

# Creation Research Society Quarterly

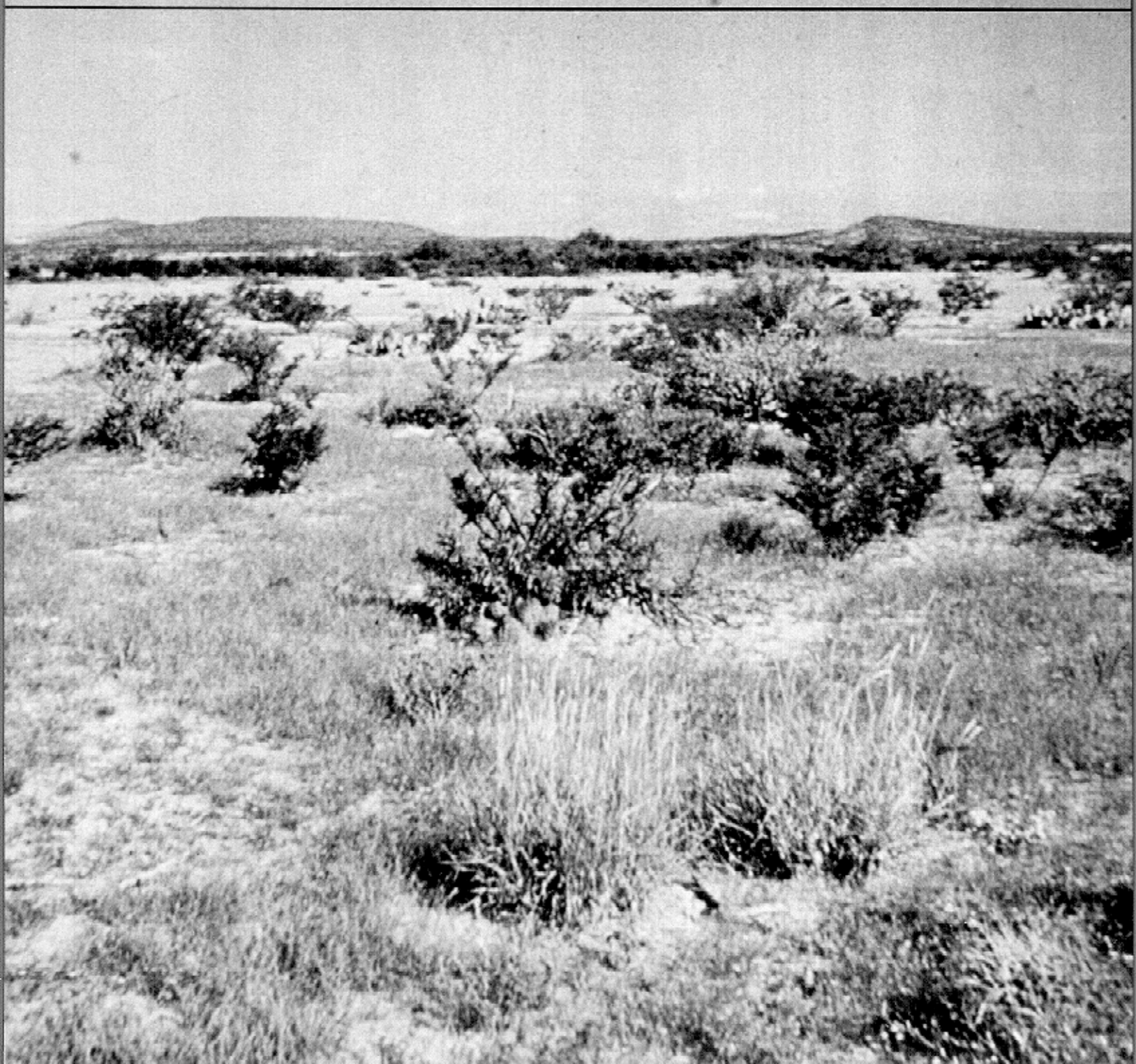
Haec credimus:

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

VOLUME 17

MARCH, 1981

NUMBER 4



# CREATION RESEARCH SOCIETY QUARTERLY

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VOLUME 17

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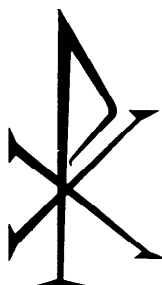
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## COVER ILLUSTRATION

The picture on the front of this issue of the *Quarterly* is a view in the Chihuahuan Desert, in Mexico. As mentioned in Dr. G. Howe's article, elsewhere in this issue of the *Quarterly*, there are barren areas, playa-like and of dimensions about 200 by 400 or more meters, interspersed with vegetated strips. The latter are typically 200 to 400 by 20 to 50 meters in dimensions. The possible significance of this close proximity of vegetation and desert is discussed in Dr. Howe's article.

Professor T. Recht, of the California State University, Dominguez Hills, took this picture, and has kindly given permission for its use. However, Professor Recht does not subscribe to the views expressed here, or in Dr. Howe's article.

Dr. Howe attended to getting the use of this picture for the *Quarterly*.

## DATES OF THE ANNUAL MEETING FOR 1981

The Annual Meeting of the Society will be held on the 10th and 11th of April, 1981. The dates were given incorrectly in the report of the annual meeting for 1980, on page 135 of the *Quarterly* for September, 1980.

The present plan is to hold the open session on Friday, the 10th. Research papers, which members have been invited to present in earlier issues of the *Quarterly*, will be presented from 1 to 3 and from 6:30 to 8:30 P.M. From 3 to 5 P.M. there will be C.R.S. Committee reports.

## MAGNETIC FIELDS IN MEDICINE: BONE REPAIR

KEVIN C. McLEOD\*

Received May 26, 1980

*Evidence is accumulating which shows that magnetic fields may prove to have beneficial aspects for human beings. This information is being used in medical research, and therapeutic results obtained. Here some data are presented on one example: the healing of fractures of bones.*

*There is evidence that the earth's magnetic field may formerly have been greater than at present. The implications of such a situation, particularly to the life spans of the patriarchs, are discussed.*

### History

The rapid exponential decay of the earth's magnetic field with time is a most remarkable discovery of modern science.<sup>1</sup> This electromagnetic field (EMF) analysis has led to speculations of a young earth age and, through biological reports, of organic benefits.<sup>2,3</sup> Some of the reported bio-physical effects of variously applied EMF's seems to be a retardation of ageing and a stabilization of the genetic code.<sup>4</sup> Recently medical investigators have used EMF's in an increasingly wide variety of areas such as disintegration of intragastral blood coagula by electromagnetic resonators,<sup>5</sup> EMF anti-inflammatory affects in arthritic animals,<sup>6</sup> and in EMF treatment of traumatic edema in humans.<sup>7</sup>

Also dogs exposed to high electromagnetic pulses (447 KV/M) over long periods of time have shown no biological impairments and no injurious affects even to highly mitotic tissues such as hematopoietic bone marrow.<sup>8</sup> Partly based on similar findings the Occupational Safety and Health Administration decided that a proposed standard on human exposure to electromagnetic pulses should not be issued (St 75). Thus this expanding knowledge of the value of EMFs has led Dr. C. Andrew L. Bassett, professor of orthopedic surgery at New York's Columbia P&S, to say "... a modern era of electrotherapy (via magnetic inducements, author) built on sound scientific foundations is being established."<sup>9</sup>

### Fracture Therapy

The case of EMF influences on bone repair and healing is most interesting. Surprisingly this attempt was first introduced 168 years ago when a non-union fracture was treated electrically in 1812.<sup>10</sup>

In 1964 Dr. C. A. L. Bassett demonstrated that increased osteogenesis could be 'triggered' by weak electric currents.<sup>11</sup> Medical news (1980) offered a report that 4 of 5 patients with fractures in which the bone ends did not unite with time could heal themselves with electromagnetic units that promote bone growth at the fracture site.<sup>12</sup>

Dr. Bassett developed the technique of non-invasive stimulation by the application of electromagnetic coils strapped to the outside of the patient's cast. See Figure 1. Some of the EMF methodology is detailed in reference 13.

The original tests were done on humans with multiple failures of surgical repair and candidates for amputa-

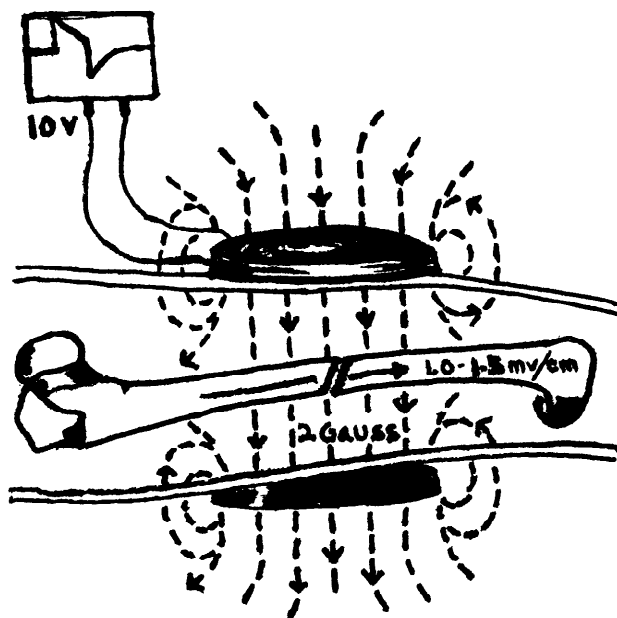


Figure 1. The application of electro-magnetic treatment to promote healing of a fracture. Drawn by the author, from information in Reference 12.

tion.<sup>14\*</sup> Although the procedure can not bridge wide gaps (greater than 1 cm),<sup>15</sup> an 80% success rate has been reported. In a study conducted over a five year period the inductive coupling resulted in functional union of 198 of 249 fractures with 86% joining in tibial fractures and 66% joining in femoral fractures.<sup>16</sup>

While more research into the nature of magnetic influences is needed, Dr. Bassett has stated that the EMF "modifies cell behavior in the gap", resulting in increased alkaline phosphate levels, mineralization, vascular invasion, and endochondrol ossification.<sup>17</sup> Also another influence of EMF stimulation seems to be the increased release of calcium in the tissues. The release of  $Ca^{++}$  from membranes has been shown to affect mitosis, secretion, transcription, cyclic AMP, and calcification.<sup>18</sup>

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\* One remarkable case of the pathologic lesions studied, was the example of the oldest living individual with Thalassemia major. He had extensive heart and lung disease, profound osteoporosis, non-union and excruciating pain in both hips. A coil was fitted over the anterior surface of the right hip joint. Three months of 'stimulation' achieved union, increased radiographic bone density with the electromagnetic field, and completely eliminated the right hip pain. The same procedure followed on the left hip and produced the same results.

### Ageing

The ageing process involves almost all organs, tissues, and many cellular operations. Of the many interrelated proposals on ageing no one theory can yet explain the entire phenomenon. However some observations in the context of this report are worth mentioning.

Generally functions of replacement, regeneration, and wound healing processes decline with time in ageing.<sup>19</sup> It has been shown that chromosomal aberrations accumulate in mammalian liver cells with ageing.<sup>20</sup> Collagen, 30-40% of total body protein and an important organic component of bone, undergoes proportional cross-linking with ageing in the soft tissues.<sup>21</sup> Advancing age on the skeletal bones corresponds with decalcification and a 15% loss in mass between youth and old age.<sup>22</sup> And changes in body ions seem to exhibit important indications of ageing. In this regard evidence from P. S. Timiras, M.D., Ph.D. and author of *Developmental Physiology and Ageing* is most interesting:

"For example, aprogeria-like syndrome, i.e., precocious ageing, can be induced in rats by administering hydrotachysterol (DHT), a derivative of viosterol, used in the treatment of rickets and other manifestations of faulty calcium and phosphate assimilation. Young animals in which certain types of disturbances of calcium metabolism have been so induced demonstrate a variety of changes such as normally occur in old individuals (e.g., kyphosis, loss of hair, wrinkling skin with histologic changes reminiscent of senile elastosis, loss of muscle protein, involution of the thymus and lymphatic organs, atrophy of the sex organs, anomalies of the teeth. Such experiments have been conducted in order to clarify whether certain disturbances in calcium metabolism may underlie conditions resembling ageing and thus represent a significant factor in ageing itself.)"<sup>23</sup>

### Discussion

These findings encourage the rationale behind the theory that a once stronger earth EMF might have had beneficial influences on past organisms, with special concernment for the early people of Genesis. The studies appear to indicate that EMF's may have greater effects on young tissues<sup>24</sup> and healing and repairing tissues as reported here. The possibility that EMF's may affect the genetic code is important in future investigations on ageing. Also the evidence that EMF's affect tissue calcium coupled with the speculation of the role

of calcium in ageing should promote investigation into this area.

### References

- <sup>1</sup>Barnes, Thomas G. 1973. Origin and destiny of the Earth's magnetic field. Institute for Creation Research, San Diego, California.
- <sup>2</sup>Barnes, Thomas G. 1975. Earth's magnetic energy provides confirmation of its young age. *Creation Research Society Quarterly* 12 (1):11-13.
- <sup>3</sup>Hamby, Robert V. 1976. Biomagnetic effects in the light of the formerly stronger geomagnetic field. *Creation Research Society Quarterly* 13 (2):106-107.
- <sup>4</sup>Ibid., pp. 106-107.
- <sup>5</sup>Wobser, E., and U. Stumpff, 1978. Intra-gastral disintegration of blood coagula by mechanical vibration. *Endoscopy* 10 (1):15-19.
- <sup>6</sup>Mizushima, Y. 1975. Effects of magnetic field on inflammation. *Experientia* 31 (12):1411-1412.
- <sup>7</sup>Degen, I. L. 1970. Magnetic fields in the treatment of traumatic edema in humans. *Ortopedia Travmatologia Protezirovani* 11:47.
- <sup>8</sup>Baum, Siegmund J. 1979. Tests of biological integrity in dogs exposed to an electromagnetic pulse environment. *Health Physics* 36 (2):159-165.
- <sup>9</sup>Bassett, C. A. L., A. A. Pilla, and R. J. Pauluk, 1977. A non-operative salvage of surgically resistant pseudarthroses and non-unions by pulsing electromagnetic fields. *Clinical Orthopaedics* 124:128.
- <sup>10</sup>Hartshorne, A. M. 1840. On the causes and treatment of pseudoarthrosis and especially of that form of it sometimes called supernumerary joint. *American Journal of Medicine Science* 1:43.
- <sup>11</sup>Bassett, C. A. L., R. J. Pauluk, and R. O. Becker 1964. Effects of electric currents on bone formation in vivo. *Nature* 204 (4959):652-654.
- <sup>12</sup>Medical News. 1980. Electrowaves heal unjoined bone at home. Volume 4, No. 9, Page 1.
- <sup>13</sup>Bassett, Op. Cit. 1977, p. 131.
- <sup>14</sup>Ibid., p. 131.
- <sup>15</sup>Medical News, Op. Cit., p. 4.
- <sup>16</sup>Ibid., p. 4.
- <sup>17</sup>Ibid., p. 4.
- <sup>18</sup>Bassett, Op. cit., 1977, p. 139.
- <sup>19</sup>Smith, David W. 1973. Biology of ageing, page 21. W. B. Saunders Company, Philadelphia.
- <sup>20</sup>Ibid., p. 22.
- <sup>21</sup>Timiras, P. S. 1972. Developmental physiology and ageing. Page 451. Macmillan Company, New York.
- <sup>22</sup>Busse, Ewald W. 1973. Theory and therapeutics of ageing. Page 23. Medicam Press, New York.
- <sup>23</sup>Timiras, Op. cit., p. 467.
- <sup>24</sup>Barnothy, Madeline F., Editor. 1964. Biological effects of magnetic fields. Pages 86-87. Volume 1. Plenum Press, New York.

## BOOKS: SPECIAL OFFER

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## THE NECESSITY OF THE CANOPIES

EVERETT H. PETERSON\*

Received April 9, 1980

*There has been much discussion of the possibilities, composition, and maintenance of a pre-Flood canopy surrounding the earth. Venus space probes have shown a canopy to be possible; for Venus has one. This paper discusses the idea that not only was the canopy possible but that it was a necessity. It was necessary before the Flood to produce the climatic conditions the Bible describes for that time. When that canopy was emptied its water became the erosional force that produced the sediments that formed the sedimentary rock. A restored canopy was necessary after the Flood to produce the climatic conditions that made Oregon's weather tropical and that allowed mammoths to live at the Arctic Circle. When that canopy was emptied it produced the ice age and froze and preserved the mammoths.*

### Introduction

"And said God, Let be an expanse in the midst of the waters, and let it (be) dividing between waters (and) the waters. And made God the expanse, and He separated between the waters which (were) under the expanse and the waters which (were) above the expanse, and it was so. And God called the expanse, Heavens." (Genesis 1:6,7)<sup>1</sup>

This passage has caused much discussion among Creationists. In 1961 Morris wrote, in reference to it, "We feel warranted, therefore, in suggesting such a thermal vapor blanket around the earth in pre-Pleistocene times as at least a plausible working hypothesis, which seems to offer satisfactory explanation of quite a number of Biblical references and geophysical phenomena."<sup>2</sup>

Since those words were written and until now, many have been "working" on and writing about the canopy. Some have defended its existence Biblically<sup>3,4</sup> and some are not quite convinced.<sup>5,6</sup> Proposals have been made for canopies of liquid water<sup>3</sup>, of ice<sup>7</sup>, and of superheated steam<sup>8</sup>. Methods of maintaining a canopy have been suggested<sup>7,8</sup>. Kofahl reviewed some of these conflicting ideas and found them inadequate. Yet he wrote,

"The pre-Flood atmosphere may have and (in this author's opinion) probably did have a water vapor canopy. . ."<sup>9</sup>

The present writer is also of that opinion and was pleased that Akridge brought to our attention that Venus has a canopy.<sup>10</sup>

On December 9, 1978, the Pioneer Venus 2 spacecraft sent its five probes through the Venusian atmosphere to five different spots on the planet. The information those probes sent back about the cloud canopy (for that is what the clouds form) and the atmosphere is significant for Creationists. The cloud-top temperatures vary, depending on the location, from -72° F to -10° F. The cloud bottom is at 194° F and the planet's surface is around 900° F. The cloud is made up of thick layers. The upper layer contains sulfuric acid and water droplets. The next two layers probably contain particles of liquid or solid sulfur. Surprisingly the clouds end abruptly, almost exactly 30 miles up, everywhere on the planet. The first 10 miles below the clouds contain a few particles, 1/10,000 of an inch and smaller. In the next 20 miles to the ground no particles of any size were

detected. Dr. Robert Knollenberg, whose cloud particle-size spectrometer was designed to detect solids and vapor droplets, said,

"It was a very clean atmosphere. Below 30 miles it was immaculate."

At the interface of cloud and atmosphere the pressure was slightly more than at sea level on earth. At the planet's surface it was more than 90 times that on earth. One probe kicked up a cloud of dust when it landed. It took more than four minutes for the air to clear which seems to indicate almost no wind at the surface. It is worth noting that the accepted theory as to why Venus is so hot is because of the so-called Greenhouse effect.<sup>11</sup>

All this information brings questions to mind. What supports the canopy at an altitude of 30 miles above the surface all around the planet? What prevents the canopy from mixing with the atmosphere even though there is pressure at the surface where they meet? Is the pressure at the interface due to the weight of the canopy? Because the canopy is colder than the atmosphere, shouldn't it be heavier and therefore sink into the atmosphere? What prevents it from doing so?

However, Venus has a canopy and it would seem that whatever is maintaining it could surely have maintained a water vapor canopy around the earth.

Let us now consider some evidence, Biblical and otherwise, that shows that a canopy was a necessity before and after the Flood and that each time it was emptied it produced profound effects on the earth.

### I - BEFORE THE FLOOD Temperature

A significant clue as to the temperature on the newly created earth is the fact that Adam and Eve were created naked. In keeping with God's seeing that all creation was "very good", it could not have been cold enough to make them shiver, not hot enough to make them sweat, but always, day and night the year-round, the temperature had to be in the comfort zone for naked bodies. This zone is what Smith calls the "thermal neutral zone".<sup>12</sup> He points out that for homeotherms there is a portion of the range of changing environmental temperatures where the energy required to maintain proper body temperature is the lowest. To determine the exact limits of the neutral zone would require a special temperature controlled room. A rough estimate of the limits was made, however, by placing a thermometer next to the skin while varying the amount of body covering. Below 84° F was too cool and over 94°

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F was too warm. Thus we conclude that the temperatures on the newly created earth were always within those limits.

### Wind

Many people, especially those in cold climates, are familiar with the "wind chill factor". They know that for a given temperature, it takes more energy to stay warm when the wind is blowing than when the air is still. This fact, together with the "very good" nature of the new earth, means that in those days there was no wind when the temperature was on the low side of its range but there could be a mild breeze when the temperature was on the high side. The Bible tells us that such was the case. That information is in one phrase of Genesis 3:8. The familiar translation of this verse is,

"And they heard the voice of the Lord God walking in the garden in the cool of the day."

The word "cool" is a mistranslation of the Hebrew word, "ruwach", which means "wind" and comes from a root word meaning "to blow". It speaks therefore of any movement of air and is translated throughout the Old Testament by "wind" and "breath". It also means "spirit". The Interlinear Bible<sup>1</sup> translates "ruwach" in Genesis 3:8 as "breeze" of the day. This phrase tells us two things: that at a certain time every day a breeze came up and there was no air movement all the rest of the 24 hours.

What time of day was the "breeze of the day"? Our earlier deductions determined that air movement could only be when the temperature was at its highest. That time, of course, was mid-afternoon. It was then that the warmed earth had heated the air above it enough to cause it to rise. That movement pulled in cooler air from the side creating the "breeze of the day".

### Every Day the Same

Adam and Eve were naked when God commanded them to "be fruitful and multiply and fill the earth." (Genesis 1:28). Thus, everywhere on the face of the earth and all the time the temperature was in the "comfort zone". This would have been an impossibility if the polar regions had several months of darkness as at present. The earth, therefore, must have had its axis perpendicular to the ecliptic thus making each day the same length, from pole to pole, throughout the whole year.

Objections to the earth being perpendicular to the ecliptic have been raised on the basis of Genesis 1:14 which states that one purpose of the lights in the heavens was to be "for seasons". The seasons in the verse are equated with the four seasons of the year the earth now goes through. This view is not needed, however, to satisfy Genesis 1:4, for that can be done with Job 38:32, which reads,

"Can you bring out the constellations in their season. . .?"

### No Rain

"For not had rain sent Jehovah God on the earth . . . and a mist went up from the earth and watered all the face of the ground . . . And a river went out

from Eden to water the garden." (Genesis 1:5, 6, 10)<sup>1</sup>

At creation God installed an underground watering system instead of today's overhead system. He also had to provide a method to prohibit the present hydrologic cycle. How did he do it? Today when the air pressure is high we have clear weather. Several years ago when California was having a drought, we were told it was caused by a high pressure ridge off the coast. If high pressure stops rain, then it is likely that the original atmosphere was at a pressure somewhat higher than the highest of today.

It has been shown that three conditions were present on the newly created earth that are not with us today. The temperature, world-wide and all the time, was in the "thermal neutral zone". There was no wind except for a mild breeze at mid-afternoon, and there was no rain. To produce these three conditions, two things were necessary: the earth's axis had to be perpendicular to the ecliptic and there had to be a canopy to pressurize the atmosphere and produce a Greenhouse effect.

## II - DURING THE FLOOD

### Sedimentary Rock

Sedimentary rock has become, for me, the prime evidence of a world-wide flood.

More than two-thirds of the land area of the earth is covered with sedimentary rock. Estimates of the volume of such rock vary, of course, because of the great uncertainties that confront those that make such estimates. In 1924, the American geochemist, F. W. Clark, estimated that the sedimentary rocks made up about 5 percent of the crust to a depth of 10 miles. That would be a volume of 10<sup>8</sup> cubic miles, enough to cover the entire earth to a depth of one-half mile. Others have made estimates from somewhat lower to three times as much. Nearly all estimates are made on the assumption that all of the material of which the rocks are composed must have ultimately been derived from igneous rocks<sup>13</sup>.

As to when the sedimentary rocks were formed, the evolutionist believes that the processes of erosion, transportation, deposition, and solidification have been going on for at least 3.5 billion years. But even if 3.5 billion years had been available, could 100 million, or even less, cubic miles of igneous rock have been eroded?

### The Evolutionist's Dilemma

For a moment, let us grant the evolutionist his assumptions. Imagine, then, the time in that dim past, just before the first bit of sedimentary rock had been formed. The total land area of igneous rock was open to the forces of erosion. Some sediments were produced which were washed together with other sediments and deposited in some area where they hardened into rock. That rock is with us today. It has been given the name Precambrian. The fact that the rock is observed by us means that from the time it was formed until now no erosional forces acted upon it. If they had we would not be observing it today. Thus, the area occupied by that first bit of sedimentary rock made no more contributions of sediments. Time went on and other areas became covered with sedimentary rock that we observe

today and then those areas also ceased being a contributor of sediments. In time, over two-thirds of the land area became covered with a layer of sedimentary rock.

At that point an impossible situation arose. Erosional forces would be restricted to less than one-third of the land area which would have to supply millions of cubic miles of sediments which somehow would have to be spread over the more than two-thirds land area. Thus the Evolutionist has no way to build the Geologic Column. And all his billions of years are no help.

If the great thickness of sedimentary rock cannot be built up by gradual process over a long time span, how can it be produced? The answer will be in a method that will somehow continually store the material that is being eroded until all 100 million cubic miles (or whatever is the correct figure) of sediments have been produced and then deposit it in layers over two-thirds of the land area. The evolutionists, however, have no such method.

### The Creationist Solution

In the flood of Noah's day, the Biblical Creationist has a method to produce the necessary sediments, not from igneous rock but from originally created soils.

"... the same day were all the fountains of the great deep broken up, and the windows of heaven were opened." (Genesis 7:11)

"And the rain was upon the earth forty days and forty nights." (Genesis 7:12)

"And the waters prevailed upon the earth a hundred and fifty days." (Genesis 7:24)

The waters surging up from the deep and the currents produced by them undoubtedly produced much sediment. The greatest erosional force, however, was the water that fell from the canopy. For 960 consecutive hours that water rushed downhill, literally melting away the soil down to bedrock or to the level of the slowly rising flood waters. After the forty days of rain the waters of the Deep kept pouring forth for 110 more days, mixing and sorting and depositing the sediments. Finally the flood waters flowed off the land into the sinking ocean basins, carrying much sediment out to the continental shelves but leaving most behind. Then the sediments hardened into today's sedimentary rock.

Sedimentary rock says that in the past there was a time of erosion. A lot of sedimentary rock says there has been a lot of erosion. Fifty million cubic miles of sedimentary rock says that there has been erosion of cataclysmic proportions, almost beyond belief.

Fifty million cubic miles of sedimentary rock is only half the amount of the previously quoted estimate. From the Creationist's viewpoint, however, I believe it is more realistic. To produce that much from a suggested pre-flood land area covering half the earth's surface, the average elevation to be eroded away would have had to be over 2600 feet.

These figures make one reassess his belief about the magnitude of the changes wrought by the flood. They seem to indicate that God took the total originally created landmass down to bedrock and refashioned it into an entirely new and different world.

### III - AFTER THE FLOOD Low Sea Level

"Blue holes" are underwater caverns several hundred feet deep. In such a hole, in the area of the Bahama Islands, stalagmites and stalactites have been found at depths greater than 140 feet. This is evidence that the sea was once much lower than it is today. Also, some of the stalagmites were dated between 139,000 and 160,000 years old by radiologic dating techniques. A news article with this information states that this,

"... agrees with other evidence that the sea level may have plunged as much as 400 to 500 feet during the glacial period 130,000 to 200,000 years ago."<sup>14</sup>

Berlitz writes at length about discoveries<sup>15</sup> of buildings, temples, walls, roads, ports, and cities which are under the waters of the continental shelves of America, and primarily in the area of the Bahamas. What he calls the "evident explanation" for these things is that "they were constructed on dry land" during the last ice age about 12,000 years ago "which was subsequently engulfed when the ice melted at an accelerated rate."<sup>16</sup>

The evidence is convincing that at one time in the past the sea level was much lower than it is at present. The question is, when was it lower? The evolutionist has the level repeatedly lower as ice ages supposedly came and went in the hundreds of thousands of years in the past. The Biblical Creationist, however, doesn't have all those years. When, then, can he date the time of low sea level?

The evidences of low sea level quoted above were concerned with the area around the Bahamas which is basically limestone. In the previous section it was shown that the flood is what brought sedimentary rock into existence. Anything, therefore, that has happened to or on sedimentary rock is post-Flood. The time of low sea level, then, is after the Flood.

### Post-Flood Warm Weather World-Wide

When did the mammoths live that have been found frozen in the cold regions of northern Siberia? There were no freezing temperatures before the Flood and the complete reworking of the land mass during the Flood would have destroyed, not preserved them. Therefore, they must have lived after the Flood. For them to have lived at the Arctic Circle means that warm weather prevailed there after the Flood. The conclusion, then, is that there had to be an extended period of time between the end of the Flood and the beginning of the ice age.

This same conclusion was reached by Nevins when he studied the strata of the John Day Country of north-eastern Oregon. He wrote at length about it declaring it post-Flood and states that

"The climate was originally tropical in Clarno time changing to cold and humid during accumulation of the recent glacial deposits."<sup>17</sup>

He then concludes,

"It is therefore necessary to postulate a post-Flood era probably of some hundreds of years duration between the close of the Flood and the initiation of the recent continental glaciation."<sup>17</sup>

### The Canopy Restored

The "greenhouse effect" of a water vapor canopy would produce the weather conditions just described for Oregon and the Arctic. The water contained in a canopy would mean a lower sea level.<sup>18</sup> Thus, what was needed immediately following the Flood was a second canopy. The Bible indicates that such was the case.

"And remembered God Noah and every living thing and all the cattle which were with him in the ark. And made to pass God a wind over the earth and subsided the waters. And stopped the fountains of the deep, and the windows of the heavens; and was restrained the rain from the heavens. And retreated the waters from the earth, going and retreating; and diminished the waters at the end of fifty and hundred days." (Genesis 8:1-3)<sup>1</sup>

"And the waters were going and falling until the month tenth; in the tenth (month) on the first of the month were seen the tops of the mountains." (Genesis 8:5)<sup>1</sup>

The restoring of the canopy was made possible by three things God did on day 151 of the Flood year. Those things were: placing a restraint on rain, stopping the windows of heaven, and inaugurating a world-wide drying wind. After the first forty days of rain the canopy was empty. With the canopy gone the conditions that had prohibited today's hydrologic cycle were gone, so what we call normal rainfall took place. This, then, is the rain God restrained. With the wind evaporating immense quantities of water, and rain being prohibited, the moisture had to go above the stopped windows, thus remaking the canopy. In 73 days of wind the waters went down only several hundred feet, for the record says that after that length of time only the tops of the mountains were seen.

God's original underground watering system (Genesis 2:5, 6, 10) was totally destroyed by the Flood, after which it became necessary to permit the present hydrologic cycle to function. The first canopy prohibited wind and rain. The second canopy had to be installed to allow both.

### The Tilted Earth

Not specifically mentioned, but necessary for God to do, was to tilt the earth to its present inclination. This produced such profound changes from pre-Flood days that God calmed the survivors fears with this promise:

"While the earth remaineth, seed time and harvest, and cold and heat, and summer and winter, and day and night shall not cease." (Genesis 8:22)

The first day of the first month is the day Noah saw that the face of the earth was dried. (Genesis 8:13) That is the day, I suggest, that God tilted the earth and in such a way as to make it the vernal equinox, i.e. our March 21. Noah, being in the northern hemisphere, would then be going into his first spring. When he came out of the ark 57 days later, i.e. our May 17, he would still have had time to plant the seeds he had brought with him, and raise a crop before his first winter came upon him.

### IV - AFTER THE SECOND CANOPY Emptying the Canopy

The second canopy is obviously no longer in existence. The Bible has no direct statement about emptying the canopy but does have two statements which are clues to the how and when.

"... and the waters shall no more become a flood to destroy all flesh." (Genesis 9:15)

Emptying the canopy quickly would have caused another world-wide flood. Instead it must have been emptied slowly; I suggest as snow in the polar regions, and that only during the winter months. More snow fell each winter than could melt during the summer, and so the ice sheets built up, continually spreading southward. At the same time the sea level was slowly rising due to the summer melt. Perhaps it took up to a hundred years to empty the canopy, after which the ice sheets slowly melted, raising the sea level to its present height.<sup>19</sup>

Peleg, whose name means "a channel of water", lived from 100 to 339 years after the Flood. He was given his name because, "in his days was the earth divided". (Genesis 10:25)

The land masses were divided by water when the sea level rose high enough to flood the land bridges such as between Asia and Alaska, England and the Continent, and others. To do this in Peleg's day the snow may have started falling as late as 250 years or so after the Flood.

### Frozen Mammoths

An analysis of the temperature drop necessary at the time of the mammoth's death to leave them in the state of preservation in which they have been found, reveals it to be below -150° F.<sup>20</sup>

The Wind Chill table lists -148° F as the effective temperature of -58° F with a 50 mph wind. Those conditions could easily have been exceeded when God opened the canopy over the polar region to start the ice age. The sudden and great temperature change literally took the mammoth's breath away. Eventually, though, they had to breath and then they inhaled a great quantity of the frigid air which immediately froze their lungs. Thus they died by asphyxiation in a matter of minutes. The high winds and low temperature combined to rapidly freeze them.

The winds, I suggest, blew for some days before the snow fell in order to freeze the ground. Much erosion was caused by them and the loose material was packed around the fallen animals eventually burying them.

### References

- <sup>1</sup>Green, Jay, 1976. The Interlinear Hebrew/Greek English Bible. Associated Publishers and Authors, Lafayette, Indiana.
- <sup>2</sup>Whitcomb, John C. Jr. and Henry M. Morris, 1961. The Genesis Flood, Presbyterian and Reformed Publishing Co., Philadelphia, Pa., p. 256.
- <sup>3</sup>Udd, Stanley V., 1975. The Canopy and Genesis 1:6-8, *Creation Research Society Quarterly*, 12 (2):90-93.
- <sup>4</sup>Dillow, Joseph C., 1979. Scripture does not rule out a vapor canopy, *Creation Research Society Quarterly*, 16 (3):171-173.
- <sup>5</sup>Strickling, James E., 1976. The waters above the firmament. *Creation Research Society Quarterly*, 12 (4):221.

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## SOLUTION AND DEPOSITION OF CALCIUM CARBONATE IN A LABORATORY SITUATION IV

EMMETT L. WILLIAMS\*, KENNETH W. HOUSE\*\*, and RICHARD J. HERDKLOTZ\*\*\*

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*This is a final report in a series of research investigations designed to determine the conditions necessary to attain rapid precipitation of  $\text{CaCO}_3$  in the laboratory. It is shown that rapid formation of deposits is possible utilizing a decrease in pressure as limestone-laden waters emerge into the atmosphere.*

### Introduction

A tentative model for the formation of limestone, cavern development, and subsequent precipitation of stalactites, stalagmites, and dripstone in relation to the Flood has been reported.<sup>1</sup> Also experimental results were presented on the various conditions that could cause the rapid formation of  $\text{CaCO}_3$  structures in the laboratory.<sup>2-4</sup>

A series of experiments and field observations on the conditions under which calcium carbonate ( $\text{CaCO}_3$ ) can be deposited rapidly from solution in the laboratory are reported at this time. The principal variable investigated in this sequence is pressure difference. Rain or flood waters are subjected to pressure variations when moving through soil and limestone into caves. The acidic water ( $\text{H}_2\text{O} + \text{CO}_2$ ) dissolves  $\text{CaCO}_3$  as it flows through fissures in layers of limestone. When this calcium carbonate-laden water enters a cave it experiences a decrease in pressure causing precipitation of dissolved material. Such conditions are considered to be one of the chief mechanisms in the formation of cave deposits.<sup>5</sup>

### Precipitation Experiments - Apparatus 1

The laboratory apparatus shown in Figure 1 was employed in the early tests. A 6 inch  $\times$  6 inch  $\times$  6 inch Plexiglas solution box was filled with crushed Beekmantown dolomite (used in all experiments) and sealed. Deionized water charged with  $\text{CO}_2$  was allowed to flow into the solution box and drip down  $\text{CaCO}_3$ -coated strings suspended from the base. The water reservoir was positioned at a height such that the test pressure ( $P_t$ ) varied depending upon the water level, from 1 to 1.4 atmospheres. The results obtained are shown in Table I.

The drip rate per string was monitored for the first 250 hours of the test. The time of drop formation and the amount of  $\text{CaCO}_3$  precipitation was classified into four distinct groups as shown in Figure 2. The averaged results are tabulated in Table II.

The amount of precipitate increases as the drip rate decreases up to a maximum then decreases with a further slowdown of drip formation. Fast drop formation is a deterrent to precipitation. Possibly the "dwell time" of the drop on the string is not sufficient to allow the release of  $\text{CO}_2$  so that  $\text{CaCO}_3$  can precipitate.<sup>6</sup> An ex-

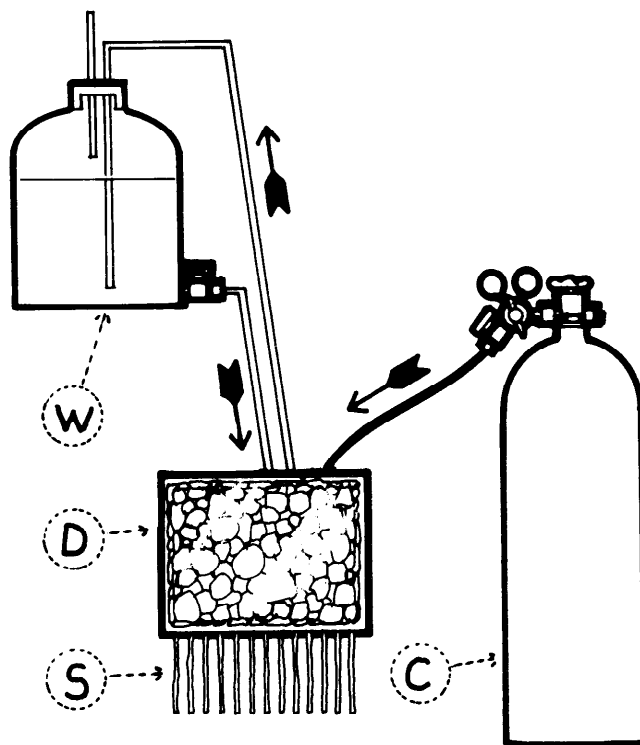


Figure 1. Small laboratory apparatus. The significance of the letters is as follows: C, carbon dioxide; D, dolomite; S, strings; W, water supply.

cessive drop "dwell time" may cause slow monocrystalline growth rather than rapid polycrystalline growth that occurs with faster moving drops.<sup>7</sup>

Another test was conducted using the same apparatus; and the results are recorded in Table III.

It was difficult to keep the box sealed against the internal pressure. Three trials were attempted before an experiment was completed. Also the small amount of dolomite in the box limited the amount of water-solid contact area which hindered the solution process. Therefore it was decided to construct another test rig.

### Precipitation Experiments - Apparatus 2

A large cylindrical Plexiglas apparatus (Figure 3) was built to avoid as many "square" corners and edges as possible to eliminate leakage and to increase the amount of dolomite in the solution chamber. The sealed 1900 cubic inch apparatus contains three coated strings (A) inserted in the base. Fresh strings are mounted for

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**Table I. Precipitation of  $\text{CaCO}_3$  on Strings by Pressure Decrease - Run 1**

| String Number | Mass of Deposition<br>$\text{CaCO}_3$ (grams) |
|---------------|-----------------------------------------------|
| 1             | 0.3228                                        |
| 2             | 0.2481                                        |
| 3             | 0.2040                                        |
| 4             | 0.1771                                        |
| 5             | 0.1964                                        |
| 6             | 0.2434                                        |
| 7             | 0.2170                                        |
| 8             | 0.2542                                        |
| 9             | 0.2598                                        |
| 10            | 0.1949                                        |
| 11            | 0.2119                                        |
| 12            | 0.1740                                        |
| total 2.7036g |                                               |

Test Time - 500 hours      118 liters of water

Rate of Deposition - 0.401 grams of  $\text{CaCO}_3$   
liter of water - year

**Table II. Effect of Drip Rate on Quantity of Precipitate Formed**

| Time Between Drops<br>(seconds) | Mass of Precipitate<br>(grams/string) |
|---------------------------------|---------------------------------------|
| 43                              | 0.0514                                |
| 90                              | 0.0552                                |
| 125                             | 0.1317                                |
| 215                             | 0.1082                                |

**Table III. Precipitation of  $\text{CaCO}_3$  on Strings by Pressure Decrease - Run 2**

| String Number                | Mass of $\text{CaCO}_3$ Deposition<br>(grams) |
|------------------------------|-----------------------------------------------|
| 1                            | 0.5565                                        |
| 2                            | 0.1417                                        |
| 3                            | 0.1975                                        |
| 4                            | 0.1749                                        |
| 5                            | 0.4202                                        |
| 6                            | 0.3130                                        |
| 7                            | 0.3781                                        |
| 8                            | 0.4215                                        |
| 9                            | 0.4288                                        |
| 10                           | 0.2102                                        |
| 11                           | 0.4657                                        |
| 12                           | 0.2066                                        |
| Ppt. at leak in solution box | 0.0239                                        |
| total 3.9386g                |                                               |

Test Time - 1314 hours      783 liters of water

Rate of Deposition - 0.0335 grams of  $\text{CaCO}_3$   
liter of water - year

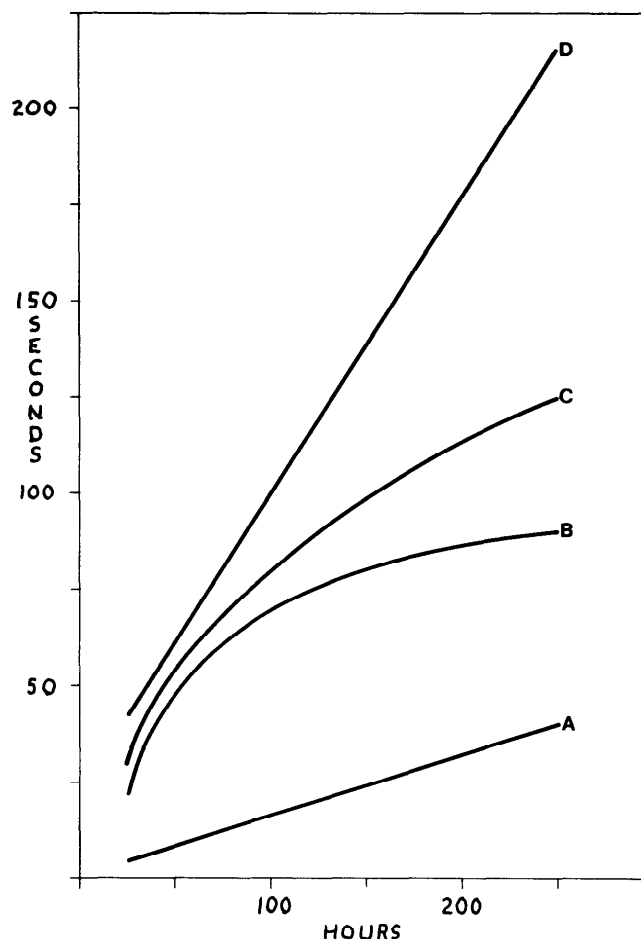


Figure 2. Drop formation time. Time between drops, in seconds, vs. test time, in hours. The different curves show the results for different strings, as follows: A: strings 4, 5, 8, and 11, drop time at 250 hours, 35-50 seconds. B: strings 2, 6, 7, and 10, drop time at 250 hours, 80-100 seconds. C: strings 1 and 3, drop time at 250 hours, 120-130 seconds. D: strings 9 and 12, drop time at 250 hours, 210-220 seconds.

each run. A hole (B) was drilled in the side of the container so that water with dissolved dolomite could trickle down the outside, precipitating  $\text{CaCO}_3$ . The water leaving the strings dropped onto a glass plate, then into a container. The collected exit water was recycled through the apparatus. Since natural water may travel considerable distance through limestone before entering a cave,<sup>8</sup> the recycled run-off water will contact more dolomite surfaces allowing a more realistic solution time.

Gas was periodically emitted into the solution chamber rather than allowing a continual flow as had been done in previous experiments to prevent the formation of an excessively acid solution which would hinder precipitation. Information collected in natural caves (Appendix I) indicates a slightly basic ( $\text{pH} \approx 8$ ) drip solution at active precipitation sites. The results of the first run in the new apparatus are tabulated in Table IV.

A second trial was conducted and the results are shown in Table V.

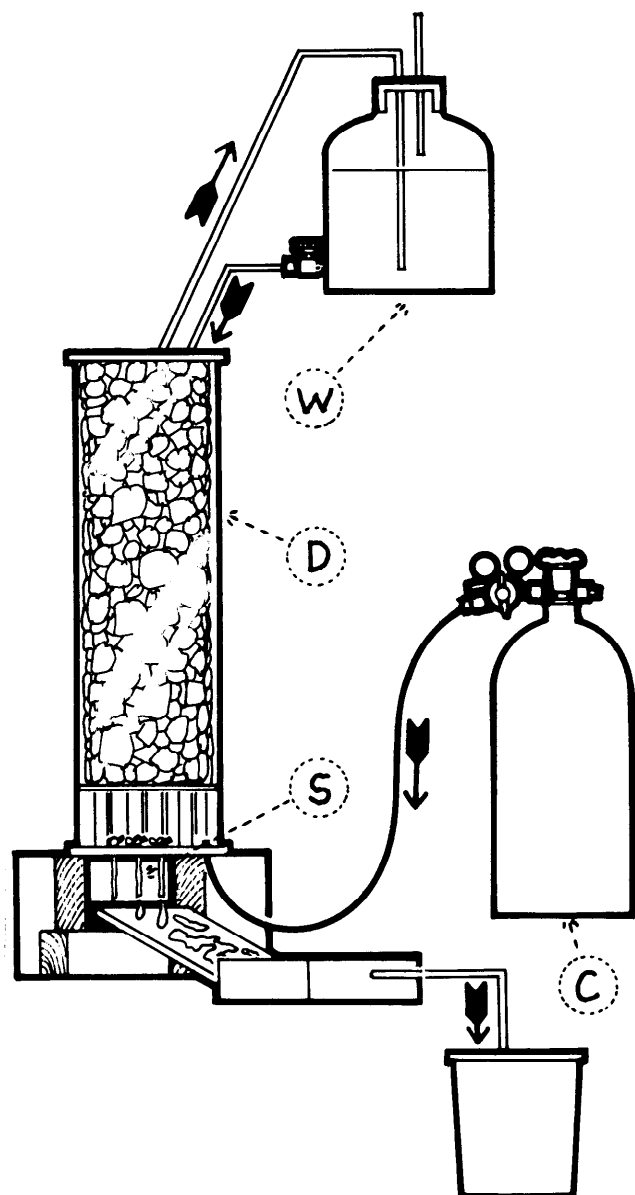


Figure 3. Large laboratory apparatus. The significance of the letters is as follows: C, carbon dioxide; D, dolomite; S, strings; W, water supply.

### X-Ray Diffraction Studies

An x-ray diffraction analysis of precipitates formed in all of these experiments revealed that crystalline form of the  $\text{CaCO}_3$  is calcite.

### Initiation of Precipitation Tests

The onset of precipitation in all experiments does not occur until a certain "incubation" time (about 400 hours) has passed where no apparent precipitation takes place. After this time the precipitate becomes obvious and growth is visible.

The lag time-to-precipitation phenomena was investigated as follows. High purity reprecipitated  $\text{CaCO}_3$

Table IV. Precipitation of  $\text{CaCO}_3$  on Strings By Pressure Decrease - Run 3

| String Number | Mass of Deposited $\text{CaCO}_3$<br>(grams) |
|---------------|----------------------------------------------|
| 1             | 0.0353                                       |
| 2             | 0.0435                                       |
| 3             | 0.4855                                       |
| hole (B)      | 0.1803                                       |
| glass plate   | 9.9110                                       |
| total         | 10.6556g                                     |

Test Time - 600 hours    157 liters of "fresh" water  
                                   315 liters of recycled water  
                                   472 liters total

Rate of Deposition - 0.330 grams of  $\text{CaCO}_3$   
                                   liter of water - year

Table V. Precipitation of  $\text{CaCO}_3$  on Strings By Pressure Decrease - Run 4

| String Number | Mass of Deposited $\text{CaCO}_3$<br>(grams) |
|---------------|----------------------------------------------|
| 1             | 0.8222                                       |
| 2             | 0.6035                                       |
| 3             | 0.3622                                       |
| hole (B)      | 1.1972                                       |
| glass plate   | 9.8583                                       |
| total         | 12.8434g                                     |

Test Time - 600 hours    60 liters of "fresh" water  
                                   131 liters of recycled water  
                                   191 liters total

Rate of Deposition - 0.982 grams of  $\text{CaCO}_3$   
                                   liter of water - year

was placed into a liter of deionized water, and  $\text{CO}_2$  was bubbled through the stirred mixture. The system was maintained for three days before stirring was ceased. At that time the undissolved calcium carbonate was allowed to settle and 500 ml of clear solution was decanted into a clean beaker. To encourage the removal of dissolved  $\text{CO}_2$  the solution was again agitated with a magnetic stirrer. As shown in Figure 4, the pH increased slowly and leveled off at a value of 8.27. No precipitate was observed after three hours. The solution was then checked after 19 hours and found to have a pH of 8.15.  $\text{CaCO}_3$  (calcite) had precipitated on the bottom and sides of the beaker. Most of the precipitate except for a small amount that had settled to the bottom of the container could not be washed away; it had to be removed by mechanical scraping. The same experiment was repeated using a known amount of limestone as an aggregate. After precipitation occurred the solid mass was dried and weighed. The limestone had gained 0.27 grams of adherent precipitate.

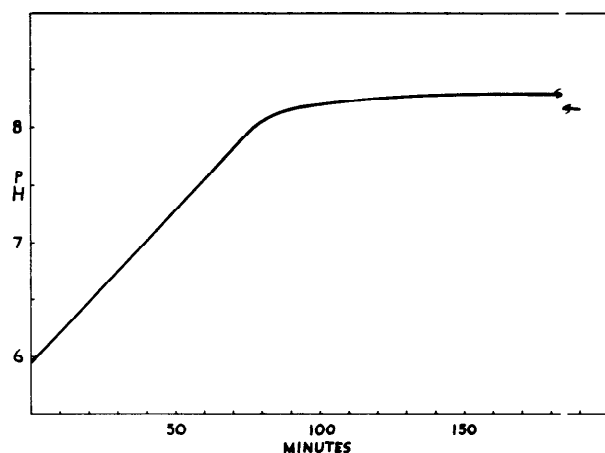


Figure 4. pH increase with time - calcium carbonate solution. Times in minutes, except that the mark after the break indicates 19 hours.

As explained, there is a time lag between the start of the experiment and the initiation of calcite precipitation. The lag may be due to time necessary to allow the removal of  $\text{CO}_2$  from solution or the time necessary to supersaturate the solution with  $\text{CaCO}_3$  before solid nuclei of the precipitating compound will become stable. Once precipitation occurs, it appears that the great majority of the deposit adheres to an existing solid surface. It is tempting to speculate on the role of fossil material as an aggregate medium for the deposition of sedimentary beds of limestone during the Flood similar to the function of gravel or stone aggregate in the hardening of Portland cement. Also, it is possible that falling or moving drops in a cave need to be exposed to the cave atmosphere or surfaces for a sufficient time to allow for stalactite and stalagmite formation because of the time lag before precipitation.

### Conclusions

The results presented in this study indicate that a pressure loss in dripping water can produce rapid precipitation of  $\text{CaCO}_3$  in the laboratory. Since 75-90% of the deposit is found on the glass plate, either the longer drop travel distance or the force exerted when a falling drop collides with a solid surface encourage precipitation. Also the rate of drop formation is another controlling factor in the amount of precipitate formed on the strings. Tentatively it appears that an optimum rate of flow down a surface yields a maximum amount of deposited  $\text{CaCO}_3$ .

In previous experiments it has been shown that temperature differences, as well as chemical composition differences in the solution and atmosphere, affect the amount of precipitate. Therefore it is concluded that large masses of  $\text{CaCO}_3$  can be deposited rapidly under proper conditions.

### Acknowledgements

The authors gratefully acknowledge the receipt of grants from the Creation Research Society for several years. These grants helped to finance part of the work.

Also the authors appreciate the help of other students at Bob Jones University in this phase of the study: Richard Mowrey, James Harper, and Carol Brumbalow.

### References

- <sup>1</sup>Williams, Emmett L. and Richard J. Herdtklotz, 1977 Solution and deposition of calcium carbonate in a laboratory situation II, *Creation Research Society Quarterly* 13(4):192-199
- <sup>2</sup>Williams, E. L. et. al. 1976 Deposition of calcium carbonate in a laboratory situation I, *Creation Research Society Quarterly* 12(4):211-212
- <sup>3</sup>Williams, Emmett L. and Richard J. Herdtklotz 1978 Solution and deposition of calcium carbonate in a laboratory situation III, *Creation Research Society Quarterly* 15(2):88-91
- <sup>4</sup>Williams and Herdtklotz, 1977 *Op. cit.*
- <sup>5</sup>Thraillkill, John, 1976 Spelothems, Chapter 3.2 in *Stromatolites Developments in Sedimentology* Series no. 20 (M. R. Walker, editor) Elsevier Scientific Publishing Company, Amsterdam, p. 82
- <sup>6</sup>Roques, H. 1969 A Review of Present-Day Problems in the Physical Chemistry of Carbonates in Solution, *Trans. Cave Research Group of Great Britain* 11(3):158
- <sup>7</sup>Roques, *Ibid.*
- <sup>8</sup>Thraillkill, John, 1968 Chemical and Hydrologic Factors in Excavation of Limestone Caves *Geological Society America Bulletin* 79:19-46

### Appendix I Cave Observations

At the kind invitation of Mr. Richard Lambert, the research team visited four caverns in the Riverton, West Virginia area on December 2, 1978. Several measurements were made in various caves, particularly at the sites of actively growing stalactites and stalagmites. A synopsis of the results is given below.

#### Seneca Caverns - a commercial cave

- A. First large room just inside commercial entrance  
pH of water - slightly basic  
temperature - 56° F  
relative humidity 99%
- B. Several active sites throughout cave  
pH of water - slightly basic  
temperature variation - 51-55° F  
relative humidity variation - 89-99%

#### Stratosphere Balloon - very dry cave populated with hibernating bats

- A. Large formation at end of "phreatic tube"  
temperature - 53° F  
relative humidity - 99%
- B. Area near the wall of "phreatic tube"  
temperature - 62° F  
relative humidity - 61%

#### Ruddle Cave - contains many active areas

- A. Large inactive formation  
relative humidity - 98%
- B. Active soda straw site  
relative humidity - 100%
- C. Main room at end of "phreatic tube" with many helictite formations  
relative humidity - 47%

### Appendix II Rapidly-Growing Structures in Caves

Examples of quickly-developing structures in various active caves can be documented (see the literature cited

(Continued on page 226)

## THE HEBREW FLOOD EVEN MORE DEVASTATING THAN THE ENGLISH TRANSLATION DEPICTS

G. RUSSELL AKRIDGE\*

Received December 11, 1979

*The special Hebrew words and Hebrew usages that appear in the Genesis flood account are explained. The titanic destruction and uniqueness, not adequately brought out in the English translation, appear remarkably and deliberately emphasized in the Hebrew.*

### I. Introduction

The English translation of the account of the Genesis flood (chapters 6-9) evidently describes a worldwide unparalleled catastrophe. The Genesis flood was capable of producing geologic changes that would otherwise require hundreds of millions of years. However, the usual English translations of the Genesis flood cannot approach the spectacular description in the Hebrew. This treatise explains the special Hebrew usages and constructions that appear in the Gen. 7-8:5 portion of the account of the Genesis flood.

The Hebrew words referred to in the order they first appear in Section II of this article are given in Table 1.

The English transliterations will be used to represent the Hebrew words in this article.

Several very special Hebrew words are used in Gen. 7 through Gen. 8:5 to describe the flood. The Genesis flood was so distinct from any other flood or catastrophe that it is given a special name in Hebrew, *mabul*. The Hebrew verb *baqa'* used to describe the breaking up of the fountains of the great deep (*t'hom*) pictures a gigantic cleavage of the crust of the earth with oceans of water exploding from these fissures in continual commotion. The rain during the flood was a *gesem*, the most violent of all rains, possibly accompanied by tornadic winds and hail. The "waters prevailed" (*gabar*) actually pictures a conflict between the flood and the land, in which the flood was victor.

The Hebrew usage is also descriptive of an unimaginable destruction. The increase of the flood waters translated by the simple "exceedingly" is described by a doubly emphatic superlative *m'od m'od*, used only one other time in the entire Old Testament. The Hebrew carpenter's term *mil'ma'lah* in Gen. 7:20 explains a source of confusion—the flood waters were not a mere 15 cubits above the land. Rather, the ark had a draft of 15 cubits as it rode upon the waters. The Hebrew description of the waters after the rain stopped pictures huge commotion of water capable of fantastic erosion and sedimentation.

The lexical references to the meanings of the Hebrew words are all from the *Hebrew and Chaldee Lexicon* by Gesenius as translated by Tregelles.<sup>1</sup> The quotations from the English translation are all from the King James Version of the Holy Bible. The Hebrew text used is the *Biblia Hebræica* as edited by Rudolf Kittel.<sup>2</sup>

### II. The Hebrew Word Study Flood

*Mabul* means "an inundation of waters, a deluge," according to Gesenius. This is a special word, because of its limited use. It occurs in only seven places in the entire Hebrew Old Testament. Six of those occurrences are in the first 10 chapters of Genesis, and the only time it appears outside of Genesis is once in Psalms where it is used to describe Noah's flood.

The seven occurrences of *mabul* in Genesis are as follows:

- 1) Gen. 6:17: "And, behold, I, even I, do bring a flood (*mabul*) of waters upon the earth, to destroy all flesh, wherein is the breath of life, from under heaven; and every thing that is in the earth shall die." The *mabul* was so destructive and extensive that God alone could bring it about. It was to destroy all flesh. The "I, even I" emphasizes the divine power required for such an event.
- 2) Gen. 7:6: "And Noah was six hundred years old when the flood (*mabul*) of waters was upon the earth." Gen. 7:10: "And it came to pass after seven days, that the waters of the flood (*mabul*) were upon the earth." Gen. 9:28: "And Noah lived after the flood (*mabul*) three hundred and fifty years." These three verses describe an event that happened only once during Noah's 950-year lifetime.
- 3) Gen. 7:7: "And Noah went in, and his sons, and his wife, and his sons' wives with him, into the ark, because of the waters of the flood (*mabul*)." The *mabul* was what Noah and his family had to enter the ark to escape.
- 4) Gen. 7:17: "And the flood (*mabul*) was forty days upon the earth; and the waters increased, and bare up the ark, and it was lift up above the earth." This was the only flood in history that lasted for 40 days of increase.
- 5) Gen. 9:11: God tells Noah, "And I will establish my covenant with you; neither shall all flesh be cut off any more by the waters of a flood (*mabul*); neither shall there any more be a flood (*mabul*) to destroy the earth." God promised that nothing like that would ever happen again. It is part of God's solemn covenant. This verse shows that Noah's flood was not a local flood, because local floods have occurred countless times since Noah's flood.
- 6) Gen. 10:1: "Now these are the generations of the sons of Noah, Shem, Ham, and Japheth: and unto them were sons born after the flood (*mabul*)." Gen. 10:32: "These are the families of the sons of Noah, after their generations, in their nations: and by these were the nations divided in the earth after the flood (*mabul*)." This particular flood was unique in that it separated the age into antediluvian and postdiluvian eras much like our division into B.C. and A.D.
- 7) Psa. 29:10: "The Lord sitteth upon the flood (*mabul*); yea, the Lord sitteth King for ever." This Psalm is a Psalm of God's strength. The Psalm progresses to more and more powerful evidences of God's strength. It ends with the greatest demonstration of God's strength since creation, the flood. It is the only non-Genesis use of *mabul*, "flood."

*Mabul* is derived from the Hebrew verb *yabal*, which has the root meaning of "to flow, especially copiously and with some violence." Another Hebrew word is translated "flood" in the Old Testament. *Setep* is translated "flood," but never as a part of the Noahic flood. *Setep* refers to the usual floods as distinct from

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|                                                    |                                                        |                                                           |
|----------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------|
| מַבּוּל <sup>mabûl</sup> , "deluge"                | מְעַלְמָה <sup>l<sup>e</sup>m'alah</sup> "exceedingly" | לְמַעַל <sup>l<sup>e</sup>m'alah</sup> "upwards"          |
| יָבַל <sup>yābal</sup> , "to flow"                 | גָּבַר <sup>gābar</sup> "to prevail"                   | חָלוּךְ <sup>hālòk w'êsh, "to return continually"</sup>   |
| שֶׁטֶף <sup>šēṭep</sup> , "flood"                  | מִלְמַלָּה <sup>mil'malah</sup> "upward"               | וְשׁוּב <sup>hālòk w'êsh, "to return continually"</sup>   |
| בָּצָץ <sup>bāqá</sup> , "to cleave"               | מַעַל <sup>ma'al</sup> , "higher"                      | חָלוּךְ <sup>hālòk w'êsh, "to decrease continually"</sup> |
| חֲהוּם <sup>t<sup>e</sup>hom</sup> , "(the) deep"  | מִן <sup>min</sup> , "from"                            | וְשׁוּב <sup>šûb</sup> , "to return"                      |
| מַיִם <sup>mayim</sup> , "waters"                  | מִמַּעַל <sup>mima'al</sup> , "from above"             | חָלָק <sup>hālak</sup> , "to go"                          |
| מָטָר <sup>māṭar</sup> , "to rain"                 | חָ <sup>āh</sup> , "toward" (a suffix)                 | חָסַר <sup>hāsar</sup> , "to lessen"                      |
| גֶּשֶׁם <sup>gešem</sup> , "to rain with violence" | לְ <sup>l<sup>e</sup></sup> , "to" (a prefix)          |                                                           |

Table 1. This shows the Hebrew words discussed in the article, with their transliterations and meanings.

Noah's flood. This general use of *setep* only emphasizes the uniqueness of *mabul* in referring specifically to the Genesis flood. *Setep* is translated "flood" in Psa. 32:6, Nah. 1:8, Dan. 9:26, and Dan. 11:22. The same word is translated by "the overflowing of waters" in Job 38:25, and by "outrageous" in Prov. 27:4.

### Broken Up

The Hebrew word *baqa'* is translated "broken up" in Gen. 7:11. "In the six hundredth year of Noah's life, in the second month, the seventeenth day of the month, the same day were all the fountains of the great deep (*t<sup>e</sup>hom*) broken up (*baqa'*) and the windows of heaven were opened." The verb *baqa'* was carefully chosen here to describe a violent cleavage. Any impression of the breaking forth of the fountains of the great deep as being some kind of a gurgling artesian well does a gross injustice to the Hebrew verb *baqa'*. Whenever *baqa'* is used, a violent cleavage is occurring. In Ecc. 10:9, *baqa'* is used to describe a man cleaving wood with an axe. In Ex. 14:16 God miraculously divides (*baqa'*) the Red Sea for Moses and the children of Israel as they left the land of Egypt. Amos 1:13 describes Israel's enemies as having ripped up (*baqa'*) Israel's pregnant women. Isa. 34:15 presents an excellent illustration of *baqa'* from nature. An egg cleaves (*baqa'*) as the infant bird breaks forth into life. In Num. 16:31, *baqa'* is translated "clave asunder." The earth split open suddenly enough and wide enough so that Korah, Korah's family,

Korah's mob, and all their houses fell into the fissure created. This was the supernatural event that ended Korah's rebellion against Moses.

Many similarities exist between this happening and Noah's flood. In both (1) a rebellion against God was in progress, (2) God's person remained faithful, (3) the rebellion ended with a splitting of the earth, (4) the cause of the splitting was supernatural, i.e., God caused it, and (5) even the same stem, the Niphal, of the same verb (*baqa'*) is used. Prov. 3:20 is a partial quote of Gen. 7:11. In Proverbs the same word is used for depths (*t<sup>e</sup>hom*) and for broken (*baqa'*) as is used in Genesis. Prov. 3:20 is the conclusion of two verses that go together. Prov. 3:19 reminds the reader that Jehovah knew what he was doing when He founded the earth. Prov. 3:20 concludes that Jehovah knew equally well what He was doing when He split (*baqa'*) the earth in Noah's day. Both events were unique, divine, and factual. One must keep in mind that Proverbs is a book of earthly truths. In Isa. 35:6 in a list of sudden and mighty miracles of God such as healing of the blind, deaf, and lame, occurs the miracle of the waters breaking forth in the desert. The event must refer to a flood, not Noah's flood, since the waters were to turn the desert into a fertile garden. A solitary gurgling brook would have no such effect on the desert. Psa. 78:15 describes the rock Moses struck in the wilderness. That rock "clave" (*baqa'*) and a river of water flowed forth. It sounds like Noah's flood in miniature. The flood

waters that burst out were *t'hom* discussed next. The words occur here together just as they do in Gen. 7:11.

The deliberate use of the Hebrew verb *baqa'* to describe the breaking-up action of the earth in the Genesis flood pictures the earth splitting open as an egg with oceans of water violently erupting from the fissures.

### Fountains of the Great Deep

What is the special significance of the unusual phrase, "the fountains of the great deep (*t'hom*)" in Gen. 7:11? A more natural phrase would be the fountains of waters (*mayim*), since it seems to be waters that came forth. The difference between fountains of (*mayim*) water and fountain of (*t'hom*) the great deep is that the Hebrew word *mayim* "water" is a general word describing all kinds of H<sub>2</sub>O, while the Hebrew word *t'hom* (fountain of) the great deep specifically means water making a noise, or water in great commotion. The shepherd of Psa. 23 leads his flock beside the still waters (*mayim*). He would not dare take the flock near the noisy, turbulent waters of the great deep (*t'hom*). Several examples illustrate the particular emphasis desired by the author who uses *t'hom*.

Psa. 42:7 describes wave after wave in the ocean in continual commotion and without cessation by the use of *t'hom* "of the great deep." This particular usage might well apply to the Genesis flood. Ex. 15:5 and 8 uses *t'hom* to describe the divinely restrained waters held back to allow Moses to lead the children of Israel to cross the Red Sea before Pharaoh. In Psa. 78:15, "the great depths" describes where the waters came from when Moses struck the rock and it clave (*baqa'*). It could also describe the condition of the water issuing forth from the rock. (See the previous section for the discussion of *baqa'*.)

Thus, the writer of Gen. 7:11 chose the specific word *t'hom* to clearly picture the flood waters as being a large quantity of water in violent commotion.

### Rain

Gen. 7:12 describes the rains associated with the flood. "And the rain was upon the earth forty days and forty nights." Two Hebrew nouns are usually translated "rain." The first word is *matar* "rain." *Matar* is a general word that can be used to describe a rain of any kind. In Ex. 9:18 *matar* describes a violent rain, in Gen. 7:4 *matar* describes the rain of the Genesis flood, and in Deu. 28:12 *matar* describes a normal light rain. If the writer of the Genesis flood account had used *matar* exclusively to describe the Genesis flood, we would not know what kind of rain was meant, because the word *matar* is too general. He didn't. He used the Hebrew noun *gesem* which denotes a violent, heavy rain, as distinct from *matar* which denotes any rain. *Gesem* is derived from the Hebrew verb *gasam* which means "to rain, especially with violence." Two verses serve as good examples of the distinctive force of *gesem*.

In I Kings 18:45, Elijah had prayed for rain to end the 3½-year drought after the destruction of the prophets of Baal. The result was a *gesem* "rain." It was such a torrent that Ahab's chariots bogged down and

Elijah on foot ran past Ahab in his chariot. In Eze. 13:11 and 13 the rain translated "overflowing shower" is not an ordinary rain, but is violent enough to destroy mortared walls. It contains stormy wind and great hailstones. This could be a clue to the nature of the Genesis flood.

The rain of the Genesis flood was not a gentle rain shower. Rather, it was such a violent rain that the specific Hebrew noun used to describe it was the noun for the most violent rain in the Hebrew language.

### Exceedingly

*M'od* means "exceedingly." The word is fairly common in the Bible. It occurs in the books of Genesis, Numbers, Deuteronomy, I Samuel, I and II Kings, Isaiah, Job, Psalms, Ezra, Daniel, and II Chronicles. Its only use in Genesis other than the ones to be explained is in Gen. 1:31 where God states that the entire creation is very (*m'od*) "good."

In only two instances in the entire Old Testament is the Hebrew adverb *m'od* doubled. In these two instances, it appears in the form *m'od m'od*, "exceedingly exceedingly." This doubled superlative construction is the form used to express the greatest possible emphasis. Both uses of *m'od m'od* occur in Genesis. The first instance of *m'od m'od* occurs in Gen. 7:18 and 19 to describe the flood waters.

"And the waters prevailed, and were increased greatly (*m'od m'od*) upon the earth; and the ark went upon the face of the waters. And the waters prevailed exceedingly (*m'od m'od*) upon the earth; and all the high hills that were under the whole heaven, were covered."

The translator's "greatly" and "exceedingly" in these verses are ridiculously temperate. In view of the doubled superlative construction, the maximum possible emphasis is intended here. The writer does not describe waters that increased only "greatly." Rather, he describes an unimaginable explosion of water everywhere. This unbelievable explosion and increase of water during the flood was like unto only one other event in the Old Testament.

The only other Old Testament instance in which the double construction *m'od m'od* is used is in Gen. 17:2, 6, and 20 where God makes a covenant with Abraham. God promises to multiply Abraham's children, *m'od m'od*.

That, like the one unique flood, is an unbelievable increase, because of maximum possible emphasis in the Hebrew. The increase promised by God was from no children at that time to an entire nation that could not be numbered.

The magnitude, severity, and uniqueness of the Genesis flood is described in the Hebrew with the unique usage of the maximum emphasis possible in Hebrew, the doubly emphatic superlative.

### Prevail

*Gabar* in the Qal stem means "to be strong, to prevail." The verb is translated "prevail" everywhere it is used in the account of the Genesis flood. In the flood account it is used in Gen. 7:18, 19, 20, and 24. In each verse *gabar* is used in the Qal stem. *Gabar* in the Qal

stem is used only four other times in the entire Old Testament. Therefore, its use seems to be special. It is of interest to examine the other places that use *gabar* in the Qal stem.

In Gen. 49:26, Jacob blesses Joseph. Jacob says that his blessing prevails over (*gabar*) the blessing of his ancestors. One blessing thus covers up another blessing. This is the only use of *gabar* in Genesis other than the flood account. In Ex. 17:11, Israel was at war with Amalek. When Moses lifted his hands, Israel prevailed (*gabar*), otherwise Amalek prevailed. One force thus overcomes another force. In II Sam. 1:23, in a song of lament, David cries that Jonathan was stronger than (*gabar*) the lions. This is another use of the concept of one force overcoming another force. In Job 21:7 there is a general reference to the strength (*gabar*) of the wicked overcoming the righteous. These verses contain all of the Qal stem uses of *gabar* in the Old Testament, excluding the flood. From them one can surmise that *gabar* in the Qal means that one force overcomes another or conquers another or covers up another. What do these concepts mean when applied to the flood account that uses them?

In the Genesis flood account *gabar* of water over land pictures water completely covering up all of the land. One could say the force of the waters overcame the land, or that the waters conquered the land, or that the water covered up the land and made it null and void. The only picture consistent with the use of *gabar* in the Qal stem in the Genesis flood is a picture of a very deep, totally worldwide flood that completely overcame all land.

### Upward

Gen. 7:19, 20 states: "And the waters prevailed exceedingly upon the earth; and all the high hills, that were under the whole heaven, were covered. Fifteen cubits upward (*mil'ma'lah*) did the waters prevail; and the mountains were covered." These verses seem at odds with each other. Verse 19 states that all the high hills were covered by water. Verse 20 says after that even the mountains were covered by water. However, verse 20 also states that the flood waters rose only 15 cubits. A cubit is approximately one-half a yard, so that we have a very unusual situation. A worldwide flood covered all the mountains, but the flood was less than 10 yards deep. What was the writer trying to tell us in these verses?

To answer the question, we must examine the Hebrew word, *mil'ma'lah* translated "upward" in verse 20. The same Hebrew word appears a few times in books other than Genesis (Ex. 25:21; 26:13; 36:19; Josh. 3:13, and 16), but it appears only one other time in Genesis. One chapter earlier Noah was building the ark. In this location *mil'ma'lah* is associated with a numerical value just as it is in Gen. 7:20. None of the non-Genesis uses of *mil'ma'lah* are associated with numerical values, so they are of little help here. The other use of *mil'me'lah* in Genesis is in 6:16, "A window shalt thou make to the ark, and in a cubit shall thou finish it above (*mil'ma'lah*); and the door of the ark shalt thou set in the side thereof; with lower, second, and third stories

shalt thou make it." To what technical dimensions is God referring here as he instructs Noah in the construction of the ark? What does the Hebrew word *mil'ma'lah* mean?

*Mil'ma'lah* is derived from the Hebrew word *ma'al*, which has an unused root meaning of "higher, the higher part." The word is found in the Hebrew Old Testament only with prefixes attached. It is found with the prefix *mi(n)* attached in the form *mima'al*. In this form it usually means "from above." It can also have the suffix *ah* which indicates direction. There is no need to supply an English word for the *ah*, only to remember that its presence indicates a direction. With an additional prefix *l'* "to" it appears in the form *l'ma'lah* translated "upwards," literally, towards upwards. The most altered form of the Hebrew word is the form having both prefixes and the directional suffix. This is the form *mil'ma'lah* "upward" that it is used in Gen. 7:20 and in Gen. 6:16. In this form the word literally means, "from the above," "from the thing that is above," or "from the top." In this light, use of the word in Gen. 6:16 makes clear sense. In Gen. 6:16, the thing that was above the window was the top of the ark. God was telling Noah to finish the window so that it was no more than one cubit from the top of the ark. This was of great importance, because the ark would probably float low in the water. The violence of the flood would produce waves high enough to sink an ark with low open windows. God told Noah to make the windows high enough so that the flood waters would not get in as the waves pounded. This interpretation of *mil'ma'lah* makes the rest of the verse make more sense, too. Since the windows would be high in the ark, the second and third floors would naturally be below the windows. That is where God told Noah to build them.

What would Gen. 7:20 mean if the amplified translation of *mil'ma'lah*, "from the top" were used instead of the brief translation "upward?" The verse would read, "Fifteen cubits from the top of the ark did the waters prevail; and the mountains were covered." The conflict is resolved. The waterline of the ark, as it rode the flood waters came halfway up to the 30-cubit-tall ark. The verse further states that the flood covered the mountains. The 15-cubit dimension does not refer to the depth of the waters from the surface of the earth, but to the draft of the ark in the flood waters.

### Continually

Gen. 8:3 tells us that "the waters returned from off the earth continually (*halok w'sod*); and after the end of the hundred and fifty days the waters were abated." Two verses later the Bible states, "And the waters decreased continually (*halok w'hisor*) until the tenth month: in the tenth month, on the first day of the month, were the tops of the mountains seen." The flood waters were not tranquilly seeping into the soil as these verses in English translation would seem to say. The Hebrew words translated "continually" explain the actual condition of the decreasing flood waters.

The "continually" in Gen. 8:3 is actually a translation of *two* Hebrew verbs in the infinitive absolute form. The two verbs are *sub*, which means, "to turn

about, to return," and *halak*, which means "to go." The two verbs describe a going followed by a returning. The infinitives alone are used to express *emphasis* and *duration*.<sup>3</sup> Thus we do not get a picture of water that tranquilly seeped into the soil. Rather, the flood waters moved going and coming a vast amount. Since Noah was viewing an ocean of water, the picture given by the double-infinitive construction of these two verbs describes a motion such as the waters of Tampa Bay suddenly draining out into the Gulf of Mexico, only to return roaring back and overflowing the bay and the city moments later. The "ing" suffix is deserved. The duration interpretation of the infinitive is intended. A single coming and going of the flood waters could be properly written in the perfect tense. If the imperfect tense had been used, the reader of the Hebrew text could easily mistake the water movement as a single coming and going sequenced in with the rest of the narrative. However, the specific double-infinitive construction seems to be used to describe unmistakable continual action coming and going and coming and going, etc. The tremendous hydraulic and erosional forces would quickly change the surface of what used to be the earth thousands of feet beneath the ark. This huge force possibly continued for three months as the ark remained on top of the mountain. Then in Gen. 8:5, the day that the first mountain tops were seen was the first day that the waters decreased continually (*halok w'hisor*). It is important to note that the pair of Hebrew infinitives translated "continually" is different here from what it

was in verse 3. The construction of a pair of infinitive absolutes is the same, but the final verb of the pair has changed from "returning" (*sub*) to "lessening" (*hasar*). It seems that the flood waters continued their wave motion, but each time a bay of water would surge off into the distance, it would not return. Instead, the top of a mountain would be exposed.

The writer chose the double infinitive Hebrew construction purposely. He used it to clearly describe the magnitude and continued duration of the giant water movements during the flood. These water movements were enough to erode or deposit miles of material. The forces were enough to wrinkle the crust of the earth.

### III. Conclusion

The special words and constructions that appear in the Hebrew account of the Genesis flood add special emphasis to the English translation. Once the Hebrew description is understood, the Genesis flood is unquestionably a worldwide catastrophe of unparalleled destruction, death, erosion, burial, and deposition in a very brief time.

### Reference

- <sup>1</sup>Gesenius, William. Hebrew and Chaldee lexicon. (Translation by Samuel Prideaux Tregelles, Eerdmans, Grand Rapids, 1967.)
- <sup>2</sup>Kittel, Rudolph, (ed.), 1962. *Biblia Hebraica*. Wurttembergischen Bibelanstalt, Stuttgart, Germany.
- <sup>3</sup>Weingreen, J., 1963. A practical grammar for classical Hebrew. Clarendon Press, Oxford. Section 42.

## The Necessity of the Canopies

(Continued from page 204)

- <sup>8</sup>Morton, Glen R., 1979. Can the canopy hold water? *Creation Research Society Quarterly*, 16 (3):164-169.
- <sup>9</sup>Westburg, V. Luther, 1979. Floodtime changes in the earth's heating and lighting, *Creation Research Society Quarterly*, 16 (3):182-184.
- <sup>10</sup>Dillow, Joseph C., 1978. Mechanics and thermodynamics of the pre-Flood vapor canopy, *Creation Research Society Quarterly*, 15 (3):148-159.
- <sup>11</sup>Kofahl, Robert E., 1977. Could the Flood waters have come from a canopy or extraterrestrial source? *Creation Research Society Quarterly*, 13 (4):202-205.
- <sup>12</sup>Akridge, G. Russel, 1979. Venusian canopy, *Creation Research Society Quarterly*, 16 (3):188-189.
- <sup>13</sup>Scheffer, Jim, April 1979. Pioneer Venus - report from the mysterious planet, *Popular Science Magazine* pp. 64-67, 172, 175.
- <sup>14</sup>Smith, E. Norbert, 1975. Body temperature regulation in reptiles, birds and mammals. *Creation Research Society Quarterly*, 12 (1):54-58. See especially p. 55.
- <sup>15</sup>Gilluly, J., A. C. Waters, and A. O. Woodford, 1968. Principles of Geology, Third Edition, W. H. Freeman and Co. San Francisco and London, pp. 368, 369.
- <sup>16</sup>*San Jose Mercury News*, San Jose, California, Sunday, November 11, 1979, from the Associated Press.
- <sup>17</sup>Berlitz, Charles, 1972, *Mysteries from Forgotten Worlds*, Doubleday & Co., Inc., Garden City, New York, Chapter VI.

<sup>18</sup>*Ibid.*, p. 100.

<sup>19</sup>Nevins, Stuart E., 1974. Post-Flood strata of the John Day Country, northeastern Oregon, *Creation Research Society Quarterly*, 10 (4):191-204. See especially p. 203.

<sup>20</sup>420 feet of liquid water making up the canopy would be enough to raise the sea level 400 feet from post-Flood low to today's level, plus 200 feet more which is what is estimated should all the ice melt. If the pre-Flood canopy had the same amount, the 40 days of rain would have been at the rate of 5.25 inches per hour.

<sup>21</sup>Oard, Michael J., 1979. A rapid post-Flood ice age, *Creation Research Society Quarterly*, 16 (1):29-37. Undoubtedly, many of the factors described by Oard were at work while the canopy was being emptied and afterward.

<sup>22</sup>Dillow, Jody, 1977. The catastrophic deep-freeze of the Beresovka mammoth. *Creation Research Society Quarterly*, 14 (1):5-13.

## Panorama of Science

(Continued from page 227)

- <sup>1</sup>Cott, H. B., 1957. Adaptive coloration in animals. Methuen, London. Pp. 47-67.
- <sup>2</sup>Hailman, J. P. 1977. Optical signals: animal communication and light. Indiana University Press, Bloomington. Pp. 164-166.
- <sup>3</sup>Silberglied, R. E., A. Aiello, and D. M. Windsor, 1980. Disruptive coloration in butterflies: lack of support in *Anartia fatima*. *Science* 209 (4456): 617-618.

## IS LANGUAGE AN EXCLUSIVE ABILITY OF MAN?

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*One result of the acceptance of the evolutionary theory is a belief that the gap between man and the lower primates is much less than previously supposed. When it was believed by most scientists that man was a direct creation by God, man was seen to be clearly distinct and different. Evolution on the contrary, stresses a continuity between the lowest form of life and the highest. Evolutionary theory has permeated virtually all of the sciences, and humanities, and even the study of language ability. For many years, it was accepted that language ability is unique to man and, that, biologically, animals do not have the brain structure or the speech mechanism needed to use language. This idea has been challenged for the past decade or so. New research, though, indicates that the older view, i.e. that there is a chasm between man and the animals regarding language ability, is probably more correct.*

Scientists and other researchers have always held that there is an unbridgeable chasm between humans and the animals. Man was seen to be unique in many ways, but his primary uniqueness was his "higher" level brain. It was felt that animals were able to learn, but their learning was very limited, and they could not even approach man's thinking ability or his language (although they could communicate via simple signs).

In the past century, a number of researchers, such as B.F. Skinner, have concluded that all behavior is learned via a simple behavioristic model, and this includes the behavior of both man and animals. Further, the behavioral learnings, or results, of man was not seen as drastically different from that of the animals. Skinner and others concluded that language and thinking are learned behaviors, which are learned according to the reward and punishment system of the environment, so that it was possible to teach animals how to use language if this system were exploited correctly. In the last twenty years, Noam Chomsky has compiled a great deal of research data and indirect evidence to counteract this belief. Chomsky claimed that the basis of language is biological, not learned, and that language is unique to man. Hence animals would never, regardless of the amount of training, learn to use a language.

In the last decade, Chomsky's position has been challenged by a number of researchers. Foremost has been the research which indicates that primates and other animals *are able to learn a language*, and are much closer to man in their thinking ability than was previously thought. If language can successfully be taught to primates (specifically chimpanzees and apes), this would bridge much of the chasm between man and the higher primates. Research by Kellogg<sup>1</sup> Desmond<sup>2</sup>, Premack<sup>3</sup> and Rumbaugh<sup>4</sup> indicated that, indeed, chimpanzees could learn both to use language and to read. Penny Patterson of Stanford University declared that "language is no longer the exclusive domain of man." Similarly, David Premack, whose famous chimp Sarah, learned to use a series of plastic chips, reported: "Sarah comprehended (and in a few cases produced) sentences formed by a process more demanding than that of combining phrases." Many more exaggerated claims came out in both the popular and the professional press, which claimed, in essence, that many primates possess a

language ability similar to that of man. It now seemed that the chasm between man and the primates was, at least relative to language abilities, bridged to a large degree.

Further study, though, and extensive examination of previous studies, have caused researchers to reevaluate the above revolutionary opinions, *lending support to the earlier position*, that there is, after all *an unbridgeable chasm between man and the animals*.

An article in *Time* stated<sup>5</sup>

"though a few experts express skepticism, these claims of the ape's linguistic ability were widely accepted during the 1970's. But now many scientists are beginning to have second thoughts. They suggest that much of what the animals are doing is merely mimicking their teachers and that they have no comprehension of syntax. What is more, they say, the primate experimenters are probably eager to prove their case, so that they often provide inadvertent cues to the animals, who quickly realize that 'right' answers will bring them some goody. In short, the skeptics raised the possibility that the apes have been making monkeys out of their human mentors."

One of the first researchers to question the belief that "monkeys could talk" was Wilson<sup>6</sup>. Wilson relied primarily upon his own reading and a critical examination of most previous studies. Those directly connected with the research he used, though, insisted that chimps can read, "think" and "talk" much like humans.

The first researcher directly involved in primate research seriously to question the position that some primates can use language was Dr. Herbert S. Terrace, a professor of psychology at Columbia University, with a doctorate from Harvard under B. F. Skinner. He has concluded from his extensive research that the earlier position is most probably correct. Terrace's work is significant in that he is a secular researcher, and has published his works in the secular press, both in the popular *Psychology Today*<sup>7</sup> and the book *Nim*.<sup>8</sup>

In Terrace's own words, he describes his experience<sup>7</sup>

After a five year research project of (my) own I became skeptical about such pronouncements. When I began my study with a male chimp called Nim Chimpsky, I hoped to demonstrate that apes can, indeed, form sentences. I wanted to go beyond the anecdotal evidence reported by other studies and show that grammatical rules are needed to describe many of an ape's utterances. Initially, the

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regularities I observed in thousands of Nim's communications in sign language suggested that he was, in fact, using grammar. However, after analyzing videotapes of his 'conversations' with his teachers, I discovered that the sequences of words that looked like sentences were subtle imitations of the teacher's sequences. I could find no evidence confirming an ape's grammatical competence, either in my own data or those of others, that could not be explained by simpler processes.

Although it is recognized that many animals can communicate via song, certain noises, and other means, human language is distinctive from animal communication because of its use of *sentences*. The concept of "sentence" usually suggests using a set of words or symbols to communicate *according to their position within the total set of words; i.e., there is grammar. The meaning of words can be learned individually, but sentences can not. Instead, a person must master grammatical rules*, which allow meanings to be conveyed by arranging a set of words in certain orders. Thus, *concepts*, such as subject, verb, preposition, pluralization, etc., individually must be mastered. The sentence "Frank threw a ball at Larry," contains the same words as "Larry threw a ball at Frank," but means something entirely different, as does the sentence, "Larry threw Frank at a ball," or, "Frank threw 'a' at Larry Ball."

Because all primates are physically incapable of producing the broad range of sounds that exist in most of man's languages, most researchers have used various signs or symbols to teach primates to "talk" and "think." For example, the word "apple" may be represented by a triangular piece of blue plastic, or the pressing of the knuckle of the index finger into the cheek and twisting it forward.

Using these symbols, apes have been able to produce sequences which make sense to humans, such as "Mary gives Sarah apple." Nonetheless, we must determine whether or not "such sequences were actually generated by a grammar." Terrace<sup>9</sup> concludes that: "It is difficult to answer this question, if for no other reason than that linguists have yet to devise a decisive test of whether a sequence of words constitutes a sentence. Even if an animal produced such a sequence, we could not conclude that it was a sentence . . . when viewed in the larger perspective of the monkey's total output, meaningful sequence (can often be) seen as *chance utterances*." As he further notes: "Although the words and word order may be meaningful to an English speaker, they may be meaningless to the animal producing them."<sup>10</sup>

Terrace concludes that the assumption that primates are able to create elementary sentences is at least premature for other reasons also. One important such reason is that the word order which was given by the animal was sometimes changed in the final report in order to make it conform to the rules of English. Thus, as Terrace points out: "The combinations 'more drink' and 'drink more' were both recorded as instances of 'more drink.'" Clearly, if both the symbols for "more" and "drink" were rewarded, it could be expected that *both signs would occur in the same utterance* without

the animal actually purposely combining them to produce a "sentence."

In addition, it was *assumed* by some researchers that (e.g.), the sight of a swan caused the chimpanzee to create a new word from separate words, namely, "water" and "bird", in a novel manner. Yet, there is *no way of knowing* whether or not "water" and "bird" are actually *unrelated* signs, *each* appropriate to a separate stimulus received, or whether they were the result of a true "new word" construction.

Actually, when the chimp was shown a swan, and responded "water bird," it was not clearly known *why* the chimp responded this way. The chimp could have responded to conditioning by seeing water, and respond with "water," and also seeing a bird, have responded with "bird." Or, the chimp could have responded to "water," and because of not being rewarded for this response try again with "bird," with the hope that this time he will receive a reward. The primates were trained primarily by conditioning, i.e., responding with the appropriate sign when the appropriate stimulus was presented, then were rewarded only if correct. If incorrect, lack of a reward could be seen as "punishment" for a wrong answer. Regardless of what signs were given, we cannot conclude that the animal purposely put them together in order to convey a "new" idea.

The same could be true with other symbols, such as "blue line" or "big doll." The chimp could be responding totally to conditioning, i.e., responding "blue" because the line is blue, and "line" because the blue object is a line. This simple conditioning is *not* clear proof that the primates were learning a language, but only an example of a characteristic that is present in all animals (conditioning).

Analyzing the signing process indicates that typically the teacher tries to initiate signing, and that then *the chimp learns that the more rapidly it signs, the more rapidly it can obtain what is wanted*. Therefore, it seems evident that the chimp is not specifically communicating with the teacher, but eliciting somewhat random responses through which it hopes to obtain some reward—and the faster the responses, the *more likely the chimp will be rewarded*. For this reason, the chimp puts words together in what has been interpreted by researchers as a sentence, but actually the chimp may simply be spewing out a large number of signs in an effort to produce "The right one" so as to be rewarded. Terrace notes that "From the chimpanzee's point of view, the teachers' signs provide an excellent model of the signs it is expected to make. By simply imitating a few of them, often in the same order used by the teacher, and by adding a few 'wild cards' . . . the chimpanzee may well produce utterances that appear to follow grammatical rules." "In short, the primates seem to be simply mirroring the signs of its teachers, and its behavior is really nothing more than conditioning and does not even *approach* the level of behavior exhibited by a human child.

As noted above, Terrace's *original* research was undertaken to *confirm* the conclusion that primates could learn a language. He himself stated, at first: "The more I analyze Nim's (the chimpanzee's) combinations,

*the more certain I felt I was on solid ground in concluding that they were grammatical and that they were comparable to the first sentences of a child*" (emphasis mine). Further research, though, caused him to question this conclusion. In Terrace's words, "it was not until Nim was returned to Oklahoma Institute for Primate Studies. . . that I became skeptical of that conclusion." In analyzing the data, he then concluded that there were "a number of important differences between Nim's and a child's use of language." Some of these differences were as follows:<sup>12</sup>

- 1) The average length of Nim's utterances fluctuated between 1.1 and 1.6 signs, and there was no increase in their length. Children, when they begin combining words, enunciate short utterances; but in time, quite soon, in fact, the *average length increases*. Terrace reasoned that "despite the steady increase in the size of Nim's vocabulary, the *mean length of his utterances did not increase*."
- 2) The *maximum length* of a child's utterances is very reliably related to their *average length*. As a child uses longer sentences, the average length increases. On the other hand Nim's utterances showed no such relationship.
- 3) Extensive research by Richard Sanders showed that Nim's signing with his teachers "bore only a superficial resemblance to a child's conversations with his or her parents."
- 4) Very few, only 12%, of Nims' utterances were spontaneous, whereas a significantly larger proportion of a child's utterances are spontaneous.
- 5) As the child matures, his/her utterances which are full or partial imitations decrease to zero percent by the time the child is three. On the other hand, when Nim was 26 months old, 38% of his utterances *were* full or partial imitations of his teachers, and when he was 44 months old, the *proportion had actually risen to 54%*, showing an inverse relationship!
- 6) Another difference was found in that children generally involve themselves in two-way conversation, i.e., they add information to the proceeding utterance. On the other hand, Nim rarely added information and showed no evidence of "turn taking," but primarily repeated what was given him.
- 7) There is also clear evidence that prompting (possibly conscious) by the teacher influenced the chimp's so-called "original responses," and that this was *not* the chimp's own thought process.
- 8) And, lastly there had evidently been much misinterpreting of the chimp's signs. It is necessary to film the entire sequence, preferable focusing on the face expressions, etc., of both the researcher *and* the primate. In many, if not most, cases, this evidently was not done.

Sebeok noted that when Coco (a female gorilla worked with by psychologist Patterson at Stanford University) gives the sign for drink and makes the proper gesture, but touches her ear instead of her mouth, it was assumed that the gorilla did not make a mistake but "was joking!"<sup>13</sup> If Coco smiles when asked to frown, it was assumed that she was displaying an understanding of opposites! Such interpretations could purport to prove anything.

### The Controversy

This controversy is so involved that *Time* states that it is "now the center of a raging academic storm."<sup>14</sup> It has even gotten to the point where, according to the *Time* magazine quoted above, the Gardeners, monkey researchers, have considered suing Terrace.

Terrace is not the only psychologist critical of the belief that primates other than man are able to use language. Linguist Thomas Sebeok and his wife, anthropologist Donna Jean Umiker-Sebeok, both at Indiana University, maintain that much of what passes for language skill in apes can just as well be explained by the "Clever Hans" effect.<sup>15</sup> The "Clever Hans" effect is named after a German circus horse that astounded audiences at the turn of the century by tapping out with his hooves the correct answer to complex mathematical and verbal problems. It was found, however, that the horse, Clever Hans, was actually picking up unintentional cues, primarily posture and facial expression (but also possibly breathing patterns and eye-pupil size) from the questioner, who knew the answer and unintentionally conveyed to the horse when to stop stomping.<sup>14</sup> This may be done quite unconsciously, but nonetheless the information was evidently conveyed.

The famous husband and wife team of researchers at Georgia State University, Duane and Susan Rumbaugh, concluded "there is no solid evidence to date that would indicate that the ape is capable of using syntax with competence." And the famous Noam Chomsky concluded "It's about as likely that an ape will prove to have a language ability as that there is an island somewhere with a species of flightless birds waiting for human beings to teach them to fly." This comment refers to the fact that Chomsky does not believe any animal aside from man has the innate ability to use language—Chomsky feels that language ability is biologically unique to humans, including the ability to conquer syntax, and link words into sentences, however simple.

### Summary

There is much evidence to indicate that the original assumptions that chimpanzees and some primates are able to learn language, and therefore the assumption that language is no longer the exclusive domain of man, is at least premature. This assumption was based partly, if not mostly, on evolutionary theory; and was an attempt to decrease the chasm between man and higher primates. Further research, especially that of H. S. Terrace and others, has indicated that this assumption is incorrect. Critical examination of the ape-chimpanzee language studies finds that there are a number of explanations for their seeming production of language that are both simpler, and more empirically supportable, than the assumption that primates are able to use and create language.

### References

- <sup>1</sup>Kellogg, Winthrop N., 1973. Communication and language in the home-raised chimpanzee.
- <sup>2</sup>Desmond, Adrian J., 1979. The ape's reflection. The Dial Press.

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## IS THE ABILITY TO USE LANGUAGE UNIQUELY HUMAN?

JOHN W. KLOTZ\*

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*More and more evidence is appearing to show that the claims to have taught apes a language, which were heard so commonly a few years ago, are at least premature, and most likely unfounded. It still appears that language is an exclusively human ability.*

There is no doubt that there are many similarities between man and other animals and that the number of similarities is largest when man is compared with the anthropoids. Evolutionists have had a field day in listing the similarities and in challenging creationists to deny that they are evidence of descent from a common ancestor. Actually, though, there is no reason why God should not have used the same general plan in creating many, if not most, of His creatures. Why be so arrogant and dictatorial as to demand a separate plan and design for each kind? A common general plan with the same DNA and the same metabolic processes is not evidence of a common origin but rather of a skillful and wise Creator.

What critics conveniently forget, moreover, is that there are also many differences between man and the anthropoids, most of which are probably of little significance but some of which are important. For instance, man has relatively short arms but a relatively long thumb. He has a bridge on his nose and a prominent nasal tip. His head is hinged to the top of his spinal column, not on the side. He lacks thumbs on his feet. All three of his molars are of approximately the same size and his canine teeth project little if at all below the level of the molars.

Perhaps the most significant difference between man and the anthropoids is man's ability to use language and to develop a culture. He can communicate in abstract terms and can convey concepts. It is true that many animals communicate. They warn, they call attention to food, they use sounds to teach their young. However, until recently it was believed that only man could really use language and that this fact accounted for the culture which he has developed and for his ability to learn vicariously from the past. Because of this ability to use language only man has a history which he can pass on to his children and descendants.

Of course, there is a long history of attempts and claims to communicate with animals.

Early efforts to teach animals to communicate in the fullest sense of the word were unsuccessful. From time to time there were animals that were supposed to be able to think, to reason and to communicate. By 1937 there were more than seventy so-called "thinking" animals: dogs, cats, and horses. In the 1950's a number of such claims were made for dolphins. Of late, however, most of the claims have been made for chimpanzees and gorillas. One chimpanzee eventually learned to make and to recognize 125 signs. Psychologists from the University of Nevada taught a chimp named

Washoe to use 132 signs. A female gorilla named Koko is reported to have learned more than 400 signs.

Originally efforts to teach primates, particularly chimpanzees and gorillas, to communicate were unsuccessful. These early efforts failed, it was suggested, because the animals are physiologically incapable of producing the sounds needed for vocal speech. Then came the idea of teaching communication by other than sounds. In the 60's there was a wave of attempts to teach American sign language, and other types of language which do not require vocalization, to what were believed to be man's closest relatives.

But are these anthropoids able to use language as man does? Part of the problem is the philosophical one revolving around the question of the nature of language. There is still no general agreement about what does or does not constitute language. Are these apes communicating? Are they using words or symbols? Can we determine what an ape is thinking when he does use a sign or some other symbol? Do apes have the same interests and concepts we have? Do they understand such things as work and play, love and hate, life and death? Or are they responding to conditioned reflexes—probably the most common current explanation.

While there is still a lack of agreement as to what constitutes language, most linguists agree that two elements are necessary: first, the words or signs must be symbols for something and recognized as such by the user, and second, the words must be combined with one another to form novel phrases or sentences that are understandable by others. The second criterion requires that there be at least rudimentary grammatical rules and that these be followed.

Two general ways for studying the problem of animal language have developed. Some investigators use American sign language with their animals. They raise gorillas or chimpanzees in a highly social, family-like environment in which the animals are exposed to sign language in much the same way as human infants who are deaf are exposed to sign language. These investigators assume that language is a social behavior developing out of the parent-infant bond. Later the apes' linguistic capacities are assessed by comparing their language development with that of human children.

Other investigators have developed artificial languages for testing the communicative abilities of chimpanzees. One of these has used a set of plastic chips of various sizes, shapes and colors to represent words. Another team has developed a system of geometric symbols which they call lexigrams and which are displayed on the keyboard of a computer. The computer records every use of the lexigrams by the chimpanzees. Their

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results have not been as successful as those of investigators who use sign language.

Proponents of these two approaches have regularly criticized the methods of the other as flawed, because they are subject to cuing of the animal's responses by the investigators. This criticism is especially interesting in the light of the general criticisms which have emerged lately, for the latest research suggests that these anthropoids are not learning to use language at all; but rather that what have been interpreted as instances of language usage are actually responses to conditioned reflexes. One investigator suggested that all of these are really instances in which *Homo sapiens* was made the servant of the apes. The animals have learned that the use of certain signs or symbols are ways of securing a reward, and it is this reward that they seek rather than the communication of a thought or concept. Through these signs or symbols the crafty ape obliges man to supply what he wants.

Much has been made of the development by anthropoids of sentences or word combinations. One is said to have designated a watermelon as a "drink fruit," a swan as a "water bird" and a zebra as a "white tiger." It is possible, though, that these are not instances of sentences or word combinations. The ape may have seen the swan swimming in the water and have been moved first to sign the symbol for "water" and then the symbol for "bird."

One complication has been the subjectivity of researchers in selecting their evidence. For instance, one anthropoid was asked to give the sign for "drink" and made the proper gesture except that he touched his ear instead of his mouth. One psychologist explained this deviation by assuming not that the animal was making a mistake but that he was joking. If the animal smiles while asked to frown he may be said to be displaying a "grasp of opposites." Obviously if mistakes can be explained in this way, a wide variety of what appeared to be mistakes at first glance can actually be used to support the individual's thesis and to demonstrate that apes do show insight and can use symbols;<sup>1</sup> indeed, such arguments could purport to prove anything.

Perhaps some of the most significant studies are those which have been carried on with a young chimpanzee named "Nim." His full name was "Nim Chimpsky", a play on the name of Professor Noam Chomsky of Massachusetts Institute of Technology, a staunch proponent of the idea that language ability is biologically unique to humans. The researcher, Herbert Terrace, expected to be able to prove Chomsky wrong and to show that creatures other than man could indeed conquer syntax and link words together into sentences.

Nim was put through forty-four months of intensive sign language drill and treated as a child. While the initial results seemed favorable, Terrace reports that Nim never mastered even the rudiments of grammar or sentence construction and that his speech did not grow in complexity. Phrases spoken by children increase both in length and complexity as they grow older; the average length of Nim's utterances remain stuck at around 1.5 signs during the last two of the four years he underwent training. Moreover 88% of the time he talk-

ed only in response to specific questions from his teacher.

As a result of these findings Terrace began to review the reports and video tapes of other experimenters and reached the conclusion that there were rarely any "spontaneous" utterances. What seemed at first glance to be original sentences emerged largely as imitations of signs made by the teacher or responses that the anthropoid had learned to associate with reward. Indeed, Nim himself in as many as 40% of the cases merely repeated the signs made by the trainer without adding new ones of his own. Even when he expanded on the signs used by his trainer, he tended to use signs that did not add any new information.<sup>2</sup>

Terrace's work has been criticized because he used some sixty trainers, many poorly trained in American sign language. His opponents charged that communication is the binder of a relationship such as that between Nim and his trainers. By having so many changes critics have charged that the relationship necessary for a language to develop was disturbed and de-emphasized. Terrace, however, has pointed out that in spite of the changes there was a core group of about six persons who did most of the training and of whom Nim became quite fond. This was approximately the same size as the groups that have worked in training other apes.

Many of these developments with anthropoids are now believed to be instances of the "Clever Hans" effect. Around the turn of the century a retired school teacher by the name of Wilhelm Von Osten exhibited a German horse which could apparently count by tapping out numbers with his hoof. There is little doubt that Von Osten sincerely believed he had taught Hans to solve arithmetical problems and to add and subtract. What he didn't know was that he was involuntarily providing the horse with cues as to when he should stop his hoof taps. Apparently in most cases Von Osten gave an unconscious cue by moving his head ever so slightly; and Hans was able to detect head movements as slight as 1/5 of a millimeter. In other cases there were changes in facial expression, breathing patterns, or even eye pupil size, so that Hans learned when he needed to stop stomping.

Man has great difficulty in being objective. He often finds what he is looking for. The dolphin communication studies of the 50's have now been discredited. It is believed that the dolphins' behavior can be influenced by the use of positive conditioning and that the investigators were using this method without being aware of it. Similarly some believe that police dogs are not the excellent trackers they are purported to be but that they respond to unwitting clues provided by their handlers. Thus reported instances of apes learning the sign language may be due to "the age-old burning desire of mankind to take up language contact with animals."

So the purported ability of apes to learn language and to communicate in sentences seems to be another instance of wishful thinking, and the gap between anthropoids and man remains the same chasm that it was before these experiments were begun.

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## WHICH WOODY PLANTS GROW WHERE AT THE GRAND CANYON

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*This paper is a hiker's list of trees and shrubs at key places along certain of the South Rim trails at the Grand Canyon National Park. It also contains discussion of several patterns of distribution found among Grand Canyon woody plants; and these patterns are interpreted historically from the standpoint of scientific creationism and flood geology. Some hints at distinguishing between pairs of plants that resemble each other are also included.*

### Introduction

There are several excellent books in which plants of Northern Arizona have been thoroughly described and carefully illustrated. These books also designate altitude zones at which particular plants may be found. Learning the trees and shrubs becomes easier, however, if one has a checklist stating which ones are found in each exact locality.

In part I of this paper are lists of plants found at different points along the trails at the Grand Canyon. Attention centers on trees and shrubs rather than herbs because the former are present and easily identified throughout the entire year.

Altitudes, landmarks, and permanent trail signs are listed in sequence along the South Kaibab Trail to Bright Angel Campground. Next there is a similar survey of landmarks along the River Trail and the Bright Angel Trail up to and including sections of the South Rim. Plant lists are also provided for some areas of the South Rim and for the nearby settlement of Tusayan.

These trail materials of part I have been arranged on the assumption that the hiker will go down the South Kaibab Trail and up the Bright Angel Trail. One may use the lists in reverse if the opposite hiking pattern is selected.

While hiking these trails, one passes through a sequence of rock strata. A list of trees and shrubs for each whole rock layer is given first. Then the various altitudes and other landmarks within that particular rock span are given along with special assemblages of plants found here or there.

Altitudes may be measured with an inexpensive altimeter available at most sporting goods stores. The altimeter can be calibrated at the South Kaibab trailhead to 7200 feet. Recalibration may be carried out in keeping with altitude signs along the trail. It was my experience, however, that the altimeter readings were sometimes more accurate than certain of the altitude markings along the trail! Although there is a measure of inaccuracy and non-repeatability in this procedure, it helps to narrow the selection of trees and shrubs and thereby assists in the more rapid identification of woody plants. Common names are used for these plants in part I since people learning plants generally find the common names most useful.

In part II each plant is listed alphabetically as a separate entry with its full common name, scientific

name, and brief description. After each plant in part II there is also a statement regarding the life zones where it is usually found together with its general range in the Park. The plant is given a number in part II which corresponds to one of the numbered patterns described in part III.

Part II contains a discussion of plant distribution in reference to altitude and to the interpretive framework of special creationism and flood geology. Plants are assigned one of several numbered categories depending on their distribution.

Full and final identification of plants can be confirmed by use of several inexpensive books which may be carried in a day-pack and used in conjunction with this trail list. Some that I have found quite helpful are listed under general references.

Correspondence is welcome from any who wish to comment regarding the lists and their use along the trails. Possible additions, corrections, or suggested deletions are invited and will be considered when this publication is revised and expanded.

### I. Part I. Plants at Various Trail and Altitude Points, South Rim, Grand Canyon.

#### A. South Kaibab Trail

##### 1. Kaibab Limestone:

banana yucca, cliffrose, Douglas fir, Gambel oak, jointfir, pinyon pine, sagebrush, serviceberry, Utah juniper.

##### a. at trailhead:

banana yucca, cliffrose, pinyon pine, sagebrush, serviceberry, Utah juniper.

##### b. climate belt sign about 6900 feet altitude:

douglas fir, Gambel oak, jointfir, pinyon pine.

##### c. sign at junction of Kaibab Limestone and Toroweap Formation:

banana yucca, jointfir, pinyon pine, serviceberry.

##### 2. Toroweap Formation and Coconino Sandstone:

apache plume, banana yucca, cliffrose, douglas fir, jointfir, opuntia, pinyon pine, sagebrush, serviceberry, Utah agave, Utah juniper.

##### a. sign "South Rim 0.5 miles":

cliffrose, pinyon pine, serviceberry, Utah juniper.

##### b. 6800 feet altitude:

cliffrose, sagebrush.

##### c. 6600 feet altitude:

apache plume.

##### d. 6500 feet altitude:

jointfir, pinyon pine, Utah juniper.

##### e. 6400 feet altitude:

jointfir, pinyon pine, sagebrush, serviceberry.

##### f. sign at contact between Coconino Sandstone and Hermit Shale: (6300 feet altitude)

jointfir, pinyon pine, serviceberry, Utah juniper.

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3. Hermit Shale:  
banana yucca, Douglas fir, four-wing saltbush, jointfir, pinyon pine, serviceberry, Utah agave, Utah juniper.
  - a. sign "You can come down 1500": banana yucca, jointfir, pinyon pine, serviceberry, Utah juniper.
  - b. sign at junction between Hermit Shale and Supai Formation: cliffrose, jointfir, pinyon pine, serviceberry, Utah agave.
4. Supai Formation:  
ash, banana yucca, blackbrush, cliffrose, curl-leaf mountain-mahogany, four-wing saltbush, jointfir, pinyon pine, rabbitbrush, serviceberry, Utah agave, Utah juniper.
  - a. 5900 feet altitude, a "saddle": cliffrose, jointfir, pinyon pine, Utah juniper.
  - b. 5800 feet altitude: banana yucca, Utah agave.
  - c. 5400 feet altitude: blackbrush, Utah agave, Utah juniper.
  - d. 5300 feet altitude: pinyon pine still present.
  - e. 5200 feet altitude: cliffrose, four-wing saltbush, rabbitbrush, Utah juniper.
  - f. sign at contact between Supai and Redwall Limestone (about 4900 feet altitude).
5. Redwall Limestone:  
baccharis, banana yucca, blackbrush, catclaw, cliffrose, curlleaf mountain-mahogany, four-wing saltbush, jointfir, opuntia, pinyon pine, rabbitbrush, soaptree yucca, Torrey ephedra, Utah agave, wafer ash.
  - a. 4800 feet altitude: four-wing saltbush, Utah agave.
  - b. 4700 feet altitude: curlleaf mountain-mahogany, jointfir, Utah agave.
  - c. 4700 feet altitude, sign indicating 3.5 miles to South Rim, 3.8 miles to Phantom Ranch: catclaw, jointfir.
  - d. 4600 feet altitude: baccharis.
  - e. 4500 feet altitude: soaptree yucca, wafer ash.
  - f. 4200 feet altitude, sign discussing "unconformity" - purple rock of Temple Butte Formation visible: catclaw, four-wing saltbush, jointfir, rabbitbrush.
  - g. sign at contact between Muave and Bright Angel Shale: blackbrush, four-wing saltbush, jointfir, rabbitbrush, Torrey ephedra.
6. Bright Angel Shale, Tapeats Formation, and Shinomo Quartzite: baccharis, banana yucca, blackbrush, brittlebush, catclaw, four-wing saltbush, jointfir, opuntia, rabbitbrush, serviceberry, soaptree yucca, Utah agave, wafer ash.
  - a. desert animal sign 4100 feet altitude: catclaw, four-wing saltbush, rabbitbrush.
  - b. sign stating River Trail 2.4 miles: four-wing saltbush, jointfir, rabbitbrush, wafer ash.
  - c. 4000 feet altitude: blackbrush.
  - d. desert sign at 3900 feet: banana yucca, blackbrush, jointfir.
  - e. desert plant sign: blackbrush, catclaw, Utah agave.
  - f. emergency telephone: brittlebush, four-wing saltbush, jointfir.
  - g. sign at contact between Tapeats Formation and Shinomo Quartzite: brittlebush, jointfir, opuntia, rabbitbrush.
  - h. 3800 feet altitude: wafer ash.
  - i. Shinomo Ripple Mark sign at 3600 feet altitude: jointfir, soaptree yucca.
7. Hakatai Shale:  
brittlebush, catclaw, jointfir, opuntia, rabbitbrush.
  - a. sign "South Rim Trail 1.4 miles" 3500 feet altitude.
  - b. 3400 feet altitude: brittlebush, catclaw, jointfir, opuntia.
  - c. 3200 feet altitude: catclaw, jointfir, opuntia.
8. Bass Limestone: (marker at about 3100 feet altitude)  
brittlebush, catclaw, jointfir, opuntia.
9. Brahma Schist:  
brittlebush, catclaw, jointfir, soaptree yucca, Utah agave.
  - a. Brahma Schist sign at 2900 feet altitude: brittlebush, catclaw, jointfir.
  - b. Colorado River Sign at 2700 feet altitude: jointfir, soaptree yucca.
- B. Along the Colorado River from bridge to and including Bright Angel Campground:  
baccharis, brittlebush, catclaw, four-wing saltbush, mesquite, opuntia, rabbitbrush, tamarix, Utah agave, willow.
- C. River Trail from the western bridge to the upward ascent of Bright Angel Trail:  
baccharis, catclaw, jointfir, opuntia, rabbitbrush, soaptree yucca.
  1. Zoroaster Granite sign:  
catclaw.
  2. Wind and water sign:  
baccharis, catclaw, jointfir, soaptree yucca.
- D. Bright Angel Trail:
  1. Brahma Schist and Tapeats Sandstone:  
baccharis, blackbrush, brittlebush, California redbud, canyon grape, catclaw, four-wing saltbush, Fremont cottonwood, hollygrape, jointfir, opuntia, tamarix, Utah agave, wafer ash, willow.
    - a. 2500 feet altitude: catclaw, jointfir, opuntia.
    - b. 2600 feet altitude: Fremont cottonwood along creek catclaw, jointfir.
    - c. 2700 feet altitude: much jointfir here.
    - d. desert animal sign at 2700 feet: catclaw, jointfir.
    - e. 2900 feet altitude: California redbud.
    - f. polished rock sign: catclaw, jointfir, opuntia.
    - g. 3400 feet altitude: still have some tamarix along stream, jointfir, hollygrape.
    - h. 3800 feet altitude: wafer ash.
    - i. 3900 feet altitude: California redbud.
    - j. just above sign at contact between Tapeats Sandstone and Bright Angel Shale: blackbrush, brittlebush, Fremont cottonwood, jointfir, Utah agave.

2. Bright Angel Shale and Redwall Limestone: apache plume, ash, banana yucca, blackbrush, brittlebush, California redbud, catclaw, cliffrose, four-wing saltbush, Fremont cottonwood, hollygrape, jointfir, opuntia, pinyon pine, rabbitbrush, turpentine-broom, Utah agave, Utah juniper, wafer ash, willow.
  - a. sign before reaching Indian Gardens indicating 0.4 miles to Indian Gardens: apache plume, Fremont cottonwood.
  - b. juncture of Tonto Trail with Bright Angel Trail: apache plume, blackbrush, Fremont cottonwood, jointfir, Utah juniper, willow.
  - c. Indian Gardens area: apache plume, ash, blackbrush, brittlebush, California redbud, catclaw, cliffrose, four-wing saltbush, jointfir, opuntia, Utah agave.
  - d. flash flood sign above Indian Gardens: apache plume, catclaw, turpentine-broom.
  - e. 4100 feet altitude in ravine just above Indian Gardens: Utah juniper.
  - f. 4200 feet altitude: pinyon pine.
  - g. 4300 feet altitude: banana yucca.
  - h. 4400 feet altitude: apache plume, ash, Utah juniper.
3. Supai Formation: ash, banana yucca, currant, hollygrape, jointfir, opuntia, pinyon pine, serviceberry, shrub live oak, Utah agave, Utah juniper, wafer ash.
  - a. sign at contact between Redwall Limestone and Supai Formation at the 3 mile rest house, 5000 feet altitude: ash, jointfir, pinyon pine, serviceberry, Utah agave, Utah juniper.
  - b. sign indicating South rim 2.3 miles: banana yucca, currant, hollygrape, jointfir, opuntia, pinyon pine, shrub live oak, wafer ash.
  - c. sign indicating South Rim 2 miles, 5400 feet altitude: banana yucca, hollygrape, opuntia, pinyon pine, shrub live oak, Utah juniper, wafer ash.
  - d. sign with words "Do not cut across switchbacks" about 5700 feet altitude: banana yucca, hollygrape, jointfir, shrub live oak, Utah juniper, wafer ash.
4. Hermit Shale: ash, banana yucca, creeping mahonia, Douglas fir, gambel oak, jointfir, pinyon pine, serviceberry, Utah juniper, wafer ash.
  - a. sign at contact of Supai Formation and Hermit Shale, 5900 feet altitude: jointfir, pinyon pine, serviceberry.
  - b. thickets of Gambel oak exist.
  - c. rest house at 6200 feet altitude: pinyon pine.
5. Coconino Sandstone: bamama uicca, creeping mahonia, Douglas fir, Gambel oak, hollygrape, jointfir, pinyon pine, serviceberry, wafer ash.
  - a. sign at contact of Coconino Sandstone and discussing that sandstone, 6000 feet altitude: creeping mahonia, Douglas fir.
  - b. on the talus wedge: here one trudges up a triangular talus wedge that has a shorter and

shorter switchback up to the top which is a bowl of Coconino Sandstone: banana yucca, Douglas fir, hollygrape, pinyon pine, Gambel oak.

6. Kaibab Limestone: banana yucca, Douglas fir, fernbush, Gambel oak, hollygrape, jointfir, pinyon pine, serviceberry.
  - a. sign indicating transition from Toroweap to Kaibab Limestone: Douglas fir (dead), Gambel oak, hollygrape, serviceberry.
  - b. right near the South Rim and back a way at the trailhead of Bright Angel trail: banana yucca, fernbush, pinyon pine, ponderosa pine, sagebrush, Utah juniper.
  - c. walking along the road one sees many seedlings of pinyon pine and Utah juniper.
  - d. center strip in the road near Yavapi Point: fernbush, sagebrush, Utah agave.
  - e. other plants along road to the South Kaibab trailhead from the Bright Angel trailhead: banana yucca, pinyon pine, Utah juniper.
  - f. right at Mather Point: much cliffrose.

## II. Part II. Alphabetical List of South Rim Trail Woody Plants.

agave, see Utah agave.

apache plume, *Fallugia paradoxa*

Shrub. Short, brittle, mat-like, resembling cliffrose. Peely grey to reddish bark. Fruit with feathery appendage - dozens in cluster. Leaves like small mittens varying from one on up to 5 or 7 lobes. Type 7. See thumbnail sketch #1.

ash, *Fraxinus sp.*

Short tree. See also wafer ash.

baccharis, *Baccharis spp.*

Shrub. Leaves resemble willow. Many branches from close to ground level. Several species in Grand Canyon. Type 6 and 1.

banana yucca, *Yucca baccata*

Leaves up to 3 cm broad. Tip of leaf spearlike, margin of leaf has long white threads, unlike the margin of a similar plant - Utah agave which is saw-toothed. Broad leaves easily separate it from the other Grand Canyon yuccas.

barberry, see creeping mahonia.

blackbrush, *Coleogyne ramosissima*

Shrub. Leaves slender, linear, of various sizes. Branch tips sharp. Great numbers of blackbrush plants from a distance look like huge flocks of sheep scattered out on the Tonto Plateau. Type 7. See thumbnail sketches #2.

brittlebush, *Encelia farinosa*

Short shrub. Much branched. Flowers showy, yellow, resembling little sunflowers. Type 6.

burrowbrush, see blackbrush.

California redbud, *Cercis occidentalis*

Short tree. Leaves heartshaped, rounded. Bark dark grey. Pods reddish when dried. Buds and flowers red in Spring. Type 7.

canyon grape, *Vitis arizonica*

Vine.



catclaw, *Acacia greggii*

Short tree. Stem with backward pointing spines and linear grey-brown stripes. Leaves doubly compound, subleaflets up to 5 mm long. Pods brown, indented, twisted. Type 5. See thumbnail sketches #3.

century plant, see Utah agave.

cliffrose, *Cowania mexicana*

Dwarf tree or shrub. Leaves small, variably shaped but many look like three-fingered mittens. Leaves with small white dots. Fruit with a tail. Cliffrose leaves resemble those of apache plume but fruits of cliffrose are borne farther down in a more trumpet-shaped flower tube than apache plume. Cliffrose fruits in clusters of 5 while apache plume fruits in clusters of many more than 5. Old cliffrose plants at Mather Point resemble Utah juniper but a close look at the leaves will distinguish. Type 8. Thumbnail sketches #4.

cottonwood, see Fremont cottonwood.

creeping mahonia, *Berberis repens*

Small shrub, close to ground. Leaflets with spines like hollygrape. Type 10.

curleaf mountain-mahogany, *Cercocarpus ledifolius*

Shrub or short tree. Leaves slender, grey-green, rolled under along the edges, approximately 3 cm long. Older bark peels off in small chunks. Type 7.

currant, *Ribes sp.*

Type 7.

datil, see banana yucca.

douglas fir, *Pseudotsuga menziesii*

Tall trees. Leaves are needles which are not bound together in clusters but are spaced singly along the stem. Evergreen. Small cones have forked leaf or "bract" under each scale. Type 10.

ephedra, see jointfir and Torrey ephedra.

fernbush, *Chamaebatiaria millefolium*

Leaves small, divided into many sections and resembling a miniature fern leaf. In winter resembles sagebrush but has a redder color to its bark and dried flowers than does sagebrush. Type 10.

fir, see douglas fir or jointfir.

four-wing saltbush, *Atriplex canescens*

Shrub. Leaves slender and fuzzy. Fruit with four wing-like appendages. Type 6.

Fremont cottonwood, *Populus fremontii*

Large trees. Leaves triangular, margins toothed. Near water. Types 6 and 1.

Fremont mahonia, see hollygrape.

Gambel oak, *Quercus gambelii*

Short tree forming thickets or clumps. Rocky habitats, north facing slopes. Leaf or typical "oak" shape. Type 10. See thumbnail sketch #5.

grape, see canyon grape, hollygrape, and creeping mahonia.

hollygrape, *Berberis fremontii*

Tall shrub. Each leaf has 5 to 7 leaflets with pointed margins. Bark striped when young but stripes not perfectly straight. Type 9.

honey mesquite, see mesquite.

hop tree, see wafer ash.

jointfir, *Ephedra viridis*.

Low shrub. Leaves only 2 papery projections at each joint of stem. Stem green, resembling another species also found in Grand Canyon - Torrey ephedra. Type 4.

juniper, see Utah juniper.

live oak, see shrub live oak.

mahonia, see hollygrape.

mesquite, *Prosopis juliflora*

Large tree, some plants up to 1 foot in diameter. Thorns come straight out from stem in pairs. Bark slippery grey with furrows. Leaves doubly divided but has only 2 leaflets, each leaflet having up to 34 subleaflets, each about 2 cm. long. Type 2.

mormon tea, see jointfir.

mountain-mahogany, see curleaf mountain-mahogany

narrowleaf yucca, *Yucca angustissima*

Leaves very narrow - less than 1/2 inch wide. It has a simple flower stalk (unbranched) not to be confused with soaptree yucca at lower altitudes in the Canyon and along the Colorado River - soaptree yucca

On the facing page are thumbnail sketches of some of the plants, common at the Grand Canyon, mentioned in this article.

1. Apache plume, *Fallugia paradoxa*. Shows various leaf shapes, flowers, fruit with tail, stem with flower, and more leaves.

2. Blackbrush, *Coleogyne ramosissima*. Shows spines at stem tips with leaf clusters. Farther right are flowers; then at the extreme right one of the hairy seeds, shown enlarged.

3. Catclaw, *Acacia greggii*. Shows double compound leaf and thorns along the stem.

4. Cliffrose, *Cowania mexicana*. Shows leaves normal size, then enlarged so dots appear on the back. Flower and fruit are seen at the right.

5. Gambel oak *Quercus gambelii*. Shows a typical leaf. Somewhat reduced.

6. Narrowleaf yucca, *Yucca angustissima*. Shows leaf with thin strands curling off the margins. The soaptree yucca is similar; but the strands of the banana leaf yucca are much thicker. Utah agave has spines, not strands along leaf. Somewhat reduced.

7. Serviceberry, *Amelanchier utahensis*. Shows typical leaf.

8. Squawbush, *Rhus trilobata*. Shows typical leaf.

9. Utah juniper, *Juniperus osteosperma*. Top left to right shows three views of the seed, and then four views of the cone, which resembles a blue berry. Extreme and bottom right, both the smooth and the sharp foliage, as this plant has leaves of two types. Lower left, abnormal "cones" sometimes found.

having a branched flower stalk. Narrowleaf yucca is a short, ground-level plant while soaptree yucca gets to be 1 or 2 meters tall. Type 11. See thumbnail sketch #6.

nut pine, see pinyon pine.

oak, see Gambel oak or shrub live oak.

opuntia, *Opuntia* spp.

Cactus. There are several types of opuntia or prickly pear in the Canyon. Most species have needles or spines. Consult texts for characteristics of the various species. Type 3.

oregon grape, see creeping mahonia.

pinyon pine, *Pinus edulis*

Tree. Leaves short needles in clusters of 2. Needles shorter than those of ponderosa pine. Seed edible - "pine nut". Type 8.

pine, see pinyon pine or ponderosa pine.

ponderosa pine, *Pinus ponderosa*

Large tree. Leaves are needles in clusters of 3. Needles 4 to 5 inches long. Bark with picture-puzzle pattern and odor of vanilla. Type 10.

prickly pear, see opuntia.

rabbitbrush, *Chrysothamnus nauseosus*

Small shrub. Stems slender, greenish, topped with sprays of flowers. Plant has overall fan or top shape. Type 5.

redbud, see California redbud.

sagebrush, *Artemisia tridentata*

Shrub. Leaves small, whitish, three-forked. May be confused with fernbush which has a reddish tint. Type 10.

saltbush, see four-wing saltbush.

salt-cedar, see tamarix.

serviceberry, *Amelanchier utahensis*

See thumbnail sketch #7. Type 8.

shrub live oak, *Quercus turbinella*

Shrubby tree. Leaves small with many points on margins. Type 7.

soaptree yucca, *Yucca elata*

Older plants tall - up to 2 meters along Colorado River north shore. Flower stalk branched, unlike banana yucca which has unbranched flower stalk - narrowleafed yucca also has unbranched flower stalk. Leaves quite thin, like narrowleafed yucca. Type 6.

squawbush, *Rhus trilobata*

Trifoliate leaves. Resembles poison oak but has a more woody or shrub-like growth form. Present in the woodlands near Tusayan. See thumbnail sketch #8.

tamarix, *Tamarix pentandra*

Tree. Leaves tiny, scale-like. Flowers in bright pink clusters at Springtime. Along rivers and streams. Types 1 and 6.

Torrey ephedra, *Ephedra torreyana*

Looks much like jointfir but has 3 papery little projects at each stem joint, rather than 2. Low shrub. Leaves papery projects. Resembles jointfir which is much more prevalent. Type 7.

turpentine-broom, *Thamnosia montana*

Type 7. Beautiful blue flowers in Spring. Bare green stems.

Utah agave *Agave utahensis*

Cluster of thick, fleshy, spear-shaped leaves with sharply toothed margins. Long dried flower stalk. May be confused with banana yucca which has leaves of about the same size but with whitish fibers rather than spines along its margin. Type 3.

Utah serviceberry, see serviceberry.

Utah juniper, *Juniperus osteosperma*

Short tree. Leaves small, flat or sharp, closely pressed against stem. Cone resembles bluish or reddish berry. Both male and female cones on same tree. Resembles another species *J. monosperma* which grows along the road between the South Rim and Flagstaff, Arizona. Monosperma has male and female cones on different trees. Sometimes Utah juniper produces abnormal cone-like growths that resemble tiny pine cones - see thumbnail sketch #9. Type 8.

wafer ash, *Ptelea angustifolia*

Short tree. Leaves three-parted, each made of three leaflets. Fruit broad, winged, wafer-like. Type 7.

western yellow pine, see ponderosa pine.

willow, *Salix* spp.

Short tree. Near streams or other water sources. Leaves slender. Flowers in short, drooping clusters called "catkins". Similar to *Baccharis* which also grows near streams. Types 6 and 1.

yucca, see banana yucca, narrowleaf yucca, or soaptree yucca.

### III. Part III. Distribution Patterns Seen Among Woody Plants of The South Rim, Grand Canyon National Park.

A. Distribution classes. Each of the following classes is given a number. These numbers are listed at the end of each description in Part II so that a reader could discover, for example, that the Utah agave is a type 3 plant, meaning that it is present from the rim to the Colorado River but is nowhere dominant.

1. Associated with streams at various altitudes, sometimes also including the Colorado River riparian: baccharis, Fremont Cottonwood, tamarix, willow.
2. Along the Colorado River only: mesquite.
3. From the South Rim to the Colorado River, sporadically present but nowhere dominant: four-wing saltbush, opuntia, Utah agave.
4. From the South Rim to the Colorado River, at various altitudes, dominant or prevalent in one zone only: jointfir.
5. From the Colorado River up to middle altitudes - dominant at one altitude only (Lower Sonoran Life Zone of Merriam): catclaw - prominent along the river and in Brahma Schist but scattered up to 5000 feet altitude on Redwall Limestone. rabbitbrush - prominent at Tonto Plateau up to 4200 feet altitude at Indian Gardens.
6. From the Colorado River up to middle altitudes but nowhere dominant. Lower Sonoran Life Zone:

baccharis, brittlebush - up to the Bass Limestone on South Kaibab Trail and up to Bright Angel Shale on the Bright Angel Trail, Fremont cottonwood - along streams only but up to the Bright Angel Shale, soaptree yucca, tamarix - streams up to 3400 feet altitude, wafer ash.

7. At middle altitudes only; ash - Bright Angel Shale, Supai, and Hermit Shale, blackbrush - dominant on Tonto Plateau and up to Supai in areas, California redbud - Bright Angel Shale, canyon grape - Tapeats on Bright Angel Trail, curleaf mountain-mahogany - Supai on Bright Angel Trail, currant - Supai, Torrey ephedra - Redwall of South Kaibab Trail, turpentine bush - Bright Angel Trail above Indian Gardens.
8. From the South Rim down to the Tonto Plateau - dominant at one altitude (Upper Sonoran Life Zone): cliffrose - prominent near the Rim, pinyon pine, prominent near the Rim, serviceberry - prominent near the Rim on Kaibab and Toroweap formations, Utah juniper - prominent near the Rim.
9. From the South Rim to the Tonto Plateau but nowhere dominant (Upper Sonoran Life Zone): hollygrape - from above Bright Angel Shale up to an including Kaibab Limestone on Bright Angel Trail, banana yucca.
10. Near South Rim only: creeping mahonia - from the Hermit Shale to the Kaibab Limestone on Bright Angel Trail, Douglas fir - Kaibab Limestone to the Hermit Shale on the Bright Angel Trail plus Toroweap and Kaibab formations on South Kaibab Trail, fernbush - Kaibab Limestone on Bright Angel Trail, Gambel oak Kaibab on South Kaibab Trail as well as from Supai to Kaibab on the Bright Angel Trail, ponderosa pine, sagebrush - down to the Coconino on the South Kaibab Trail.
11. Present near the settlement of Tusayan but not near the South Rim itself: narrowleaved yucca, squawbush.

#### B. Discussion of South Rim Plants in Relationship to Creationism and Flood Geology:

The pre-flood fabric of vegetation contained plants which had varying amplitudes of tolerance to environmental factors. Some plants were suitable to grow over widespread land areas, others to grow sporadically in smaller numbers - nowhere being dominant. In the pre-flood environment presumably there were variations of climate: but these were much more moderate than present variations.

This tropical and temperate pre-flood world underwent violent change and diversification during and after the catastrophe. Plants became established in the many new habitats formed by the worldwide event. Depending on their designed limits of tolerance, plant types repopulated various ecological niches in the wake of the catastrophe.

After the flood the Creator may likewise have allowed

such processes as gene mutation, natural selection, and polyploidy to equip these plants further for their new roles of clothing the earth with its diverse network of nascent habitats. There was thus an array of plant forms ready to cover the new-formed land surfaces as the waters receded. Plants like the jointfir were evidently present in moderate numbers within the pre-flood vegetation. But after the flood they apparently took on new proportions since their genetic tolerances were just what was required to fit the specificities of life in the Canyon gorges.

Since the time of the flood, it appears that the western United States region has undergone a warming and drying trend. A. M. Phillips asserted that at an earlier date plants like the juniper prevailed on the slopes of the inner gorge but that more recently have given way to desert shrubs and cacti.<sup>1</sup>

As I indicated five years ago, cactus species may have been present in low numbers within the original pre-flood fabric - frequenting drier areas even back then. But the unique patterns of water conservation may have destined cactus family members to become dominant in changed habitats of post-flood times.<sup>2</sup>

I assume that all plants presently growing in the Grand Canyon grew in various regions of the pre-flood world. After the flood there was a sorting of genotypes and as a result land areas were repopulated by clusters of species that had been best endowed to thrive under particular environmental constraints. This assumes that considerable "design" and "preadaptation" were programmed into the plants from the first days of creation. When conditions arose after the flood favoring one plant above others, it reproduced well and covered much of the open ground, becoming dominant.

Evidence from other localities can be interpreted, for instance, in line with the proposition that southwestern deserts and other biomes of today arose from one and the same pre-flood vegetational fabric. Professor T. Recht of California State University has found areas in Mexico where patches of true Chihuahuan desert lie adjacent to highly vegetated strips of a more mesic or verdant character.<sup>3</sup> He reports that the mesic strips are 200-400 meters by 20-50 meters while the nearby barren areas are playa-like, being 200 meters by 400 meters or more in dimensions. In the vegetated areas, rich stands of grass flourish together with opuntia cacti.

Recht also indicates that rich tropical scrub forests occur 90 km north of Mazatlan in Mexico. I believe the close proximity of such diverse biomes indicates that all these separate plant communities derived from one original plant assemblage which existed before the flood.

While some workers hold that plants changed gradually and adapted over vast periods of time to meet the changes in the environment, I believe that each plant type was originally formed with fixed amplitudes of survival. The environment changed drastically, displaying a vast array of extreme niches after the flood. Plants which were preadapted for growth in various niches grew there. Thus plants did not fill niches by slow change but by the fact that they had been created with the potential to fill those niches; and

that potential became fully manifest after the flood. In addition, each plant may have undergone further change after finding its series of niches in the postflood environment.

Oddly enough, such a view implies "selection" - not the gradual selection of mutations within a species over long ages but the immediate selection and survival of suitable genotypes on the newly formed habitats as flood waters abated. As a result we find the fascinating array of plant distribution patterns seen in the Grand Canyon and described briefly in this paper. The following quotation from my earlier paper summarizes this view adequately:

"... the Creator has reclothed the earth with biomes that can be traced both altitudinally (as here at the Canyon) and latitudinally from the equator to the poles. Particular types of plants are especially suited for life in each microhabitat. This adaption of plant types to their own habitats and the preparedness of each habitat on the other hand for its specific plant forms reflects the great wisdom of the Creator and shows that even in catastrophe (the flood) there was a design, direction, and finally, restoration."<sup>4</sup>

#### Acknowledgements

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#### References

- <sup>1</sup>Phillips, A. M. III, 1977. A botanist's view. *Plateau* 49 (4): 10-17. (Spring).
  - <sup>2</sup>Golike, S., and G. Howe, 1975. The Grand Canyon - a winter ecology laboratory. *Bible-Science Newsletter* 13 (2):1-3.
  - <sup>3</sup>Recht, Tony, 1980. Personal correspondence with the author. Professor Recht is at California State University, Dominguez Hills, Carson, California.
  - <sup>4</sup>Golike, S., and G. Howe, 1975. The Grand Canyon - a winter ecology laboratory (continued). *Bible-Science Newsletter* 13 (3):4.
  - <sup>5</sup>Elmore, F. H. and J. R. Janish, 1976. Shrubs and trees of the southwest uplands. Southwest Parks and Monuments Association, P.O. Box 1562, Globe Arizona 85501 (available at Visitor's Center, South Rim, Grand Canyon.)
  - <sup>6</sup>McDougall, W. B. 1964. Grand Canyon wild flowers. museum of Northern Arizona, Flagstaff, Arizona. (available at Visitor's Center, South Rim.)
  - <sup>7</sup>Patraw, P. M. and Jr. Janish, 1977. Flowers of the southwest mesas, 6th edition. Southwest Parks and Monuments Association, 339 South Broad St., Box 1562, Globe Arizona 85501. (available at Museum of Northern Arizona booktable, Flagstaff, Arizona).
  - <sup>8</sup>Phillips, A. M. III and J. Richardson, 1979. Grand Canyon wildflowers. Grand Canyon Natural History Association. (available at Visitor's Center, South Rim.)
  - <sup>9</sup>Stockert, J. W. 1979. Common wild flowers of the Grand Canyon. The Wheelwright Press, 925 South 300 West, Salt Lake City, Utah 84101. (available at Visitor's Center, South Rim.)
- Two larger books that will be of great help to the more advanced students are:
- <sup>10</sup>Kearney, T. H. and R. H. Peebles. 1960. Arizona flora. University of California Press, Berkeley.
  - <sup>11</sup>McDougall, W. B. 1973. Seed plants of Northern Arizona. The Museum of Northern Arizona, Flagstaff.

#### Solution and Deposition of Calcium Carbonate (Continued from page 208)

in earlier papers by Williams and Herdklotz). Please note the following comments from the newsletter of a caving club.<sup>1</sup>

The trip really became interesting when we came to the area just above the rubble slope which leads to the "Rattlesnake Room". The new growth was simply unbelievable. All who were familiar with the cave were engaged in a "come over here and see what is new" contest.

The real shock came when someone pointed out the new growth behind the "Bat Burial" formation. Three new stalactites had grown and the longest was some longer than 12". The time since the last photo was taken of this wall was just over 3 months ago so the growth rate of the largest stalactite would be approximately 4" per month or 1 inch every 7.5 days. Unbelievable? Yes! In fact, if any caver believes this without seeing for himself it would surprise me. Luckily though we have been photographing the same spot for 15 years and have all the photos with dates.

#### References

- <sup>1</sup>Trout, Jerry, Trip Reports of Guadalupe Grotto, Cottonwood Cave, November 24, 1975.

#### Is Language an Exclusive Ability of Man? (Continued from page 216)

- <sup>2</sup>Premack, Ann J., 1976. Why chimps can read. Harper and Row, New York.
- <sup>4</sup>Rumbaugh, Duane N. (ed.) 1977. Language learning by a chimpanzee: the Lana project. The Academic Press, New York.
- <sup>5</sup>1980. Are those apes really talking? Time Magazine, 10 March, pp. 50 & 51.
- <sup>6</sup>Wilson, Clifford, 1978. Monkeys will never talk. . . or will they? Master Books, San Diego.
- <sup>7</sup>Terrace, Herbert S., 1979. How Nim Chimpsky changed my mind. Psychology Today.
- <sup>8</sup>Terrace, Herbert S., 1979. Nim. Alfred A. Knopf, New York.
- <sup>9</sup>Reference 7, p. 67.
- <sup>10</sup>*Ibid.*, p. 68.
- <sup>11</sup>*Ibid.*, p. 67.
- <sup>12</sup>*Ibid.*, p. 75.
- <sup>13</sup>Sebeok, Thomas, and Jean Umiker-Sebeok, 1980. Speaking of apes. The Plenum Press, New York
- <sup>14</sup>Jastrow, Joseph, 1962. Error and eccentricity in human belief. Dover Publications, New York.

#### Is Language Uniquely Human? (Continued from page 218)

#### References

- <sup>1</sup>Marx, Jean L., 1980. Ape-language controversy flares up. Science 207 (4437):1330-1333.
- <sup>2</sup>Terrace, Herbert, 1979. Nim: a chimpanzee who learned sign language - New York, Knopf.

## PANORAMA OF SCIENCE

### Living Dinosaurs?

A report states that there have been enough reports from Africa of animals resembling dinosaurs that Dr. Roy Mackal, of the University of Chicago, and Mr. James Powell, who has had much experience with crocodiles, plan to investigate, believing that there may possibly be dinosaurs of some kind living there. The reports seem to be of: "a large, brownish-grey creature with a long, flexible neck and a long tail", living around rivers in the Congo and Zaire districts.<sup>1</sup>

It will be recalled that there have been reports of an ocean-going dinosaur-like animal, like the plesiosaurus, still living.<sup>2,3</sup> So maybe these reports of somewhat similar land-dwelling creatures are not so surprising after all.

### Wilberforce Defended

A letter in *Nature* suggests that Bishop Wilberforce has been maligned these many years over what happened in his debate with Huxley.<sup>4</sup> Apparently neither of the two journalists present at the meeting thought that Wilberforce had played into Huxley's hand, and Huxley thereby scored a great victory.

The author suggests that what Wilberforce really asked was where, according to Darwinian theory, one was to draw the line between human descendants and ape-like ancestors. And such a question would certainly be a valid one, according to any canon of scientific discussion.

### Mechanisms of Overthrust Questioned

The idea of overthrusting or nappe movement, involving near horizontal sliding of slabs of rock over other rocks for considerable distances, has been frequently questioned by Creationists. It has been demonstrated that little physical evidence for extensive sliding exists at the supposed zones of movement in many instances, implying that the claims about overthrust motions are greatly exaggerated.<sup>5</sup>

One mechanism frequently invoked for overthrusting involves the assumption of very high pore fluid pressures at the zone of movement.<sup>6</sup> The overthrusting is thought to have occurred by means of gravity sliding. This idea has recently been criticised in a brief note.<sup>7</sup>

It was pointed out that since the tensile strength of rocks is very low, if high pore pressures existed at the zone of sliding, fracturing of the moving slab would occur, in the direction normal to the least principal stress, once the pore pressures exceeded this least principal stress. The fractures would be vertical for most of the proposed mechanisms of overthrusting.

The fracturing of the overthrust slab would limit the pore pressures at the base, by increasing the permeability, and increasing the pore volume. This would likely preclude the pore fluids at the zone of sliding acting as a lubricant. Thus the occurrence of "inverted" strata, according to the evolutionary dating scheme, remains a dramatic contradiction of the geologic time-scale.

Contributed by Mr. Douglas E. Cox

### Beauty of Butterflies - Is it Functional?

Prior to the widespread acceptance of evolution, the beauty of nature was often seen as evidence of God. Indeed, scriptural support abounds "For how great is his goodness and how great is his beauty . . . Zech. 9:17 (see also Ps. 19:1, 139:13-14, Is. 6:3) with the acceptance of evolution, nature must be functional. The evidence of a Creator - God once seen in the beauty of flowers is now seen only to function in pollination. Yet problems remain. Consider the markings and color of butterflies. Surely we have all marveled at the beautifully varied patterns of butterflies and moths. So beautiful, in fact that North American Indians called them "flying flowers". Evolutionists have long ago concluded (albeit without a shred of experimental evidence) that the contrasting markings of butterflies - called disruptive coloration - functions by fragmenting the visual image.<sup>8,9</sup> It is thus a form of protective coloration. In fact few concepts in adaptive coloration theory are as well accepted as that of disruptive coloration.

In a recent *Science* paper:<sup>10</sup> attempts to demonstrate the adaptive significance of disruptive coloration in the butterfly, *Anartia fatima* were unsuccessful. A small insular population of butterflies was studied extensively on the Panama island, Borro Colorado Island. A significant proportion of the native population of butterflies was collected and the disruptive color markings were masked. The butterflies were released and survived under field condition for more than 90% of their lives. Recapture data showed no significant difference in life expectancy of marked and unmarked butterflies.

What then is the function of the beautifully patterned wing markings of butterflies? It remains a mystery. But I submit at least one function is to declare the Glory of God the creator. It is also of interest how a theory may be produced, accepted (often dogmatically) and modified without any definitive experimental evidence, "... guard what has been entrusted to you, avoiding worldly and empty chatter and the opposing arguments of what is falsely called 'knowledge' which some have professed and thus gone astray from the faith". (I Tim. 6:20-21.)

Contributed by Dr. E. Norbert Smith

### References

- <sup>1</sup>1980. Live dinosaurs may still roam African jungle scientists say. *The Kingston Whig-Standard*, p. 1, 15 October.
- <sup>2</sup>Swanson, Ralph, 1978. A (recently) living plesiosaur found? *Creation Research Society Quarterly* 15 (1): 8.
- <sup>3</sup>Snelling, Andrew, 1980. More plesiosaurs? (In *Panorama of Science*.) *Creation Research Society Quarterly* 17 (1): 74.
- <sup>4</sup>Lucas, J. R., 1980. Wilberforce no ape. *Nature* 287 (5782): 481.
- <sup>5</sup>Burdick, Clifford L., 1977. Heart Mountain revisited. *Creation Research Society Quarterly* 13 (4): 207-210.
- <sup>6</sup>Hubbert, M. K., and W. W. Rubey, 1959. Role of fluid pressure in the mechanics of overthrust faulting. *Geological Society of America Bulletin* 70: 1107-1122.
- <sup>7</sup>Willemin, J. H., P. L. Guth, and K. V. Hodges, 1980. Comment and reply on high fluid pressure, isothermal surfaces, and the initiation of nappe movement. *Geology* 8 (9): 405-406.

(Continued on page 213)

## BOOK REVIEWS

*The Discovery of Genesis. How the Truths of Genesis were Found Hidden in the Chinese Language.* By C. H. Kang and Ethel R. Nelson, 1979. Concordia.

Reviewed by Ralph Swanson.\*

*Kanji* (Chinese characters) are the only ideographic writing that has continued in general use for over 4,000 years. They are used not only by China and Taiwan, but also by Japan (since the seventh century) and by Korea to write their languages, being known to about one fourth of the earth's people. Only since the last war have some of the characters been revised and "simplified" for the first time.

The authors advance the theory that the Chinese people originally migrated to the east from the area of Babel, carrying with them the memory of such historical events as the Creation, the Flood, etc.. As pictographs were invented so that they might permanently record their language, the more abstract ideas were drawn with parts which symbolized actual events, well known to the people. (Most *kanji* are built up from small parts - radicals - which themselves may stand alone as a character.) The Chinese were monotheistic for about 2,000 years, until the introduction of Confucianism, Taoism, and Buddhism a little over 2,000 years ago. The authors believe that these characters embody important evidence of the truth of a recent Creation, the Fall, the world-wide Flood, and the division of mankind at the Tower of Babel. To see how the authors' thesis works out, let us examine several simple ideographs.

|               |            |                |
|---------------|------------|----------------|
| 人 man [human] | 女 woman    | 火 fire         |
| 木 tree        | 林 woods    | 森 forest       |
| 田 rice field  | 口 mouth    | 土 dust [earth] |
| 上 up          | 下 down     | 一 one          |
| 二 two         | 三 three    | 十 ten          |
| 中 middle      | 山 mountain | 川 river        |
| 雨 rain        | 門 gate     | 日 sun          |

Those unfamiliar with Kanji may now appreciate to some extent a few examples offered by the authors to support their hypothesis. 土 dust + 口 breath of mouth + 人 alive = 告 talk + 走 walking = 造 to create. God formed man from the dust of the earth 土 and breathed with His mouth 口 into inert man's nostrils the breath of life and man became a living soul able to talk 告 and walk 走.

An interesting supposition that the authors have derived from their model is that through *kanji* it can be deduced that Adam and Eve were clothed or covered by a glow [similar to Moses when he descended from Sinai] before the Fall.

This is shown in the character for fire 火 which shows man 人 with two lines like flames radiating from him.

The same radical occurs in other *kanji* as 談 [to converse] which shows two 火火 exchanging 言 [words].

The character for covet 婪 consists of two trees [mentioned in the Garden] and woman[Ève]. 禁 [to forbid] shows the two trees with an abbreviated form for God underneath. Perhaps the most convincing *kanji* offered to support their hypothesis is the ideograph for boat 船. It consists of 舟 vessel + 八 eight + 口 mouth [people]. This seems to be a clear reference to the 8 people who survived the Flood and repopulated the earth.

My personal opinion (I have studied *kanji* for eleven years) is that there are several clear links between the Chinese characters and the early history of Genesis 1-11 which seem to be above the realm of pure chance. Some of the *kanji* used in the book may seem a bit far-fetched to prove the theory; but if the authors' basic thesis is correct they would fit.

*The Cycles of Heaven: Cosmic Forces and What They Are Doing To You*, by Guy L. Playfair and Scott Hill. 1978. Souvenir Press, London. 368 pages. \$10.00.

Reviewed by Erich A. von Fange.\*

This is a book of uneven quality, hastily revised up to the last moment before publication. Few would accept some of the findings and claims in the book, but this reviewer finds himself somewhat unwillingly accepting more than he would have thought possible only a few years ago. One cannot deny such apparently reasonable statements as these: (1) If all electromagnetic and acoustic waves were visible, we would find ourselves in a jungle as apparently dense as any tropical rain forest; (2) We perceive only a tiny band of these waves; (3) All living beings, including man, do respond in countless ways to influences of which they are not consciously aware; (4) Electromagnetism, gravitation, and the strong and weak nuclear forces are merely manifestations of one principle not yet discovered; if and when the principle is found, much human knowledge will become obsolete overnight; (5) The sun, moon, and planets influence the cyclic nature and strength of many of the emissions noted above.

One must almost hasten to say that astrology comes off badly in this book, yet some elements of influence from the heavenly bodies are supported scientifically and should not be associated with astrology. Long prior to this book, the United States National Institute of Mental Health (1970) issued an astonishing 183-page overview of the cyclic nature of man: *Biological Rhythms in Psychiatry and Medicine*. In March 1980

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the *Reader's Digest* published extracts of new books on how cosmic forces may influence man, such as *The Lunar Effect: Biological Tides and Human Emotions*; *Moodswing: The Third Revolution in Psychiatry*; and *Lifetide: The Biology of the Unconscious*.

If we reject cyclic phenomena of unusual nature out of hand, we reject what appears to be very solid documented scientific research; if we accept even part of the evidence offered by Playfair and Hill, life at once becomes much more complicated than we might have

thought possible. Somewhat in the pattern of the recent books by Corliss, the authors have combed the scientific literature for evidences to support the statements above and to unnerve the reader in the process. There are indeed many strange accounts lying around in *Nature* and other respectable scientific sources. But, as the authors say, some claims are so startling they are simply ignored. The topics of the book are relevant to most of the areas treated in the *CRS Quarterly*, and the book deserves to be read.

## LETTERS TO THE EDITOR

### Reply to Morton: the Canopy CAN Hold Water

Many thanks to Glen Morton for his good critique of my article.<sup>1</sup> However, he does make a number of serious errors which, to my mind, invalidate his analysis.

First, he assumes, as I incorrectly did, that 1 cm of precipitable water equals one optical depth. Subsequent study has revealed this figure to be incorrect. Secondly, and this is his major error, the water vapor spectrum is far from gray. A correct analysis must take the non-grayness into account. The contribution of solar flux in each spectral interval for each absorbing gas must be calculated. When this is done, the result shows a much lower temperature than that which Morton calculated.

In fact, at about 35 km the saturation vapor pressure curve and the atmospheric pressure curve intersect, proving, contrary to Morton, that clouds will form. Furthermore, when the vertical temperature profiles are studied (which Morton neglected to do) it is seen that vertical lapse rate is everywhere above the critical. This means strong convection, cooling by adiabatic expansion, and the formation of clouds near the base of the canopy.

I modeled the canopy under the conditions mentioned, in a more sophisticated (yet still crude) approach, and calculated a surface temperature of about 68 °F with a strong temperature inversion. These results are to be published in my book *The Waters Above: Earth's Pre-Flood Vapor Canopy*, Moody Press, expected February 1981.

### Reference

<sup>1</sup>Morton, Glenn R., 1979. Can the Canopy hold water? *Creation Research Society Quarterly* 16 (3): 164-169.

Your brother in Christ

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### Reply to Dillow

I would agree with Dr. Dillow that 1 cm of precipitable water does not equal one optical depth.

That is just an approximation which turns out to be a charitable to the canopy position. The equation for optical depth is  $\tau = \int k da$ , where  $k$  is the absorption coefficient and  $da$  is the amount of mass per  $\text{cm}^2$  along the travel path. Kondratyev<sup>1</sup>, in his classic work, points out that in the weakest part of the water infrared absorption spectrum (8.5-12  $\mu$ ) the absorption coefficient is .1. For a forty-foot canopy the optical depth in this region is 122. If water absorbed this weakly over all spectral ranges, the equation used would be perfectly valid since that would be a gray atmosphere, and it would yield a minimum temperature. Using an albedo of .8 one finds that for a forty-foot canopy, the temperature of the earth's surface would be 303 ° C.—based upon the absorption coefficient of the weakest part of the spectrum!

For the 8.0-8.5  $\mu$  range Kondratyev gives  $k = 3.4$  implying  $\tau = 4144$ . For 15  $\mu$ ,  $k = 1.3$  and  $\tau = 1584$ . Weighting these values according to the energy which escapes out of these spectral ranges, one finds an approximate average optical depth of 1429. Since there are 1219 cm of precipitable water in forty feet, this means that .8 cm of water is equal to one optical depth not the one cm used. This means that the temperatures would be hotter than those calculated in my paper.

If Dr. Dillow is suggesting that convection can occur under the canopy, I would like to point out that Goody and Walker show this to be impossible. They say,

*"We conclude that convection can only occur spontaneously if the temperature of the atmosphere decreases quickly enough with altitude . . . During an inversion, convection is strongly inhibited and very little mixing occurs from one level of the atmosphere to another."*<sup>2</sup>

Dr. Dillow apparently missed Figure 8 of my paper in which I show the atmospheric temperature profile as a function of optical depth. The only thing needed to convert this relation to altitude is an assumption of the dependence of optical depth with altitude.

I might also point out that when this theory is applied to the Venusian atmosphere ( $\tau = 68$ ,  $A = .76$ ) it yields a surface temperature of 612 ° K, approximately 100 ° too cool.<sup>3</sup>

### References

- <sup>1</sup>Kondratyev, K. Ya., 1969. Radiation in the atmosphere. Academic Press. P. 119.  
<sup>2</sup>Goody, R. M., and J. C. G. Walker, 1972. Atmospheres. Prentice-Hall. P. 62.  
<sup>3</sup>For an approximation of Venus' optical depth see *ibid.*, p. 57.

In Christ

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### Comment on the Triplet's Paradox

Jeffrey Lee's article<sup>1</sup> purporting to show a *reductio ad absurdum* of Einstein's Special Theory of Relativity succeeded only because Mr. Lee's argument was itself badly flawed. A consistent and thorough application of the principles of relativity leads to the conclusion that Alvin and Bill will both agree with Ernie: Alvin's clock and Bill's clock each read 0.80 seconds at the instant they pass by Ernie.

Everything that Mr. Lee states about this gedanken experiment as Ernie observes it is quite correct. He also correctly applies the formula for addition of velocities to show that Bill is approaching Alvin (or vice-versa) with a velocity of 0.88 c. And he correctly calculates the time dilation factor of 0.47 that Alvin must observe for Bill's clock (or vice-versa.)

Mr. Lee makes his first error by stating that "according to Alvin's viewpoint, as the still frame of reference, the photograph would show his clock to read one second" as Ernie passes by him and snaps a photograph. Apparently Mr. Lee has suddenly reverted back to the easy and comfortable pre-relativistic notions of space and time. He has apparently forgotten that from Alvin's frame of reference, the rigid rod attached to the earth is length-contracted by a factor of  $(1 - v^2/c^2)^{1/2} = (1 - (0.6c)^2/c^2)^{1/2} = 0.80$  as a result of its velocity of 0.6c with respect to Alvin. Thus, at the instant that the near end of the rod passes by Alvin, Alvin observes Ernie to be at a distance of  $(0.8)(180,000 \text{ km.}) = 144,000 \text{ km.}$  rather than the rest length of 180,000 km. of half of the rod. And the time it takes Ernie to travel this 144,000 km. distance to Alvin, going at 0.6 c, is  $(144,000 \text{ km.})/(0.6 \text{ c}) = 0.80$  seconds of Alvin's time. So we see that Alvin's observation of his own clock at the instant that Ernie passes by and snaps a photograph is precisely in agreement with Ernie's observation and/or photograph of Alvin's clock.

What about Alvin's observation of Bill's clock at this instant? Here Mr. Lee makes a second error, ignoring the fact that relativity predicts that events which are simultaneous in one frame of reference will not be simultaneous in another frame of reference if these events are separated by a distance. He has assumed that Bill's clock began ticking simultaneously with Alvin's clock in Alvin's frame of reference.

According to Ernie's frame of reference, Bill's clock and Alvin's clock started ticking simultaneously when Alvin and Bill passed by the ends of the rigid rod. But relativity predicts that in Alvin's frame of reference,

Bill's clock started ticking before Alvin's: in Alvin's frame of reference, Bill reached the far end of the rod long before the near end of the rod ever reached Alvin. And relativity tells us how to figure these things out by transforming from one frame of reference to another.

Preparatory to using the Lorentz transformation in standard form, let us take a frame of reference at rest with respect to Ernie's frame, but with origin at point "P" at the left end of the rigid rod, and x axis extending to the right along the rod. This we call the "unprimed" frame.

For the "primed" frame, we take Alvin as the origin, and let the x' axis likewise extend to the right along the direction of the rod. Clocks in each frame are synchronized with clocks at the respective origins, and the clocks at the origins are set to  $t = t' = 0$  when the origin of the "primed" frame coincides with the origin of the "unprimed" frame.

The "unprimed" frame is at rest with respect to Ernie, being essentially the same as Ernie's frame, the only difference being that the origin was shifted to the left. For both the "unprimed" frame and for Ernie, the measurement of time ( $t = 0$ ) begins with Alvin reaching the left end of the rod. So times measured in the "unprimed" frame are the same as times measured by Ernie in all cases.

The Lorentz transformation gives us the formula  $t' = (t - Vx/c^2) / (1 - V^2/c^2)^{1/2}$  for calculating the time coordinate of an event in the "primed" frame, given the velocity V of the "primed" frame with respect to the "unprimed" frame, and given the time and position coordinates of the event in the "unprimed" frame. And the event in which we are interested is the starting of Bill's clock. In the "unprimed" frame, Bill's clock started at  $t = 0$  (simultaneously with Alvin's clock), and the position of this event was  $x = 360,000 \text{ km.}$  The velocity of the "primed" frame of Alvin with respect to the "unprimed" frame is  $V = 0.6 \text{ c.}$  Plugging these values into the Lorentz transformation for  $t'$  gives  $t' = -0.90$  seconds. So according to Alvin, Bill's clock started ticking 0.90 seconds before Alvin's clock started, or 0.90 seconds before the near end of the rod ever reached Alvin. (But of course, Alvin could never see Bill's clock start ticking until some time after Alvin had started his own clock, because it takes more than 0.90 seconds of Alvin's time for the light signal to travel from where Bill was when Bill's clock started, all the way to Alvin.)

From the time Bill started his clock (in the frame of Alvin), it took 0.90 seconds for the near end of the rod to reach Alvin, at which time Alvin started his own clock. And the rod was moving toward Alvin at 0.6 c, so it had to move a distance of  $(0.6 \text{ c})(0.90 \text{ sec.}) = 162,000 \text{ km.}$  in that 0.90 seconds of Alvin's time. So the near end of the rod was 162,000 km. from Alvin when Bill's clock started running. And Bill was at the far end of the rod. So Bill's total distance from Alvin at that time was the 162,000 km. separating the rod from Alvin, plus the length of the rod which is contracted by a factor of 0.80 in the frame of Alvin. Thus  $162,000 \text{ km.} + (0.80)(360,000 \text{ km.}) = 450,000 \text{ km.}$

This 450,000 km. distance is just the x' coordinate of the event of Bill starting his clock, in the reference

frame of Alvin, the "primed" frame. We could have achieved the same result with fewer words (but perhaps less understanding of what is actually going on in the frame of Alvin) by simply plugging in the same  $t = 0$ ,  $x = 360,000$  km., and  $V = 0.6$  c that we used before in calculating  $t'$ , but this time using the Lorentz transformation which gives  $x'$  in terms of these variables.  $x' = (x - Vt) / (1 - V^2/c^2)^{1/2} = 450,000$  km. According to Alvin, Bill is rushing toward Alvin at  $0.88$  c as Mr. Lee stated in his article. And Bill must travel  $450,000$  km. from the point where he started his clock in order to reach Alvin's position. Thus according to Alvin, it will take Bill  $(450,000 \text{ km.}) / (0.88 \text{ c}) = 1.70$  seconds to travel this distance, and Bill's clock will have been running for  $1.70$  seconds when Bill reaches Alvin. But in Alvin's frame of reference, Bill's clock is slowed or dilated by a factor of  $0.47$  as Mr. Lee stated. Therefore Alvin will observe Bill's clock to have advanced to only  $(0.47)(1.70 \text{ sec.}) = 0.80$  seconds at the instant that Bill passes by Alvin, the same instant that Ernie passes by Alvin and snaps a photograph of both clocks.

And of course, the same arguments apply to Bill's frame of reference as apply to Alvin's. All three witnesses agree that Alvin's clock and Bill's clock both read  $0.80$  seconds at the instant that these three observers pass each other in space. A simple additional calculation reveals that they will all agree that Ernie's clock reads  $1.00$  second at that instant.

As usual, special relativity leads to consistent conclusions between all observers about the events that happened, providing that the person who is looking at the predictions of relativity does not make assumptions based on the pre-relativistic ideas of space and time. But while the events themselves remain constant, the questions of where, how far, when, and how long are answered differently by different observers. This does not prove that relativity is the correct theory of space and time, but anyone who thinks that they have found an inconsistency should be warned that relativity has already proven itself the victor in many such skirmishes.

### Reference

<sup>1</sup>Lee, Jeffrey, 1980. The triplets' paradox. *Creation Research Society Quarterly* 17 (1): 47-49.

Sincerely

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### The Answer to the Triplet's Paradox

The triplet's paradox presented by Lee in the June, 1980 issue of this journal is an exercise in special relativity. The paradox attempted to show that the theory of relativity is internally inconsistent. "We have here a simple but clear paradox for which Relativity has no solution."<sup>1</sup> Actually, relativity does have a solution. This letter explains that solution.

Lee's paradox has a cast of three triplets, Alvin, Bill, and Ernie. Ernie is on the earth. He observes Alvin on a rocket approaching him at speed  $0.6c$  from our left. He observes Bill approaching him at speed  $0.6c$  from our right. When Ernie first observes them, Alvin and Bill are each  $0.6c$  ( $180,000$  km) away. At this instant each triplet's clock reads time  $0$  as seen by Ernie.

Ernie takes a photograph of the three triplet's watches at the instant they all three simultaneously pass. Ernie's photograph shows his own watch to read  $1.0$  sec and Alvin's and Bill's watches to read  $0.8$  sec, because of time dilation.

Lee says that if Alvin had taken a picture of all three of the triplets' watches at the instant they simultaneously passed, Alvin's photograph would have shown different times on the triplets' watches than Ernie's photograph showed. Lee says the same photograph taken by Bill would be different from either of the other two photographs. Since all three watches are simultaneously together, photographs of them at that instant ought to show the same times on the watches regardless of who took the photograph. Because Lee finds Alvin's, Bill's, and Ernie's photographs different when they shouldn't be, Lee concludes relativity is internally inconsistent.

The truth is that Lee has worked out his relativity problem incorrectly. Let me explain.

Simultaneity is relative. Within the framework of special relativity, two events which occur simultaneously in one Lorentz frame do not occur simultaneously in another Lorentz frame. One event is the passing of Alvin and Ernie. A second event is the passing of Bill and Ernie. Only in Ernie's frame do these two events occur simultaneously. Only Ernie can hold the camera and take the picture of all three watches at the same place at the same time. In Ernie's picture, his own watch does read  $1.0$  sec while Alvin's and Bill's watches read  $0.8$  sec each. Lee worked out that part correctly.

When Alvin holds the camera and takes the picture at the instant of the first event (Alvin and Ernie passing), Bill will not be in the photograph, because he has not yet arrived at Alvin's and Ernie's location. In other words, the two events that occurred simultaneously in Ernie's rest frame have not occurred simultaneously in Alvin's rest frame. Why?

Lee correctly determines that Alvin sees Ernie moving toward him at a speed  $0.6c$ , and that Alvin sees Bill moving toward him at speed  $0.88c$  (from the velocity addition formula). Bill is twice as far from Alvin as Ernie is, but Bill is only moving about  $1.5$  times as fast as Ernie toward Alvin, as seen by Alvin. Therefore, Ernie will pass Alvin before Bill passes Alvin, as seen by Alvin. Bill will catch up to Ernie, but only after both Ernie and Bill have passed Alvin, from Alvin's point of view.

Lee overlooked this relativity of simultaneity, and sketched Alvin's and Bill's pictures (the top two of three pairs of watch dials) in his Figure 2 as though Alvin, Bill, and Ernie all passed one another simultaneously as seen by Alvin or by Bill. Only in Ernie's rest frame will a photograph catch all three triplets passing simultaneously.

The resolution of Lee's triplet paradox is that the photograph Lee blames on special relativity does not in fact come from special relativity. This resolution does not prove anything about the truth of special relativity. It shows that within the framework of special relativity, the triplet paradox is no paradox, because in special relativity, simultaneity is relative.

#### Reference

<sup>1</sup>Lee, *op. cit.* (in the previous letter.)

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#### Reply to Pewther and Akridge

In reply to Mr. Pewther's letter concerning the "Triplets' Paradox" I would like to point out three outstanding oversights.

The first is the assumption that the rigid rod attached to the Earth, hence all lengths in the moving Earth frame, will experience a length contraction due to their .6c velocity with respect to Alvin's frame at the same time Mr. Pewther has Ernie's clock, instead of experiencing a comparable time dilation, running 1.25 times faster than Alvin's. Consequently, Alvin must observe Ernie's clock to record one second pass as his records .8 seconds pass yet observe measuring rods in Ernie's frame to be contracted. It is well known in Relativity that it is mass that increases inversely proportional to length contraction and not time. According to Relativity length contraction and time dilation must be observed to occur simultaneously and at the same rate in the moving frame by the still frame if C is to remain invariant. Mr. Pewther states that Alvin observes Ernie traveling toward him at .6C to traverse the 144,000 km. distance in .8 seconds of his (Alvin's) time and yet sees Ernie's clock to run for 1 second or 1.25 times faster than his. The obvious question is: How can Alvin observe Ernie to be moving towards him at .6C and see lengths in Ernie's frame to contract at the same time observing Ernie's clock to run faster than his instead of experiencing a time dilation?

The second contradiction stems from the first and concerns the relationship of Ernie and Bill to Alvin. Mr. Pewther has Ernie and Bill traveling at different velocities in the same direction toward Alvin yet Bill experiences a time dilation with respect to Alvin whereas Ernie, as already pointed out, does not. How can Ernie and Bill both have relative velocities traveling towards Alvin and one clock (Bill's) experience a time dilation with respect to Alvin while the other (Ernie's) clock runs faster than Alvin's?

The third oversight simply underlines the obvious question asked by the "Triplets' Paradox". The statement is made by Mr. Pewther that Bill's clock will have been running for 1.7 seconds when he reaches Alvin. Two sentences later the statement is made that when Bill passes Alvin Bill's clock will read .8 seconds. As

stated in the article: How can a clock's hand be in more than one position at a time? The point to be made here is that a clock running for 1.7 seconds must read 1.7 seconds and cannot be observed to read .8 seconds or anything else. This third oversight seems more a reinforcement of the paradox than an attempt to solve it.

Still another more basic question we might ask is this: Relative to Ernie are Alvin and Bill in the same inertial frame of reference or not? Mr. Pewther has both clocks running at the same rate relative to Ernie and we know from Relativity that clocks only run at the same rate if located in the same inertial frame. From Ernie's still frame he observes Alvin and Bill to have a .88C relative velocity. Accordingly, if either Alvin or Bill wanted to be at rest in the other's frame he would have to reverse his .6C velocity with respect to Ernie and then accelerate to .6C in the opposite direction thus experiencing a force, etc. as he went from one frame to the other. How, then, can Ernie observe both clocks of Alvin and Bill to experience this .88C relative velocity (which clearly puts them in different inertial frames relative to each other with respect to Ernie) and still observe both clocks to run at the same rate?

It is the purpose of the "Triplets' Paradox" to bring forth such contradictions in Relativity so that we may examine the theory in the hope of opening up new avenues of reason leading to a better and more precise understanding of the overall relationship of motion to spacetime.

In responding to Dr. Akridge's letter, I would like to point out what seems to me to be somewhat of an obvious contradiction stemming from the relativity of simultaneity as it is applied in this particular case.

Dr. Akridge states that Ernie takes a photograph of the three clocks at the instant they all simultaneously pass at point X and that the two events (Alvin passing Ernie and Bill passing Ernie) occur simultaneously and at the same place in Ernie's frame. Consequently, Ernie's picture, as described by Dr. Akridge will show all three clocks to be together at the same time and place.

Dr. Akridge then goes on to say that if either Alvin or Bill took a picture with their camera as they passed Ernie that the other triplet approaching from the opposite direction would not be in the picture at all. This, according to Dr. Akridge is due to the fact that when Alvin takes the picture as he passes Ernie Bill will not have yet arrived at point X in Alvin's frame. This likewise he says is true concerning Alvin's relationship to Bill in Bill's frame. The obvious problem with this reasoning is clearly evident and is as follows:

If Ernie takes a picture of Alvin and Bill passing him when they are all simultaneously located at point X in Ernie's frame then, as Dr. Akridge says, Ernie would obviously get a picture of Alvin and Bill together with him at point X. Now, suppose Alvin and Bill, likewise, were holding cameras. Wouldn't the picture Ernie obtained show both Alvin and Bill, each standing beside their clocks, each holding their cameras pointing them toward Ernie and the other triplet? Couldn't Alvin or Bill snap their shutters at the same time Ernie snapped his to obtain a picture of all three clocks also? The fact that Alvin and Bill are seen in Ernie's picture holding

their cameras proves that either could photograph the event just as Ernie does.

Thus it is clearly evident that if Alvin and Bill are simultaneously located at point X in Ernie's frame then this must be true of their cameras also since they are holding them. So, the picture Ernie takes of Alvin and Bill together, each with their clocks and cameras, completely disproves Dr. Akridge's reasoning which he brought forth using the concept of Relativity that simultaneity is relative. Consequently, we can see it doesn't matter who holds the camera because in Ernie's frame (as proved by his picture) all three cameras are together at the same time and in the same place and either could snap the shutter of his cameras to take the picture of the entire event as it takes place.

Thus the impossible situation arrived at by Dr. Akridge demonstrates very well the contradiction embodied in the concept that simultaneity is relative. Dr. Akridge in correctly applying the concepts of Relativity to this situation, as has been illustrated here, obtained an obvious contradiction that Relativity must assume in order to attempt to solve the Triplets' Paradox. Accordingly, the only reasonable conclusion we can draw from this is simply that Relativity is incorrect in assuming simultaneity to be relative.

So, as we can observe, it is the internal nature of the Theory of Relativity that is contradictory and therein lies our problem. It is the aim of the Triplets' Paradox to reveal and examine these contradictions and oversights in Relativity in the hope of developing a new and more lenient attitude towards alternative theories.

I want to thank Mr. Pewther and Dr. Akridge for their letters and the interest expressed concerning the Triplets' Paradox, and would continue to invite everyone to respond with their comments and opinions.

Yours truly

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### Recent Developments About Solar Neutrinos

Between the time my article Solar Neutrinos and a Young Sun<sup>1</sup> was submitted and the time it was published some rather important developments have occurred. It seems ironic that though I have been aware of the importance of this subject to creationism for eight years, these developments should happen at this very time. The two developments are the possible discovery that neutrinos have mass, and further measurements of solar shrinkage.

If neutrinos indeed have non-zero rest mass, then they must travel at less than the speed of light, making the phase velocity different from the group velocity. If, as is supposed, neutrinos are a superposition of three types of neutrino, each will in turn be manifested in the neutrino as it oscillates among the three types (electron, muon and tau). Since it is only the electron neutrino which can initiate the reaction in Davis' tank of chlorine, only about one third of the incident neutrinos will be

measured, hence the difference between the predicted flux, 4.7 SNU's, and the measured, 1.3 SNU's. Perhaps the sun is burning hydrogen after all.

This is not yet assured, however. While certain Russian scientists have made a claim for massive neutrinos, other American scientists have not been able as yet to confirm this. Only the future will tell.

The same can be said for the shrinkage of the sun. Eddy's claim that the sun was shrinking has met with much scepticism, and the timing of transits of Mercury over the centuries seems to indicate that no shrinkage is taking place. Eddy continues to maintain that the sun is presently shrinking, probably as part of a long period oscillation in the solar radius, and recent eclipse measurements tend to confirm the change in radius. In both cases only time will tell what the ultimate outcome will be and its importance to creationism.

### Reference

<sup>1</sup>Steidl, Paul M., 1980. Solar neutrinos and a young sun. *Creation Research Society Quarterly* 17 (1): 60-64.

#### General References on Solar Neutrinos

1980. *Science News* 117, 292.  
Robinson, Arthur L., 1980. Nuclear evidence that neutrinos have mass. *Science* 208 (4445): 679.  
Thomsen, D. E., 1980. Colour changes on a scale of centuries. *Science News* 117 (4): 56.  
1980. Identity crisis. *Scientific American* 243 (1): 72-75.  
Close, F. E., 1980. Is the sun still shining? *Nature* 284 (5756): 507-508.  
Lubkin, G. B., 1980. Do neutrinos oscillate from one variety to another? *Physics Today* 33 (7): 17-19.  
Overbye, Dennis, 1980. The ghost universe of neutrinos. *Sky and Telescope* 60 (2): 115.

#### General References on Solar Shrinkage

1979. *Science News* 115, 420.  
Sofia, S., J. O'Keefe, J. R. Lesh, and A. S. Endal, 1980. Solar constant: constraints on possible variations derived from solar diameter measurements. *Science* 204 (4399): 1306-1307.  
Shapiro, Irwin I., 1980. Is the sun shrinking? *Science* 208 (4439): 51-53.  
1980. Shrinking sun? *Sky and Telescope* 60 (1): 10-11.  
Hughes, David W., 1980. Solar size variations. *Nature* 286 (5772): 439-440.  
Lubkin G. B., 1980. Mercury data show no sun shrinkage. *Physics Today* 33 (5): 21-22.  
Fiala, A. D., D. W. Dunham, and J. B. Dunham, 1980 Preliminary results from observations made near the edge of the path of the 1980 Feb. 16 total solar eclipse. *Bulletin of the American Astronomical Society* 12 (2): 474.

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(Editor's note.) 1980. Whatever happened to neutrino mass? *Nature* 287 (5782): 481, states that, at the time of writing (9 October, 1980) great doubt had developed about the massive neutrinos.

### Order, Entropy, and Intelligent Activity

Some years ago I published an article, A Law of Biological Conservation.<sup>1</sup> Since then I have considered the apparent ability of the human race to suspend the

second law of thermodynamics by creating order through its own achievements in non-biological areas.

Every birth introduces a large amount of negative entropy or information into the universe. In my previous paper it was suggested that the measure of the information contained in the genetic material of the original plant, animal and human creation could never be exceeded, no matter how widespread life becomes or how much genetic engineering is done. In fact, the total remaining information will slowly and steadily decrease through destructive mutations and the extinction of species; thus the second law of thermodynamics holds within the sphere of reproducible life.

However, every human achievement in art, literature, scientific theory and engineering introduces additional order. Given sufficient time, man appears to have the theoretical capacity to impose order upon the entire universe, thus, to extend the original ideas to take in human creativity, we may say that:

(a) Every thought, design, and construct of mankind exists in the mind of God at what to us is every moment from eternity past to eternity future.

(b) Man has the ability, itself an evidence of Divine creation, to rethink Divine thoughts to some limited extent; to record the results of such thoughts, and to apply them to creating order among the materials of his environment.

(c) But man could never, given maximum time and capacity for achievement, think any thought, formulate any valid idea, produce any correct theory, or use these to design, invent, build or bring into being anything not already in the mind of God. This applies no less to "art", for which a quantitative theory of true beauty might in time be developed.

#### Reference

<sup>1</sup>McDowell, Ian, 1971. A law of biological conservation. *Creation Research Society Quarterly* 8 (3): 189-193.

IAN McDOWELL

Principal, Emmaus Bible School  
P.O. Box 234  
Epping, New South Wales  
Australia.

#### The Biblical Creation Society

Your readers may be interested to learn of the formation of the *Biblical Creation Society* in Britain. With its beginnings three or four years back, BCS now has over five hundred paid-up members and as many again receiving its literature. We publish a journal *Biblical Creation* every four months which aims at a serious though not normally technical readership, and which reflects our concern for the creation question in its entirety, encompassing both science and theology. The only requirements of membership are agreement to an evangelical basis of faith and to our aim, which rejects the theory of evolution. Membership is largely made up of students, teachers, academics, professional people, and so on.

Any US readers interested in subscribing to our journal are asked to write to Dr. David Lachman, 316 Hamel Ave., North Hills, Pennsylvania 19038 - the rate is \$4 surface, \$5 airmail. Any interested in joining the Society should write to the Secretary at the Glasgow address of the Society. We have a number of overseas members, and are working hard to build up contacts with creationist movements worldwide.

Our activities are setting into a pattern, with a day conference each autumn in central London (the gathering last year was reported nationwide on the BBC, a rare—if not unique—achievement for creationism over here!), and a study conference over several days every two years. We are working on audio-visual material for use in schools, and producing pamphlets and booklists particularly aimed at students. A major problem which we face in this country is the widespread assumption of theistic evolution by evangelical leaders, especially most of the evangelical scientists of note. So our efforts are devoted to fighting on two fronts, and we are hoping to strengthen the forces working for change in the evolutionary consensus.

We send our greetings to our American brethren!

Yours faithfully

THE REV. D. N. M. de S. CAMERON  
Chairman

Biblical Creation Society  
51 Cloan Crescent  
Bishopbriggs, Glasgow, Scotland  
Received September 3, 1980.

#### Anti-Evolution Ammunition Available

For over three generations tax supported schools (K-12) and the federal government (parks, museums, grants) have been promoting the unprovable belief-system of evolution, while carefully suppressing scientific information that contradicts evolution.

We can finally do something to help stop this censorship of scientific information currently being imposed by our state and federal governments. At my own expense I will send to anyone a set of well developed tools to correct this current evolution monopoly.

P. ELLWANGER

2820 Leconte  
Anderson, South Carolina 29621  
Received September 23, 1980.

#### A Very Quotable Quote

Enclosed is my favorite Quotable Quote taken from Alfred Sherwood Romer's *Notes and Comments on Vertebrate Paleontology*, 1968, University of Chicago Press.

The passage is here quoted with the important part underlined. It is found on page 12 of Chapter One, the "Introductory."

The earliest history of bone is, thus, almost unknown, although the presence of heterostracan material in the Middle Ordovician shows that bone,

or bonelike tissues, is exceedingly ancient. *Considering the trend toward bone reduction seen in many cases in the Devonian and later periods, one is tempted to extrapolate backward and assume that the ancestral vertebrates were highly ossified throughout the skeleton. Such a position however, is quite surely unwarranted; after all, [since evolution is a fact and the history of the vertebrates could not contradict it,] there had to be a period in which bone was being acquired, before the process was reversed and loss set in.*

Emphasis added. Comment enclosed thus [ ], my own.

Please note that Romer here states that the scientific evidence tempts an evolutionist to the thought that vertebrates came from vertebrates which were even more "complex".

In His Majesty's Service

CRAIG GUTH

5445 Prado Ct.

San Bernardino

California 92407

Received September 23, 1980.

### No Need to be Intimidated by Radiometric Dates

Surely the orthodox geologists have forgotten something that must be a vital factor in attempts at radiometric dating. The uranium and other radioactive minerals whose decay products are measured are usually found in igneous rocks. Therefore they arrived at their present locations under conditions of immense heat.

Might this not have caused a tremendous acceleration in the rate of decay? May it not be that almost the whole of those products, on which the uniformitarian figures of age are based, were in fact formed quite quickly, until cooling took place? Certainly Gentry has presented evidence to show that there is something very odd about the radioactive inclusions in these minerals.<sup>1</sup> Thus, the uniformitarian figures may be not merely in error; they may be totally valueless.

There is also the matter of the segregation of materials during melting and solidification, a phenomenon which is well known and is applied in the technology of semiconductors.

As to the nature of the materials concerned while they were still in the uninterrupted magma, does this not enter into the realm of the unknowable?

It seems hard to believe that in the earth as God created it, in which He saw everything to be "very good", there could have been any death-dealing volcanoes. All igneous deposits may therefore be no older than the time of the Flood.

### Reference

<sup>1</sup>Talbott, Stephen L., 1977. Mystery of the radiohalos. *Creation Research Society Quarterly* 14 (2): 103-107.

Yours sincerely

ERIC A. KNAPPELT

(M.R.C.S., L.R.C.P., London)

Lycham, Crown Road, Buxton

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Received October 1, 1980

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*In Volume 17, Number 1 contained pages 1 to 84 inclusive, Number 2, pages 85 to 140, Number 3, pages 141 to 196 and Number 4, pages 197 to 240.*

*All pages of the Quarterly have been numbered consecutively; hence only the beginning page number is provided for each reference.*

*Letters to the Editor are designated by the symbol (L).*

*Items in Panorama of Science are listed alphabetically, in a separate section, according to the contributor.*

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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 \$12.00 (\$13.00 U.S. for overseas) per year and may be sent to Wilbert H. Rusch, Sr., Membership Secretary, 2717 Cranbrook Road, Ann Arbor, Michigan 48104. Sustaining membership for those who do not meet the criteria for voting membership, and yet who subscribe to the statement of belief, is available at \$12.00 (\$13.00 U.S. for overseas) per year and includes subscription to the Annual Issue and Quarterlies. All others interested in receiving copies of all these publications may do so at the rate of the subscription price for all issues for one year: \$15.00 (\$16.00 U.S. for overseas.)

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

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

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

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

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

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

**Board of Directors** *Biochemistry*: Duane T. Gish, Ph.D., Institute for Creation Research, 2716 Madison Avenue, San Diego, CA 92116. *Biological Sciences*: Wayne Frair, Ph.D., Secretary, The King's College, Briarcliff Manor, NY 10510; George F. Howe, Ph.D., President, Los Angeles Baptist College, Newhall, CA 91321; John R. Meyer, Ph.D., Los Angeles Baptist College, Newhall, CA 91321; Wilbert H. Rusch, Sr., M.S., LL.D., Membership Secretary, Professor of Science, Concordia College, Ann Arbor, MI 48105; E. Norbert Smith, Ph.D., Northeastern Oklahoma State University, Tahlequah, OK 74464; Paul A. Zimmerman, Ph.D. Concordia Junior College, River Forest, IL; *Engineering*: D. R. Boylan, Ph.D., Professor of Engineering, Iowa State University, Ames, Iowa 50011; *Genetics*: John W. Klotz, Ph.D., Director of Graduate Studies, Concordia Seminary, St. Louis, MO 63105; *Geology*: Clifford L. Burdick, M.S., D.Sc., 924 N. 6th Avenue, Tucson, AZ 85705. *Geophysics*: Harold Slusher, M.S., D.Sc., University of Texas at El Paso, TX 79902. *Physical Sciences*: Harold Armstrong, M.S., Publications Editor, Queens University, Kingston, Ontario, Canada; Thomas G. Barnes, D.Sc., University of Texas at El Paso, TX 79902; Richard G. Korthals, M.S., Treasurer, P. O. Box 135, Arcadia, MI 49613; Henry M. Morris, Ph.D., Institute for Creation Research, 2716 Madison Avenue, San Diego, CA 92116, and President of Christian Heritage College, San Diego; George Mulfinger, M.S., Content Telephone Laboratories, Norcross, GA; Emmett L. Williams, Jr., Ph.D., Vice-President, Bob Jones University, Greenville, SC 29614. *Science Education*: John N. Moore, M.S., Ed.D., 136 Brody Hall, Michigan State University, East Lansing, MI 48824.

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# Why Not Creation?

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Edited by

**WALTER E. LAMMERTS**

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

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