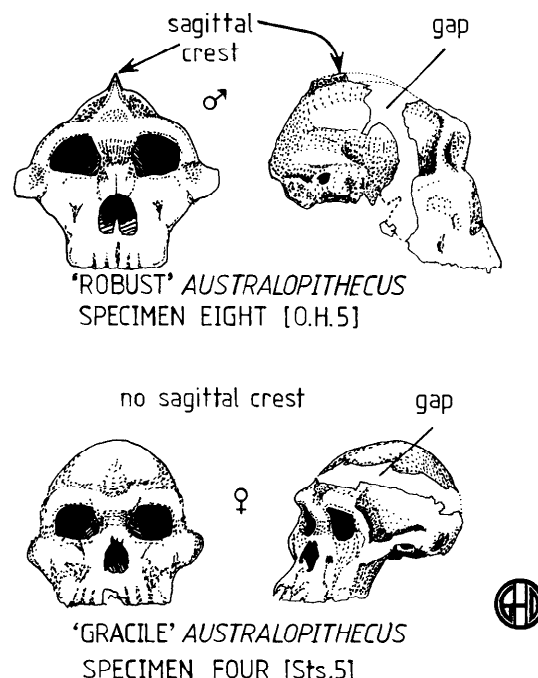
Therefore, a specimen considered to belong to *A. robustus* is frequently referred to simply as a 'robust australopithecine' or a member of the 'robust' form of *A. africanus*. In several sections of this present study (e.g., section 3.1) we shall delve into the significance of the 'gracile' and 'robust' forms of australopithecines.

Owing to "discoverer's bias" already referred to in section 1.2 of this present study, it is obvious that originally the specimens were given different names. For instance, specimen four was called *Plesianthropus transvaalensis*; specimen eight was *Zinjanthropus boisei* and specimen ten was *Paranthropus crassidens*. But on account of the Law of Priority the first-found specimen retains its name and even gives it to the other specimens found later. So specimen one (and therefore specimen two) have always been named *Australopithecus africanus*. Unofficially it has been called 'Dart's baby' after its discoverer and also 'Taung child' after the site where it was found.

3 SEXUAL DIMORPHISM

The idea that sexual dimorphism alone can account for the distinctive features that separate the 'robust' form from the 'gracile' form is worth following up. In fact, specimen number four was affectionately called "Mrs. Ples" owing to two reasons. One was that it was

FIGURE 1 TWO FORMS OF AUSTRALOPITHECINES
BELIEVED TO SHOW SEXUAL
DIMORPHISM



'gracile' and the other was that it originally belonged to the genus *Plesianthropus* as mentioned in sections 1.2 and 2.2 of this present study.

Now it follows that because specimen four which is alleged to be female and is now named *africanus*, then specimens one to seven, inclusive must also be female. Conversely, specimens eight to eleven, inclusive must be male. So, provided that that assumption is correct, then at a stroke we have the sex of each specimen by examining the identified species given in column three of Table 1.

3.1 Sagittal Crests

A glance at Figure 1 will reveal that the male specimen has a keel like ridge running over the top of the cranium. This is termed the sagittal crest and served to provide a greater area for powerful jaw muscles. Correlated with the presence of that crest is the fact that the molars are not only larger compared with skulls having no crest, but also the lower premolars tend to be 'molarized'; that is, they have extra cusps or tend to and so resemble molar teeth.

Obviously the 'robust' form with the sagittal crest possessed masticatory musculature to increase bite pressure. Robinson⁷ thinks that they were herbivorous whereas the 'gracile' form was omnivorous. The anterior teeth of the 'gracile' specimens are on average larger than those of the 'robust' specimens.

In passing, it is interesting to note that whereas the 'gracile' form has a cranium that resembles man's more than the 'robust' form, it is the 'robust' form which possesses canines more closely resembl(ing) canines in later hominids than do those of the 'gracile' specimens:

AUSTRALOPITHECUS AFRICANUS					
CRANIAL [BRAIN] CAPACITIES					
My reference no.	cubic centimetres		Difference	% difference	
	Original	Revised			
1	510	407	-103	-20.2	
2	597½	440	-157½	-26.4	
3	435	415	- 20	- 4.6	
4	480	485	+ 5	+ 1.0	
5	500	428	- 72	-14.4	
6	530	436	- 94	-17.7	
7	480	435	- 45	- 9.4	
Totals	3532.5	3046	486.5	-13.8	
Averages	504.6	435.1	69.5	-13.8	

AUSTRALOPITHECUS ROBUSTUS					
CRANIAL [BRAIN] CAPACITIES					
My reference no.	cubic centimetres		Difference	% difference	
	Original	Revised			
8*	530	530	0	0	
9	530	530	0	0	
10	750	500	-250	-33.3	
11	800	500	-300	-37.5	
Totals	2610	2060	-550	-70.8	
Averages	652.5	515	137.5	-21.1	

*Australopithecus robustus boisei

TABLE 2 ANALYSED DATA

they are more conical and the crowns lack the asymmetry seen in the teeth from Sterkfontein.

Whereas only the male sex of orang-utans and gorillas possess a sagittal crest, it is a sober thought that none exists in chimpanzees. So the idea of being able to sex specimens of fossil apes on the basis of the presence/absence of a keeled cranium may prove to be an oversimplification of the case. Already the first signs of future complications is the claim by Wolpoff⁸ to have demonstrated sexual dimorphism within the 'gracile' sample.

Before leaving the subject of sagittal crests it is perhaps pertinent to note that a slight trace exists in male Eskimoes. In other words, it occurs in the males of one race of *Homo sapiens sapiens*, which is enough to

question the validity of mankind being descended from chimpanzees.

3.2 Relative Brain Size

The ratio of brain volume to body weight is termed relative brain size. The formula is as follows:

$$\text{Relative Brain Size} = \left[\frac{\text{Cranial Capacity in cc.}}{\text{Body Weight in g.}} \right] \times 100.$$

Harrison and Montagna⁹ reckon that australopithecines weighed between 40 and 50 lb. So I am assuming that the 'robust' (males?) weighed an average of 47½ lb. and the 'gracile' (females?) weighed an average of 42½ lb.

Using the data shown in Table 2, it is then possible to try and calculate the relative brain size for each specimen on the basis of revised cranial capacity and average body weight which is 19278 g. for *affricanus* (females?) and 21546 g. for *robustus* (males?), respectively.

Figure 2 shows the plot of cranial capacities against relative brain sizes for each form of australopithecine.

Incidentally the relative brain size for an 18 year man having an average body weighing 63.05 kg is 2.379 and that for a woman of the same age having an average body weighing 54.39 kg. is 2.482. Of course once anyone puts on weight, his relative brain size diminishes. That probably explains why Schultz¹⁰ calculated man's as 2.02 compared with 1.94 for a gibbon's. Compared to which the average australopithecine specimen yielded a relative brain size of 2.325.

In passing, it is good to be reminded that even the relative brain size is not a foolproof parameter to verify humanity as the squirrel monkey (*Saimiri orstedii*) has a score of 2.97!

4 DRASTIC SHRINKAGE

Whatever complications may obscure simple methods of sexing specimens or even identifying them as species on the sole basis of their skulls and particularly by only their crania, it still holds true that the main purpose of this present study is to draw attention to the existence, extent and direction of the discrepancies in assessing the cranial capacities of the same ten 'best-preserved' specimens of australopithecines. The underlying reason will be considered.

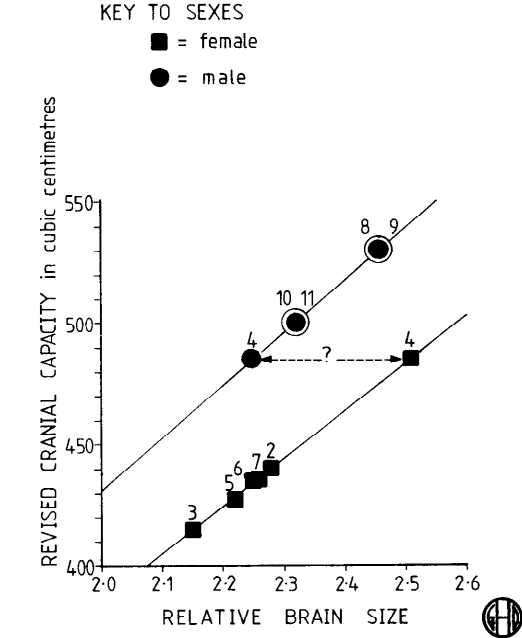


FIGURE 2 PLOT OF AUSTRALOPITHECUS AFRICANUS SPECIMENS TO INVESTIGATE SEXUAL DIMORPHISM OF CRANIA AND TO QUESTION THE SEXUAL IDENTITY OF SPECIMEN 4 [sts.5]

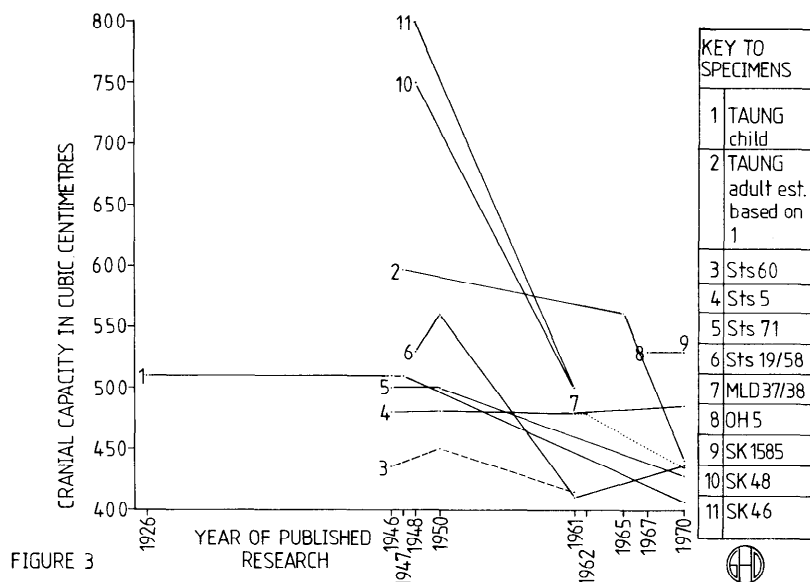


FIGURE 3

4.1 Discrepancies Revised

Figure 3 shows the data of Table 1 plotted as cranial capacity in cubic centimetres with year of published research. A glance at that figure will reveal that nothing much happened to cranial capacities between 1926 and 1945, but in 1946 other specimens were measured. Therefore, Figure 4 concentrates upon the period between 1946 and 1970 (inclusively). Also, in order to spot the direction and extent of revisionary trends the cranial capacities are plotted in terms of the percentage difference (if any) per box as shown in italics in Table 1. The first details of volume in c.c. is termed the original volume on the vertical axis of figure 5 and the final details of volume in c.c. is termed the revised volume on the vertical axis of figure 6.

Although specimens three, four, five and six showed some rise (i.e., increased calculated result for cranial capacity) only specimen four ended with a final volume of 485 c.c. (a 1% increase compared with the original volume) whereas the other specimens showed final volumes much less than the original volumes. Specimen three came to 20 c.c. less (a drop of 4.6%); specimen five dropped by 72 c.c. (a drop of 14.4%); and specimen six 'shrank' by 94 c.c. (a drop of 17.7%).

Out of the specimens that showed no sign of any revisionary rise in cranial capacity volume, specimen one fell by 103 c.c. (a drop of 20.2%) and also this affected the rating of the adult cranial capacity for this specimen which I have listed as specimen two. That fell by 157½ c.c. (a drop of 26.4%). But, whereas specimen seven showed a shrinkage of 45 c.c. (a drop of 9.4%) specimens ten and eleven gave drastic reductions. The former dropped 250 c.c. in size (a 33.3% reduction) and the latter dropped 300 c.c. in size (a record reduction of 37.5%)!

Overall the revisionary calculations of australopithecine skulls have led to reductions of their calculated volumes. The total percentage differences amount to -157.9!

4.2 Disturbing Discovery

Having established the nature of the discrepant data for the best-preserved australopithecine skulls, it still remains to suggest a reason for two phenomena. The first phenomenon must surely be the fashionable trend to over-emphasize the volume of each specimen when originally measured. Then the second phenomenon must be the dramatic reduction that is evident when the original and final volumes are compared.

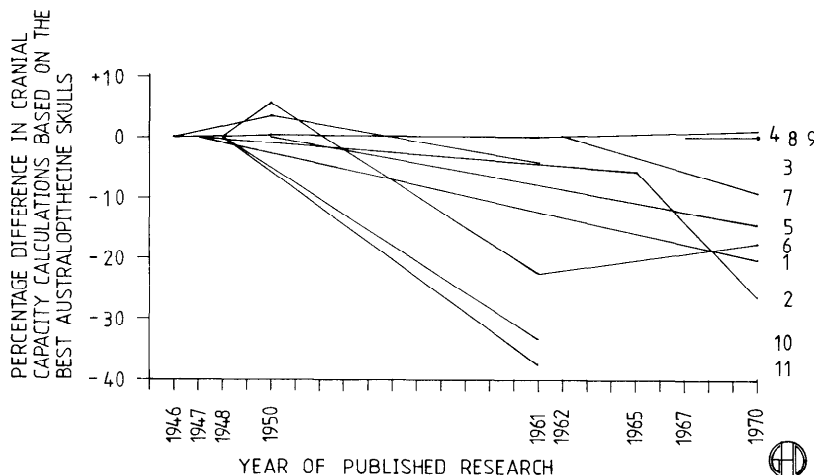


FIGURE 4

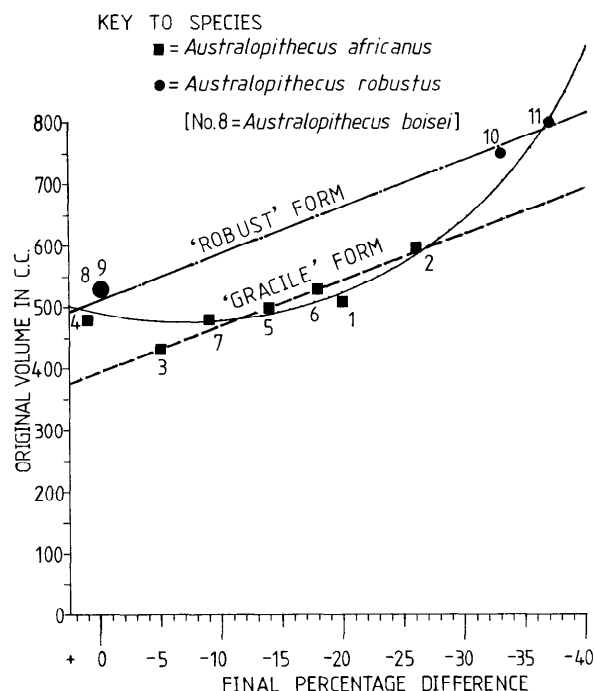


FIG.5 REGRESSION ANALYSES OF PLOT FOR VARIANT CRANIAL CAPACITIES OF AUSTRALOPITHECINE SPECIMENS SORTED INTO SPECIES

Now, remembering that in the popular mind (and subconsciously in the scientific mind) cranial capacity in primates is equated with intelligence, then the reason for the pseudoinflationary estimates of australopithecine cranial capacities could well lie in "discoverer's pride." On the grounds that the larger the cranial capacity, the larger is the brain that it used to enclose. So the tendency to be generous towards the specimen was really to claim for it a better place in the quest for fossil evidence of the proverbial 'ape-man.'

In 1946, the calculations based upon specimens three, four and five were modest, yet only specimen four proved to be an original underestimation. But the scores given in 1948 for specimens six, ten and eleven were way-out! Could it be that specimen six was made to look bigger than those of 1946 yet the author was ignorant of the high estimation based on the Taung child as an adult in 1947? Surely only "discoverer's pride" can account for the cranial capacities ascribed to specimens ten and eleven. If they were rising house prices, then a "Dutch auction" technique would have been suspected!

Then in 1950 — apart from specimen five's rating that remained the same — the rating for all of the other specimens (viz., three, four and six) showed modest increases. But in 1961 the revised estimates for each specimen showed a reduction when compared with the foregoing estimates except for specimen seven for which no previous estimate had been calculated. Thereafter the general trend is for further reductions compared with just one specimen showing a 1% increase.

The only clues the data give about the underlying reason for the dramatic switch of trends resulting in some instances of revisions producing drastic reductions are as follows:

DATES OF PUBLISHED RESEARCH										
My ref	(1926)	(1946)	(1947)	(1948)	(1950)	(1961)	(1962)	(1965)	(1967)	(1970)
1	✓	=	=							▼
2			✓					▼		▼
3	✓					▲				
4	✓				▲	▲				▲
5	✓				=					▼
6			✓		▲	▼				▲
7						✓	=			▼
8									✓	=
9										✓
10				✓		▼				
11				✓		▼				
No. =	1	1			1		1		1	5
No. UP					3				2	5
No. DOWN						5	1		4	10

Key to symbols
 ✓ 1st measurement
 = same as former
 Revised value is
 ▲ up/down 1-29cc.
 ▼ up/down 30-300cc.

- (1) The reason occurred some time after the preparation of the 1950 publication.
- (2) The reason occurred before the 1961 publication.
- (3) If the reason caused the 1961 publication, then it might well have occurred in the previous year.
- (4) The reason resulted in what amounted to mathematical rather than physical 'head-shrinking' of the australopithecine specimens (actually involving the ten 'best-preserved skulls!').
- (5) The reason (whatever it was) certainly stopped the inflationary trend dead in its tracks.
- (6) Therefore the reason must have made it clear to evolutionists that there was no longer any value in believing that australopithecines with large heads gave rise to mankind.

My reference number for specimens	Original volume's position	Revised volume's position	Positional difference
1	7	11	down 4
2	3	6	down 3
3	11	10	up 1
4	9	5	up 5
5	8	9	down 1
6	4	7	down 3
7	9	8	up 1
8	4	1	up 3
9	4	1	up 3
10	2	3	down 1
11	1	3	down 2

TABLE 4 SPOTLIGHTING INCONSISTENT TREATMENT OF AUSTRALOPITHECINE CRANIAL CAPACITIES

- (7) The reason most likely was another fossil discovered to have a cranium more in keeping with the shape of an ancestor for mankind but not as large as the inflated ratings already existing in scientific publications.

Now the only fossil that fits perfectly as an explanation for the fall after the previous rise in australopithecine cranial capacities is "*Homo habilis*" found in 1960 by Dr. L. S. B. Leakey.¹¹ It was at first hailed as 'pre-Zinj.' Alternatively its familiar name is "Handy Man" on account of a bone tool reckoned to have been a lissoir used in leatherwork.

The aforementioned up and down trends are depicted in the contents of Tables 3 & 4. Also the two slightly increased revised cranial capacity measurements for specimens four and six shown in the 1970 column indicate an eighth clue to check my contention that the discovery of 'pre-Zinj' was the key fact that supported evidence of man's ancestry better than the (other) australopithecines, e.g., *Australopithecus boisei* or *Zinjanthropus boisei* which was named "East Africa Man" and was reckoned to have a cranial capacity of 530 c.c. For specimens four and six in 1970 were rated as having scores of 485 c.c. and 436 c.c., respectively. They certainly presented no challenge to 'pre-Zinj' which Tobias¹² calculated to have a possible range of between 642.7 c.c. to 723.6 c.c. giving an average value of 680.8 c.c. for its cranial capacity.

A final clue that springs to mind is that the score for 'pre-Zinj' not only had to be larger than those of any australopithecine skull's cranium, but also it must at the same time be smaller than the smallest known *Homo erectus* cranial capacity which according to Tobias was 775 c.c.

5 DATA 'SPIN-OFFS'

Although the main purpose of this present study has been fulfilled by the data analyzed in sections 4.1 and 4.2, respectively, two items of peripheral importance should be mentioned before drawing conclusions. Both concern some of the plots shown in Figures 2, 5 and 6 and are best dealt with separately.

KEY TO SPECIES

- = *Australopithecus africanus*
- = *Australopithecus robustus*
- [No. 8 = *Australopithecus boisei*]

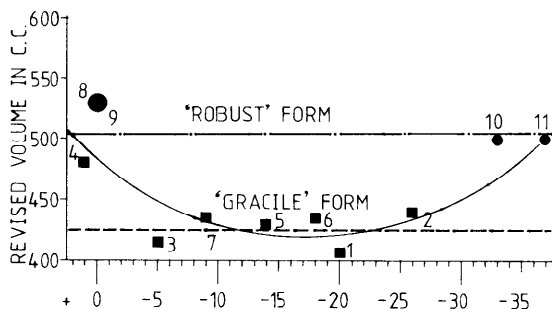


FIGURE 6 FINAL PERCENTAGE DIFFERENCE REGRESSION ANALYSES OF PLOT FOR VARIANT CRANIAL CAPACITIES OF AUSTRALOPITHECINE SPECIMENS SORTED INTO SPECIES



5.1 Singular Discovery

Specimen one was described as the Taung child or Dart's baby, so it might be imagined that no attempt was possible to decide upon its sex. Yet that is not the case. In Fig. 2 whilst it does not exist as specimen one, it is plotted as the estimated adult cranial capacity termed by me 'specimen two.' There it exists definitely on the regression line with all the other female specimens.

Similarly, as specimen one the Taung child exists much closer to the regression line for the 'gracile' (=female?) form identified as *Australopithecus africanus* than compared with the 'robust' (=male?) form identified as *Australopithecus robustus*.

5.2 Doubtful Specimen (Sts. 5)

Having apparently solved one mystery in section 5.1, a new one is only now showing itself within Figures 2, 5 and 6. It is the identity of specimen four in this present study. In the scientific world it is registered as Sts. 5.

Although it is listed in Tables 1 and 2 as being *Australopithecus africanus*, that is a 'gracile' form: a niggling doubt remains about whether it is really from a female individual.¹³

Not only was it the only specimen of the 'ten best-preserved specimens' of australopithecines to show a final volume increase in its cranial capacity, which is better visible on Figure 4 than compared with Figure 3, but also it occupies an anomalous position in Figures 5 and 6 because it lies much closer to the regression line drawn through the plot of other 'robust' form specimens than it does to that of 'gracile' form specimens.

Therefore, in view of the above mathematical contraindications of the sexual status (hitherto accepted) for Sts. 5, I have shown its position plotted both as a male with the 'robust' forms and as a female with the (other) 'gracile' forms in Figure 2. There, although the specimen fits on both regression lines, as a male its position is closer to the position of the plots of the other males than on the other line where it distances itself from the other females.

But before resting my case on what is very peripheral to the main point of this present study I notice from photographs and line drawings of australopithecine skulls in the British Museum (Natural History) guidebook entitled *Man's Place in Evolution* (1980) that the top of the cranium is nowhere materially attached to the rest of the specimen's skull. So anyone who doubts that Sts. 5 originally had a sagittal crest on its skull top could well be 'talking out of the top of his head'!

6 DISTURBING SEQUELS

In this present study I am not accusing any palaeontologist involved in the finding and measurement (or estimation) of the ten 'best-preserved' cranial capacities of the fossil material known as australopithecine skulls of 'skulduggery' or of conscious falsification. Rather, I wish to point out some facets of this survey which arise as implications. The one thing that each implication has in common with the australopithecine fossils is the common goal to support the theory of evolution — to plot out its allegedly prehistoric route irrespective of finally knowing its mechanism.

6.1 Theoretical Transference

Not only does 'discoverer's pride' play some part in raising the status of a specimen nearer to the discovery of a veritable 'ape-man,' but also institutions survive on funds and, I suspect, that as in editing small changes are made, then almost inevitably co-workers within the same institution gather around material and express opinions which imply that their laboratory is handling the very best in fossil-ware.

When looking at the face it is obvious that little can be done to 'reconstruct' the muzzle-like jaws, and anyway the public have learned to expect ape-like jaws for an 'ape-man,' but the skull cranial bones are invariably fragmented and seldom fit as properly as 'jig-saw puzzle pieces' would, so there is scope for slightly (perhaps imperceptibly and subconsciously) leaving a gap between each piece to represent the edge of the bone that time (reckoned in millions of years!) has worn away. In such a way a cranium is reconstructed that does not obviously violate the geometry of the domed pieces.

What this present study has shown is that in order to provide evidence for the change of one species into another, the size of the ten 'best-preserved' specimens was altered in two ways. First there tended to be an upward trend. The discovery of specimens ten and eleven were put at 750 c.c. and 800 c.c., respectively, by scientists who were in effect saying 'My specimen's conk is bigger than your specimen's conk!' Thus the mentality of schoolboys playing 'conkers' was carried into the study of human evolution (alias physical anthropology and hominid phylogeny) and all because of the 'Yuri Geller effect' of the theory of evolution upon the fossil material transmitted through the fingertips and thought processes of the workers.

That the above explanation is close to the facts of the case of the variant and discrepant cranial capacities for australopithecines may be confirmed by a fact of twentieth century history. It is that as soon as 'pre-Zinj' was discovered in 1961 which meant that inflationary estimates had been backing the wrong horse in the race of evolution, then and only then did revisionary reductions of cranial capacity volumes occur.

Whilst it is a fact of life that biological material shows variation when one specimen is compared with another, each specimen does not vary — certainly nowhere as much as those best ones that form the main theme of this present study.

Only during the process of birth does nature allow brainboxes to survive the experience of being treated as 'squeeze-boxes': a situation far removed from museum laboratories!

6.2 'Near-Men' Misnamed

The revised cranial capacities of the australopithecine specimens that form the main part of this present study show nothing greater than 530 c.c. Therefore, the upper limit of endocranial volume of all *Australopithecus* species is no longer standing at 800 c.c. (e.g., specimen eleven SK 46) as once it did. So it follows that any book on the subject of human palaeontology published before the 1960s must be out of date in at least two respects. One is that it was written before the discovery of 'pre-Zinj' and the other is that it

would be oblivious of the drastic reductions in calculations/measurements/estimations regarding the ten specimens included in this present study.

Yet Simons omitted to mention head-shrinking that has occurred in regard to the australopithecines in the assessment quoted from page 4 of *Primate Evolution: an introduction to man's place in nature* as follows:

Because of many new finds, as well as new dates for previously known fossils, most books on this subject published before the 1960s are now out of date.

Although on page 278, Simons conceded that:

The hypothesis that brain enlargement marked the beginning of man was long popular, but went out of fashion with the discovery that the endocranial volumes of the australopithecine group were not larger than those of gorillas.

Previously, on page 276, he still maintained that:

Australopithecus africanus, *A. habilis*, *Paranthropus robustus* or *Zinjanthropus boisei* whether tool-makers or not can be styled adequately by the popular term "near-men."

Now I believe that one implication of this present study is that no australopithecine should be regarded nowadays as 'near-man' when cranial capacity reduction places that group well within the range of apes. Therefore, I believe there is more sense in calling them 'near-apes' — certainly no longer 'near-men'! Such a term is simply a misnomer based upon wishful thinking.

6.3 Futile Phylogenies

Knowing that the 'robust' forms and 'gracile' forms are now reckoned to be the male and female sexes, respectively, then the phylogenies shown in Figure 7 are clearly inaccurate. They neither do justice to the basic 'facts of life' nor to the definition of the term species.

The first one purports to show cladogenesis (= branching evolution). In effect it claims that the common ancestor of man was hermaphroditic which diverged to form the male only branch leading to *A. robustus* and *A. boisei* whilst the main trunk that was entirely female being *A. africanus* led on to *Homo* (man).

The second one purports to show anagenesis (= transformation of one species into another without involving branching). In effect it claims that the common ancestor produced only the female sex amongst its offspring identified as *A. africanus* for many generations over thousands of years until only males were born, which somehow produced other males as offspring. These were named *A. robustus* and after further generations and many years they transformed to give rise to *Homo* (mankind) which we know exists as two sexes.

The third is a variation of the first scheme but showing that the females gave rise by a side branch to the males. In other words, the *A. africanus* gave rise to *A. robustus/boisei* before another side branch produced more females (i.e., *A. africanus*) whilst the main trunk led on by anagenesis to give rise to *Homo*.

Still other schemes exist in the literature. One of them shows an unidentified common ancestor fanning out to produce four lines. The first are the males (*A.*

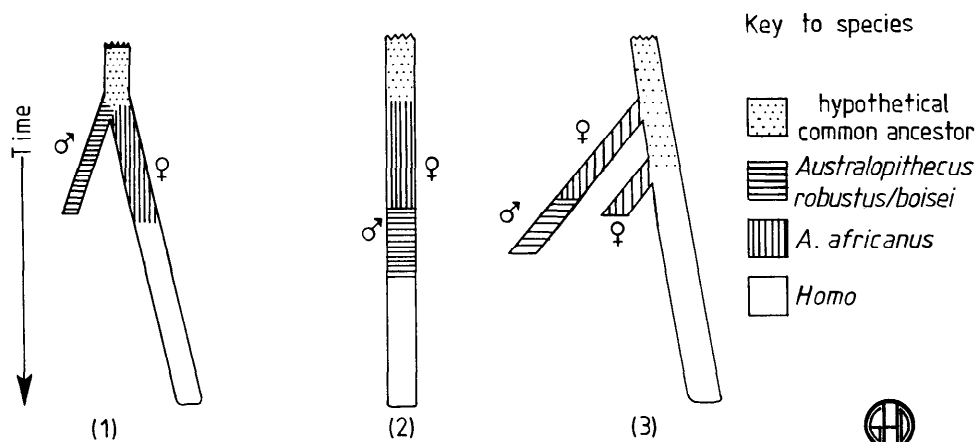


FIGURE 7 PHYLOGENIES THAT ARE INVALID BECAUSE THEY VIOLATE THE 'FACTS OF LIFE'

robustus/boisei); the second are the females (*A. africanus*); the third is *Homo erectus*; and the fourth shows *Homo habilis* (alias 'pre-Zinj') leading on to *Homo sapiens* (so-called 'modern man'). A further scheme places the usual australopithecine sexual nonsense as a side branch from the main trunk leading from their common ancestor anagenetically through *Homo habilis* (alias 'pre-Zinj') on again through *Homo erectus* and then finally culminating in *Homo sapiens* (present-day mankind).

As a further variation of the mistakes shared by all of the above phylogenies is the desire of authors to depict the naked body clothing the fossil's skeleton. For instance, *Australopithecus africanus* is illustrated as a male (!) on page 54 of *The Evolution of Early Man* by Wood.¹⁴

6.4 Shifting Support

The discovery of 'pre-Zinj' toppled the status of the other *Australopithecus* spp. from their position in the early evolution of mankind — at least in alleged schemes. Now that their swollen heads have been reduced to their proper size, *A. africanus* fossils represent simply an extinct form of 'Southern Ape' as their generic name implies.

Therefore, with heads shrunk smaller than those of present-day apes, the new quest for man's evolutionary relationship (if it ever exists) is along the lines of comparing the sequence of amino acids within certain proteins as well as by comparing the sequence of bases along the length of the DNA molecules of man and great ape.

Is it too much to believe that when the ten 'best-preserved' australopithecine skulls were revised which resulted in their reduced cranial capacity, then that caused such a revolution in palaeontology that the evidence for evolution has shifted to biochemistry because the fossil bones were check-mating attempts to support human evolution with australopithecine morphometrics?

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THE AGE OF LUNAR CRATERS

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The currently accepted uniformitarian views on the origin and age of lunar features are contradicted by the facts of the rheology of materials. In view of the nature of the material at the surface of the Moon, the craters, in particular, could not be older than a few thousand to a few million years. But the craters are there; hence they must be far younger than the uniformitarian view would allow.

Current views of the history of the moon hold that the major period of cratering on the lunar surface ended four billion years ago. This conclusion is inferred from radioactive age measurements from the various Apollo landing sites. Wood says,

The concentration of highland rock ages at about 4.0×10^9 years points either to an epoch of specially intense meteoroid bombardment at that time, or . . . a bombardment rate during the first 0.6×10^9 years of solar history so intense that virtually all rocks at the lunar surface had their radiometric clocks repeatedly reset until the bombardment tapered off 4.0×10^9 years ago.¹

Everyday experience teaches us the difference between a liquid and a solid. Liquids flow out until their surfaces are relatively level. Solids on the other hand remain basically in the same geometrical shape in which they were fashioned. For instance, water is a liquid and when placed on an inclined plane, will flow down slope. Ice is the solid phase of water. When it is placed on an inclined plane, it may slide but will not flow down the slope.

This easy distinction between solids and liquids becomes blurred when extended periods of time are considered. In the above example, ice is a solid, but when enough ice is placed on an inclined surface, it will flow just like water. The only difference is the speed with which it flows. With water one can see the movement down a mountain in a matter of minutes, but with ice, it may take a year to detect the flow. If it were not for this phenomenon of a solid acting like a liquid, glaciers would be impossible.

The difference in speed between the flow of ice in a glacier and the flow of water is due to the friction generated between one molecule of ice and another and the far less friction generated by two liquid water molecules. The greater friction in the case of ice causes it to flow very slowly. The property due to this type of friction is called viscosity, and is measured in a unit called poise. The range of measured viscosity varies from less than one poise for water to over 10^{22} poise for the mantle of the earth. Table 1 gives values of viscosity for several materials.

Glass, in ordinary experience appears as a solid and yet over a century the lower edge of a window pane noticeably thickens. The glass flows in response to the pull of gravity. Salt, too, is considered as a solid

in everyday experience but when subjected to forces which endure for several centuries, it will flow just as water or ice. But once again, due to the greater viscosity, it flows very slowly. This movement can be seen in salt domes, some of which appear to be moving today,² and in the salt glaciers in Iran.³ Granite, an igneous rock, has also been observed to flow, albeit exceptionally slowly. N. Kumagai and H. Ito cut long bars of granite and supported them at each end. They then measured the deformation in the granite bars over a period of several years. The deformation was enough to prove that granite had a viscosity of 10^{20} poise.⁴

At the other time extreme, liquids can act as solids. In solids pressure waves travel with a velocity of $[(k + 4\gamma/3)/\rho]^{1/2}$ where k is the bulk modulus, γ is the rigidity of the solid, and ρ is the density. In liquids, the rigidity is zero; so sound travels with a velocity of $(k/\rho)^{1/2}$. Glycerine is a liquid in everyday experience and the velocity of sound through it obeys the latter law. However, when the frequency of the sound becomes high enough, the liquid no longer obeys the liquid velocity law. With (ultra) sound waves of 10^{10} cycles per second, the speed obeys the velocity law for solids.⁵ Raman and Venkateswaran conclude,

Our observations thus seems to establish that for mechanical disturbances of sufficiently high frequencies, a liquid behaves essentially as a solid.⁶

Thus when considering whether a material behaves as a solid or a liquid, the time over which the forces persist must also be considered.

When considering the lunar surface it is reasonable to assume that the surface prior to meteoric impact is in isostatic equilibrium. This means that the basaltic surface is essentially level. The impact and subsequent crater formation alters this equilibrium. Part of the surface, the crater rim, is above the former level. The crater depression is below the former surface. This change from a level surface to an uneven topography

Table 1. Viscosities of various materials.

Material	Viscosity (poise)
Earth's Mantle	10^{22}
Limestone	10^{21}
Granite	10^{20}
Mudstone	10^{18}
Salt	10^{18}
Rubber	10^{15}
Ice	10^{13}
Silicone Putty	10^7
Glycerine	10^0
Water	10^{-2}

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produces stress in the crust. Gravity will tend to pull the structure down and hydrodynamic forces will push the crater depression up. Over a long enough period of time, the lunar crust will flow to reduce the stress.

The equation which describes this restoration of isostatic equilibrium is given by Officer:⁷

$$H = H_0 \exp -(\rho g t / 2 \mu k) \quad (1)$$

where ρ is the density, g is the acceleration of gravity, μ is the viscosity, t is the time, H is the height above or below the isostatic level, and H_0 is the initial distance the crater surface is away from the equilibrium level. k is defined as; $k^2 = l^2 + m^2$, where $l = \pi/a$ and $m = \pi/b$ where a and b are the orthogonal dimensions of the load. For a crater $a = b = 2R$ where R is the crater radius. Substituting, we have

$$H = H_0 \exp -(\rho g R t / 2^{1/2} \pi \mu) \quad (2)$$

Rearranging,

$$t = \ln \left(\frac{H}{H_0} \right) \left[\frac{2^{1/2} \pi \mu}{\rho g R} \right] \quad (3)$$

The density of basalt is 2.9 gm/cm³ and the gravitational acceleration on the lunar surface is 163 cm/sec.². However, the viscosity of basalt is the most uncertain parameter in this equation. Both manual and computer assisted literature searches revealed that no measurement of the viscosity of basalt at the applicable temperatures has ever been made. However, even without this measurement, it is possible to define an upper limit to the viscosity of lunar basalts. It must first be noted that the chemical composition of lunar basalts is very close to terrestrial basalts.⁸ Table 2 shows the average composition of terrestrial and lunar basalts. Because of this similarity, we may use what we know of terrestrial basalts. One of the things that we know about terrestrial basalts is that the viscosity over all temperature ranges over which it has been measured is always less than granitic material.⁹ This is because the viscosity increases as the igneous rock contains more silicon. Granitic rocks contain an average of 70 percent SiO₂ while basalts contain only 40 percent. Thus we can use the viscosity of 10²⁰ poise measured for cold granite as an upper limit for the viscosity of basalt.

Another limiting factor is the lack of any *measured* viscosities larger than the 10²²-10²³ poise value which is ascribed to the earth's mantle. Thus we can be rather confident that the lunar viscosities are definitely below 10²³ poise and most likely below 10²⁰ poise.

Since the value of the viscosity involved in this flow is absolutely critical to the validity, or lack thereof, of this argument, it would be useful to discuss these measurements in more detail. In looking over the lit-

erature one can make an interesting observation. Authorities when talking about terrestrial materials seldom cite values greater than 10²³ poise. The values they cite are taken from laboratory measurements and terrestrial measurements.^{10, 11, 12} However it is not exceptionally difficult to find values cited as high as 10³⁰ poise but upon investigation, these cases turn out to be extrapolations from lower values.¹³ Solomon, Comer and Head¹⁴ when discussing the viscous flow of lunar craters include two graphs showing extremely high viscosities. They include these charts as "examples" but fail to adequately explain to the reader that the higher viscosities are extrapolations.

The problem is that in discussing lunar craters, one must know two facts: the age of the crater and the viscosity. Laboratory measurements give us the surface viscosity within certain limits; but using these values yields ages that contradicts the current accepted chronology. Thus, many investigators have chosen to assume the age and solve for the viscosity. J. Arkani Hamed in an article on the viscosity of the moon¹⁵ derives a viscosity of 10²⁷ poise. This value was not derived from measurement of the physical properties of lunar basalts but from the assumption that the lunar crust is billions of years old. If the viscosity were lower than that then certain lunar features could not have lasted the necessary 3 billion years. In this paper we will use the laboratory measurements since they are the only firm information available.

In using equation 3 to determine how long it will take for a crater to flow back to the original surface level, we will assume that when 99 percent of the structure is gone, equilibrium is restored. This is identical to setting H/H_0 equal to 0.01. Table 3 shows how long it would take for craters of various sizes to be reduced in height by 99 per cent due to hydrodynamic flow. As can be seen, the lunar craters can not last longer than a few million years for any reasonable value of the viscosity. If the viscosity of granite is the upper limit for the viscosity of basalt, then lunar craters can not be more than a few thousand years old.

Should the objection be made that these rates are too fast and we should see these effects in old earth structures or mountains, it can be shown that this is not so. In the case of mountains, they are in isostatic balance (or close to it); so the mountain as a whole would not sink. Mountains are supported by a low-density root which keeps them floating far above normal elevations. Because they are in isostatic balance, equation (3) is not strictly applicable to describing the flow.

The only type of flow which an isostatically supported mountain would undergo is for it to flow out

Table 2. Composition of Terrestrial and Lunar Basalts.

Mineral	Terrestrial %	Lunar %
SiO ₂	40	42
Al ₂ O ₃	10	13
FeO	18	16
MgO	7	8
CaO	11	12
TiO ₂	11	8

Table 3. Time for Re-Establishment of Isostatic Balance for Various Viscosities (time in Years).

Crater Radius Km	Viscosity (poise)				
	10 ²⁰	10 ²¹	10 ²²	10 ²³	10 ²⁴
450	3,050	30,500	305,000	3,050,000	30,500,000
125	10,980	109,800	1,098,000	10,980,000	109,800,000
50	27,000	270,000	2,700,000	27,000,000	270,000,000
25	55,000	550,000	5,500,000	55,000,000	550,000,000

and fill up the valleys. In this case the hydrodynamic equations must be derived differently. Following Hubbert's approach¹⁶ we have

$$\frac{\partial V_z}{\partial z} = \frac{\sigma_{zz}}{3\mu} \quad (4)$$

where V_z is the velocity in the vertical direction (z axis), σ_{zz} is the stress parallel to the z axis and μ is the viscosity. With the origin fixed at the base of the mountain, the velocity as a function of z can be found by integrating the above equation.

$$V_z = \frac{\sigma_{zz}}{3\mu} z + C \quad (5)$$

where $C = 0$ since $V_z = 0$ at $z = 0$.

To determine how far a given particle has moved in a given time, we integrate equation (5) with respect to time remembering that $V_z = dz/dt$. This yields

$$t = \frac{3\mu}{\sigma_{zz}} \ln(z/z_0) \quad (6)$$

For a cliff $\sigma_{zz} = \rho g z$ where ρ is the density of the rock, 2.5 gm/cc, g is the acceleration of gravity, 980 cm/sec.² A 3000 foot cliff would have a stress of approximately 2×10^8 dynes/cm². Using a viscosity of 10^{22} poise we find that it would take 47,000 years for the cliff to be shortened by 1 percent or thirty feet. The important question is: would we ever be able to observe this flow? Unfortunately we wouldn't. The rates of erosion in mountainous areas is exceptionally rapid. The overall rate of erosion averaged over the entire continent is 1 inch every thousand years. But in the Transverse Range in California, the USGS reported an erosion rate of 25 feet per thousand years.¹⁷ Thus while flow would lower the cliff by 30 feet over 47,000 years, erosion would lower that same cliff by nearly 1200 feet. Thus we would never observe the flow.

In the case of old human structures, they too are generally flowing at too slow a rate for it to be observed. For instance, the Great Pyramid of Egypt is made of limestone which has a viscosity of 10^{21} poise. Following Hubbert's method, which is more applicable to the case of a pyramid than equation (3) we find that it would take over 26,000 years for it to shorten by four feet. In the 4,600 year history of the pyramid, the original 481 feet height has been reduced to 451 feet by weathering and plundering. Thus once again we would be unable to detect flow in a small object.

Equation (3) was first derived by Z. F. Danes of the United States Geological Survey. In a short report on this work, the USGS stated,

The history of a circular crater in a highly viscous medium is derived from the hydrodynamic equations of motion by Z. F. Danes . . . Correspondence between theoretical crater shapes and observed ones is good. However, the time constant, T , is surprisingly short if commonly accepted viscosity values are used. Thus, if the present analysis is valid and if lunar craters are of the order of 10^9 years, lunar rock viscosities must be of the order of 10^{25} to 10^{26} poises. If viscosities of lunar rocks were around 10^{21} to 10^{22} poises, the ages

Table 4. Crater Radii.

Crater	Radius (kms.)
Oriental Basin	450
Clavius	120
Crimaldi	120
Copernicus	50
Plato	48
Tycho	40
Krafft	26
Cardanus	25
Hansteen	23
Zupus	19
Damoiseau	18
Harpalus	17
Giordano Bruno	10

of large craters would have to be only 10^4 to 10^7 years.¹⁸

Considering the time at which this was written (1966) it was perfectly within the right of the investigator to speculate that the lunar material was extremely viscous. In 1966 we really had no idea of the exact chemical composition of the moon's surface. However, since the Apollo missions have shown that the lunar surface is merely a basalt with a very similar composition to terrestrial basalts, such speculation is no longer reasonable. In spite of this, such speculation continues to the present.

In a recent article, Binder and Lange remarked,

Meissner assumed in his discussions of the present viscosity of the moon that n_0 and g are the same as for terrestrial mantle materials and hence that [the viscosity equals] 10^{21} [poise] at the solidus, the value found for the earth's upper mantle from the rebound of the Fennoscandian and Canadian shields. However, our results indicate that these assumptions lead to viscosities which are too low to be consistent with certain boundary conditions.¹⁹

Among the boundary conditions listed by Binder and Lange is the assumption that the moon separated from the earth 3 to 4 billion years ago.²⁰ This extremely old age for the moon is the only boundary condition in their list which could possibly be violated by low viscosity values.

Because the laboratory measurements on terrestrial materials indicate that viscosities could not be much more than 10^{23} poise, the lunar craters can not possibly have lasted the three to four billion years assumed by secular lunar theories. The evidence presented here demonstrates that the lunar surface and the craters on it are relatively young structures.

Postscript

Even though it is normal for the erosion rate to be faster than the rate of fluid flow under most conditions, fluid flow has been observed in recent man-made structures. This fact simply verifies the youth of the craters in the solar system. L. L. Nettleton gives several examples of fluid flow in hard rocks in his classic paper on salt dome formation. He stated,

There are several lines of evidence showing that hard rocks will flow under small stresses maintained for long times. Bingham calls attention to

the deformation of tombstones under their own weight in a cemetery in Washington, D.C., and quotes several instances of rock flow from ancient structures in the old World. In an old cemetery in Richmond, Virginia, the writer has noticed a pronounced concavity of tombstones which consisted of horizontal slabs mounted on brick pillars at the four corners. Slow flow and 'elastic after effect' has been determined on bars of rock cut from the coal measures of England. Bingham and Reiner have shown that long slender bars (about 1 inch square by 33 inches long) of thoroughly cured cement mortar bend appreciably under their own weight in a few months. Flow of marble slabs, probably from forces arising from diurnal temperature changes, has been noticed in a cemetery in Havana, Cuba. All the evidence quoted on the flow of rocks shows only small deformations, but they were caused by small forces (in most cases, of the order of the weight of the rock) and for times which are infinitesimal in comparison with geological time.²¹

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ARE THE BRISTLE-CONE PINE TREES REALLY SO OLD?

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Various treatments were given to 8-month-old bristle-cone pine seedlings; and it was found that supplementing the winter day length with a 250-watt heat lamp in order to give a total of 16 hours of illumination proved most effective. The lamp was placed about three feet above the seedlings, and the temperature in the growth chamber was kept at about 70°F. Those which received a short (circa 21 days) drought stress period in August of the third growing season showed up having one more growth ring than the control seedlings, that is four growth rings instead of three.

Also seedlings which received a two week drought stress period in August of the fourth growing season showed a similar extra growth ring.

The bearing of this on the estimates of the age of the bristle-cone pine forest is discussed. Under the San Francisco type of both spring and fall rainfall with a relatively dry period in the summer the young forests on the White Mountains would have grown an extra ring per year quite often. Accordingly it is believed that the presumed 7100 year age postulated for these trees by Ferguson would be reduced to about 5600 years, on the assumption that extra rings would be formed by stress during about 50% of the years between the end of the Flood and about 1200 A.D.

Introduction

In his paper, "Bristlecone Pine: Science and Esthetics," C. W. Ferguson points out that in some species of conifers one season's growth increment may be

composed of two or more flushes of growth, each of which may strongly resemble an annual ring. Such multiple growth rings are extremely rare in the bristle-cone pine, especially in the White Mountain area, according to Ferguson.¹ Now this range of mountains is located east of the Sierra Nevada and separated from

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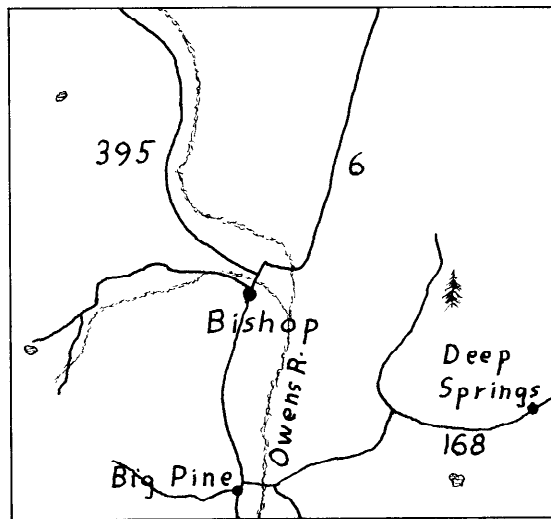


Figure 1. The region in which the bristle-cone pines grow, in the vicinity of Bishop, California. Nevada is to the right. The tree sign shows a place, in a park, where the trees may be seen. Highway numbers are shown on some of the roads.

it by a fairly wide desert valley. It is about 14 miles east of Big Pine, California which is 15 miles south of Bishop, and may easily be reached by going out highway 168 from Big Pine. A paved highway goes north to the entrance of this Ancient Bristlecone pine area as shown on the map in Figure 1. When we visited this park on August 23, 1973, we saw two species of pine. One was a fairly long greyish needled one called *Pinus flexilis*, and the other a shorter needled one called *P. aristata* or bristlecone pine so named because the scales of the cone have slender bristles on the ends of them.

The great age of many of the trees in this park is most impressive, though it may be a surprise to most readers that the oldest living trees are presumed to be about 4600 years old. The age of 7100 years is reached only by the addition of rings from long-dead specimens to the record of the living trees. The pattern of the ring formation in these older trees is distinctive enough from that of the younger ones that there seems to be no question as to their having been formed earlier.

My own observation of the growth of this pine confirms the claim of Ferguson that they are singularly difficult to influence as regards their growth and formation of annual rings. However, as will be shown, it is possible to do so under circumstances which may well have occurred many times in the habitat in which they are growing.

Material and Methods

The growth studies of this pine were done in a growth chamber constructed in my greenhouse. The supporting 4x4's are 12 feet apart. So I nailed 2x4's to the side of the central bench extending them to the plastic supporting beams of the greenhouse, placing them at the same distance apart as the 4x4's, or 12 feet. Now the 4x4's are 4'8" from the outer edge of bench and 7'8" high above it. The 2x4's are 6'8" high. By placing 4 mil polyethylene around these both on the outer and inner side it was possible to make a fairly good heat retaining chamber 4'8" by 12' and

sloping from 6'8" to 7'8" high. A 250 watt heat lamp was used as well as fluorescent light tubes. Also a small electric heater which was equipped with an automatic control was used to keep the temperature at 70 degrees F.

Seed of the Colorado strain of the bristlecone pine was purchased from the Clyde Robin Seed Co., Inc., and planted March 9, 1978. By way of explanation, because of park restrictions it is practically impossible to get seed of the trees growing in the White Mountain area. However, botanically speaking, the trees growing in California and in Colorado are all considered to be the same species. Germination was excellent and the seedlings were transplanted on April 6, 1978 to small plastic pots using a commercial planting mix. They were given a balanced high nitrogen 25-10-10 nutrient solution at the rate of two teaspoonfuls per gallon on August 16, 1978, and January 16, March 9, and March 24, 1979.

On December 23-24, 1978 the seedlings were divided into 5 groups. Twenty-two were placed outdoors after being transplanted into four-inch pots. These were buried in the soil so that the top of the pot was level with it. In this way maintenance was reduced to a minimum and growth conditions were made as similar to natural conditions as possible. This group is designated as "outdoor" in Table 1. A second group of 25 plants were transplanted to five-inch pots and placed in the greenhouse where the temperature dropped to as low as 40 degrees F at night during January and February. This second group is designated as "Greenhouse" in Table 1. Group three consisted of 22 seedlings which were transplanted into four-inch pots and placed in two rows of 11 plants each so as to receive as much sunlight as possible. These are the "70 degree minimum no extra light" plants of Table 1. Twenty seedlings were transplanted into five-inch pots and placed in a circular arrangement so as to receive as much light as possible from the 250 watt reflector red heat lamp placed three feet above them. They are called "Heat lamp, 16 hour day 70 degrees minimum" in Table 1. Finally the remaining 12 were transplanted into five-inch pots and placed directly under the fluorescent light tubes about four feet from those under the heat lamp. They are the "Fluorescent light, 16 hour day" group of Table 1. The fluorescent lights were six feet above these plants and so actually illuminated both the plants under the heat lamp and these 12 plants. Both 4- and 5-inch pots were used since at the time there were not enough empty pots of either type available for the whole experiment. Since the seedlings were still so small actually 4-inch pots would have been adequate.

The plants out of doors were placed under a mist type nozzle on the end of a hose held about 2½ feet above the ground by strapping the hose to a 1" by 1" stake. The mist was set to go on each day at noon and so the plants were kept at nearly 100% humidity during the summer and fall until September 20, 1979. They and all the other seedlings which received the treatments described above and removed to this location in May of 1979 were given the same type of mist treatment in the summer and fall of 1980 and 1981.

Table 1. Increase of growth in height of *Pinus aristata* seedlings during a period of about 3.5 months. (December 24, 1978-April 6, 1979)

Treatment during the 3.5 month period	Total number plants in treatment	Number of plants showing various height increments (in inches)										Summated total; of increments for all plants in treatment	Average height increase for each plant
		0	0.125	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00		
Outdoor	22	10		9	1	2						4.25	0.19
Greenhouse	25			6	4	3	5	3	2		2	21.5	0.86
70 degrees minimum with no extra light	22	9	2			1	7	2			1	12.5	0.57
Heat lamp 16 hour day, 70 degrees minimum	20			1		3	2	1	6	2	5	28.25	1.41
Fluorescent light 16 hours per day, 70 degrees minimum	12	2				1	4		4		1	12.25	1.06

Results

The results of these experiments may best be summarized by describing them in three parts, namely, the effect of various light treatments, then the age of the bristlecone seedlings when the first annual growth ring is formed, and finally the effect of various treatments designed to induce extra ring formation.

1. Effect of light treatments on seedling growth

Since the plants were a year old on April 6, 1979, measurements were made of their increase in height between December 24, 1978 and April 6, 1979. When these seedlings were transplanted they all were 1 to 1½ inches high. Ten height increments were established at 1/8 inch (0.125) intervals from zero on up to two inches. Each plant was placed in the increment class to which its height increase most closely corresponded. Plants showing little or no growth were placed in the zero class. At this time the seedlings were so small that slight diameter differences could not be measured. These data are given in Table 1.

The seedlings outdoors did not resume growth until the end of March 1979; so the small amount of growth recorded occurred in about one week of time. With warm days beginning in May they all began growing and continued to make slow growth until mid-August. Though measurements of their growth were not made, the average was less than half an inch per plant.

Those kept in the unheated greenhouse did not begin growth until about March 15, 1979. The total growth of 21.50 inches all occurred in about three weeks and averaged 0.86 of an inch per plant.

The plants under normal day length and temperatures of about 70 degrees F minimum with maximum exposure to the sun made a total growth of only 12.50 inches or an average of 0.57. Quite evidently, higher temperature alone is not enough to cause extra growth. In fact it seems to have a detrimental effect, since it deprives the seedling of normal winter chilling without giving it any extra light stimulation.

The much greater stimulation of the seedlings under the heat lamp was quite remarkable, especially since the experiment had run for only slightly over three months. (Figure 2) The average amount per plant of 1.41 inches is considerably more than the average of 1.06 made by the plants under fluorescent light. Since I needed the chamber space to force seedlings from the seed of ornamental plants collected in Chile in

1978, all of the plants were moved outdoors in May of 1979.

These various light treatments indicate that although the bristlecone pine is not as easily influenced by the length of day as other pine species, it can be stimulated significantly, especially by long-day heat-lamp treatment. The bearing of this on the rapidity of their growth under conditions formerly existing in the Owens River Valley and White Mountain area will be discussed later.

2. Age of seedling at first annual ring formation.

My first attempts to influence annual ring formation were made by subjecting seedlings to cold storage treatment at 40 degrees F for three weeks in May of 1979. No outward effect was noticeable and examination of cross sections showed no interruption of growth. A similar attempt in 1980 was also unsuccessful.

Examination of the cross sections of several seedlings when one year of age (April 6, 1979) showed only pith growth. Evidently it takes a young bristlecone pine seedling a long time to grow out of its juvenile state. Even in late September of 1979 they showed only a small amount of woody tissue consisting of 9 to 12 circles of cells. No distinction between spring and fall growth could be seen. In order to recheck on this behavior I planted another packet of seeds on June 7, 1980. These germinated in about a month and were



Figure 2. Showing added growth from exposure to the heat lamp, December 24, 1978, to April 6, 1979, by the seedling on the right. The seedlings are shown actual size.

transplanted to small plastic pots a few weeks later. They made very little growth in the summer and fall. Cross sections showed only pith growth. Since the greenhouse was unheated they made no growth in the winter. Late in the spring of 1981 they began growing and were about 1 inch high by December 1981.

I then made cross sections of several of these seedlings which by then were 1½ years old and a photograph of one of these sections is shown in Figure 3. Though not nearly as clear as when examined under the low power lens, this photograph does show that a considerable amount of wood tissue had been formed. Actually there are nine circles of cells in addition to the pith in the center.

These seedlings were left growing in the greenhouse all during 1982 and by December were 1½ to 2 inches tall and had increased considerably in diameter. A cross section of one of these seedlings clearly showed the central pith cells, the nine to twelve circles of wood tissue cells, and a spring and fall growth, or only one growth increment in addition to the central area formed in its first 1½ years of growth.

It is clear then that a bristle cone pine seedling which shows one growth ring is actually 2½ years old: a rather unexpected conclusion and certainly one which I never anticipated when this study was begun.

3. Effect of various treatments

As mentioned above attempts to induce extra ring formation by cold storage treatments were unsuccessful. Meanwhile I had read Philip R. Larsen's article

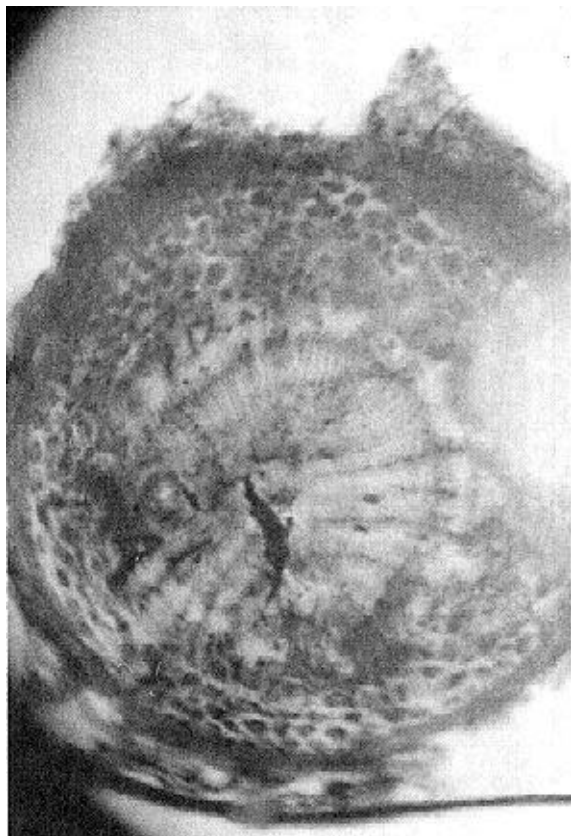


Figure 3. Cross section of a 1½ year old seedling x 64.

entitled "Auxin gradients and the regulation of cambial activity" in the book *Tree Growth*. He stated that drought occurring during the period of active elongation can result in the temporary suspension of growth and extra ring formation in the larch and other deciduous trees.² Accordingly I decided to try this treatment on my bristlecone pine seedlings all of which had been moved outdoors and placed under the mist system in May of 1979. So on August 5, 1980 I removed six seedlings of the original outdoor group (those which had been transplanted on April 6, 1978), placed them on a bench in the greenhouse, and did not give them any water until August 26, 1980. It is amazing how long the bristlecone pine can live without the pots being watered! For at the end of this three week period, though of course all growth had been checked, the plants did not seem to be suffering very much. The humidity of the greenhouse reduced the stress; but even so any other plant which I know of would have been dead in less than a week without water, except of course cactus.

When these seedlings were removed to the ground area under the mist system they resumed growth in about one week and continued growing until late September, an unusually hot month, and did not form the usual terminal buds until in October.

Then on August 3, 1981 I removed six seedlings to the greenhouse bench and kept them there until August 18th without watering them. They were then replaced in the ground under the mist system where they soon resumed growth and finally formed terminal buds in October.

Examination of cross sections

In December of 1981 I made cross sections of the seedlings which had been given drought treatments and examined them under the low power objective to see how many growth rings had been formed.

The central area of Figure 4, a cross section of an untreated seedling, may be recognized as the growth of the first year and three quarters. The pith and central area has grown to the tripartite figure in the center which extends to the end of the first year's growth. Then the light colored area is the spring growth of the second year, and this ends at the two small resin ducts indicated in the figure. The darker fall growth ends at the somewhat larger duct about 5 inch above the two. Then the spring growth of the third year begins and ends at the large duct about ¼ inch above. All of the rest is the late summer growth clear to the margin where the bark tissue begins.

Figure 5 shows a cross section of a three year old seedling which was kept in the greenhouse without water for 15 days. Only a small portion of the central area is shown. The three growth rings in addition to the first year and three quarters of growth are fairly clearly shown. Accordingly this seedling gives the appearance of a four year old plant in contrast to the untreated one which showed only two growth rings.

Figure 6 shows a cross section of a seedling which had been dried out for three weeks in August of 1980. Here also a total of four growth rings are quite clearly shown. Actually these were very much clearer when actually observed under the low power objective, but

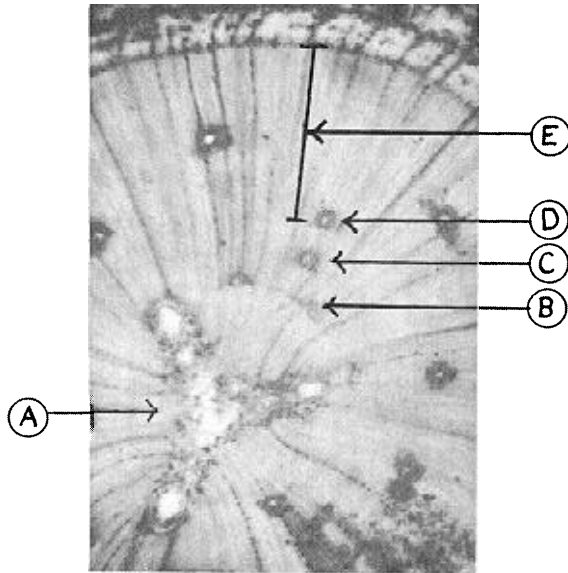


Figure 4. Cross section of a three year old seedling. The central area is the first year growth. It is bounded by the tripartite pith area. The spring part of the second year's growth ends at the two ducts; fall growth at large one. The third year spring growth ends at the duct just above it and all the rest is late summer growth. Key: A: tripartite pith mass in center; B: end of second year's spring growth; C: end of fall growth; D: end of third year spring growth; E: third year fall growth.

it was very difficult to get equally clear photographs of these cross sections.

A further contributing factor which helped the seedlings survive for three weeks without water was the foggy weather during most of August 1980. During most of the time the fog lasted until noon or even

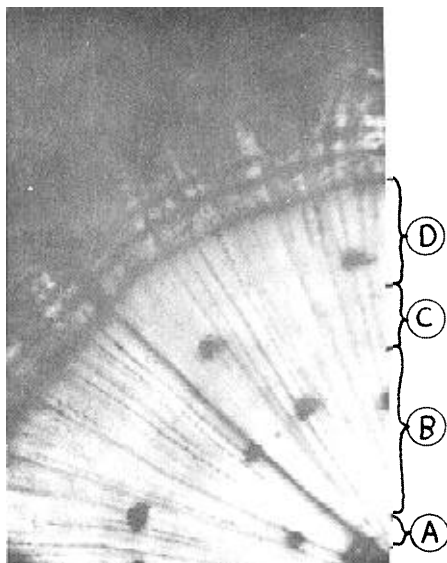


Figure 5. Cross section of a seedling which was kept in the greenhouse without water for 15 days. The dark area at the bottom right is the outer part of the first year's growth, unfortunately shown in this photomicrograph, the only one taken after the two week treatment. The three growth rings in addition to the central one are quite clear, and are indicated. Key: A: outer part of first year's growth; B: second year growth ring; C: third or extra ring; D: fourth ring.

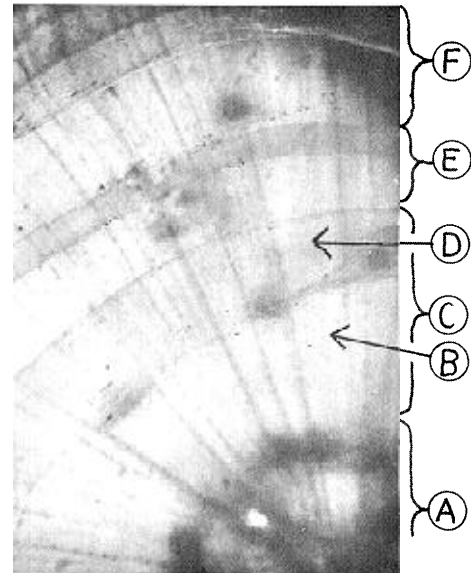


Figure 6. Cross section of a three year old seedling that was dried out for three weeks when it was two years old, from August 5 until August 26, 1980. The sharp differentiation at the edge of each ring is caused by heavy absorption of iron aceto carmine stain at the boundaries of each growth period. x 40. Key: A: first year; B: spring growth; C: second year; D: fall growth; E: extra ring caused by drought for three weeks; F third year.

later. The few sunny days were very cool and the humidity was very high. September is always one of our hottest months and this, no doubt, was a strong factor in the ability of the seedlings to resume growth after being dried out for the two and three week periods. They were of course fertilized soon after being replaced in the ground under the mist system.

Seedling size is given in Table 2. Here we may note that the largest diameter plant among the control or untreated plants is 0.1875 inches which is just barely as wide as the smallest among those dried out for three weeks. Two plants among those dried out for two weeks in August 1981 were 6½ inches high as compared to 4 inches for the tallest of the untreated plants.

In January of 1982 the remaining untreated seedlings were planted in three locations, that is 8 of them under the mist system, 8 in a basin area near several rows of *Leptospermum* hybrid plants so they all could be watered by one sprinkler setting, and the remainder in a row near my greenhouse. All three groups of

Table 2. Range in size of seedlings in December, 1981

Type of Treatment	Number of seedlings (originally all about 1-1.5 inches high)	Lowest widest diameter in inches	Shortest and tallest plants in inches
Dried out 3 weeks; August 5-August 26, 1980	6	0.1875-0.25	3-4.5
Dried out 2 weeks; August 3-August 18, 1981	6	0.1875 (all seedlings)	3-6.5
Control—other seedlings not dried out	6 (average ones of total)	0.125-0.1875	2-4

plants were kept wet during the 1982 growing season, by furrow irrigating the ones in the row, sprinkling the ones near the *Leptospermum*, and using the mist system on the others. I quit watering the two groups of 8 plants August 31, 1982 since growth appeared to have stopped by then. The ground was very dry by September 15th. It rained hard September 23rd, so I resumed watering all the seedlings once per week. Growth did not entirely cease, after starting again following the rain, until about the middle of November.

Cross sections of two plants of each of the dried out-group were made in January of 1983 and all four plants showed the usual central pith and primary wood cell area and in addition four growth rings. That is, they gave an apparent age of five and three quarters years.

Cross sections of two plants of each of the dried-out group were made in January of 1983 and all four them also showed the usual central area plus four growth rings! Several others, however, showed only three growth rings in addition to the central area, or gave their true age of four and three quarters years. Whether the ones which had the extra growth ring had responded to an unusually hot spell from July 2-19, 1982 cannot of course be determined, though they did make a much more rapid growth following this weather than in the long period of high fog in May and June.

Bristlecone pine seedlings growing in the ground do then respond to drying out and resumption of watering by forming an extra growth ring. The plants still remaining of each of the three groups will be given the

same differential treatments next year in order to determine if drought treatment can cause extra ring formation on older, more mature plants.

Discussion

As pointed out in my article, "On the Recent Origin of the Pacific Southwest Deserts,"³ the snowfields of the High Sierras were formerly much more extensive than now. Even as late as 1860 they were much larger as judged by the size of the King's and Kern rivers, according to Hittel.⁴ Thus the King's River was 60 yards wide where it left the mountains. With extensive snowfields there would be much evaporation from them in the spring and early summer, as they melted and decreased somewhat in size until replaced by new snow in the winter. The prevailing westerly winds would carry this evaporation over the areas east of them as clouds giving rain to a limited extent, but much more than now, in the Owens River valley and the White Mountains.

An article in *Fremontia* entitled "Owens Valley and Mono Lake 1. Dying of Thirst" by David Gaines and Mary DeBecker⁵ is most informative as regards former conditions in the Owens River valley. They say "With the spring snowmelt, numerous streams cascade down the steep eastern escarpment, flowing over immense alluvial fans that stretch down to the valley floor. Along the base of the alluvial fans, where downward percolating water is obstructed by claypans deposited in ice age Lake Owens, free-flowing artesian wells and springs supply marshes, sloughs, meadows and other moist habitats. . . . Over most of the valley floor, the water table ranges from the surface to less than fifteen feet in depth, i.e., within the root zone of grasses and shrubs. In the early 1900s the water table was less than four feet deep over 46% of the valley floor. But that was before the Los Angeles Department of Water and Power began extensive groundwater pumping." Now only remnants are left of the woodlands, marshes and meadows that once lined the banks of the Owens River. By 1928, deprived of water by the Los Angeles Aqueduct, Owens Lake had turned into glaring white alkali. Looking across its parched bed, clouds of dust rising from its surface, it is difficult to imagine steamboats plying its waters or millions of birds feasting along its shores. Figure 7 shows the comparison between Rush Creek, Mono Lake's largest tributary stream before diversions, ca. 1920; and after in 1981! Figure 8 shows the progressive shrinking of Mono Lake.

Though I had realized that this formerly lovely valley had suffered greatly as a result of the insatiable lust of the Los Angeles area for water, I had not realized until reading this article that the effect was either so bad or so recent.

Further back in history, Lake Bonneville (to consider another example) had an area of 50,000 square miles. Its decrease in size is correlated with a 200 year period of drought beginning about the year 1200 as determined by tree ring studies (actually probably later). Now, of course, it is known as the Great Salt Lake; and even since 1925 it has gotten smaller. Thus the big amusement palace built on its shore then is now one mile from it! Thus the decrease in rainfall

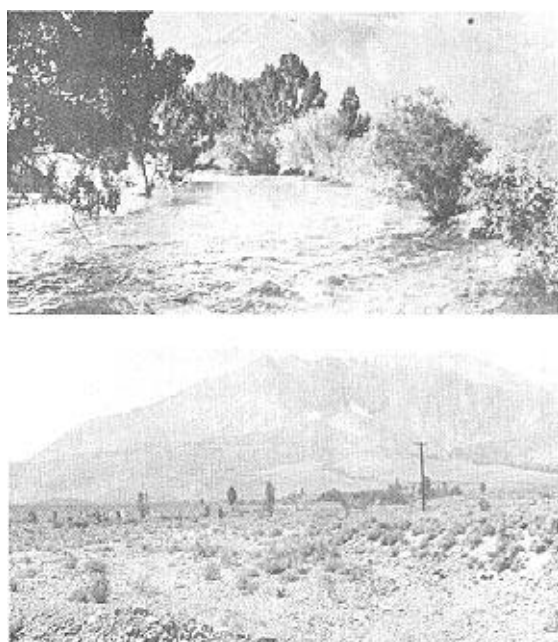


Figure 7. Upper: Rush Creek, Mono Lake's largest tributary stream, before diversions, ca. 1920. Photograph courtesy of Enid Larson. Lower: Rush Creek in 1981. Water diversions have turned the creek into a dry wash. Riparian woodlands, marshes, and meadows are gone. Photograph by David Strelnick.

This picture, and also Figure 8, are used here by courtesy of *Fremontia*.

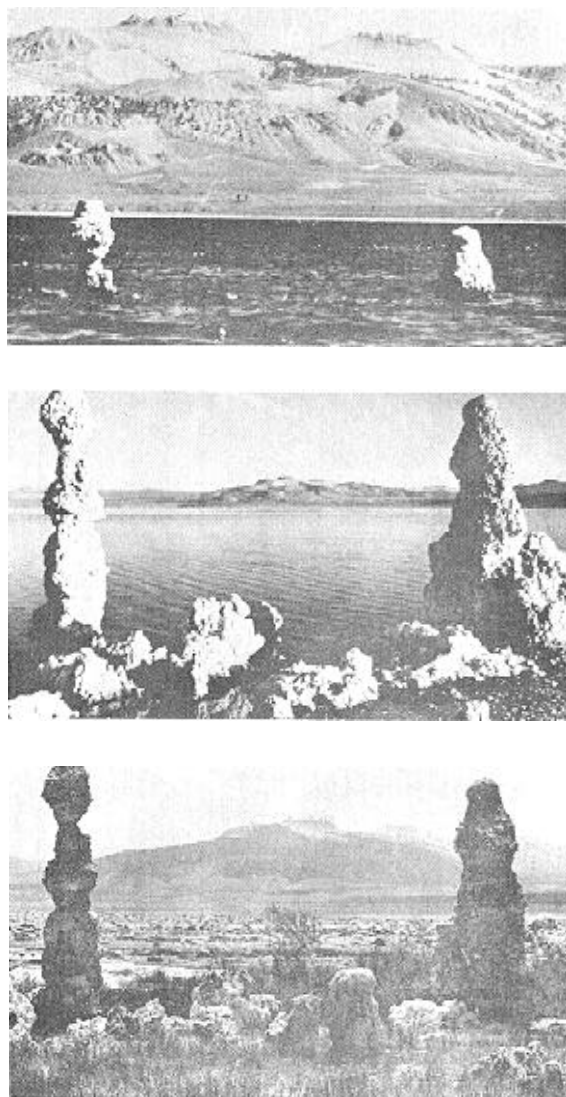


Figure 8. Progressive (or should one say retrogressive?) shrinking of Mono Lake is seen in the three pictures above showing the same tufa towers. Top picture was taken in 1962; center 1968; bottom 1978. The level of the water has fallen forty-six feet. Upper photographs by Eben McMillan; lower by Jim Stroup.

in such areas as the White Mountains is correlated with two phenomena: (1) the drying up of such great lakes as Bonneville, and (2) the decrease in size of the glaciers and snowfields. Water in a sense begets water; and as these lakes dried up the moisture became inadequate to form clouds and the rainfall on the more inland mountain areas decreased.

Prior to 1200, then, it would seem that such areas as the White Mountains had what is technically known as the San Francisco pattern of rainfall. As discussed by Waldo S. Clock and Sharlene R. Agerter in their chapter on "Rainfall and Tree Growth,"⁶ in the book *Tree Growth*, in this pattern of rainfall a rainy season occurs in the winter and a dry season in the summer. (Figure 7, page 36, called California pattern in their discussion.) They discuss the effect this has on the problems of cross-dating and state: "the matter awaits

careful study, especially in light of the fact that a second tip flush was observed to occur on conifers in August in the central Sierra Nevada at an elevation of 9,000 feet."

Soil moisture is at an optimum in the spring, and then diminishes steadily to such an extent as often to halt growth. Then, as the high pressure builds up and the heat increases, even more stress has to be endured by the young pine forests. In the early fall, however, evaporation from the formerly existing large lakes again results in clouds and early fall rains even in such inland mountain areas as the White Mountains. The pine trees would then resume growth as Glock points out, with the result that another flush of growth and resultant growth ring occurs, just as in the experiment where the young seedlings formed an extra growth ring following return into the ground under the mist system after their drying out.

In the spring the hot sun and increasingly long days would act the same as the heat lamp treatment, only more so, and stimulate growth of the pine trees, especially in June and July, thus causing them greatly to extend their root systems. This would make them even more vulnerable to stress resulting in cessation of growth until the early fall rains.

As regards the question as to whether older trees would react in the same way as young seedlings, the experiments of James W. Hanover are pertinent. In his article, "Control of Tree Growth,"⁷ his experiments show that shoot growth in seedlings of typical single-flush species will remain in the steady state of growth if given long periods of light (18-24 hours). That is, growth is continuous, and this occurs only in seedlings under three years of age. After three years the seedlings become locked into an endogenous system of plant growth. That is, even though they are exposed to long days and high temperatures, growth ceases, bud scales develop, and a resting bud forms. Only in the fall in response to both chilling and greatly increased moisture is a new cycle of growth resumed. This sort of situation no doubt occurred frequently in the past; a preliminary drop in temperature accompanied the first fall snow followed by hot late fall weather.

Now of course even the seedlings placed in the ground and responding to drying out by forming an extra growth ring were only three and three quarters years old. They would therefore behave as mature trees, as determined by Hanover. His Figure 5, mature tree, three years plus behavior illustrates this. Accordingly it would seem that the results obtained by drying them out would also apply to older trees.

In the three thousand years or so from the end of the Flood until 1100 A.D. there would then have been an opportunity for the formation of many extra rings. It would seem that they would be fully comparable to those formed in the spring and so difficult if not impossible to detect. For as shown in Figure 6 the extra ring has a very similar diameter and might well have been formed during a regular but relatively dry growing season. J. L. Giddings in his article "Development of Tree-Ring Dating as an Archeological Aid"⁸ in *Tree Growth*, claims that false annual rings can be detected because of the ability to retain a mental image of

typical ring patterns or "signatures." Though this is correct, the very basis of these "signatures" is the concept that in the past climatic conditions were essentially the same as now. This, as we have shown, was certainly not the case. Therefore it is our belief that the 7100 years which such men as Ferguson claim have been attained by some of the bristlecone pine trees may actually be only about 5600 years, assuming that extra rings are formed about 50% of the years since the end of the Flood due to summer stresses.

Much further work needs to be done on such questions as how the pine forests got started in the White Mountains in the first place. The species is found also in the mountains of Colorado, where it varies only slightly from the White Mountain strain, and in northern Arizona. Which area is its primary location? Also we need to know more about rainfall patterns in the past, and just when such areas as the Owens River valley became so desert-like. As judged by the citation from *Fremontia* it would seem to be much more recent than is usually assumed by Flood geologists. Experiments need to be continued on the older seedlings yet remaining to see how they will react to both continuous irrigation and to drying out. Finally, a new crop of seedlings has been germinated as of February 10, 1983 in order to try cold storage treatments again, using the short day, low temperature treatment following high temperature, long day growth as reported by Hanover.

Acknowledgements

I am very much indebted to Richard Rasches of the Moss Landing Marine Biological Laboratory for taking the photomicrographs and to Alex Stepick of Stepick's Studio and Photo Shop, Watsonville, California, for converting these into black and white pictures.

Summary

Various treatments were given to 8 month old bristlecone pine seedlings and it was found that supplementing the winter day length with a 250 watt heat lamp to give 16 hours of illumination proved most effective. The lamp was placed about three feet above the seedlings.

When two-year-old seedlings were given the stress of a three week period of not watering them when in pots on the greenhouse bench and then replaced in the ground to pot level under a mist system, they resumed growth in late August and continued growth until late in September. When cross sections of these were made in December of 1981 it was found that they showed four growth rings as compared to the usual three of untreated seedlings.

Also three year old seedlings were given a two week period of drying out from August 3 until August 18, 1981. These also resumed growth when replaced under the mist system. These also showed four growth rings when examined by making cross sections in December of 1981.

Furthermore, when set out in the ground in January of 1982, kept continuously moist until August 31, 1982 and then given a 23 day stress period before resumption of irrigation these seedlings also showed an extra growth ring.

The bearing of this on the estimates of the age of the bristlecone pine made by Ferguson and others is pointed out. Under the San Francisco or California pattern of rainfall with a dry period in the summer the young forests on the White Mountains would have grown an extra ring per year quite often also. This would be in response to a sudden lowering of temperature after an early fall rain or possibly snow and then resumption of hot growing weather. Accordingly it is believed that the presumed 7100 years of age postulated for these trees by Ferguson would be reduced to about 5600 years, on the assumption that extra rings would be formed by effects of stress during about 50% of the approximately three thousand years since the end of the Flood.

The need for further study of the effect of drying out on older trees is pointed out. Also such questions as just when the Owens River valley became so desert-like need to be investigated.

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QUOTABLE QUOTE

"... my simple art ... is but systematized common sense ... when you have eliminated all which is impossible, then whatever remains, however improbable, must be the truth. It may well be that several explanations remain, in which case one tries test after test until one or other of them has a convincing amount of support."

Sherlock Holmes, in the story *The Adventure of the Blanched Soldier*.

Is this not a simple statement of the principles about which so much has been written as the scientific method?

WHAT BIBLE-SCIENTISTS CAN LEARN FROM BIBLE-SCIENCE

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This article is a philosophical inquiry into the way in which Bible-science or creation-science is conducted, and into the status of terms such as "conceptual framework," "model," and "paradigm," which are often used in Bible-science writings. The ways in which Bible-science differs from other science are considered, and some suggestions are made which may help writers on Bible-science to improve their clarity. Also, similarities to, and differences from, some other particular scientific viewpoints are noted.

This paper is about (among other things) three terms: "conceptual framework," "paradigm," and "model," and how each of these terms can be used to label different aspects of Bible-science. This paper is about getting workable definitions, so that our labels make things clearer than they were before they were labelled. Because many Bible-scientists in the past twenty years have used terminology developed by theoreticians such as Norwood Hanson, Sir Karl Popper, Imre Lakatos, and Thomas Kuhn, and by epistemologists such as Clarence Irving Lewis, Robin Collingwood, and H. N. Lee, I will try to be guided by these philosophers where I find their thinking intelligible and applicable. However, since Bible-scientists in actual practice have frequently reinterpreted this terminology (as others, too, have done), I will also try to guide myself by the intent of Bible-scientists as far as I understand it.

I want to sharpen three key terms so that we know to what they apply and for what they can be used. By so doing I hope to make more cogent certain aspects of the Bible-science enterprise.

For some people the Bible provides a point of view that determines what they see and how they will describe to others what they have seen. For some people, such as many with a formal education in science and a religious background in American Protestant fundamentalism, the Biblical point of view has been conjoined with a scientific one. As philosopher H. N. Lee has noted: "... religion yields perhaps the most characteristic example of a complex set of inter-related beliefs. In this case the set of beliefs can become the controlling factor in one's whole attitude toward the world . . . even of what the person who holds it is willing to call knowledge." Lee goes on to cite William Jennings Bryan, the great Fundamentalist and prosecuting attorney at the Scopes trial, as an example of how a Bible-oriented outlook relates to one's view of science.¹

That which results from the conjunction of such a religious viewpoint and science is an all-encompassing *conceptual framework* that generates Bible-science research about major issues in biology, geology, astronomy, physics, etc. Bible-science is a way of looking at the world. It is a complete conceptual framework in the sense that everything — data, concepts, theories, and methodologies — gets filtered through it. What will be called a "fact" will be determined by the conceptual framework; that which will be accepted as a theory will be determined by the conceptual frame-

work. And Bible-scientists of the calibre of Leonard Brand, Biology Department chairman at Loma Linda University, clearly understand the far-reaching effects of conceptual frameworks:

In the study of science, as in the study of religion, we receive new information only through our senses, and the scientist, as well as the religionist, has a "filter" in his mind, with a feedback mechanism. The concepts developed in his mind determine what observations the filter will allow, and what observations will be filtered out because they are not relevant.²

The Bible-science framework generates paradigms for the various areas of science. Since Thomas Kuhn's employment of "paradigm" as a technical term in *The Structure of Scientific Revolutions*, the word has been worked, re-worked, and over-worked. In spite of Margaret Masterman's claim in *The Nature of a Paradigm* that Kuhn gives twenty-one different senses to his term, it is still found useful as a classificatory concept by scientists, historians, anthropologists, aestheticians, and epistemologists. The popular press is dependent on the term. In a recent *New York Times* article "The Other Darwin: Scientist as Moral Man," Bruce Mazlich, professor of history at MIT, writes: "To judge him (Darwin) by our knowledge and sensibilities would be to expect that he could have transcended the assumptions and paradigms of his time." And the same need to use the term is found in Bible-science literature. In a review in *Bible-Science Newsletter* (July '82), editor Paul Bartz freely uses "paradigm."

Generally, the formation for one area of science of a well-articulated program of research, which will include among other things theory and observation, constitutes a paradigm of scientific thinking in that area of science. Not only in biology and geology are there Bible-science paradigms, but also in astronomy, astrophysics, physics, genetics, and various social sciences. And the paradigm determines what we shall perceive as sensible research, admissible data, and worthy conclusions; or in the words of psychologist Edwin C. Boring, "A paradigm is a way of perceiving nature, and, as in all perception, the shift from one hypothesis to another is all-or-none. . . . The camel in the field suddenly is seen for what it is, a pile of stones."³

In turn, some paradigms require a *model* to explain what is beyond observation. Where no one can give an eye-witness account, imagined models serve graphically to explain the unobservable (or unobserved) event or object. Good examples of this are the Bohr model of the atom, or the picturing of electricity running through a wire like water running through a pipe.

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The word "model," if not the actual role of models in science, has given Bible-scientists some difficulty. "Model" in Bible-science literature sometimes has the meaning "physical object used to represent something else,"⁴ sometimes, "a conceptual pattern involving listed statements about imaginary objects,"⁵ or, "a temporary plan,"⁶ or; "A 'model' is a conceptual framework, an orderly system of thought, within which one tries to correlate observable data and even to predict data."⁷

Since these definitions are neither identical nor sharp, I believe we would do well to distinguish two features found in them. One feature is the notion of "theory," which philosophers of science frequently define as "a non-contradictory listing of primary and essential principles explaining some important occurrence." The second feature deals with "model," which might best be limited to what I stated above, "an imagined event or object offered so that we may graphically explain or picture some supposed unobservable phenomenon." Given this distinction between theory and model, we can now say that in many areas of science, Bible-science suggests a theoretical explanation that employs a model of how unobservable or unobserved events or things are imagined to be or to have been. Of course theories and models are generated by a paradigm which is ultimately generated by an over-arching conceptual framework.

One Bible-science paradigm deals with the creation and continued support of the heavens and earth. This is part of Bible-science astronomy and astrophysics, and the paradigm, "creation and maintenance by Divine fiat," contends that the universe was created *ex nihilo* by a Creator Who even today keeps this creation going.

A second Bible-science paradigm is a certain view of the creation, generation, and maintenance of plants and animals. This is Bible-science biology, and the paradigm entails a model picturing non-evolving *baramins* (literally, created kinds; the term is now in fairly common use).

A third Bible-science paradigm implies specific occurrences in regard to the formation of geological features. This is Bible-science geology, or Deluge geology, with its Canopy theory, held by many, and the hypotheses of ecological zonation and hydrodynamical selectivity also often proposed. In light of Genesis a model is proposed, featuring an antediluvian world destroyed by a vast Noachian flood.

"Creation" is the common thread that runs through these paradigms, and Bible-scientists have been most concerned with the creation of the physical and biological universe. This is the reason why Bible-scientists are accustomed to describing themselves as doing "creation-science," and speaking of the "creation-model (paradigm) of the universe." However, as can be seen by the enumeration of the above distinct areas, Bible-science is dealing with more than just origins, with more than just one kind of origination, and with more than just one paradigm or model. R. Daniel Shaw's claims in *Fossil Man: Ancestor or Descendant of Adam?*² is a good example of this. While in explaining his correlation between Biblical history and fossil record, he says, "Coupled with this dispersion-degenera-

tion model. . . ." Here is really not an all-encompassing "creation-model," but more a model for geological dating.

It is instructive also to consider what is sometimes viewed as a confrontation: Bible-science or creation-science versus evolution-science — one kind of research, one model, one paradigm, pitted against another. Raymond F. Surburg, in his Bible-science essay, *The Influence of Darwinism*, is certainly correct in saying, "These new concepts of the evolutionary process eventually affected ideas concerning the nature of reality, the nature of knowledge, and the nature of morals."⁸ But there is no such one thing as evolution-science. As for evolutionism as philosophy, for instance, the synthetic philosophy of the nineteenth century thinker Herbert Spencer, it has been discarded,⁹ (although some may be unaware of that), while pragmatism, which Surburg correctly identifies as having been strongly influenced by Darwinism, has gone on to develop a theory of knowledge that, as I will show later, might surprise the Bible-scientist.

Evolution, if we mean by that (neo-) Darwinian evolution, is a theory (for Kuhn and the contemporary Bible-scientist, paradigm) in biology. Unfortunately many people have linked this biological concept with the geological concept that the earth changes, that it "evolves." Often Bible-scientists expand the application of this biological concept even further: John Moore writes, "Nevertheless, in this context evolution is understood to mean 'molecules to man,' to use one textbook subtitle expression. . . . Actually the 'molecules to man' thesis of modern evolutionists involves stellar evolution, molecular evolution, organic evolution, and social (societal) evolution. . . ."¹⁰ But to do this to the word "evolution" is to treat it metaphorically, and so broadly that all worthwhile meaning is stripped from it.

The Bible-scientist, maybe in an effort to make clear to his readers what he considers to be the issue, creation-science versus evolution-science, often uses "evolution" in just such a broad and metaphorical fashion. By doing this the fundamentalist and Bible-literalist can see in all of science a conflict between two competing systems.

Let me suggest that what actually exists is what Kuhn has called "normal science," which is the standard, accepted way of doing things. Normal science is the normal way of doing science — the way the overwhelming number of scientists work, what fills science journals, and what gets grants from the National Science Foundation and the Pentagon. And normal scientists work in a hundred different areas as do Bible-scientists.

What I have attempted to demonstrate so far is that the content of each Bible-science paradigm is as diverse as the areas of research in which it is found, even though the paradigm is a direct result of the single Bible-science conceptual framework. I have attempted to show this by making clear the usage of such terms as "conceptual framework," "paradigm," and "model." However, more still needs to be said in regard to their specific application to Bible-science and the role of scientific methodology in all this.

What all Bible-science areas of science share is a way of getting things done — each area of science assumes the same methodology, a methodology generated by the Bible-science conceptual framework. To illustrate:

When Copernicus put forward his heliocentric paradigm to replace Ptolemy's geocentric one, Copernicus' paradigm was restricted to astronomy; it did not apply to biology for example, and therefore was not in any real sense a vast, all-encompassing conceptual framework. However, the Copernican way of doing astronomy — one might say a solid Baconian modernism — was applicable to all areas of science. In other words, though the change of paradigm was restricted to astronomy, Copernicus's new methodology could apply not only to astronomy, but also to mechanics, physics, chemistry, etc.¹¹

This distinction between the content of scientific areas and the methodology employed is an important one. There is one all-inclusive methodology for normal science as there is one all-inclusive methodology for Bible-science. It is a distinction that Bible-scientists have not as yet made much of, and it may be worth their consideration.

In many respects Bible-science methodology is similar to that of normal science. Bible-science accepts the usefulness of field research, laboratory experimentation, the process of replication, and statistical analysis. Where hypotheses are open to falsifiability, Bible-scientists often pay more than lip service to this principle.

Yet in four important ways the method of Bible-science is different from normal science's methods. The first is that observation and experimentation are viewed as limited devices. Secondly, the supernatural is figured as an explanatory principle. Thirdly, science is, among other things, a moral enterprise. And lastly, and somewhat paradoxically, as will appear, is the acceptance of the Bible's testimony as indisputable fact. We will look at each of these four points in more detail.

1. A radical empiricism constitutes the first tenet of Bible-science methodology; it is the empiricism of Sir Francis Bacon pushed to its furthest extreme. What can be known with certainty is what can be gained through direct observation and experimentation, here and now, which, accordingly, only provide data about the here and now. As the Bible-science textbook, *Biology: A Search for Order in Complexity*, remarks:

Also, experimentation is limited in time and space. It can be used only with phenomena on our time level (the present) and with phenomena that can be examined within the limitations of the laboratory. It is impossible to conduct controlled experiments regarding the past. This is true also of direct observation. There are areas, such as the makeup of the atom or studies of the past, in which little direct observation can be carried out.¹²

Therefore, any inference made about some other time and place must always remain conjectural. Data derived from experiment or observation have only limited circumstantial use in regard to claims about events that are beyond immediate observation. As Dr.

John N. Moore notes, "Thus conclusions that some geologists reach about events that occurred on the surface of the earth in the past are based on circumstantial evidence — evidence that cannot be repeated."¹³ Model-building now becomes essential for the Bible-scientist, since the model must convey all that cannot be observed. Since no human observed the origin of the planet a model is required so that we may picture this event and understand a certain paradigm of astronomical creation. (The assertion by fundamentalists that the Bible is or contains, an eyewitness report of creation events obviously has great Bible-science utility, and this issue will be addressed later in this paper.)

In geology, Bible-scientists use this strictly delimited conception of observation and experimentation to attack what they call the principle of uniformitarianism: the principle that geological change occurs in a uniform fashion throughout time. Bible-scientists suggest in its stead that great catastrophies such as the Edenic curse and Noachian flood changed the entire world very rapidly.

The Bible-scientist, by limiting observation and experimentation, is not only following Bacon, but is also walking in the footsteps of philosopher David Hume. Hume held that simply because Y is observed to follow X today, there is no guarantee it will do so tomorrow or has done so, unobserved, in the past. There is no guarantee that the experimental result of today would hold six thousand years ago or at some time in the future. Thus "uniformitarianism" as a principle in geology actually becomes a discarded, or at least breakable, principle of scientific methodology.

Though the Bible-scientists wish to discard the geological principle of uniformity in its more extreme form, some are aware that it would be dangerous completely to do away with the principle as a methodological tenet. If the methodological tenet is done away with there really would be no point in doing experiments, or probably doing anything for that matter. What the Bible-scientist does, therefore, is to use uniformity in a guarded fashion: he uses uniformity unless it contradicts Bible testimony or is overruled by the occurrence of a *bona fide* miracle.

2. The second unique tenet of Bible-science methodology is the inclusion of the supernatural as a scientific explanation. Where normal science limits itself to natural phenomena and events, Bible-science uses both nature and the supernatural. It makes sense to the Bible-scientist, therefore, to claim that men are distinct from apes because the Creator made man in His image, but did not choose to do anything of the sort with apes. This tenet of explanation might run into problems with principles of verification, but the Bible-scientist has frequently countered that many things in normal science run into the same problem.

This second tenet of methodology, the use of the supernatural as an element of explanation, has a second important implication for Bible-science. Using an appeal to supernatural intervention in natural events serves not only as an explanation for prior causes for some event, but also for final, purposive causes. Bible-science is therefore teleological and not simply mechanistic. As the textbook, *Physical Science for Chris-*

tian Schools reports: "Creationist scientists often speak about teleology . . . It means *purposiveness* or *design in nature*. The Christian man of science, in studying an object or an event in nature, will try to understand God's purpose behind it."¹⁴ Things happen not only because of mechanically prior causes, but also because they serve some final purpose. This is very similar to the position Aristotle took in what Kuhn has pointed to as a viable scientific procedure.

3. The third tenet of Bible-science methodology is that science, besides being a discoverer of facts, may also be the bearer of morality — commonly fundamentalist Christian morality. At least, it should not go counter to morality. Bible-science is not a morally, socially, or religiously neutral enterprise. Bible-science is fact-discovery, but it may be also a way to moral edification. Hence, the first and second laws of thermodynamics (what is created is created — no increase and nothing new under the sun; and, things tend to run down and go to disorder) not only disprove evolution, but also demonstrate that the world is decaying, it is running down.

Because Bible-science develops facts and values, it makes sense to the Bible-scientist to criticize Darwinian evolution on moral grounds as well as factual grounds. As understood through the Bible-science framework, scientists while doing science are not amoral or engaged in an amoral, value-less, enterprise. Hence for Bible-scientist William Tinkle, it is a matter of science to observe that:

the theory of evolution by natural selection encourages selfish aggression and violence. It not only condones selfishness; it is founded upon it. The animal which asserts itself and overcomes its fellows is supposed to do so because it has superior genes. It therefore leaves more descendants than the average; and, thus, in time a superior strain is built up, and later, an improved species. But if a human being follows this example — asserting himself and disregarding the rights of others — we say that he is immoral.¹⁵

The Bible-scientist is saying what some philosophers have long held — science is not a value-neutral enterprise.

4. The last tenet of Bible-science methodology is somewhat paradoxical, and one is a bit puzzled as to how to treat it. The Bible-scientist accepts the Old and New Testament as inerrant and as the Word of God. This means that the Bible is the ultimate authority on scientific truth; and, therefore, in matters with which it deals, there is really only one set of facts and only one set of correct models of the universe. The Bible, in good Baconian fashion, is a text of divinely accurate observations. As one high school text informs students, "The facts about the manner and order of creation that God has chosen to reveal to us in the Bible are all we (including the scientist) can know with certainty about the beginning."¹⁶

What seems paradoxical is this. Much Bible-science literature speaks of the two-model approach: creation-science and evolution-science. The Bible-scientist seems here to be allowing two models (competing conceptual frameworks and paradigms), although he

knows that only one of them is true. Bible-scientists might perhaps make their position, and their reason for taking it, clearer here.

Now there is a secular (often) philosophical theory which adopts a similar position: the theory of conceptual relativism. This theory would claim that competing paradigms are really never right or wrong, true or false, but rather more or less useful. We are dealing with a relativity based on workability, not absolutes based on eternal truth. Brand, writing as a Bible-scientist, takes the same position: "Eventually it ('theory'-paradigm) will succeed only if it stands the test of time and criticism. In other words a theory (paradigm) will succeed if the practical world of research shows that it works."¹⁷ Conceptual frameworks and paradigms determine and organize experience; and such classificatory devices can be more or less useful. These devices are not eternal verities. This is the position not only of Kuhn, but also of a long line of epistemologists such as Lewis, Collingwood, Whorf, and Lee.

So here is a rather curious position. The whole scheme of conceptual frameworks, paradigms, and models is part of pragmatism, a philosophy which denies the possibility of absolute truth. For pragmatism, truth is a function of conceptual interpretations which evolve due to man's constant interaction with the world.

Many Bible-scientists have pointed to pragmatism as an offspring of evolutionism, and a bad thing. Surburg, for instance, blamed John Dewey for holding such a philosophy: "Dewey ignored or forwent all efforts to describe what is Absolute Reality, Absolute Truth, and Absolute Goodness."¹⁸

For some decades, Bible-science methodology was strictly Baconian. Then, in the mid-1960's, Bible-scientists took up frameworks and paradigms, the paraphernalia of conceptual relativism. This seems an abrupt change of stance.

In conclusion, then, the four procedural tenets just considered constitute the essential differences between Bible-science and normal science methodology. We may say that the Bible-science conceptual framework, being an all-encompassing view of the scientific enterprise, determines a methodology which constitutes the accepted procedure in all Bible-science areas.

I have attempted to relate the terms "conceptual framework," "paradigm," and "model" to specific aspects of Bible-science. In some cases I have adjusted these terms to satisfy the needs of Bible-scientists, and (I hope) clarified these terms if their meanings were vague or ambiguous. I hope that this exercise in definition will help to make both the writings of philosophers like Kuhn and those of Bible-scientists more comprehensible.

References

- ¹Lee, Harold Newton, 1973. Percepts, concepts, and theoretic knowledge. Memphis State University Press. P. 144. See also Gillespie, Neal, 1973. Charles Darwin and the problem of creation. University of Chicago Press. He notes (p. 3) the same thing about Bible-science in the nineteenth century: "The creationist . . . saw the world and everything in it as being the result of direct or indirect divine activity. His science was inseparable from his theology."

²Brand, Leonard, 1974. A philosophic rationale for the Creation-Flood model. *Origins* 1, 73-82.

³Boring, Edwin G., 1964. Cognitive dissonance: its uses in science. *Science* 145(3633):681-685.

⁴Moore, John, 1976. Questions and answers on creation/evolution. Baker Book House, Grand Rapids. P. 104. (This quotation has been paraphrased somewhat.)

⁵*Ibid.*

⁶Bliss, Richard, 1976. Origins: two models: evolution/creation. Creation-Life Publishers, San Diego. P. 2.

⁷Morris, Henry M., 1974. Scientific creationism. Creation-Life Publishers, San Diego. P. 9.

⁸Surburg, Raymond F., 1959. The influence of Darwinism. (in) Darwin, evolution, and creation. Concordia Publishing House, St. Louis. Pp. 177 & 178.

⁹This is realized by some, but not by all. See Davidheiser, Bolton, 1971. Social Darwinism (in) Scientific Studies in special creation. Baker Book House, Grand Rapids. Pp. 338-343. Cf. LaHaye, Tim, 1980. The battle for the mind. Fleming H. Revell Co., Old Tappan, New Jersey.

¹⁰Reference 4, p. 24. The term "molecules to man" had been used earlier in a textbook which deals only with issues in biology:

Biological science: molecules to man, the B.S.S.C. blue version, published in 1963.

¹¹Aristotle's *Organon* was replaced by Bacon's *Novum Organum*, literally a "new tool" for doing science.

¹²More, John, and Harold Slusher, eds., 1971. Biology: a search for order in complexity. Zondervan Publishing House, Grand Rapids. P. 9.

¹³Reference 4, p. 18.

¹⁴Williams, Emmett L., and George Mulfinger, 1974. Physical science for Christian schools. Bob Jones University Press, Greenville, South Carolina. P. 15.

¹⁵Tinkle, William J., 1971. Immorality in natural selection (in) Scientific studies in special creation. Baker Book House, Grand Rapids. P. 230.

¹⁶Steele, DeWitt, 1981. Science: matter and motion. A Beka Book Publications, Pensacola, Florida. P. 495.

¹⁷Reference 2, p. 82.

¹⁸Reference 8, p. 181.

¹⁹The reader may find it interesting to compare these conclusions with those reached in Berkeley's *Principles of human knowledge*, which may be found in any collection of his works.

BOOK REVIEW

The Rise of the Evolution Fraud, by M. Bowden, 1982. Sovereign Publications, P.O. Box 88, Bromley, Kent, BR2 9PF, England, and Creation-Life Publishers, San Diego, California. (£3.90 or \$7.95)
Reviewed by David J. Tyler*

Readers of *Ape-men: Fact or Fallacy?* by Malcolm Bowden will be interested to learn of a companion volume. In the new publication, attention is focussed on the men who were responsible for promoting the Darwinian theory of evolution by natural selection. As he traces the history of evolutionary thinking, Bowden provides an original and challenging account of the way Darwin, Lyell, Huxley and others went about their work.

After consulting the text of Darwin's original manuscripts and letters, Bowden has some radical comments to make about the development of his ideas. Towards the end of his life, when Darwin was writing for public consumption, he stated that he "worked on true Baconian principles, and without any theory collected facts on a wholesale scale . . ." Bowden's probing analysis makes it obvious that this claim is quite absurd. Chapter 16, entitled 'A critical review of "Origins"', is also an important section of the book: the reviewer has not before read such an incisive assessment of Darwin's *magnum opus*. Bowden's comments on Darwin's poor health show similar radical departures from tradition. During the centenary year of Darwin's death, one of his biographers claimed that Darwin suffered from psychosomatically induced illnesses brought about by "the bile of abuse and calumny relentlessly poured upon his peace-loving head."

Bowden also thinks that Darwin's poor health was linked with his writing about evolution. However, he suggests that "the root cause of Darwin's illness was the stress generated in him when he was writing about a theory *which he knew was basically false*." (p. 87) There are problems with all historical studies because there is often insufficient information to come to firm conclusions. Nevertheless, the reader is invited to examine Bowden's work, to assess whether there are reasonable grounds for his suggestion.

The image of Lyell is probably the one which is in most need of revision — if Bowden is right in his analysis. Lyell is generally recognized as a founding father of modern geology. His ideas on uniformitarianism have dominated the thinking of generations of geologists. Yet, Lyell is also described as an opponent of evolution — at least until Darwin's theory of evolution by natural selection had become widely accepted. Bowden paints quite a different picture: there is evidence to show that Lyell had a long-standing hostility to biblical revelation and that he actively encouraged the dissemination of views which undermined the authority of the Bible.

Bowden traces the way Darwinistic thinking became the new orthodoxy. Perceptive comments are made on the 1860 British Association meeting, and on the 'overlooking' of Mendel's findings. Bowden documents some of the more recent problems creationists have found in presenting views which are at variance with the evolutionary scientific establishment.

The reviewer has found Bowden's book stimulating to read and considers it a welcome addition to the literature. There are some weaknesses which deserve brief comment here. First, Bowden makes Flood geology the accepted view of the first half of the Nine-

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teenth Century. By this, he means that most of the sedimentary strata was attributed to the Genesis Flood by the geologists of that day. However, whilst most of these men believed the record of Genesis, they had largely abandoned the idea that a single global flood was sufficient to explain the earth's sedimentary rocks. Instead, they were exploring multiple-catastrophe models, with no general consensus.

Second, although Bowden seeks to set the creation/evolution issue in a philosophical framework, the attempt is unsatisfying. On the one hand, he accepts that evolutionists and creationists seem to have an equally valid interpretation of the data. "We have then an apparent balance between the evidence supporting creation and that for evolution." (p. 180) From this, he points out the way religious views influence

the choice people make between opposing models. Yet, on the other hand, we read that evolution is a "vast scientific hoax." (p. 183) It seems to the reviewer that if the evolutionary interpretations are accepted as being reasonable, then much of the force of Bowden's studies on the "evolution fraud" is misdirected.

The most important contribution which Bowden has made is to identify sociological, psychological and religious influences which were active in Darwin and his contemporaries. As Henry Morris says in the Foreword: the book is an exploratory treatment of the subject and it shows the need for further research. Bowden is to be commended for writing in a clear and forthright manner. He brings a message with conviction, concern and a sense of urgency. He deserves a wide readership.

LETTERS TO THE EDITOR

Is the Archaeopteryx a Fake?

The most striking phenomenon undermining the evolution theory is that gradual transitions between the major categories of both the animal and the plant kingdoms are not found in fossil records. More than a century has now elapsed since Darwin published his theory, and paleontological studies still have not supplied the required intermediate types. New types have been found, but not the succession of intermediate ones required by the theory. Evolutionists try to indicate the Archaeopteryx as the best candidate for a real intermediate between reptiles and birds.

J. H. Ostrom, who identified one of the specimens that was found near Riedenburg, Bavaria, in 1955, declared that perhaps no other zoological specimens of fossils are considered so important as those of Archaeopteryx. He furthermore states that the Archaeopteryx may be "the most impressive fossil evidence of the fact of organic evolution."¹

However Du Nouy has already stated that even if an animal displays characteristics of two different groups, it cannot be treated as a true link as long as the small intermediate stages have not been found and as long as the mechanisms of transition remain unknown.²

A very interesting argument was introduced by Dr. Lee Spetner at a meeting of orthodox Jewish scientists held in Jerusalem in July 1980. He claims that the Archaeopteryx specimens were probably false and counterfeit. Dr. Spetner reported that in June 1978 he visited the British Museum (Natural History) and spent several hours studying their archaeopteryx fossil. He examined the fossil very carefully with the aid of magnifying glass and a binocular microscope.

As a result of this investigation he was left with the strong suspicion that there is something false about this fossil. He suspects that somebody took a fossil of a flying reptile (possibly a pterodactyl), gouged out a

thin layer of the limestone in the vicinity at the tail bones and the wings (or fore legs), filled these zones with cement, and then carefully carved feather signs on the cement and allowed it to harden. The reasons, Dr. Spetner claims, are the following:

(1) The area of the tail feathers appears to have been gouged out in the manner described above. Careful examination of the area showed that the rock within the tail-feather area (at least near the boundary) is slightly lower (perhaps a fraction of a millimeter) than the level of the surrounding rock.

(2) On the counter slab there is a small area of a thin layer of rock sitting on the limestone that does not seem to belong there. Dr. Spetner pointed out this area to Dr. Alan Charig, who is in charge of the fossil in the Museum, and he was unable to explain the presence of this material. This small area is raised about a millimeter above the surrounding stone level, as if a small amount of wet cement fell on the stone and hardened there. Dr. Spetner pointed out the following two strange things about this small area:

a) Its color and texture seem to match the color and texture of the feathered region on the first slab and it has the same fine feather-vane structure in it, although it is not sitting in a region of feathers;

b) Its corresponding location on the first slab shows no trace of this piece. If this piece were present in the rock before the two slabs were separated then this elevated portion of the counter slab should have a matching depression in the first slab. There is, however, no such depression according to the measurements made on the fossil.

Because the fine feather-vane structure in the small region described in (2) appears identical to the fine feather-vane structure on the feathered region of the first slab, it could be concluded that these two impressions had the same cause. Because of (b), however, the small region must be judged to be foreign material. Hence it follows that the rock material in the feathered

region of the first slab is also foreign material. These reasons lead Dr. Spetner to suspect that the feather impressions were made artificially in wet cement.

The doubt about the genuineness arises also from the historical background and circumstances of the discovery of the fossil. As Dr. Spetner indicated: except for the London Museum specimen of 1861 (which was originally in the possession of Dr. Karl Haberlein, the father) and the Berlin specimen of 1877 (which was originally in the possession of Dr. Ernest Haberlein, the son) no fossils of a feathered reptile have been found. The three subsequently identified Archaeopteryx fossils do not exhibit feathers. Some markings on these fossils have been interpreted by some investigators to be faint impressions of feathers. From these markings alone, however, it is not possible to conclude that the animal was feathered.

The fossil in the British Museum and that in the Berlin Museum were found at almost the same time and in the same vicinity. The first one was sold to the British Museum by Dr. Karl Haberlein, the district Medical officer of Pappenheim and the second one was sold by his son to the Berlin Museum.³

Thus, Dr. Spetner complains that we are left with the strange situation that two outstanding specimens of a feathered reptile were found in the space of 16 years, the first reported owners were father and son, and each sold the fossil for a good price. During the hundred years since the second find, no fossils with feathers have been found. Although, since that time, three additional fossil specimens have been identified as Archaeopteryx, they do not exhibit feathers. These facts are consistent with the hypothesis that the London and Berlin Archaeopteryx fossil specimens are fraudulent.

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2. Du Nouy, L., 1947. *Human Destiny*. The New American Library, N.Y. p. 58.
3. de Beer, G. R., 1954. *Archaeopteryx Lithographica* British Museum (Natural History) Publ. #224.

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(Editor's note.) May the following consideration have a bearing on this matter? The Archaeopteryx's feathers are very like those of a modern bird — a bird which flies well. See Akridge, C. Russell, 1979. Archaeopteryx aerodynamics. (In *Panorama of Science*) *Creation Research Society Quarterly* 16(3): 185. Now, while a Creationist might not be surprised at this fact, an evolutionist might. If, on the other hand, the thing is a fake, it is very likely that modern feathers would have been used in the faking.

Corrections and Clarifications

There are two small corrections to my article on homology.¹ Page 165, left column, third paragraph, should read: "Things were little better elsewhere. When His attempted to explain . . ." ("His" is a man's name!)

Page 171, left column, third paragraph, last line, should read: ". . . in minnow populations from cold and warm waters."

Also, upon re-reading my two articles, I realize that I have not made one point sufficiently clear. May I do so now?

I dissent absolutely from the still common view that the genome (DNA genes) is a prescription or description or blueprint of the organism; nor may genes be described as a set of instructions (or algorithms) for all the characteristics of an organism. There is neither fact nor logic to support such a contention. But I must stress that cortomes may not be so described either. Genome and cortome do not create or determine the form (organizational pattern) of an organism. Rather they provide — on different levels — certain essential conditions for the selection or stabilization of the forms specified by the relevant biological laws. Researchers in the fields of morphology and embryology have been chasing a will-o'-the-wisp for so long that we still have little idea what these laws might be. (It needs to be stressed again that the greatest gap in modern biology is that there is no theory of development, no understanding of how genomes and cortomes bring about, or condition, the development of the organism.)

A helpful (though, of course, partial) illustration is provided by a video system. Here the picture and sound components of the tape can represent the cortome and genome. Now we can ask the question: "Does the magnetic tape create the pattern of sound and picture that we subsequently enjoy? In no way! The only sensible answer is that the whole video system does. What we have is a complex and intricate system whose design principles (laws), to use Michael Polanyi's terminology, harness or act as boundary conditions for the physical laws by which it performs its function. In this context of understanding, the electromagnetic pattern on the tape simply provides carefully selected conditions so that the video system generates the appropriate form of sound and picture. The present approach in Biology is the futile attempt to try to relate the tape magnetic pattern to the resultant, and quite different, pattern of sound and picture, without any understanding of the video system and the principles of its design and operation.

Reference

1. Jones, A. J., 1982. A creationist critique of homology. *Creation Research Society Quarterly* 19(3):156-175.

Sincerely, in Christ

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(Note the change of address.)
Received 22 February 1983.

Some Thoughts on Kinds

Up to the present time I had been convinced that it would be possible to determine which plants and animals originated from the same "kind" through cross-fertilization and breeding experiments. One aspect of this criterion, so far as its use in classification of plants and animals is concerned, has continued to trouble me.

While fertilization experiments would be possible with angiosperms and gymnosperms, vertebrates and arthropods, efforts to determine kinds among the remaining plant and animal groups or phyla would present some profound problems.

For this reason I found A. J. Jones' article "A Creationist Critique of Homology"¹ provocative; and when I then reviewed his "The Genetic Integrity of the 'Kinds' (Baramins): a Working Hypothesis,"² I am on the verge of becoming a convert.

I am particularly pleased that Jones believes that we should adopt Marsh's term "baramin" for the taxonomic level which contains the created kinds. This term is particularly appropriate, since it is derived from the language our Creator used to inform us about His creation.

Jones' job of converting me might be finalized if he will eventually produce an article for CRS in which he demonstrates how his theory can be put to practical use in the field of taxonomy.

References

1. Jones, A. J., 1982. A Creationist critique of homology. *Creation Research Society Quarterly* 19(3):156-175.
2. Jones, A. J., 1982. The genetic integrity of the "kinds" (baramins): a working hypothesis. *Creation Research Society Quarterly* 19(1):13-18.

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Received 11 February 1983.

Comment on Sin as the Origin of Death

The exegesis of I Corinthians 15:20-22 by Mr. Richard Riss¹ proves once again that the word of God is living and active, sharper than any double-edged sword . . . (Hebrews 4:12.)NIV.

I would only like to add that I believe that Paul's words to the Romans, in Romans 8:10, make it very clear that the cause of bodily death is sin. Permit me to quote the entire verse, as it is of such far-reaching consequence in the origins controversy.

"But if Christ is in you, *your body is dead because of sin*, yet your spirit is alive because of righteousness." Romans 8:10: NIV. (Emphasis added.)

The original Greek text² does not leave one in doubt as to what is meant by "body" or "dead." The word for "body" is used for Christ's dead body (Luke 23:55), the word for "dead" is used for Christ's dead body (Romans 8:11), and it's clear that Christ's Resurrected body was one of "flesh and bones" (Luke 24:39).

I believe that the Biblical revelation that physical death was a direct result of Adam's disobedience makes the doctrine of evolution Biblically untenable.

Reference

1. Riss, Richard, 1983. Natural selection and the Christian view of redemption. *Creation Research Society Quarterly* 19(4):212-214.
2. 1968. Kurt Aland et al. (Ed.). The Greek New Testament, 2nd Ed. United Bible Societies.

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SPECIAL NOTICE ABOUT ELECTION, 1984

The following candidates have been nominated to the Board of Directors to serve beginning in 1984:

Burdick, Clifford L.
Frair, Wayne
Howe, George F.
Kaufmann, David A.
Meyer, John R.
More, John N.
Moore, John N.
Mulfinger, George, Jr.

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

The date of the annual election is 1 March 1984. Biographical information on each nominee will be distributed with the ballots.

QUOTABLE QUOTE

"There existed a powerful body of men whose hostility to Galileo never abated: the Aristotelians at the universities. The inertia of the human mind and its resistance to innovation are most clearly demonstrated not, as one might expect, by the ignorant mass—which is easily swayed once its imagination is caught—but by professionals with a vested interest in tradition and the monopoly of learning. Innovation is a twofold threat to academic mediocrities: it endangers their oracular authority, and it evokes a deeper fear that their whole laboriously constructed intellectual edifice might collapse."

The Sleepwalkers, by Arthur Koestler.

For "Galileo" substitute "Creationism," or the name of one of the better known Creationists; and for "Aristotelians" substitute "evolutionists." Then one will agree: "*Plus ça change, plus c'est la même chose.*"

Suggested by Dr. David C. C. Watson.

EXCERPTS FROM THE BYLAWS

Article III — Election of Directors

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

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

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



REPORT OF THE 1983 BOARD OF DIRECTORS MEETING

The annual meeting of the Board of Directors was opened at 1900 hours, Friday, 15 April, by President Howe at Concordia College, Ann Arbor, MI. President Howe called for silent prayer to open the meeting. Present: H. Armstrong, D. Boylan, C. Burdick, W. Frair, G. Howe, J. Klotz, R. Korthals, J. Meyer, G. Mulfinger, W. Rusch, H. Slusher, N. Smith, E. Williams, G. Wolfram, P. Zimmerman. Excused absences: T. Barnes, J. Moore. Also present were 15 visitors. Dr. David Schmiel, president of Concordia College, welcomed the Creation Research Society and pledged the support of Concordia College in the ongoing work of the Society.

Mr. David Golisch, president of the Creation Science Association of the Greater Detroit Area, officially greeted the audience. He reported that their group not only publishes a newsletter but also was entering into some innovative activities including display of floats for three parades this year. The C.R.S. expresses gratitude to this Detroit group for attending and supplying refreshments.

Minutes of the 1982 Board of Directors meeting were read and accepted. The secretary reported that 179 votes had been cast in electing the following for three-year terms on the C.R.S. board: Harold Armstrong, Thomas G. Barnes, David R. Boylan, Duane T. Gish, Emmett Williams, Paul A. Zimmerman. Additionally, Glen W. Wolfram was elected to fulfill the two-year unexpired term of Henry Morris. Election report was accepted.

The treasurer's report for the 1982-1983 year was: income, \$85,879.56; expenditures, \$66,403.12; and total cash assets, \$118,532.41.

The membership secretary's report showed 597 voting members; 1018 sustaining members; 238 student members; 58 senior memberships; 105 subscriptions; 202 library, 29 school, 7 church, and 11 free subscriptions, for a total of 2,265.

Rusch further reported that the C.R.S. high school biology textbook was moving ahead and according to present plans would be published in January 1984. Colored as well as black and white slides, primarily

animal, still are needed. The text includes both creation and evolution material.

Editor Armstrong indicated that Quarterly Vol. 19 contained 236 pages and that work on Vol. 20 was moving along well. He continues to receive excellent cooperation from Stone Printers.

Mulfinger reported that C.R.S. Books was selling about 250 copies per year of the thermodynamics monograph; and that the astronomy monograph, in which seven writers have portions, was in the hands of the printers. He was optimistic about the reception of the high quality papers in this upcoming book. A work being considered is *The Argument*, by Rusch; and another in progress is *Vestigial Organs*, by Jerry Bergman.

Williams indicated that C.R.S. Books had sold the following numbers during 1982-1983: *Why Not Creation?*, 46; *Variation and Fixity in Nature*, 98; *Thermodynamics and the Development of Order*, 218; *The Moon*, 7; *Decade of Creation Research*, 15; and *Time Upside Down*, 24.

On behalf of the Research Committee Williams reported that C.R.S. had contracted to purchase 2.5 acres of land in Chino Valley, AZ, 125 miles from the Grand Canyon, this to be named the C.R.S. Grand Canyon Experiment Station. Anticipated studies to be undertaken include "Canyon Formation" and "Plant Succession."

A C.R.S. Grasslands Experiment Station is to be established on 3-5 acres in Oklahoma leased long-term from E. N. Smith. During June to August 1983 a graduate student at the Grasslands station is expected to study how salt water could be overlaid by fresh water and if various organisms survive in these layers; this to be a simulation of conditions which may have existed during the Flood. Also there will be some taxonomic studies of plant life in the region. All this research is to be supported by interest from money in the Society's Laboratory Project Fund.

Saturday, 16 April, the first session opened at 0835 hours at Howard Johnson Motel, Ann Arbor, MI. It was passed that:

1. the board express commendation and confidence for the Research Committee's work on the laboratory experiment stations;
2. the matter of the name of the high school biology textbook be left to Rusch and the publisher, but that the C.R.S. logo should remain on the book;
3. the president appoint a temporary committee to prepare job descriptions for all officers of the Society;
4. the decision about printing the Rusch manuscript (*The Argument*) be left to Mulfinger in consultation with the president;
5. from this time onward writers and editors of monographs will divide as royalties 10% of the retail price on routinely distributed issues;
6. the Board accept with regret the resignation of Tom Barnes and direct the president to write him a letter of appreciation for past services;
7. persons listed elsewhere in this issue be nominated to the Board, starting their service in 1984;
8. Thomas G. Barnes and Henry M. Morris each be elected Fellow;

9. W. Rusch be elected president; G. Howe, vice president; E. Williams, editor-elect (to assume full responsibility beginning with Volume 21); and other incumbents remain in office;

10. the Board meeting for 1984 be held on 27 and 28 April; the base of operation to be the Howard Johnson Motel in Ann Arbor.

Other announcements included the suggestion that some special efforts may be made to publicize this, the 20th year of the Creation Research Society. Also, the general fund of the C.R.S. gradually has been declining, and help is needed from some quarter.

The meeting was adjourned at 1455 hours.

Respectfully submitted,
Wayne Frair, Secretary

AMENDMENT TO THE BY-LAWS

The following amendment has been proposed, and

will be voted on at the annual meeting in April 1984. The proposal is to amend Article II to read, in part:

Article II — Board of Directors

Section 1. The Board of Directors shall consist of 18 members.

Section 2. No individual shall be elected to the Board of Directors who is past his 75th birthday. Board members who do not qualify for reelection under this section shall serve as Board members emeriti and may attend Board meetings but at their own expense and without vote.

Section 3. The Board of Directors shall appoint the Editor of the Society's Quarterly. He shall serve for a period of three years and may be reappointed.

The proposed change is in Section 2. It limits the ages of Board members. Previously there was no age limitation on Board members.

CREATION RESEARCH SOCIETY RESEARCH COMMITTEE (RC) ACTIVITIES: A DECADE REVIEW INCLUDING PHILOSOPHY AND PURPOSE

The period of time covered by this brief history is from the year that Tom Barnes was elected President and Emmett Williams Vice President and Chairman of the Research Committee to the present (1983) — approximately 10 years.

In the early years of the Society, creationist scientists performed individual research activities on their own time (almost a hobby) and reported their findings in the *Quarterly*. This valuable activity, still in progress among many creationists, is a vital part of our ministry. These studies generally can be classified into three categories; laboratory, field, and library efforts.

Library research will be labeled theoretical physics, chemistry and biology. Possibly a creationist would develop a unique theme opposing the evolutionary viewpoint, perform an intense literature review, organize the data, and write a paper expounding a creationist, anti-evolutionary position.

Field studies were accomplished generally by biologists and geologists. Data were collected in a natural situation, organized, and a paper written showing how the evolutionary model could not account for the observed facts.

Laboratory work was seldom performed by creationists because of the expense involved; and likely no facilities were available for part-time work. There are, nevertheless, notable laboratory-based reports in the *Quarterly*.

As excellent as these works are, they are disjointed in the sense that each creationist followed his own line of interest and expertise, developing a particular topic. Generally none of the work was coordinated with other efforts.

At the same time as creationists voluntarily worked on their own, the Society, through the RC, offered to

fund research proposals. Some of the proposals submitted required an extensive outlay of funds, or were considered to be defective technically, and were rejected by the RC.

In an effort to encourage research on a particular topic, and to channel the efforts in a desired direction, the RC offered interested persons \$500.00 per project with no salary reimbursement. After extensive advertisement, we were able to fund three projects in Christian colleges.

Later the RC decided to accept proposals for extensive research efforts and fund large projects. A group of creationist scientists were given \$5000 for one year of work on the formation of sediments in a flood-like environment. The group never submitted a final report on this effort. It was a bitter disappointment to the RC. We were frustrated. We had paid salaries, spent thousands of dollars and we could not develop a *coordinated* research effort.

Finally after years of hand-wringing, soul searching, etc. we reached the conclusion that the *only* way we could adequately obtain the required *coordinated* research effort would be to hire men, placing them in our facility where their activity could be regulated. Thus the dream of a CRS Laboratory was born. Initially we tried to collect \$1,750,000.00 to support a laboratory director and several scientists on site.

Norbert Smith offered to donate 10 acres of land in Oklahoma as a laboratory site. Tentatively, however, the RC preferred to locate in Arizona because of the proximity of the Grand Canyon and the variable habitat available in that state (mountains, deserts, etc.).

As the funds for the Laboratory Project were increasing, the RC developed a slightly different plan of attack to solve the research dilemma. Why not per-

form research in Oklahoma as well as Arizona? Thus the concept of experiment stations was developed. These stations, directed by a Board Member (no salary) would offer the maximum control over a situation. We realized the danger of a permanent staff at any Laboratory becoming tenure-conscious, evolving into an independent force opposed to the will of the RC and the Board of Directors. Such a facility may become a law unto itself.

We accepted 3-4 acres from Norbert Smith on a long-time lease, designating the site the CRS Grassland Experiment Station. We purchased 2.5 acres in Arizona, designating the site the CRS Grand Canyon Experiment Station. These facilities will be directed by Norbert Smith and George Howe respectively.

As a pilot project we will hire a young man for the summer under the direction of Norbert Smith to do two specific research projects. Thus no permanent employees will be hired at our facilities. We will pay a stipend for a summer of research.

A further advantage of this system is that young men are more enthusiastic, elastic and willing to work

on projects at which they are unfamiliar. Without the responsibility of a 12-month job and family, these individuals can devote maximum effort to a project if given careful guidance.

All of the projects pursued at the experiment stations will be geared to elucidate and expand our knowledge of the creation model of science as opposed to projects undertaken to disprove evolution. The RC intends to follow this path of research development in the future with the use of Board Members and temporarily-employed research assistants.

The RC intends to make wise use of the interest from the Laboratory Project funds leaving the principal untouched. The interest will be used to purchase the 2.5 acres in Chino Valley, equipment, and laboratory space in the future. The interest will also provide salaries for the research assistants we hire. No member of the Creation Research Society Board of Directors will receive any salary from the research efforts.

Many of the concepts explained in this paper were primarily conceived by the Laboratory Project Steering Subcommittee within the RC — Walter Lammerts, George Howe, and Emmett Williams.

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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 \$13.00 (\$15.00 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 \$13.00 (\$15.00 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: \$16.00 (\$18.00 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:

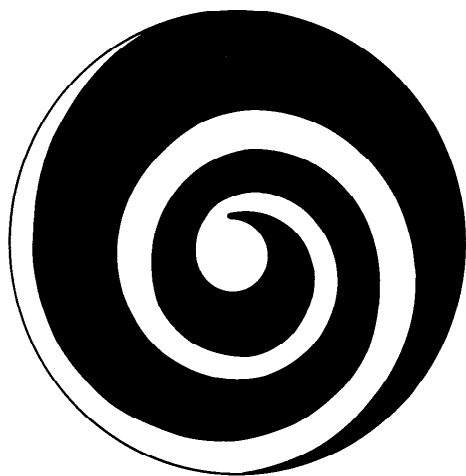
1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.

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.

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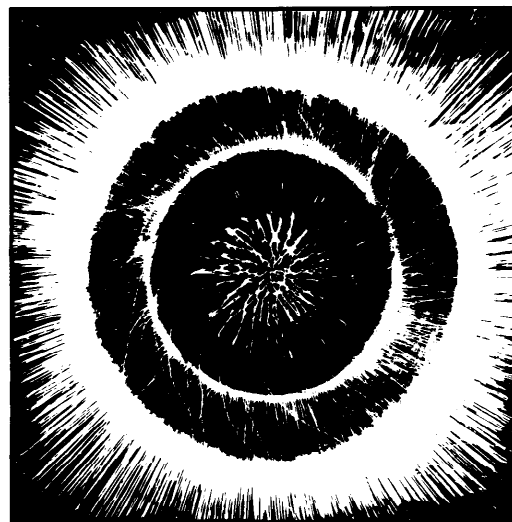


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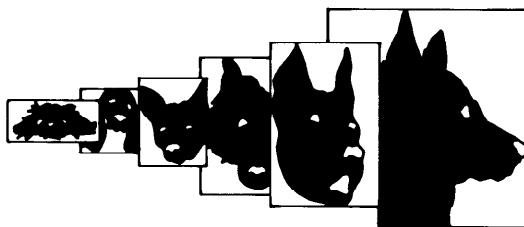
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