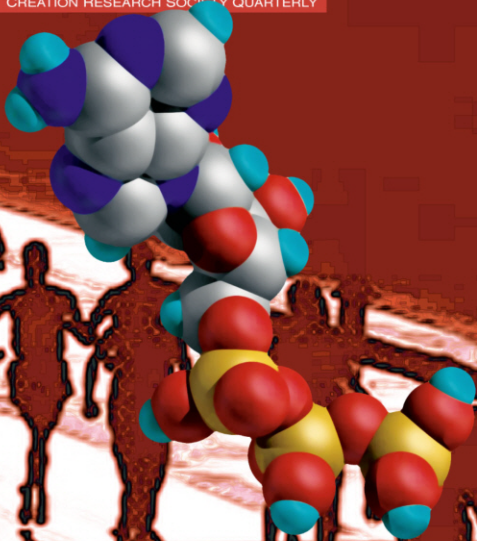


CRSQ

CREATION RESEARCH SOCIETY QUARTERLY



Volume 36

June 1999

Number 1

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Articles

- ATP: The Perfect Energy Currency for the Cell 2
Jerry Bergman
- Rapid Cliff Formation at Colorado National Monument, Mesa County, Colorado 11
Michael Shaver
- The Haymond Formation Boulder Beds of Marathon Basin, West Texas: Theories on Origin and Catastrophic Deposition 17
George F. Howe and Carl R. Froede Jr.

Panorama Notes

- Artifacts Fused in Natural Flow Stone 31
William Waisgerber
- The Wetumpka Impact Crater, Elmore County, Alabama: An Interpretation Within the Young-Earth Flood Model 32
Carl R. Froede Jr.
Emmett L. Williams

Front Cover

The molecular model is of adenosine triphosphate (ATP), which is featured in our first article. It was rendered by Fred Koestner. Assisting were René Brunner and Timothy Wallace.

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Departments

- Editor's Comments 1
Emmett L. Williams, Editor, CRSQ
- Book Reviews
- The Plight of the True Science Teacher* 1
- Taking Wing: Archaeopteryx and the Evolution of Bird Flight* 9
- Creation Evangelism for the New Millennium* 16
- Nature's Destiny—How the Laws of Biology Reveal Purpose in the Universe* 25
- Worlds Apart, The Unholy War Between Religion and Science* 29
- Origins: Linking Science and Scripture* 37
- Patrons of the Society 10
- Keyword Index for Volume 35 (1998–1999) 26
Eugene F. Chaffin
- Call for Papers 31
The Second CRS Monograph on Astronomy
- Minutes of 1999 CRS Board of Directors Meeting 38
David A. Kaufmann, Secretary
- Letter to the Editor 39
- Photo Essay: Hoodoos of the Pyramides d'Euseigne 40
Carl R. Froede Jr. and Timothy Wallace
- Errata 42
- Membership/Subscription Application 43
- Order Blank for Past Issues 44

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Haec Credimus

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

Editor's Comments

Gene Chaffin has ended his five-year term as chief editor of the *Quarterly*. He will serve as Physical Science Editor for the *Quarterly* and was elected Vice-President at the last Board meeting. Gene has been an effective and fruitful member of the Society for many years. George Howe will continue as the Biology Editor and John Reed as the Geology Editor. Don DeYoung, now President, is the Book Review Editor. Lane Lester, the Managing Editor, "makes it all happen" when he designs and constructs the *Quarterly*. The great appearance of the journal is due solely to his efforts. I assume the responsibility as chief editor, and what a difference 10 years make! My last term as editor was in the late 1980s, and it was a lonely job. It is a privilege now to serve with such a highly-qualified team. You can help by sending me articles, notes and letters. Your input is desired. We would benefit from your observations on a multitude of matters.

In his compelling style, Jerry Bergman discusses the molecule, ATP, from a design perspective. Calling ATP the energy provider for the cell, Bergman notes that the structure could not have come into existence by random means. Michael Shaver reports on his continuing field work in southwestern Colorado. Earlier he introduced the region and specifically examined Unaweep Canyon. He now presents the necessity for rapid cliff development at Colorado National Monument using the process of

cliff sapping. He relates his observations to earlier creationist work in the southeastern United States.

For years the Society has sent researchers and field workers to Trans Pecos, Texas to study the biology and geology of the area. Besides Big Bend National Park, considerable time has been spent in Marathon Basin investigating the Haymond Formation. Several articles and notes on this geological formation have appeared in previous issues of the *Quarterly*. George Howe and Carl Froede have summarized the past work, both of uniformitarians and creationists, and they discuss a young earth-Flood model for the origin of the Haymond Formation.

Bill Waisgerber notes some artifacts "glued together" by calcium carbonate and asks the question if archeological time is as suspect as geological time? An impact crater in Wetumpka, Alabama was studied by Froede and me, and a model for its origin during the late stages of the Flood is offered. In a beautifully-illustrated essay, some hoodoos in Switzerland were examined by Carl Froede and Tim Wallace. Such geologic features are found throughout the world and the authors provide a model for their development during a post-Flood ice age. I hope you enjoy reading this issue of the *Quarterly*, and I look forward to hearing from you.

Emmett L. Williams
Editor, CRSQ

Book Review

The Plight of the True Science Teacher by Randall Hedtke
True Science, P.O. Box 103, Alexandria, MN 56308. 1998, 67 pages, \$9.
Reviewed by Don B. DeYoung

Author Hedtke has a distinguished career of high school biology teaching. He has faithfully shown his students the full story of creation and evolution. This has led to occasional conflicts with his Board of Education. This small volume declares that modern evolution accepts miracles just as biblical creation does, only in a secular sense. Evolutionists are then labeled as secular creationists, a somewhat confusing title.

Hedtke further accuses evolutionists of not tolerating, admitting, or even recognizing contrary evidence. The negative experience of George Mivart (1827–1900) is explained in detail. This Catholic naturalist, a contempo-

rary of Darwin, suggested a theistic evolution position. Mivart believed that God had infused a soul into ape-like creatures. His views were expressed in *On the Genesis of Species* (1871) and *Man and Ape* (1873). Mivart's compromise was not welcomed by scientists or theologians. Darwin accused Mivart of "religious bigotry."

Hedtke challenges teachers to give the full story of origins to students. This includes the strengths and weaknesses of both evolution and biblical creation. This will then result in true science teaching, hence the book title. Some examples are given of student-generated alternatives to evolution evidence. The book contains no index.

ATP: The Perfect Energy Currency for the Cell

Jerry Bergman*

Abstract

The major energy currency molecule of the cell, ATP, is evaluated in the context of creationism. This complex molecule is critical for all life from the simplest to the most complex. It is only one of millions of enormously intricate nanomachines

that needs to have been designed in order for life to exist on earth. This molecule is an excellent example of irreducible complexity because it is necessary in its entirety in order for even the simplest form of life to survive.

Introduction

In order to function, every machine requires specific parts such as the screws, springs, cams, gears, and pulleys. Likewise, all biological machines must have many well-engineered parts to work. Examples include units called *organs* such as the liver, kidney, and heart. These complex life units are made from still smaller parts called *cells* which in turn are constructed from yet smaller machines known as *organelles*. Cell organelles include mitochondria, Golgi complexes, microtubules, and centrioles. Even below this level are other parts so small that they are formally classified as *macromolecules* (large molecules).

A critically important macromolecule—arguably “second in importance only to DNA”—is *ATP*. ATP is a complex *nanomachine* that serves as the primary energy currency of the cell (Trefil, 1992, p.93). A nanomachine is a complex precision microscopic-sized machine that fits the standard definition of a machine. ATP is the “most widely distributed high-energy compound within the human body” (Ritter, 1996, p. 301). This ubiquitous molecule is “used to build complex molecules, contract muscles, generate electricity in nerves, and light fireflies. All fuel sources of Nature, all foodstuffs of living things, produce ATP, which in turn powers virtually every activity of the cell and organism. Imagine the metabolic confusion if this were not so: Each of the diverse foodstuffs would generate different energy currencies and each of the great variety of cellular functions would have to trade in its unique currency” (Kornberg, 1989, p. 62).

ATP is an abbreviation for *adenosine triphosphate*, a complex molecule that contains the nucleoside *adenosine* and a tail consisting of three phosphates. (See Figure 1 for a simple structural formula and a space filled model of ATP.) As far as known, all organisms from the

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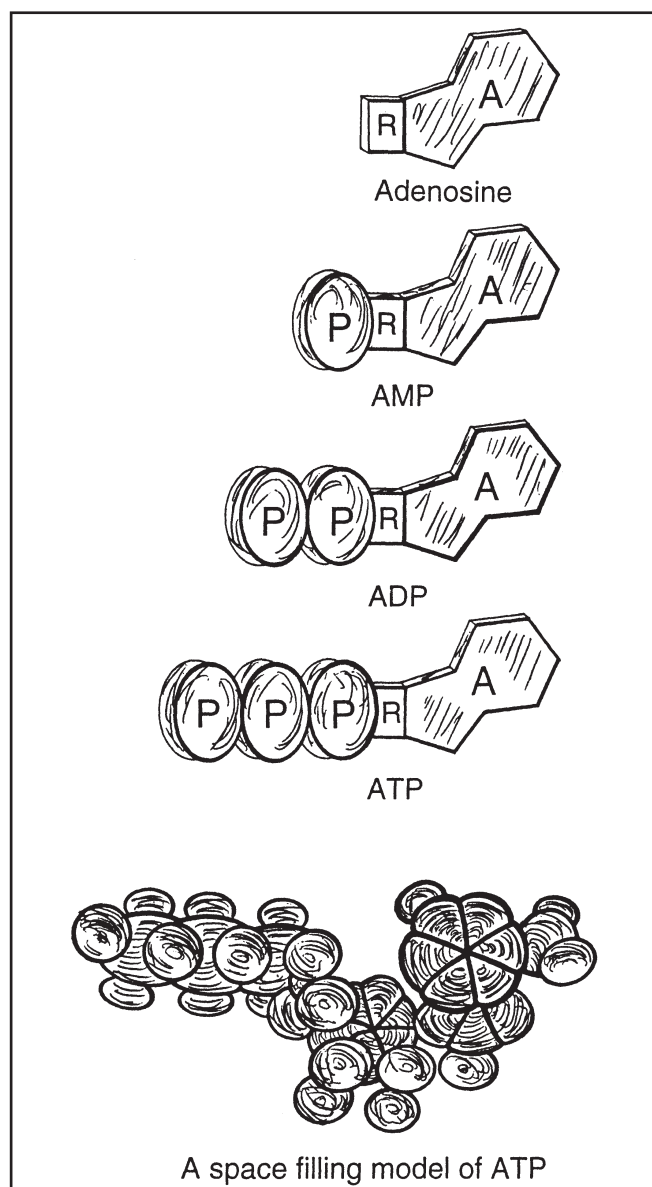


Figure 1. Views of ATP and related structures.

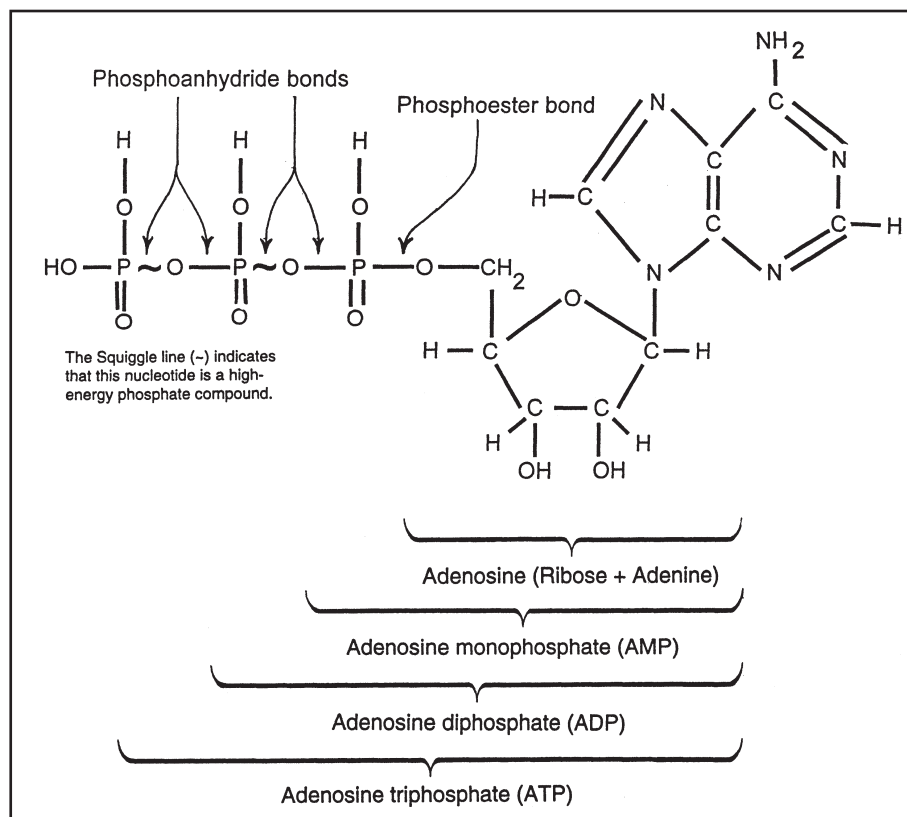


Figure 2. The two-dimensional stick model of the adenosine phosphate family of molecules, showing the atom and bond arrangement.

simplest bacteria to humans use ATP as their primary energy currency. The energy level it carries is just the right amount for most biological reactions. Nutrients contain energy in low-energy covalent bonds which are not very useful to do most of kinds of work in the cells.

These low energy bonds must be translated to high energy bonds, and this is a role of ATP. A steady supply of ATP is so critical that a poison which attacks any of the proteins used in ATP production kills the organism in minutes. Certain cyanide compounds, for example, are poisonous because they bind to the copper atom in cytochrome oxidase. This binding blocks the electron transport system in the mitochondria where ATP manufacture occurs (Goodsell, 1996, p.74).

How ATP Transfers Energy

Energy is usually liberated from the ATP molecule to do work in the cell by a reaction that removes one of the phosphate-oxygen groups, leaving adenosine diphosphate (ADP). When the ATP converts to ADP, the ATP is said to be *spent*. Then the ADP is usually immediately recycled in the mitochondria where it is recharged and comes out again as ATP. In the words of Trefil (1992, p.

93) "hooking and unhooking that last phosphate [on ATP] is what keeps the whole world operating."

The enormous amount of activity that occurs inside each of the approximately one hundred trillion human cells is shown by the fact that at any instant each cell contains about *one billion* ATP molecules. This amount is sufficient for that cell's needs for only a few minutes and must be rapidly recycled. Given a hundred trillion cells in the average male, about 10^{23} or one sextillion ATP molecules normally exist in the body. For each ATP "the terminal phosphate is added and removed 3 times each minute" (Kornberg, 1989, p. 65).

The total human body content of ATP is only about 50 grams, which must be constantly recycled every day. The ultimate source of energy for constructing ATP is food; ATP is simply the carrier and regulation-storage unit of energy. The average daily intake of 2,500 food calories translates into a turnover of a whopping 180 kg (400 lbs) of ATP (Kornberg, 1989, p. 65).

The Structure of ATP

ATP contains the purine base *adenine* and the sugar *ribose* which together form the nucleoside *adenosine*. The basic building blocks used to construct ATP are carbon, hydrogen, nitrogen, oxygen, and phosphorus which are assembled in a complex that contains the number of subatomic parts equivalent to over 500 hydrogen atoms. One phosphate ester bond and two phosphate anhydride bonds hold the three phosphates (PO_4) and the ribose together. The construction also contains a b-N glycoside bond holding the ribose and the adenine together.

Phosphates are well-known high-energy molecules, meaning that comparatively high levels of energy are released when the phosphate groups are removed. Actually, the high energy content is not the result of simply the phosphate bond but the total interaction of all the atoms within the ATP molecule.

Because the amount of energy released when the phosphate bond is broken is very close to that needed by the typical biological reaction, little energy is wasted. Generally, ATP is connected to another reaction—a process called *coupling* which means the two reactions occur at

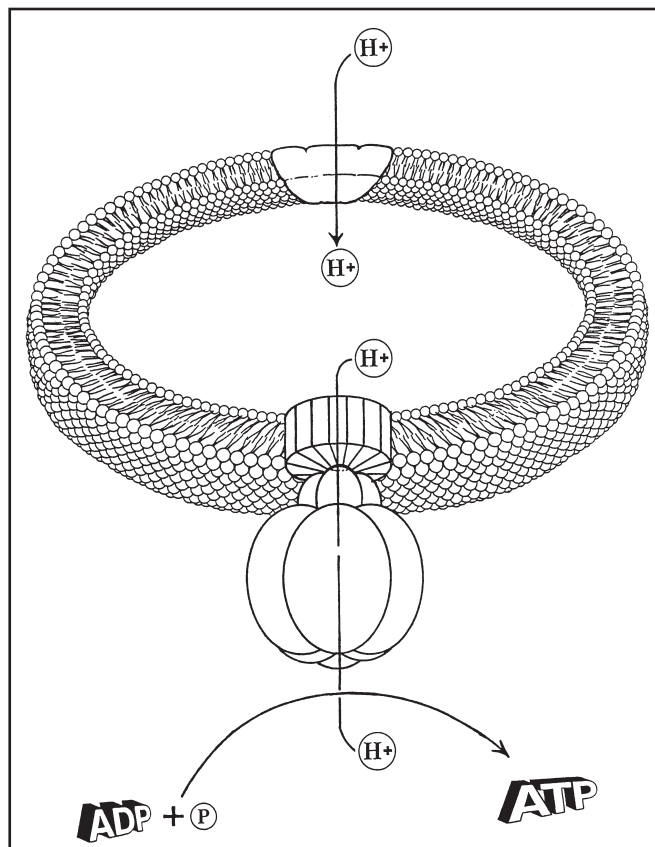


Figure 3. An outline of the ATP-synthase macro-molecule showing its subunits and nanomachine traits. ATP-synthase converts ADP into ATP, a process called charging. Shown behind ATP-synthase is the membrane in which the ATP-synthase is mounted. For ATP charged in the mitochondria, ATP-synthase is located in the inner membrane.

the same time and at the same place, usually utilizing the same enzyme complex. Release of phosphate from ATP is exothermic (a reaction that gives off heat) and the reaction it is connected to is endothermic (requires energy input in order to occur). The terminal phosphate group is then transferred by hydrolysis to another compound, a process called *phosphorylation*, producing ADP, phosphate (P_i) and energy.

The self-regulation system of ATP has been described as follows:

The high-energy bonds of ATP are actually rather unstable bonds. Because they are unstable, the energy of ATP is readily released when ATP is hydrolyzed in cellular reactions. Note that ATP is an *energy-coupling agent* and *not* a fuel. It is not a storehouse of energy set aside for some future need. Rather it is produced by one set of reactions and is almost immediately consumed by another. ATP is formed as it is needed, primarily by oxidative processes in the mitochondria. Oxygen is not con-

sumed unless ADP and a phosphate molecule are available, and these do not become available until ATP is hydrolyzed by some energy-consuming process. *Energy metabolism is therefore mostly self-regulating* (Hickman, Roberts, and Larson, 1997, p.43). [Italics mine]

ATP is not excessively unstable, but it is designed so that its hydrolysis is slow in the absence of a catalyst. This insures that its stored energy is “released only in the presence of the appropriate enzyme” (McMurry and Castellion, 1996, p. 601).

The Function of ATP

The ATP is used for many cell functions including *transport work* moving substances across cell membranes. It is also used for *mechanical work*, supplying the energy needed for muscle contraction. It supplies energy not only to heart muscle (for blood circulation) and skeletal muscle (such as for gross body movement), but also to the chromosomes and flagella to enable them to carry out their many functions. A major role of ATP is in *chemical work*, supplying the needed energy to synthesize the multi-thousands of types of macromolecules that the cell needs to exist.

ATP is also used as an on-off switch both to control chemical reactions and to send messages. The shape of the protein chains that produce the building blocks and other structures used in life is mostly determined by weak chemical bonds that are easily broken and remade. These chains can shorten, lengthen, and change shape in response to the input or withdrawal of energy. The changes in the chains alter the shape of the protein and can also alter its function or cause it to become either active or inactive.

The ATP molecule can bond to one part of a protein molecule, causing another part of the same molecule to slide or move slightly which causes it to change its conformation, inactivating the molecule. Subsequent removal of ATP causes the protein to return to its original shape, and thus it is again functional. The cycle can be repeated until the molecule is recycled, effectively serving as an on and off switch (Hoagland and Dodson, 1995, p.104). Both adding a phosphorus (phosphorylation) and removing a phosphorus from a protein (dephosphorylation) can serve as either an on or an off switch.

How is ATP Produced?

ATP is manufactured as a result of several cell processes including fermentation, respiration and photosynthesis. Most commonly the cells use ADP as a precursor mole-

cule and then add a phosphorus to it. In eukaryotes this can occur either in the soluble portion of the cytoplasm (cytosol) or in special energy-producing structures called mitochondria. Charging ADP to form ATP in the mitochondria is called *chemiosmotic phosphorylation*. This process occurs in specially constructed chambers located in the mitochondrion's inner membranes.

The mitochondrion itself functions to produce an electrical chemical gradient—somewhat like a battery—by accumulating hydrogen ions in the space between the inner and outer membrane. This energy comes from the estimated 10,000 enzyme chains in the membranous sacks on the mitochondrial walls. Most of the food energy for most organisms is produced by the electron transport chain. Cellular oxidation in the Krebs cycle causes an electron build-up that is used to push H^+ ions outward across the inner mitochondrial membrane (Hickman et al., 1997, p. 71).

As the charge builds up, it provides an electrical potential that releases its energy by causing a flow of hydrogen ions across the inner membrane into the inner chamber. The energy causes an enzyme to be attached to ADP which catalyzes the addition of a third phosphorus to form ATP. Plants can also produce ATP in this manner in their mitochondria but plants can also produce ATP by using the energy of sunlight in chloroplasts as discussed later. In the case of eukaryotic animals the energy comes from food which is converted to pyruvate and then to *acetyl coenzyme A* (acetyl CoA). Acetyl CoA then enters the Krebs cycle which releases energy that results in the conversion of ADP back into ATP.

How does this potential difference serve to reattach the phosphates on ADP molecules? The more protons there are in an area, the more they repel each other. When the repulsion reaches a certain level, the hydrogen ions are forced out of a revolving-door-like structure mounted on the inner mitochondria membrane called *ATP synthase* complexes. This enzyme functions to reattach the phosphates to the ADP molecules, again forming ATP.

The ATP synthase revolving door resembles a molecular water wheel that harnesses the flow of hydrogen ions in order to build ATP molecules. Each revolution of the wheel requires the energy of about nine hydrogen ions returning into the mitochondrial inner chamber (Goodsell, 1996, p.74). Located on the ATP synthase are three active sites, each of which converts ADP to ATP with every turn of the wheel. Under maximum conditions, the ATP synthase wheel turns at a rate of up to 200 revolutions per second, producing 600 ATPs during that second.

ATP is used in conjunction with enzymes to cause certain molecules to bond together. The correct molecule first docks in the active site of the enzyme along with an ATP molecule. The enzyme then catalyzes the

transfer of one of the ATP phosphates to the molecule, thereby transferring the energy stored in the ATP molecule. Next a second molecule docks nearby at a *second* active site on the enzyme. The phosphate is then transferred to it, providing the energy needed to bond the two molecules now attached to the enzyme. Once they are bonded, the new molecule is released. This operation is similar to using a mechanical jig to properly position two pieces of metal which are then welded together. Once welded, they are released as a unit and the process then can begin again.

A Double Energy Packet

Although ATP contains the amount of energy necessary for most reactions, at times more energy is required. The solution is for ATP to release *two* phosphates instead of one, producing an adenosine monophosphate (AMP) plus a chain of two phosphates called a *pyrophosphate*. How adenosine monophosphate is built up into ATP again illustrates the precision and the complexity of the cell energy system. The enzymes used in glycolysis, the citric acid cycle, and the electron transport system, are all so precise that they will replace only a *single* phosphate. They cannot add *two* new phosphates to an AMP molecule to form ATP.

The solution is an intricate enzyme called *adenylate kinase* which transfers a *single* phosphate from an ATP to the AMP, producing *two* ADP molecules. The two ADP molecules can then enter the normal Krebs cycle designed to convert ADP into ATP. Adenylate kinase requires an atom of magnesium—and this is one of the reasons why sufficient dietary magnesium is important.

Adenylate kinase is a highly organized but compact enzyme with its active site located deep within the molecule. The deep active site is required because the reactions it catalyzes are sensitive to water. If water molecules lodged between the ATP and the AMP, then the phosphate might break ATP into ADP and a free phosphate instead of transferring a phosphate from ATP to AMP to form ADP.

To prevent this, adenylate kinase is designed so that the active site is at the *end* of a channel deep in the structure which closes around AMP and ATP, shielding the reaction from water. Many other enzymes that use ATP rely on this system to shelter their active site to prevent inappropriate reactions from occurring. This system ensures that the only waste that occurs is the normal wear, tear, repair, and replacement of the cell's organelles.

Pyrophosphates and pyrophosphoric acid, both inorganic forms of phosphorus, must also be broken down so they can be recycled. This phosphate breakdown is accomplished by the inorganic enzyme *pyrophosphatase*

which splits the pyrophosphate to form two free phosphates that can be used to charge ATP (Goodsell, 1996, p.79). This system is so amazingly efficient that it produces virtually no waste, which is astounding considering its enormously detailed structure. Goodsell (1996, p. 79) adds that “our energy-producing machinery is designed for the production of ATP; quickly, efficiently, and in large quantity.”

The main energy carrier the body uses is ATP, but other energized nucleotides are also utilized such as thymine, guanine, uracil, and cytosine for making RNA and DNA. The Krebs cycle charges only ADP, but the energy contained in ATP can be transferred to one of the other nucleosides by means of an enzyme called *nucleoside diphosphate kinase*. This enzyme transfers the phosphate from a nucleoside triphosphate, commonly ATP, to a nucleoside diphosphate such as guanosine diphosphate (GDP) to form guanosine triphosphate (GTP).

The nucleoside diphosphate kinase works by one of its six active sites binding nucleoside triphosphate and releasing the phosphate which is bonded to a histidine. Then the nucleoside triphosphate, which is now a diphosphate, is released, and a different nucleoside diphosphate binds to the same site—and as a result the phosphate that is bonded to the enzyme is transferred, forming a new triphosphate. Scores of other enzymes exist in order for ATP to transfer its energy to the various places where it is needed. Each enzyme must be specifically designed to carry out its unique function, and most of these enzymes are critical for health and life.

The body does contain some flexibility, and sometimes life is possible when one of these enzymes is defective—but the person is often handicapped. Also, back-up mechanisms sometimes exist so that the body can achieve the same goals through an alternative biochemical route. These few simple examples eloquently illustrate the concept of over-design built into the body. They also prove the enormous complexity of the body and its biochemistry.

The Message of the Molecule

Without ATP, life as we understand it could not exist. It is a perfectly-designed, intricate molecule that serves a critical role in providing the proper size energy packet for scores of thousands of classes of reactions that occur in all forms of life. Even viruses rely on an ATP molecule identical to that used in humans. The ATP energy system is quick, highly efficient, produces a rapid turnover of ATP, and can rapidly respond to energy demand changes (Goodsell, 1996, p.79).

Furthermore, the ATP molecule is so enormously intricate that we are just now beginning to understand how it works. Each ATP molecule is over 500 atomic mass units (500 u). In manufacturing terms, the ATP molecule is a machine with a level of organization on the order of a research microscope or a standard television (Darnell, Lodish, and Baltimore, 1996).

Among the questions evolutionists must answer include the following, “How did life exist before ATP?” “How could life survive without ATP since no form of life we know of today can do that?” and “How could ATP evolve and where are the many transitional forms required to evolve the complex ATP molecule?” No feasible candidates exist and none can exist because only a perfect ATP molecule can properly carry out its role in the cell.

In addition, a potential ATP candidate molecule would not be selected for by evolution until it was functional and life could not exist without ATP or a similar molecule that would have the same function. ATP is an example of a molecule that displays *irreducible complexity* which cannot be simplified and still function (Behe, 1996). ATP could have been created only as a unit to function immediately in life and the same is true of the other intricate energy molecules used in life such as GTP.

Although other energy molecules can be used for certain cell functions, none can even come close to satisfactorily replacing all the many functions of ATP. Over 100,000 other detailed molecules like ATP have also been designed to enable humans to live, and all the same problems related to their origin exist for them all. Many macromolecules that have greater detail than ATP exist, as do a few that are less highly organized, and in order for life to exist all of them must work together as a unit.

The Contrast between Prokaryotic and Eukaryotic ATP Production

An enormous gap exists between prokaryote (bacteria and cyanobacteria) cells and eukaryote (protists, plants and animals) type of cells:

...prokaryotes and eukaryotes are profoundly different from each other and clearly represent a marked dichotomy in the evolution of life. . . The organizational complexity of the eukaryotes is so much greater than that of the prokaryotes that it is difficult to visualize how a eukaryote could have arisen from any known prokaryote (Hickman et al., 1997, p. 39).

Some of the differences are that prokaryotes lack organelles, a cytoskeleton, and most of the other struc-

tures present in eukaryotic cells. Consequently, the functions of most organelles and other ultrastructure cell parts must be performed in bacteria by the cell membrane and its infoldings called mesosomes.

The Four Major Methods of Producing ATP

A crucial difference between prokaryotes and eukaryotes is the means they use to produce ATP. All life produces ATP by three basic chemical methods only: oxidative phosphorylation, photophosphorylation, and substrate-level phosphorylation (Lim, 1998, p. 149). In prokaryotes ATP is produced both in the cell wall and in the cytosol by glycolysis. In eukaryotes most ATP is produced in chloroplasts (for plants), or in mitochondria (for both plants and animals). No means of producing ATP exists that is intermediate between these four basic methods and no transitional forms have ever been found that bridge the gap between these four different forms of ATP production. The machinery required to manufacture ATP is so intricate that viruses are not able to make their own ATP. They require cells to manufacture it and viruses have no source of energy apart from cells.

In prokaryotes the cell membrane takes care of not only the cell's energy-conversion needs, but also nutrient processing, synthesizing of structural macromolecules, and secretion of the many enzymes needed for life (Talaro and Talaro, 1993, p. 77). The cell membrane must, for this reason be compared with the *entire* eukaryote cell ultrastructure which performs these many functions. No simple means of producing ATP is known and prokaryotes are not by any means simple. They contain over 5,000 different kinds of molecules and can use sunlight, organic compounds such as carbohydrates and inorganic compounds as sources of energy to manufacture ATP.

Another example of the cell membrane in prokaryotes assuming a function of the eukaryotic cell ultrastructure is as follows: Their DNA is physically attached to the bacterial cell membrane and DNA replication may be initiated by changes in the membrane. These membrane changes are in turn related to the bacterium's growth. Further, the mesosome appears to guide the duplicated chromatin bodies into the two daughter cells during cell division (Talaro and Talaro, 1993).

In eukaryotes the mitochondria produce most of the cell's ATP (anaerobic glycolysis also produces some) and in plants the chloroplasts can also service this function. The mitochondria produce ATP in their internal membrane system called the cristae. Since bacteria lack mitochondria, as well as an internal membrane system, they must produce ATP in their cell membrane which they do by two

basic steps. The bacterial cell membrane contains a unique structure designed to produce ATP and no comparable structure has been found in *any* eukaryotic cell (Jensen, Wright, and Robinson, 1997).

In bacteria, the ATPase and the electron transport chain are located *inside* the cytoplasmic membrane between the hydrophobic tails of the phospholipid membrane inner and outer walls. Breakdown of sugar and other food causes the positively charged protons on the *outside* of the membrane to accumulate to a much higher concentration than they are on the membrane *inside*. This creates an excess positive charge on the outside of the membrane and a relatively negative charge on the inside.

The result of this charge difference is a dissociation of H₂O molecules into H⁺ and OH⁻ ions. The H⁺ ions that are produced are then transported outside of the cell and the OH⁻ ions remain on the inside. This results in a potential energy gradient similar to that produced by charging a flashlight battery. The force the potential energy gradient produces is called a *proton motive force* that can accomplish a variety of cell tasks including converting ADP into ATP.

In some bacteria such as *Halobacterium* this system is modified by use of *bacteriorhodopsin*, a protein similar to the sensory pigment rhodopsin used in the vertebrate retina (Lim, 1998, p. 166). Illumination causes the pigment to absorb light energy, temporarily changing rhodopsin from a *trans* to a *cis* form. The trans to cis conversion causes deprotonation and the transfer of protons across the plasma membrane to the periplasm.

The proton gradient that results is used to drive ATP synthesis by use of the ATPase complex. This modification allows bacteria to live in low oxygen but rich light regions. This anaerobic ATP manufacturing system, which is unique to prokaryotes, uses a chemical compound other than oxygen as a terminal electron acceptor (Lim, 1998, p. 168). The location of the ATP producing system is only one of many major contrasts that exist between bacterial cell membranes and mitochondria.

Chloroplasts

Chloroplasts are double membraned ATP-producing organelles found only in plants. Inside their outer membrane is a set of thin membranes organized into flattened sacs stacked up like coins called *thylakoids* (Greek *thylac* or sack, and *oid* meaning like). The disks contain chlorophyll pigments that absorb solar energy which is the ultimate source of energy for all the plant's needs including manufacturing carbohydrates from carbon dioxide and water (Mader, 1996, p. 75). The chloroplasts first convert

the solar energy into ATP stored energy, which is then used to manufacture storage carbohydrates which can be converted back into ATP when energy is needed.

The chloroplasts also possess an electron transport system for producing ATP. The electrons that enter the system are taken from water. During photosynthesis, carbon dioxide is reduced to a carbohydrate by energy obtained from ATP (Mader, 1996, p. 12). Photosynthesizing bacteria (cyanobacteria) use yet another system. Cyanobacteria do not manufacture chloroplasts but use chlorophyll bound to cytoplasmic thylakoids. Once again plausible transitional forms have never been found that can link these two forms of ATP production from the photosynthesis system.

The two most common evolutionary theories of the origin of the mitochondria-chloroplast ATP production system are 1) endosymbiosis of mitochondria and chloroplasts from the bacterial membrane system and 2) the gradual evolution of the prokaryote cell membrane system of ATP production into the mitochondria and chloroplast systems. Believers in endosymbiosis teach that mitochondria were once free-living bacteria, and that "early in evolution ancestral eukaryotic cells simply ate their future partners" (Vogel, 1998, p. 1633). Both the gradual conversion and endosymbiosis theory require many transitional forms, each new one which must provide the animal with a competitive advantage compared with the unaltered animals.

The many contrasts between the prokaryotic and eukaryotic means of producing ATP, some of which were noted above, are strong evidence against the endosymbiosis theory. No intermediates to bridge these two systems has ever been found and arguments put forth in the theory's support are all highly speculative. These and other problems have recently become more evident as a result of recent major challenges to the standard endosymbiosis theory. The standard theory has recently been under attack from several fronts, and some researchers are now arguing for a new theory:

Scientists pondering how the first complex cell came together say the new idea could solve some nagging problems with the prevailing theory... "[the new theory is]... elegantly argued," says Michael Gray of Dalhousie University in Halifax, Nova Scotia, but "there are an awful lot of things the hypothesis doesn't account for." In the standard picture of eukaryote evolution, the mitochondrion was a lucky accident. First, the ancestral cell—probably an archaebacterium, recent genetic analyses suggest—acquired the ability to engulf and digest complex molecules. It began preying on its microbial companions. At some point, however, this predatory cell didn't fully digest its prey, and an even more successful cell resulted when an intended meal took up

permanent residence and became the mitochondrion. For years, scientists had thought they had examples of the direct descendants of those primitive eukaryotes: certain protists that lack mitochondria. But recent analysis of the genes in those organisms suggests that they, too, once carried mitochondria but lost them later (*Science*, 12 September 1997, p. 1604). These findings hint that eukaryotes might somehow have acquired their mitochondria before they had evolved the ability to engulf and digest other cells (Vogel, 1998, p. 1633).

Summary

In this brief review we have examined only one cell macromolecule, ATP, and the intricate mechanisms which produce it. We have also looked at the detailed supporting mechanism which allows the ATP molecule to function. ATP is only one of hundreds of thousands of essential molecules, each one that has a story. As each of those stories is told, they will stand as a tribute to both the genius and the enormously complex design of the natural world. All the books in the largest library in the world may not be able to contain the information needed to understand and construct the estimated 100,000 complex macromolecule machines used in humans. Much progress has been made in understanding the structure and function of organic macromolecules and some of the simpler ones are now being manufactured by pharmaceutical firms.

Now that scientists understand how some of these highly organized molecules function and why they are required for life, their origin must be explained. We know only four basic methods of producing ATP: in bacterial cell walls, in the cytoplasm by photosynthesis, in chloroplasts, and in mitochondria. No transitional forms exist to bridge these four methods by evolution. According to the concept of irreducible complexity, these ATP producing machines must have been manufactured as functioning units and they could not have evolved by Darwinism mechanisms. Anything less than an entire ATP molecule will not function and a manufacturing plant which is less than complete cannot produce a functioning ATP. Some believe that the field of biochemistry which has achieved this understanding has already falsified the Darwinian world view (Behe, 1996).*

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**Editor's note:* Underlying the young-earth creation model is the presuppositional belief that the Creator fashioned many different kinds of animals separately from each other and that life was first created on day 3 (plants) as well as on day 5 (animals) and day 6 (more animals and people.) In such a scenario we may assume that ATP, and the cell systems governing the synthesis and usage of ATP, were formed as independent components in each of the many different life kinds. In this creation view, the presence of ATP and ATP related cell equipment in nearly all life forms indicates a common designer, not common ancestry. The ATP data have an excellent fit with the creation model.

Book Review

Taking Wing: Archaeopteryx and the Evolution of Bird Flight by Pat Shipman

Simon & Schuster, New York. 1998, 336 pages, \$25.

Reviewed by Wayne Frair, Ph.D.

Author Pat Shipman is a Pennsylvania State University professional anthropologist who when referring to her expertise on the origin of birds says, "During the researching and writing of this book, I have been transformed slowly from an outsider, struggling to understand the issues, into a researcher exploring a few avenues that had been overlooked by others..." (p. 273).

Her venture certainly captured *my* attention! For who with any concern about origins would not be interested in an exciting account constructed around seven specimens of an odd bluejay-sized creature (200–250 grams) most frequently referred to as an "evolutionary link" between reptiles and birds. Even though some sections of the book are detailed and more complex than others, overall the book basically would be understandable to an interested non-specialist. To me experiencing this publication was like listening to and seeing the slides of a person who recently had visited an enchanting foreign country.

Shipman's clarity of thinking is captivating, her objectivity comforting, scholarship compelling, and comprehensive presentation convincing. Until I read this work I still was very open to the idea that the modern-bird-like feathers of *Archaeopteryx* were the products of clever forgery, and future evidence certainly could confirm that they indeed were forged. But, based upon current data as presented by Shipman, it appears clear that we should accept these modern-type winged and feathered critters as genuine fossils.

In this book evolution itself is not on trial. Shipman merely accepts it, but she certainly raises many questions about how it could have happened. Even though she does not consider the option that birds were created rather than naturalistically evolved, her objectivity, at least in my judgment, certainly does not exclude an abrupt creation as entirely reasonable. It could be that *Archaeopteryx* is a unique created kind.

Regarding avian evolution Shipman concludes that the wrist and hands of *Archaeopteryx* “resemble those of theropod dinosaurs closely enough for homology to be defended but not proven; the ambiguity of the situation is such that theropods, thecodonts, and crocodylomorphs all remain possible ancestors for *Archaeopteryx*” (p. 137). “The anatomy is too ambiguous, the morphological gaps between birds, dinosaurs, thecodonts, and crocodylomorphs too broad to be spanned easily” (p. 138).

Did the terrestrial prebirds climb trees (arboreal hypothesis) then jump, parachute, glide and finally flap? If so, then *Archaeopteryx* would represent a gliding phase in this scheme. But no large fossilized trees good for jumping have been unearthed in the Solnhofen region where the *Archaeopteryx* fossils have been found. Also, the wrist and manual structures of *Archaeopteryx* indicate that climbing was unlikely. Arborealists reject the theropod dinosaurs as ancestors of birds because these animals likely could not climb trees; yet arborealists have no other convincing candidates.

The contending hypothesis for the arboreal (“trees down”) opinion is the older (latter 19th century) “ground up” scheme with dinosaurs as avian ancestors. Shipman favors this view. The terrestrial prebirds would have needed to evolve (1) endothermy (warm-bloodedness) and have (2) a high metabolic rate. Both of these are valuable in the production of energy for flying. Moving upward is less hazardous than gliding down while “evolving” toward flapping, but in the ground up process the ancestors of birds would have been hindered rather than helped by gravity; whereas arboreal forms would have been aided by gravity.

Problems for both positions are that in evolving wings and other organs, apparently naturally-selected and usefully-functioning organs including forelimbs would have to be lost. Shipman concludes that:

Evolving flight seems enormously complicated because so many systems are involved, so many functions are shifted or compromised... somewhere in the gaps in the fossil record between reptiles and *Archaeopteryx* some remarkable evolutionary

changes occurred... wings, feathers, enhanced respiratory system, hollow bones, and eventually a remodeled shoulder and arm. We do not yet know how this happened in any detail, or why (pp. 243-244).

Although author Shipman does not discuss creation in *Taking Wing*, in the last chapter she does lean slightly toward this topic when she says, “But opinion and personal satisfaction cannot be used to evaluate the relative merits of competing theories or the accuracy of different models of reality, unless we are speaking of religion and not science” (p. 273). My main concern involves what she means by “reality.” If the goal of science is to understand the way nature is, which I believe she is promoting, and if the supernatural is part of total reality, someone who insists on only a naturalistic perspective will miss the implications of their data which point to reality beyond physical nature. In other words they will stop short of realizing the supernatural (God) because of their limited understanding of what science is.

If God has interacted with the matter-energy-space-time creation, then the strict naturalist myopically will not perceive this clearly. So therefore his or her understanding of reality is truncated. If God created *Archaeopteryx* as a separate kind, the fossil data would be as we find it—pretty much as the British scientist, G.A. Kerkut, pronounced 40 years ago: difficult to fit into a coherent evolutionary pattern. Because of the enormously complicated problems involved in understanding the evolution of birds, Pat Shipman metaphorically portrays “The fossil record of avian evolution” as “a tangled wing” (p. 273).

Author Shipman has communicated with leading authorities, read pertinent literature, and non-dogmatically synthesized the collected material within her reference boundaries—a noble effort well worth serious reading.

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Rapid Cliff Formation at Colorado National Monument, Mesa County, Colorado

Michael Shaver*

Abstract

Williams (1995) and Froede (1996) provided a dramatic example of rapid cliff formation by cliff sapping, a very rapid form of erosion. A comparison is made with a larger set of cliffs, eroded in an earlier time at Colorado National Monument. The author envisions the development of West Central Colorado topography in two

phases: first, the retreat of Flood waters, carving the broad valleys (Shaver, 1998); and, second, a period of catastrophic post-Flood erosion, producing features such as the cliffs at Colorado National Monument. Catastrophic sapping may have applications to other sites in the Colorado Plateau region.

Introduction

The Colorado Plateau region features a large number of dramatic canyons. The prevailing uniformitarian interpretation is that such canyon systems are the product of gradual ongoing processes. A Biblical catastrophist interpretation must propose mechanisms capable of producing the canyons in a time frame compatible with a Biblical chronology.

The Uncompahgre Plateau is a northwest-southeast trending uplift in Western Colorado. The Colorado National Monument (CNM) is an area of the Plateau's largest sandstone cliffs near the northwest end of the plateau, on the northeast dipping flank of the Plateau near the Colorado-Utah border west of Grand Junction, Colorado (Figure 1). The park was set aside in 1911 by President Taft as an addition to the growing national park system, and its original 13,749 acres was later enlarged to 17,606 acres (28 square miles). The CNM overlooks the Grand Valley. The setting has been described in Holroyd (1994) and Shaver (1998a). The uniformitarian stratigraphic column is presented for reference as Table I.

Shaver (1998a) proposed that the Flood deposited the local geologic column and receding Flood waters stripped

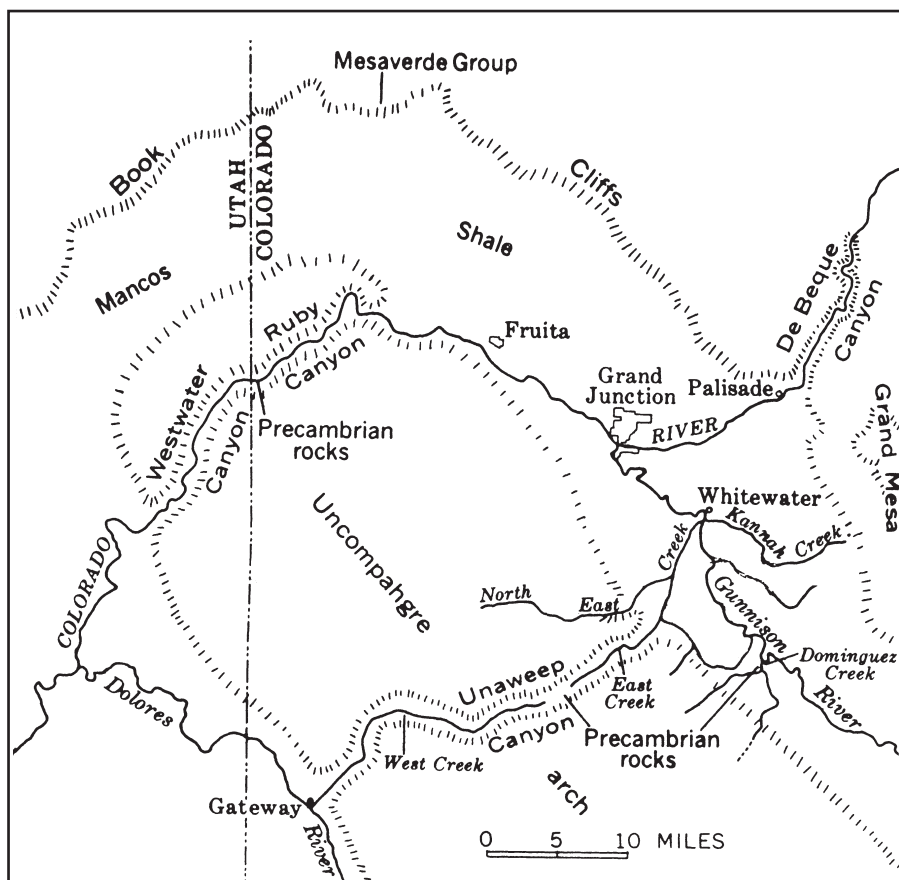


Figure 1. Map of Western Colorado showing geologic features of interest (after USGS, Lohman (1965))

out the broad valleys, "first order features," including the Grand Valley. An evidence for the rapidity of these events is that the rock exposed at the bottoms of the valleys was apparently unlithified when exposed to river erosion. That erosion left entrenched meanders in several areas, including some on the Dolores River on the west of the

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Table I. Regional Stratigraphy of Western Colorado, adapted from Lohman (1965), Prather (1982), and Young (1984).

Evolutionary Term for Time Period	Formation in Colorado Monument
Cenozoic	
Eocene	Basalt Green River Wasatch
Cretaceous	Mesa Verde Mancos Summerville Morrison
Jurassic	Entrada
Triassic	Kayenta Wingate
Permian	Chinle
Precambrian	Gneiss

Uncompahgre Plateau, where the river incised into Entrada, Kayenta, Wingate, and Chinle Formations (the same formations as the cliff formers in the park). Henry Morris notes that entrenched meanders are necessarily the product of river action on unlithified sediments (Whitcomb and Morris, 1961, p. 155).

If the large valleys (The Grand Valley, the Uncompahgre Valley) are products of retreating Floodwaters, it is possible that the canyons on the flank of the plateau (trending northeast) are the products of Floodwaters also. However, it is also possible that retreating Floodwaters did not carve the canyons of the CNM, and that they are the products of post-Flood catastrophism.

Cliff Formation at the Colorado National Monument

In the park itself are cliffs of Wingate and Entrada Sandstone, separated by a bench produced by the Kayenta Formation (Figure 2) on which the park Visitor's Center is built. A thin layer of the Chinle Formation forms a distinct red band between the Wingate and the Precambrian crystalline basement, which undercuts the Wingate Sandstone. The Uncompahgre Plateau is a long plateau with many canyons, yet the most spectacular canyon systems are clearly those within the park. These radiate into the plateau from the Redlands fault.

The Redlands fault runs northwest-southeast along the edge of the Uncompahgre Plateau through the CNM, parallel to the edge of the plateau. It disappears beneath steeply dipping cliff formations on each side of the Monument. The Uncompahgre Plateau side of the fault is higher in elevation than is the valley side, exposing in cross-section up-thrown Wingate Sandstone cliffs. The Wingate Sand-



Figure 2. A typical canyon wall at the Colorado National Monument. The canyon bottom is Precambrian crystalline rock overlain by 80 to 100 feet of the Chinle Formation. It is overlain by the largest cliff former, the Wingate Sandstone, approximately 350 feet thick in this photo. It is easily distinguished by its long lateral bands. The bench is formed by the Kayenta Formation, 45 to 80 feet thick in this photo, with juniper trees. The second set of cliffs is Entrada Sandstone, roughly 150 feet thick (thicknesses taken from Lohman, 1965).



Figure 3. Steep monocline (on the left) and faulted edge of Colorado National Monument (distant), with Grand Valley on the right, near the Grand Junction entrance.

stone dips steeply near the fault on the down-thrown side, but is more horizontal on the plateau side.

The geomorphology of the CNM displays two distinct styles of cliff formation. The first is seen in the steep walls of Wingate Sandstone which parallel the valley and the fault (Figure 3). These cliff walls have undergone little erosional retreat. The second style of cliff formation is seen in long canyon systems which run several miles into the Plateau (Monument Canyon, Ute Canyon, Red Canyon, and No Thoroughfare Canyon). Red Canyon (Figure 4) illustrates this long, narrow style of canyon.

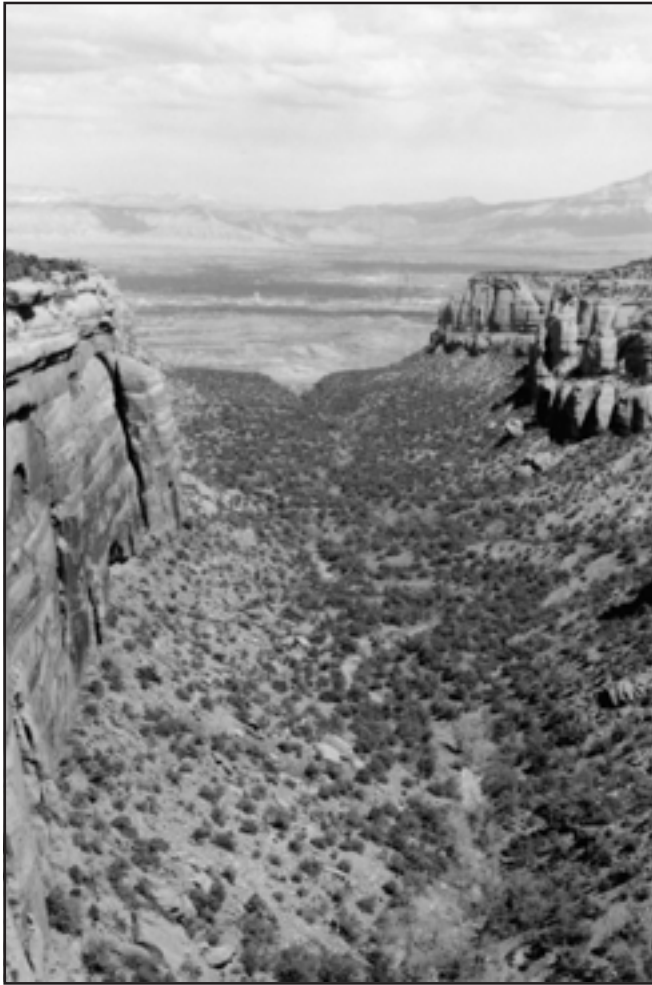


Figure 4. Red Canyon looking northeast toward the Grand Valley. The cliffs are Wingate Sandstone, the profile of the canyon bottom is seen at the end of the canyon. Utah Juniper, the trees in the canyon bottom, are roughly 8 to 10 feet high.

The prevailing uniformitarian theory of gradual erosion by present processes does not easily explain why some canyons were eroded for miles to form narrow, linear features; while other cliffs have retreated only a short distance. One prevalent uniformitarian explanation for cliff formation is the collapse of relatively small sections of canyon and cliff walls (Figure 5). This process is an extrapolation of the current process at work. This process implies that canyon walls would gradually retreat from an initial location over time. According to the prevailing view, and as I told audiences when I was a Ranger naturalist at the park:

Recession of the cliffs away from the middle of the canyons probably was caused partly by undercutting of the soft Chinle Formation by wind and in places by streams. This allowed slabs of the overlying Wingate Sandstone and younger rocks to break off and fall into the canyons—eventually to break

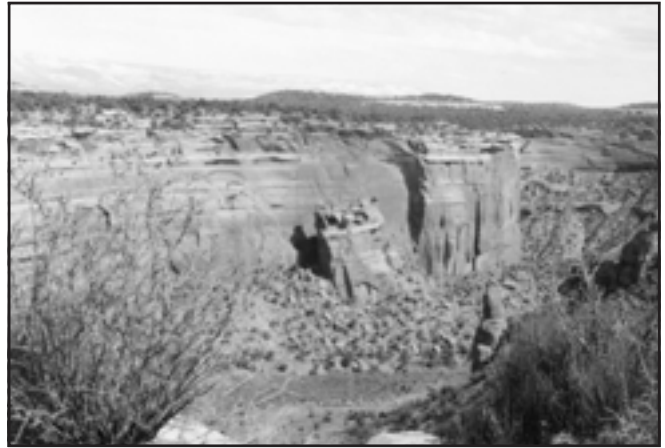


Figure 5. A collapsed section of wall at Fallen Rock Overlook. Note that the feature is so unusual that a special overlook is provided.

up and be carted off as sand and mud by the streams.

But other processes are probably the ones chiefly responsible for the present shape and width of the canyons. The summer sun heats the cliff faces until they are hot to the touch, but in the desert climate of the Monument the rocks cool rapidly after sun-down. Oftentimes the hot cliff faces are chilled rapidly by summer thundershowers.

Even more important, perhaps, is the alternate freezing at night and thawing by day on sun facing cliffs during the winter... [Lohman, 1965, p. 50]

These are the prevailing processes in the CNM at the present, and reveal the philosophical bias of the uniformitarian view. These proposed slow processes have problems. The regional climate in the area has not remained constant. It was quite wet recently, judging from the evidence for glaciation on nearby mountains which presently have no glaciers to speak of. A terminal moraine north of the town of Ridgway (90 miles southeast) shows that large glaciers once existed in the San Juan Mountains. These deposits are considered recent by both catastrophist or uniformitarian, and demonstrate recent climatic variation.

Also, a recent study by Holroyd (1994, pp. 99–109) on a nearby canyon looked at the size and angularity of the boulders and determined that the rubble was the same age at the middle and the edge of the canyon. The conclusion was that the present canyons developed abruptly, and not by the slow processes now leaving rubble. Otherwise there should be older rubble at the center of the valley and younger near the walls where active erosion is taking place. This argues against a gradually developing canyon in which there is a passage of time between the exposure of the canyon middle and the edge, or the beginning and the end. Also, at Fallen Rock Overlook in Ute Canyon



there is a section of a lateral wall, which appears to be collapsing down into the canyon (Figure 5). The Park Service placed a diorama explaining canyon formation by this mechanism. However, this phenomena does not appear to be representative of the canyon system. This site shows local and minor widening of the canyon, whereas the canyon systems are eroded narrow canyons.

Uniformitarian models of erosion do not explain the long-narrow shape of the canyons. The summer sun would heat the north side of Ute Canon and the winter chill would keep ice on the south side, but the canyon grew neither north nor south, but southeast, and uphill. Monument Mesa, which lies undissected between Ute Canyon and Monument Canyon and reaches almost to the fault scarp overlooking the valley, is also under the influence of summer sun and winter chill. Obviously, thermal weathering alone cannot explain canyon formation.

Seasonal streams form waterfalls at the heads of some of the canyons and thereby undercut the cliffs by eroding the softer Chinle Formation. This process may be a reason why the canyons do not end in amphitheaters more



often. Prevalent amphitheaters would indicate mass wasting as the dominant process, but the current setting acts to eliminate the evidence of it. However, amphitheaters are prominent at the ends of Kodels Canyon, Fruita Canyon, Gold Star Canyon, the south end of Ute Canyon, and many smaller side canyons and unnamed canyons. This implies mass wasting as a prominent process.

A Catastrophist Proposal

A catastrophist model for cliff formation in the CNM may be found in an article describing rapid canyon formation in Georgia (Williams, 1995, pp. 29–43; amplified by Froede, 1996, pp. 39–43). The post-Flood saturation of

rocks and a wet post-Flood climate at CNM would provide conditions for the agent of erosion cited in Georgia: cliff sapping. A diagram of Providence Canyon, Georgia, depicts a canyon system featuring long, narrow canyons (called "fingers" and numbered 1-9) cut into cross-bedded sand, reminiscent of CNM on a smaller scale. The canyons were developed by sapping during historic times with a rapid advance recorded in 1990 during a rainstorm. The largest Providence canyon is a half-mile long, 300 feet wide and 150 feet deep. The sapping process studied in Georgia occurs as follows:

...as rainwater permeates the Providence sands, it continues downward until it reaches a lens of kaolin which is impermeable to water penetration. There the groundwater moved laterally toward the canyon wall carrying sediment with it, weakening the wall. The overlying sediments, being undercut, often slump downward, forming a talus cone. [Williams, 1995, p. 34]

The photos from Georgia include Williams' Figure 6a, (reprinted as my Figure 5) show a monolith quite similar in appearance to Independence Monument in the CNM (Figure 6). Williams' Figure 13b looks remarkably like the canyons of the CNM except for scale.

At the CNM, the porous sandstone of the Wingate and Entrada Formations would have been saturated at the end of the Flood. Recharge of moisture would have been high in a wet post-Flood ice age. Water would have percolated through porous sands until reaching the Chinle Formation and Precambrian basement. Groundwater could then have moved along the top of impermeable basement rocks to the edge of the cliffs, emerging as springs along the Monument fault and undercutting the walls, similar to the example in Providence Canyon, Georgia. The spectacular cliffs of the CNM resulted from the presence of the Redlands fault, which exposed the cliff face to sapping. Elsewhere, the porous Wingate Sandstone is not often exposed, and instead the Dakota Sandstone forms less dramatic cliffs.

Springs re-supplied from high elevation may have provided abundant water along the up-thrown side of the fault. This water may have initiated canyon formation. As canyons lengthened, they would have lowered the local water table at the uppermost extension of each canyon, diminishing the tendency for sapping of the lateral walls and of the cliffs closest to the valley. Those cliffs would remain because the groundwater would be converted into rivers in the bottoms of canyons like Ute Canyon, largely stopping the sapping phenomena except at the uppermost end of each canyon. If the cliff-sapping seen in 20th century process in Georgia was more vigorous due to post-Flood, higher energy conditions, then larger-scale, more rapid canyon formation would have occurred in a post-Flood world. An increasingly dry climate and

lithification of the rocks would then result in decreasing canyon carving (sapping) and the onset of the present regimen. Desert varnish on the Wingate Sandstone in many locations indicates that the cliffs are relic features.

If the canyons are post-Flood there remains the question of why there is no debris at the foot of the canyons. Again, the Providence Canyon situation may be illustrative. Three figures are presented in the Georgia article, showing a sedimentary deposit from canyon erosion after the 1990 storm. The deposit was six feet high in 1990 (26a), reduced to four and one half the following year (Figure 26b), reduced to one foot four years later (26c). Normal erosive forces have removed much, if not all, of the evidence of the 1990 catastrophe. (Williams, 1995, p. 38)

A lack of rubble is a frequent topic in discussions about the Colorado Plateau in general and this area in particular. Perhaps the post-Flood ice age would flush most of the sand out of the area (the product of sapping of relatively unconsolidated sandstone would be sand, not boulders). In other desert regions, rubble chokes canyons. Browse through photos of the Great Basin region and note the broad fans of rubble surrounding the mountains. Yet the climate is quite comparable. Yet Figures 7 and 8 illustrate the conspicuous lack of talus. Perhaps the difference is the prevalence of sapping in this site, and other processes at work in the Great Basin.

Figure 7 also illustrates Shaver's two orders of canyons (Shaver, 1998a, pp. 218-224), with the entire canyon in the foreground being spectacular yet secondary to the even larger valley between these cliffs and the Book Cliffs in the dim horizon. Similarly, note the scale of the master valley in the background of Figures 4 and 5. The cliffs in the Monument are therefore reckoned by Shaver as the product of post-Flood catastrophism, whereas the master valley would be the product of cataclysm during the Flood retreat.

Conclusion

It may be that both orders of canyons are the products of the retreat of Floodwaters. This author proposed retreating Floodwaters as the mechanism by which the adjacent Grand Valley was developed. It seems that a second order of features might be produced by another means. Other hypotheses may be forthcoming. But at present the example of rapid canyon development in Georgia holds promise in explaining the development of post-Flood canyon systems in the Colorado Plateau.

Those enamored with slow processes are quick to find analogues in present day slow processes. It is interesting that as more examples of rapid processes are witnessed, more analogues can be made to features such as these cliffs.

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Book Review

Creation Evangelism for the New Millennium by Ken Ham

Master Books, Green Forest, AR. 1999, 176 Pages, \$12.

Reviewed by Don B. DeYoung

Ken Ham is the director and co-founder of Answers in Genesis (AIG). This growing ministry presently has active branches in six countries. Ken moved from Australia to the U.S. with his family 15 years ago. After several years with the Institute for Creation Research in San Diego, Ken began the AIG operations in northern Kentucky. Activities there include creation conferences, book sales, and a planned major museum/educational center.

Ken breaks new ground with this book, stating that creation evangelism “is one of the most powerful and necessary tools for God’s people today” (p.146). He also calls his approach pioneer evangelism or pre-evangelism (p.100). To support this claim he explains that western society today is similar to the godless gentile world of New Testament times. In both Acts 2 and Acts 17:1-4, Paul reasoned with his audience from the scriptures because there was a common ground of familiarity (p.49). In Acts 17:18- 34, however, Paul preaches to the Epicureans and Stoics, whose philosophies were entirely foreign to theism. This time, before teaching the gospel, Paul goes “back to Genesis” to describe the Creator of the universe. Ken Ham concludes that before the seeds of the gospel can be planted today, the “field” must be prepared by removing obstacles, mainly evolution, and introducing the Father as well as the Son.

Ken fills this book with collected testimonies, with his speaking strategies, and with his heart. In one chapter he outlines history as the “Seven Cs”: Creation, Corruption, Catastrophe, Confusion, Christ, Cross, and Consummation (p. 114). Ken also describes seven different groups of people that he encounters on the speaking circuit. These groups include (1) Young-earth creationists (2) Gap theorists (3) Progressive creationists and theistic evolutionists (4) Theological liberals (5) Skeptical university students (6) Agnostics and atheists, which are often professors (7) University graduates, often with new age leanings. Although Ken’s list is not inclusive of everyone, it is still useful. He then generalizes this list to the family structure, explaining the frequent, sad trend downward to a lower view of scripture as generations pass from grandfolks to grandchildren (p. 143). Ken also makes the case that many Christian colleges have descended through this hierarchy of gradual apostasy.

This book deserves a wide audience. It gives encouraging motivation for the defense of biblical creation. There are many diagrams, including the “trademark” AIG creation-evolution castle picture (pp. 78, 96). The book contains endnotes and further resources, but no index.

The Haymond Formation Boulder Beds of Marathon Basin, West Texas: Theories on Origin and Catastrophic Deposition

George F. Howe and Carl R. Froede Jr.*

Abstract

The Haymond Formation exposed within the Marathon Basin contains blocks and boulders derived from at least three different source areas. Uniformitarian geologists have proposed several different depositional settings in an effort to understand the origin of these blocks and associated boulder beds. This article reviews those models, explains their shortcomings, and proposes a solution within the framework and time frames of the

Young-Earth Flood model. We propose that these blocks and boulders were locally derived and subaqueously deposited during the global Flood, within at least two different yet related settings: 1) as boulders within turbidity-currents, 2) and as slump and/or slide blocks derived from the rim of the basin and from upturned thrust blocks due to tectonism associated with the Ouachita Orogeny (viewed as a Flood tectonic event).

Introduction

The Haymond Formation found within the Marathon Basin in southwest Texas, has been the subject of numerous uniformitarian investigations, spanning many decades (Figure 1). As a stratigraphic unit, the Haymond Formation contains individual layers composed of large-scale blocks and associated boulder beds of enigmatic origin. The block and boulder beds primarily occur around the rim of the basin and in the area adjacent to Housetop Mountain (Figures 2 and 3). Various studies have been conducted in an attempt to comprehend the depositional and paleoenvironmental setting in which these sediments were originally formed. Recently, creationists have brought these depositional models under scrutiny in an attempt to determine their applicability within the Young-Earth Flood model (Froede, Williams, Howe, and Goette, 1998; Howe and Williams, 1994; 1995).

Several uniformitarian geologists have proposed that some strata within the Marathon Basin reflect turbidity-current deposition (Denison, Kenny, Burke, and Hetherington, 1969; King, 1978; McBride, 1966; Thomson and McBride, 1964). Many creationists would agree, but add that the majority of the strata within the Marathon Basin was locally tectonically derived and was deposited via Flood generated turbidity-currents¹.

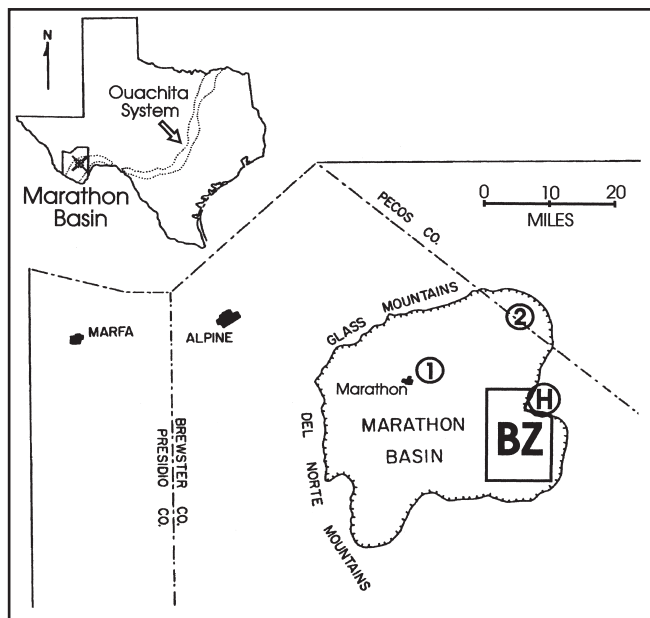


Figure 1. Location map showing the most prominent Boulder-bed zone (BZ) within the Marathon Basin, adjacent to Housetop Mountain (H). Boulders were also noted in the Haymond Formation exposed at location No. 1, [reported in Froede, Williams, Howe, and Goette (1998)] and No. 2 [McBride, 1966, p. 6]. This figure is adapted from McBride 1969b (p. 2, Figure 1).

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¹A creationist overview of turbidity currents and their resulting deposits can be found in Froede, 1998. Large-scale submarine debris flows, misidentified as glacial deposits, are described and discussed in Oard, 1997.



Figure 2. Housetop Mountain. Around the base of this flat-topped mesa lie isolated outcrops of blocks and boulder beds derived from still enigmatic source areas.

Previously, Howe and Williams (1995) reported on a section of the Haymond Formation called the Housetop Mountain Boulder Beds Member. They described its alternating layers of turbidity-current-derived flysch, composed of arkose, conglomerates, and boulder-bearing mudstone. Their report centered on the twofold nature of the boulder beds in mudstone strata: (1) large fragments of limestone and novaculite and (2) smaller cobbles of igneous and metamorphic origin. They concluded that the energy needed to deposit the boulders and blocks (some up to 40 feet in size), within such mudstone beds supports a high-energy (catastrophic) depositional setting. This mixture of cobbles and boulders within the mud matrix is identified as wildflysch. Limestone and other large boulders in the wildflysch apparently came from considerable distances away from the place of final deposition, and the source of the smaller exotic cobbles remains unknown (Howe and Williams, 1995).

This article will examine several depositional models that have been proposed by uniformitarian geologists in an attempt to explain how the Haymond Formation wildflysch formed. We will comment on the numerous shortcomings provided by these theories in addressing the block and associated boulder beds. Additionally, we will provide a valid and defensible solution to the possible origins of the Haymond Formation wildflysch, within the framework of the Young-Earth Flood Model.

Possible Origins of the Haymond Formation Boulder Beds

From 1931 to 1975, uniformitarian geologists evaluated the Haymond Formation wildflysch layers and promoted



Figure 3. Isolated blocks of rock believed to be Haymond flysch boulders. These slabs of strata are estimated to be six to ten feet in diameter and lie less than one-half mile from the base of House Top Mountain.

widely diverse theories about their origin, and method of emplacement. Advocates of each hypothesis marshaled various items of supporting evidence in an effort to address the physical evidence. What follows is an examination and evaluation of several of these uniformitarian theories.

A Glacial Theory

According to Baker (1932, pp. 598, 602) there are at least nine characteristics of the boulder beds that support a glacial mechanism of emplacement. He noted that ice, not water, would produce a deposit that is unsorted, like these boulder beds. Baker also asserted that ice would have been capable of moving even the largest of the sedimentary blocks. The flysch interbeds (layers above and below the boulder beds) had "...a typical varve structure" which would likewise fit with Baker's idea that these strata were glacially formed (1932, pp. 579-580).

Perhaps the strongest evidence favoring possible glacial deposition are the scouring, cross-striations, and percussion marks which Baker (1932, pp. 586, 588) found on certain exotic cobbles. The flattening (known as soling) was most pronounced on certain quartzite and chert cobbles that contained from one to seven flattened surfaces on a given rock. According to Baker (1932, pp. 595-596), soling occurred when the rocks were held in ice (which temporarily prevented them from changing position) while they were being flattened. He admitted, however, that soling could have been caused by faulting or by "interstitial movement" in the rocks.

Carney (1934, p. 70) wrote a brief note in which he too affirmed a glacial mechanism. He called the boulder beds "tillites" of "aqueoglacial" origin. From the mid-1920's throughout the 1930's it was common for uniformitarian geologists to attribute the transport of large boulders in

boulder beds to a glacial setting (see also Powers, 1928, p. 1046).

The Glacial Mechanism Evaluated

Problems with the glacial model became apparent when this evidence was more closely examined and compared to other similar settings. The number of soling marks and other indicators of glacial activity on the boulders/blocks within the Haymond Formation were found to be lacking for the most part. The few features that did exist could have been produced by mudflows or other mechanisms. Crowell (1957, p. 993) noted that episodes of glaciation may have been wrongly proposed, based on the assumption that such marks are necessarily caused by glaciers:

In fact, some glacial episodes may have been introduced into geologic history based on the interpretation of such rocks as tillites without independent supporting evidence. Such "tillites" should therefore be restudied, for they may have originated by slumping and mixing of interbedded gravel and mud precontemporaneously with deposition.

It is worth noting that Lehman (1945) rejected a similar glacial transport setting for erratic masses of rock in the Arbuckle Mountains of Oklahoma. At present there is little support for the idea that the Marathon Basin experienced glaciation at any time in the past.

It is the contention of Oard (1997) that none of the evidence for worldwide pre-Pleistocene glaciation is compelling. Rather, he has proposed (and we agree) that the physical evidence used to support glaciation is better explained by invoking large-scale submarine landslides globally within the framework of the Flood of Genesis. We applaud Oard's work and find it directly applicable to the Haymond Formation wildflysch.

A Mudflow Theory

King (1937, p. 91) asserted that all evidence for glacial origins "...could equally well be interpreted as the work of mud flows." He cited reports from California and Nevada in which gigantic blocks "...as large as most of those in the Haymond formation" (King 1937, p. 91) had been transported for many miles in mud-filled streams.

King also argued that the boulders in the Housetop Mountain beds were not transported by flowing water because the boulders are "intraformational" (occurring throughout a single stratum) while boulders in water-formed conglomerates are ordinarily "basal"—occurring at the bottom of a stratum only (King, 1937, p. 90). The mudstone layers are found repeatedly throughout a

thickness of about 275 m (see Howe and Williams, 1995, Figure 11). The presence of a mudstone matrix is itself strong evidence favoring a mudflow origin.

Tectonism versus Mudflows: A Published Debate

There was a hiatus in the literature (perhaps related to World War II) from the late 1930s to the middle 1950s, after which interest again centered on the boulder beds. Hall (1956, p. 2254) first referred to tectonism as the sole cause of the boulder beds. In concluding a paper on orogeny, Hall (1956, p. 2254) remarked that:

...the Haymond conglomerates were formed in response to Upper Pennsylvanian epeirogenic movements...

A year later Hall (1957, pp. 1633-1634) further suggested that the large sedimentary fragments were derived from the denuded cores of faulted folds. He proposed that the boulders were not transported and bedded, but fault breccia and outcrops of Paleozoic strata brought to their present location by faulting and folding. Hall pointed to breccia in the Housetop Mountain beds as a clear indication of their tectonic origin (Hall, 1957, p. 1635). Some of the breccia was even further brecciated, suggesting two separate fault movements.

Commenting on Hall's tectonic model, King (1958) noted that the idea these beds are the remnants of faulted folds had been previously considered by several investigators, but was discarded based on a detailed examination of the boulder bed strata. King (1958, p. 1733) admitted that many of the large novaculite and chert boulders were brecciated but he asserted that the brecciation:

...occurred before they arrived at their present positions: ...cherts and novaculites were faulted *in situ* before or during deposition of the boulder beds.

Flawn (1958) sided with King, expressing disagreement with Hall's idea that the large boulders are merely the eroded remnants of faulted cores. Flawn pointed to the interspersed igneous and metamorphic cobbles in these same beds as support for a mudflow rather than simple tectonic origin (1958, p. 1735).

The published dialogue ended in 1959 when Hall repeated his view that the "big boulders" are merely the *in situ* remnants of previous tectonism. He conceded, however, that the smaller metamorphic and igneous rocks might have been added later by a mudflow (Hall, 1959, p. 239).

Through the 1960's and 1970's, McBride elaborated on the evidence used to support the concept of gigantic mudflows as the agency of deposition (1964; 1966; 1969a; 1970; 1978). He envisioned a deep-water turbidity current depositional environment as the setting for the Haymond Formation, including the boulder beds. He

proposed that major mudflows originated as the product of submarine slides triggered by earthquakes.

We believe that King, Flawn, and McBride are correct in arguing that the blocks and boulder beds cannot be explained as merely the *in situ* remnants of faulted and eroded ridges. The large blocks are not connected to any adjacent formation but are completely surrounded by the mudstone matrix.

Catastrophic Tectonism as the Source of the Large Limestone Boulders

While it appears unlikely that the giant boulders are the remnants of faulted folds; many of the geologists who have worked on the Haymond Formation boulder beds saw a diastrophic source for the Pennsylvanian limestone blocks. Sellards (1931, p. 18) proposed that the largest boulders, which he called “erratics” are:

...evidence of uplifts, mountainous in character, adjacent to the Marathon region ...The erratics, therefore are evidence of mountain-making movements affecting the ancient land masses lying to the south and east of the Marathon region.

He believed that these limestone fragments originated by way of folding and overthrusting. Baker (1932, p. 593) likewise proposed that there was an original diastrophism which is reflected in the underlying Tesnus deposits, and then a second diastrophic event that brought on the “Haymond deposition”:

A second epoch of diastrophism, or the extension of diastrophism farther northwest, is demonstrated by the boulder deposits of the Haymond. This diastrophism was intense, since the novaculite was greatly deformed before boulders derived from it were deposited in the Haymond, and there must have been land of high relief to furnish the extremely coarse detritals from the thick suspension of rocks which are found in the Haymond boulder beds.

King, Baker, and Sellards (1931) wrote about the uplift of a source area in west Texas, probably to the south of the present day boulder beds. They expressed the belief that the boulders were produced and moved by diastrophism and uplift, not by streams, currents, or landslides. King (1937) envisioned overthrusts on the Hell’s Half Acre fault (south and southeast of Marathon Basin) as a southeasterly source of the large boulders. More recent work conducted by Palmer, Demis, Muehlberger, and Robison (1984) supports this southeasterly source.

Tectonism May Have Produced the Basin

Ross wrote of thrust faulting as providing the mechanism for the development of the Marathon Basin. He de-

scribed the northwestward growth of a series of shallow marine shelves by tectonic movements. These shallow shelves were progressively thrust northwestward, one over the other. At this time, a trough called a “fore-deep” was formed:

The general relationships are such that the uplifted and deformed sediments of the geosynclinal facies were progressively thrust northward in a series of steps onto the craton and that the weight of the thrust materials caused the depression of the craton margin to give rise to a narrow fore-deep which, in turn, received deepwater turbidites, black shales, and related deposits (Ross, 1981, p. 135).

King (1958, p. 1734) referred to the Marathon Basin as a deep, rapidly subsiding trough. Even as late as 1978, King still believed that the flysch sequence (including the boulder beds) were created by:

...quickenings tectonic activity. An exaggerated phase is the wild-flysch of the Haymond, whose small to giant clasts were derived partly from uplifts within the trough, and partly from the foreland and backland (p. 5).

A Second Debate: Mudflows Versus Stream Deltas

McBride (1966) claimed that deep-water turbidity currents produced the Haymond flysch with its wild-flysch beds. In 1970, Flores and Ferm attempted to show that the Haymond interbeds were deposited in the shallow water of prograding deltas. Flores attributed various portions of the Haymond Formation to delta-front, delta, or delta plain sedimentation (Flores, 1975a, pp. 2299–2301). In Flores’ view (1975a, p. 2294), the boulder beds were formed in a small cul-de-sac of slack water where deposition occurred only during periods of high-energy runoff:

...the Housetop middle-upper interval of black carbonaceous shale, gravelly siltstone, bouldery beds, and conglomerate probably represented deposits of cul-de-sac of slack water on the delta plain which was reached only during periods of greatest runoff and high-velocity currents.

Flores and Ferm (1970) presented what they believed to be a contemporary example of a delta model for boulder bed genesis in a short-headed stream (Canadaway Creek, New York) that flows into Lake Erie. Flores (1975a, p. 2297) summarized this delta-related boulder bed analogue by noting that the:

...Devonian and Pleistocene deposits are incised by short-headed streams (average of 50 km) with steep gradients. The narrow valleys are choked with gravels including boulders which are flushed down-

Table I. Reported Sizes of Erratic and Exotic Clasts in the Haymond Formation Boulder Beds.*

Rock Type	Maximum Size	
	Feet	Inches
Dimple limestone	130	
Pennsylvanian limestones	100	
Caballos chert and novaculite	40	
Tesnus sandstone	35	
Maravillas chert	5	
Other sandstones		24
Middle Cambrian (<i>Bolaspidella</i> Zone) limestone		24
Gneissic granite-granodiorite		10
Sheared porphyritic rhyolite		10
Vein quartz		6
Dimple chert		4
Schist		3

*This table provides a summary of the maximum size blocks and boulders encountered within the Haymond Formation across the Marathon Basin. We would agree with certain uniformitarian geologists that these blocks and boulders were likely derived due to the result of orogenic processes associated with the Ouachita Orogeny. We also agree that these blocks and boulders were derived from massive upturned strata that were faulted and thrust over one another, and whose exposed upper surfaces served as the source for sediments filling the adjacent Marathon Basin. However, we believe that the formation and filling of the Marathon Basin happened rapidly during the Flood-based Ouachita Orogeny. The table is derived from Denison et al., (1969, p. 246), McBride (1966, p. 26), and Palmer et al., (1984, p. 91).

stream into small deltas during periods of high runoff some of the large boulders simply sink into the salty to sandy nearshore deposits

Flores and Ferm (1970, p. 626) attributed the large accumulation of boulders in the walled valleys of the river to "episodes of heavy rainfall, and reworking of headland and wave cut scree detritus." They believed that "...the Lake Erie model may supply a reasonable approximation of the Haymond sedimentary conditions."

In the same year that Flores and Ferm released their views concerning Canadaway Creek, McBride promoted a river in France (the Var) as a modern analogue for a deep-water turbidite mudflow mechanism. McBride (1970, p. 80) asserted that where the Var River enters the Atlantic Ocean it demonstrates how the Haymond boulder beds may have formed:

...the blocks and associated finer debris were carried in submarine slumps, debris flows, and mudflows from shallow water into deeper water. The huge

rocks churned through unconsolidated sandstone and shale beds and generated mudstone that helped carry the blocks further. The occurrence of chert and novaculite breccias and the presence of formations that normally lie 1,000 to 3,000 m stratigraphically below the boulder beds suggests the fragments were derived from thrust sheets...

McBride envisioned thrust sheets as the source for the large sedimentary blocks, and he believed that the boulder beds formed within turbidity currents operating in deep water. The debate between Flores and McBride on the issue of possible depositional settings for the block and boulder beds occurred again in 1975, with no further resolution (McBride, 1975; Flores, 1975b).

In an effort to recognize Flores' work, King (1975, p. 8) suggested that certain sandstone beds in the *upper half* of the Haymond may have been formed on a delta:

Flores proposes that these are delta front and delta-plain deposits; this is plausible, as by late Haymond time the flysch trough had been nearly filled, especially along its northern margin.

In our evaluation of the two depositional settings, we agree with the position advocated by McBride that the preponderance of evidence used to define the Haymond Formation, is better supported invoking turbidity current deposition for the majority of the Haymond Formation wildflysch and blocks. In our catastrophic scenario, a few rapidly prograding delta-fed deposits could have formed at the top of the Marathon Basin stratigraphic sequence. However, we do not believe that a typical "uniformitarian" delta by its own actions could form the block and boulder beds of the Haymond flysch deposits as Flores has suggested.

Boulder/Block Source and Transportation Problems

Recent studies within the Marathon Basin, regarding the composition and age of the various boulders and blocks found within the Haymond wildflysch, have raised even greater confusion about their possible source areas and transport distances. According to Palmer et al., (1984, p. 94), there are three populations (see Table I) of boulders within the Haymond flysch:

- Angular to rounded clasts of older Marathon Basin formations
- Well-rounded exotic clasts of sedimentary, igneous, and metamorphic rocks
- Exotic unmetamorphosed Middle Cambrian (*Bolaspidella* Zone) limestone boulders

In 1969, Denison et al., reported on the radioactive isotope dating of igneous and metamorphic boulders collected from the Haymond Formation. Their results

determined that the source of the igneous and metamorphic boulders could not be clearly defined within the local area immediately around the basin (based on comparing rocks with presumed similar age-dates). They also examined outcrops of similar types of igneous and metamorphic rocks from as far away as 300 miles to the south (in Mexico) and 100 miles to the west (Texas and Mexico), and found nothing which yielded similar age-dates (using the Rubidium-Strontium dating method). It was concluded that the source for these Haymond Formation boulders could not be identified (Denison et al., 1969, p. 245). In attempting to determine the travel distance of these igneous and metamorphic boulders, Denison et al., (1969, p. 250) stated:

A germane question is the distance which boulders of this type and size in the Haymond Formation can be transported. The answer cannot be strictly quantitative, but the distance is certainly considerably in excess of 100 miles.

The source areas for these igneous and metamorphic rocks remains undetermined despite projected transport distances.

In a more recent paper on the boulder beds, Palmer et al., (1984) identified limestone boulders within certain areas of the Haymond wildflysch that contained well preserved phosphatic fossils of Middle Cambrian trilobites and brachiopod taxa. It is interesting to note that they could not account for the source of these limestone boulders, although the fossils correspond directly to those found:

...not only from Utah but also from Alaska, northern Greenland, Quebec, and the southern Appalachians (Palmer et al., 1984, p. 91).

Looking for a closer source area for these Middle Cambrian limestone boulders Palmer et al., (1984, p. 94) stated:

However, no source for the unmetamorphosed Cambrian boulders is apparent, and their parent rocks were originally southeast of the present location of the Devil's River uplift (approximately 125 miles to the southeast). The limited age range of these boulders suggests that they may have come from a tectonic slice. (Parenthesis ours)

To account for these fossil-rich Middle Cambrian limestone boulders uniformitarianism appeal to uplifted and thrust blocks adjacent to the Marathon Basin (southeast). However, none of the original *in situ* limestone strata outcrop in or around the basin, in any of the upturned strata. The fossiliferous Middle Cambrian limestone source area remains unidentified.

While we do not think it unreasonable to invoke "a tectonic slice" origin for the fossiliferous Middle Cambrian limestone, it does appear to require tectonism and erosion at a far greater rate than is currently recognized

within the uniformitarian model. The Middle Cambrian fossiliferous limestone is unmetamorphosed, which implies shallow burial, and that it experienced little to no heat or pressure. Yet the source strata for this limestone is projected as being approximately 125 miles away (Palmer et al., 1984, p. 93) and several thousand feet beneath the surface. Hence, in order to account for the presence of the limestone boulders within the Haymond Formation the limestone source must have moved 125 miles northwestward, while experiencing tectonic uplift and thrusting, followed by rotation, erosion, transport, and deposition (within a turbidity-current setting). This speaks of large-scale catastrophism. An alternative uniformitarian interpretation might suggest that the limestone boulders were derived from sources around western Utah and then transported approximately 870 miles!

A Young-Earth Flood Model Approach to Understanding the Haymond Formation

Viewed individually, the sedimentary blocks and boulder beds present a seemingly minor problem to the uniformitarian model. However, the required large-scale tectonism coupled with a deep-water turbidity-current depositional setting creates problems that we believe are insurmountable. Invoking millions of years of slow uniformitarian tectonism (both compression and uplift), erosion, transportation, and deposition within a deep-water turbidity-current paleoenvironment requires much imagination and no common sense! For example, many of the wildflysch boulders found within the Haymond Formation could not have traveled very far without being destroyed (Figures 2 and 3). Creationist studies into such matters supports this claim (Chui, 1997, 1998). Yet, uniformitarians tell us that many of these blocks and boulders traveled potentially tens to hundreds of miles.

The authors believe that the stratigraphic evidence (beds, translational slides/slumps, and exotic boulders) suggests that the Haymond Formation formed under catastrophic forces and process which operated during the global Flood of Genesis (see Froede et al., 1998, Figure 2, p. 96). The massive blocks and exotic boulders found within the Haymond Formation turbidites are easily explained as the remains of broken blocks or slump blocks which were derived from eroded up-dip source areas (see Morgenstern, 1967) during the Flood. Tectonism in operation during the Flood create source areas immediately adjacent to the Marathon Basin, and these locally-derived blocks and boulders simply moved under gravitation into the basin (Froede et al., 1998). These clasts and megaclasts were then rapidly buried under additional turbidites also derived from nearby source areas that ex-



Figure 4. Boulders of novaculite chert found within the Haymond Formation turbidites exposed along U.S. Highway 385, approximately 600 feet north of the intersection with U.S. Highway 90, just east of the town of Marathon (Location 1 in Figure 1). Note the one massive chert boulder on the left side of the photograph. The scale to the right of that boulder is three feet long, divided in six-inch units. Several other rounded chert boulders can be seen within the strata.

perienced tremendous erosion and transport during the Flood (Figures 4 and 5).

Conclusion

Numerous ideas have been proposed by uniformitarian geologists in an effort to explain the origin and depositional environment of the Haymond Formation boulder beds. Our review noted a blend of three different components: (1) experimentally based science, (2) uniformitarian philosophy, and (3) origin by analogy. Concerning experimental science, various workers have produced field and laboratory analyses of the lithology, tectonics, stratigraphy, and even the chemistry of these boulder beds. Woven into their technical scientific reports, however, is the philosophical “immense periods of time” to which most geologists attempt to tie their labors. Every uniformitarian geologist studying the Haymond Formation has likewise attempted to deduce an “origin” model involving glacial ice, tectonism, mudflows, prograding deltas, and/or turbidity currents using the modern depositional environment analogy as the most credible means to account for the block and associated boulders beds.

We propose that the most plausible theory for the origin of the Haymond Formation blocks and boulder beds exists within a turbidity-current depositional setting. The greatest problem now facing uniformitarians is to account for the different source areas of the three boulder

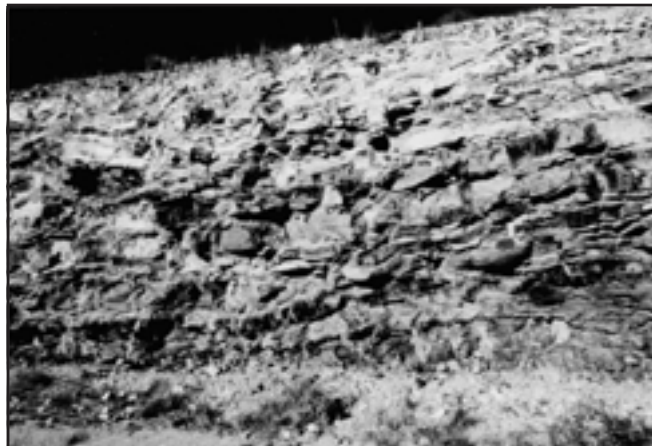


Figure 5. Various boulders of novaculite chert exposed in the turbidite deposits of the Haymond Formation. A six-inch scale rests on top of a chert boulder on the right side of the photograph. Same locale as Figure 2.

populations using uniformitarianism—it simply does not work. Rather, we believe that the Marathon Basin and all of its infilling materials (sediments, blocks and boulder beds) reflect the global Flood of Genesis.

We further believe that the stratigraphic record found within the Marathon Basin represents high-energy erosional and depositional forces coupled with short-period tectonism (the Flood-Event based Ouachita Orogeny). These catastrophic forces and processes resulted in the emplacement of locally-derived blocks, slumps, boulders, and mudflows (via turbidity currents) into the Marathon Basin. This setting clearly fits within the short-term high-energy framework expected within the global Flood.

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Book Review

Nature's Destiny — How the Laws of Biology Reveal Purpose in the Universe by Michael J. Denton

Free Press, New York. 1998, 448 pages, \$27.50

Reviewed by Michael J. Oard

Michael Denton is familiar to most creationists as the author of *Evolution: A Theory in Crisis* (1985) that is devastating to the theory of evolution. In many ways, his second book is also a great book for creationists, but in some ways it is a very big disappointment.

Most of the book, Part 1, details the ubiquitous complexity of nature and how it is fine-tuned and uniquely fit for carbon-based life. This is called the anthropic principle, which Denton takes as evidence of teleology:

The aim of this book is, first, to present the scientific evidence for believing that the cosmos is uniquely fit for life as it exists on earth and for organisms of design and biology very similar to our own species, *Homo sapiens*, and second, to argue that this “unique fitness” of the laws of nature for life is entirely consistent with the older teleological religious concept of the cosmos as a specially designed whole, with life and mankind as its primary goal and purpose (p. xi).

He has chapters on the teleology of the cosmos, water, light, the inorganic elements of the earth, carbon, vital gases, DNA, the amazing protein molecules, metals, cells, and the human body. Denton convincingly shows that chance evolution cannot even come close to evolving such a multitude of fine-tuned coincidences.

Part 2 of the book goes downhill from its beginning. One would suppose that Denton would become a creationist after researching and detailing the mass of information for design. But no, after demolishing evolution in his first book, he turns 180 degrees and accepts almost all of the theory of evolution and gives the credit for the tremendous teleological evidence to “directed evolution.”

What is directed evolution? It is “...an immense built-in generative program” (p. 265) that guides evolution from chemicals to life as well as the whole subsequent

process of organic evolution, all without a Creator! Is there any evidence for directed evolution? The evidence Denton presents is circumstantial at best. For the origin of life he states:

But even if it seems very likely that the becoming of life is built in, it has to be admitted that at present, despite an enormous effort, we still have no idea how this occurred, and the event remains as enigmatic as ever (p. 292,293)

Concerning directed evolution after the first life supposedly evolved, he says:

Although there is no direct evidence that mutational processes were directed during the course of evolution, there are two curious aspects of molecular evolution which strongly hint at the possibility (p. 288)

These two “strong” hints for directed evolution are: 1) the rate of evolutionary substitution is almost equal to the mutation rate, and 2) the rate of change in many genes is regulated by some kind of molecular clock that ticks at a constant rate (p. 292). These questionable “facts” assume evolution in the first place.

Although Denton sees the multitudinous evidence for design, he is steeped in the philosophy of naturalism and cannot seem to extricate himself:

Assuming that life arose as a result of natural processes, and nearly everyone working in the field accepts this assumption, then the very intractable nature of the problem raises the possibility that abiogenesis requires a completely new set of natural phenomena and processes, of which we have at present no idea (p. 295)

So Michael Denton has faith in naturalism, despite the overwhelming evidence for design. To me, this is irrational. I could not help but think of Esau who traded his special birthright for a bowl of stew.

Keyword Index for Volume 35 1998–1999

Eugene F. Chaffin*

For multi-page items, the reference is to the first page only. Letters following numbers indicate:

A = Article; L = Letter; P = Panorama Note; R = Review; PE = Photo Essay; and N = Note.

-
- | | |
|--|---|
| <p>Active zone 211A
 Alaskan dinosaurs 35R
 Albedo 166P
 Ancient human artifact 203A
 Animals, predatory 49L, 48L
 Anorthite 166P
 Antibiotics 76A
 Arizona 15A
 Asteroid 185R
 Atomic theory 84A</p> <p>Bacteria 99L
 Banded iron formation (BIF) 15A
 Baraminology 66A, 2A
 Basalt 126A
 Basalt lava flows 166P
 Base surge deposits 126A
 Basic types 66A, 2A
 Beach 54A
 Bentonite 31A
 Big bang 119R
 Big Bend National Park 93P, 31A
 Biochemical codependency 76A
 Black Canyon of the Gunnison 148A
 Book of Mormon 14R
 Bryophyta 27A</p> <p>Canyon formation 104L, 148A
 Carnivore(s) 49L, 48L
 Catastrophic plate tectonics 110L, 234L
 Catastrophism 100L, 156A
 Cats 2A
 Cell ultrastructure 221A
 Cells, eukaryotic 221A
 Chain, food 49L, 48L</p> | <p>Chino Valley 126A
 Cinder cones 126A
 Clay 31A
 Coastal submarine placers 211A
 Cobble beds 107L
 Codons 168L
 Conferences 45L, 1N
 Continental shelf 95P
 Continental slope 95P
 Coral reef 186A
 Cosmology 119R
 Crabs 47L
 Creation 238R
 Creation-evolution 35R, 201R, 192R
 Creation-evolution controversy 84A
 Creation Research Society, Minutes 170N
 Cretaceous-Tertiary boundary 185R</p> <p>Darwinism 171R, 192R, 200R, 201R
 Dauphin Island 54A, 124PE
 Day 168L
 Debris flows 95P
 Delta 15A
 Dental variability 66A
 Design argument 23A
 Devotionals 169R
 Diet, vegetarian 49L, 48L
 Dinosaur 185R, 202R
 DNA/RNA 2A, 76A, 221A
 Dog kind 66A
 Downcutting 148A
 Dualism 84A</p> <p>Early transitional forms 221A
 Eclipses 23A
 Ecology 47L
 Eggs 45L
 Endosymbiosis 221A</p> |
|--|---|
-
- *Eugene F. Chaffin, Ph.D., 715 Tazewell Ave. Bluefield, VA 24605.

- Energy dispersive X-ray analysis (EDX) 31A
Environmentalism 65R
Erosion 39P, 232P, 176PE
Evolution 221A
Evolutionism 200R
Exfoliation 41P
Extra-terrestrial impacts 166P
Extraterrestrial causes 100L
- Faith 200R
Field studies 199R
Flood 186A, 41P, 104L, 148A, 31A
Flood currents 148A
Flood geology 199R, 100L
Flood model 156A
Florida archaeology 54A
Florida geology 54A
Florida Keys 186A
Fluke 178A
Flysch 95P
Fossil bees 99L
Fossil humans 134A
Fossil record 27A, 134A
Fossils 111L
Fossil wood 31A
- Gaps in the fossil record 221A
General relativity 110L
Genesis 1 168L
Genesis kinds 66A, 2A
Genetics 168L, 99L
Geologic column 156A
Geologic column artificiality 107L
Giertych 99L
Grand Canyon 104L
Granite 126A, 41P
Granite Dells 126A
Grass 193A
Gravel 107L
Greek philosophy 84A
Gulf 54A
Gulf Coast 54A
Gunnison uplift 148A
Gunnison River 148A
- Haymond Formation 95P
Heat 234L, 110L
Heavy minerals 211A
- Highstand 54A
Human evolution 134A
Human figure artifact 203A
Humor 75R, 75R
Hybridization 2A
- Ice Age(s) 202R, 100L
Ice Age timeframe 54A
Impact theory 185R
Iridium 185R
- Javelina 103L
- Key Largo Limestone 186A
Kurtz image find 203A
Lag deposits 107L
Lateral coastal drift 211A
Lateral erosion 148A
Lewis, C.S. 174N
Liesegang rings, banding 126A
Liverworts 27A
Load structures 107L
Lowstand 54A
Lyell 100L
- Marathon Basin 95P
Mars 173R
Marsupialia 45L
Mathematical Model 211A
Megasequence 100L
Mendel 168L
Meteoroids 166P
Miami oolite 186A
Microbes 99L
Mid Atlantic Ridge 111L
Molecular biology 221A
Monadnock 41P
Monogastrism 49L, 48L
Moon 166P
Moons 23A
Mosses 27A
Muhlenbergia torreyi 193A
Mutation 76A
Myths 99L
- Nampa image 203A
Natural selection 76A
Naturalism 84A

- Niagara Falls 232P
- Origin of life 221A, 134A, 173R
- Ouachita system 95P
- Paleo-Indians 54A
- Paleoenvironment 31A
- Paleohydrology 107L
- Panola Mountain 41P
- Parasite 178A
- Peleg 109L
- Petrified wood 93P
- Philosophy of existence 84A
- Phreatic explosions 126A
- Phylitte 15A
- Pikes Peak iron formation 15A
- Piltdown Man 134A
- Planetary satellites 23A
- Plant evolution 27A
- Plant succession 27A
- Plate tectonics 109L, 111L
- Pleistocene 186A, 54A
- Pluton 41P
- Poland 99L
- Predator 49L, 48L
- Prey 49L, 48L
- Primates 66A
- Process rates 39P
- Quotes 53R
- Resistance 76A
- Rhyolite 126A
- Ring Muhly 193A
- Ruminant 49L, 48L
- Rythmites 107L
- San Juan Mountains 148A
- Schist 15A
- Scientific method 84A
- Sea Level 100L
- Sea-level changes 54A
- Sedimentation 211A
- Sequence 100L
- Sequence stratigraphy 100L
- Sibling speciation 178A
- Skeletal fragments 35R
- Smell 103L
- Snake 176PE
- South Florida 186A
- Speciation 178A
- Stony corals 186A
- Stratigraphy, sequence 100L
- Stratovolcanoes 126A
- Subaqueous dune ridges 54A
- Submarine landslides 202R
- Submerged forest 54A
- Supersequence 100L
- Systematics 66A, 2A
- Tectonics 15A
- Theistic evolution 75R
- Tin 211A
- Trace fossils 93P
- Trans-Pecos Texas 31A
- Transitional forms 134A
- Translational slide 95P
- Transition Zone 126A
- Trematode 178A
- Turbidites 95P
- Turbidity currents 95P
- Uniformitarian(ism) 54A, 100L, 156A, 232P
- Universe, origin of 119R, 169R
- Upheaval Dome 236P
- Upper Keys 186A
- Vail Curve 100L
- Van Andel Creation Research Center 126A, 193A
- Varves 107L
- Volcanic ash 126A, 31A
- Volcanics 15A
- Volcanoes 126A
- Web, food 49L, 48L
- West Elk Mountains 148A
- Worldview 238R
- X-ray diffraction 31A
- Yavapai County 15A
- Yavapai series 15A
- Young-earth Flood model 54A, 148A

Book Review

Worlds Apart, The Unholy War Between Religion and Science by Karl Giberson
Bacon Hill Press, Kansas City, MO. 1993, 224 page, \$22.

Reviewed by Jerry Bergman

Giberson holds a doctorate in physics from Rice University and now teaches at a Nazarene college. He endeavors in this work to reduce contemporary religion-science conflicts, especially those between creation and evolutionary naturalism. Almost half the book discusses the philosophy of science in general. The author eloquently shows that modern science is a rather new enterprise, and that many of the ancient philosophers, both Christian and non-Christian, stressed the importance of reason over experimentation.

The author shows the tragedy of welding theology to a particular science notion such as that of Aristotle (p. 96). Unfortunately, many large denominations are in this position today. They have welded themselves to evolutionary naturalism, a worldview that developed largely to explain the creation of life without an intelligent creator. Giberson's discussion of the disastrous results of the church incorporating a backward cosmological view into Christian theology could be used to argue that it is similarly ill advised to marry evolutionary naturalism as many church bodies have. Giberson's eloquent discussion of how the church uncritically accepted Aristotle could be applied to their uncritical acceptance of evolutionary naturalism. It has often fused atheism and theism into a mosaic, allowing believers to walk back and forth on whichever square fits them at that moment. The author then proceeds to try to show us that a good theist can hold to naturalism (atheism) when in science.

The author demonstrates much intolerance exists against the God hypothesis among scientists (p. 201) openly admitting that most physicists reject "the possibility that there may be a theological explanation lurking behind the finely tuned universe." He then endeavors to debunk the creation perception (p. 174-178).

Some of the author's conclusions, such as the claim that the reason ten centuries passed with "no progress in understanding the actual physical nature of the creation" was largely due to the church's influence (p. 90), are a distortion of history. Science progress did occur during the misnamed dark ages, although for many reasons at a snail's pace compared to today. A major reason was poverty and the lack of basic tools such as thermometers, accurate clocks, a uniform system of measurement, statistics, and the microscope.

It is also doubtful that empiricism and the experimental method were historically rejected to the degree that the author claims. Every person, from the developmentally handicapped to the gifted, learn from empirical ex-

perience that certain techniques do not work. Others are more successful, and thus they are more likely to use these again. Although systematic ways of gathering and analyzing data were not developed until relatively recently, interaction with the real world is a fundamental means all adults learn. Furthermore, science today is actually based heavily upon authority, reason, and logic, and while a contrast between modern and ancient science exists, this contrast is far less than the author implies. It would also have been enormously helpful if the author had provided documentation for his assertions. Few notes and no bibliography are provided, making it difficult to evaluate the author's conclusions.

Giberson does an excellent job of articulating the fact that science has become a religion, and that severe problems exist in science's attempt to negate theism. His eloquence in this area is unfortunately not extended to his comments about creationists, such as claiming they are uneducated theists attempting to inappropriately influence science. The author spends much time arguing that the Bible cannot be taken "literally," at times implying that it can be taken any way one wishes. Obviously Scripture has to be interpreted, as does every written sentence, and interpretations can vary. The argument that it "cannot be taken literally" is often used to reject the obvious meaning and accept whatever meaning one gives it so that the meaning comes from the reader and not the manuscript. As a result, the manuscript is useless as an attempt to communicate, but useful only to support and stimulate reader ideas. If the Scriptures have no authority, then Christianity has no authority.

My basic concern about the book is that it illustrates what I have often seen: The atheists are in one corner, theists in the other, and some Christian college faculty who claim to be theists invariably end up in bed with the atheists. One reason for this sad state of affairs is that most Christian colleges require faculty to earn graduate degrees in their area of expertise, requiring committed Christians to attend a secular university for five to eight years. This total immersion in the secular world is often highly effective in, at the least, diluting the student's theistic world view and firmly implanting in them an atheistic worldview. The Ph.D. then becomes a Sunday Christian, and an atheist while doing science or teaching. The Monday atheist is now intolerant of those who endeavor to maintain or develop a theistic worldview. Indeed, the author admits that this is partly what happened in his own life. A committed creationist early in his career, "something happened en-

route to my Ph.D.” (p. 173). He saw the enemy could be very kind and he largely switched sides.

My colleagues tell me it is doubtful that *any* American Nazarene college would hire a science professor who, no matter how well qualified, was anything other than a mosaic blend of evolutionary naturalism and appearance theism which does not show up in one’s professional life. My confidants, who related to me concerns about this, looked forward to teaching in a Christian college, but now all teach at secular universities. Many now state they would not teach in a pseudo-Christian school because the theistic-atheistic mosaic required of science faculty may as a whole do more harm to students than openly secular non-theistic institutions. At least the latter’s biases are open and acknowledged, whereas some professors in Christian institutions are the proverbial wolves in sheep’s clothing. They appear to be one thing when they in fact are quite something else.

The tragedy is that parents spend a fortune sending their children to Christian colleges hoping their faith will be matured and their lives steered in the right direction, only to discover much of what their children are learning is naturalism covered by a thin Christian veneer. For Christian education to survive, clear demonstrable advantages must exist, and this means that the faculty hired should manifest this commitment.

Giberson eloquently shows that the “scientific creationists” are not a monolithic entity, and many positions exist in this movement. He then claims that creationists are all of one mind and “insist that there is only one possible interpretation of the biblical account of origins” (p. 109). The author even tries to minimize the well-documented harm that evolutionary naturalism has caused society. Any belief structure can be perverted, but the harm of evolution has been well documented, even by evolutionists, and it is apparent that Giberson is not very familiar with this work. This is not to say that there is not much good material in Giberson’s work, only that the Nazarene and other conservative denominations must eventually deal with the concerns elucidated.

The author makes a distinction between evolution and evolutionism, accepting the former and condemning the latter. This is the exact distinction creationists make except when they refer to *evolution* they often mean *evolutionism* (as do evolutionists). Many writers prefer the term *evolutionary naturalism* to evolutionism, and much of the conflict could be resolved if both sides used proper terms. The author is obviously often not aware of *what* most creationists teach, ironic for one who has written a full length book on the topic.

Giberson’s Critique Against Evolution

Many of Giberson’s criticisms against evolutionism were well done and would earn the wrath of an anti-

creationist as quickly as most critiques by creationists, such as the admission that “the day-to-day practice of science was not affected in any way by philosophical assumptions of the scientist” (p. 174). Yet he relies heavily, and often somewhat uncritically, upon the atheistic critiques of creationism to lambaste creationists. Although I found few outlandish statements, some did surprise me, such as this gem: “there is only one geology Ph.D. in the entire country who has accepted” Flood geology (p. 176).

Although Giberson discusses many points so far inadequately addressed by creationists, many of the author’s claims have been thoroughly demolished by creationists. An example is the argument that ice, the formation of sugar, photosynthesis, and the production of crystals negates the creationist conclusion that the second law of thermodynamics forbids evolutionary naturalism. The concern is primarily the spontaneous production of *information*, not order. Situations exist where order can be produced naturally from non-order but, as eloquently argued by Yockey, no situation has been discovered where information can appear randomly by natural means.

Although Giberson might be termed a soft creationist, he does not even give much credence to theistic evolution, but essentially argues for atheistic evolution (p. 179) and ascribes to God an unknown and evidently undefinable role in origins. Nor is Giberson’s creationism acceptable to the atheists that he relies so heavily upon for his conclusions—nor would it be acceptable in the public schools according to many court rulings. Some atheists believe that Giberson is the most dangerous kind of creationist. He is seemingly scientifically respectable, and as such is more apt to be able to sneak his hidden agenda into public schools. Statements such as “any true complete explanation [against science] may indeed require the introduction of theological explanations in order to be complete [because] it is hard for science to address questions like why is there something rather than nothing?” surely will be vehemently objected to by creationism’s opponents.

Further, the kind of arguments Giberson uses are exactly the reasons why Wright State University fired biology professor Dan Scott, and why he was often condemned as a creationist by the mass media and many scientists. If Giberson was too open about his beliefs in a secular college classroom and encountered the typical anti-creationist, he would find himself labeled a creationist, unemployed, and unemployable in most colleges, secular or Christian.

Although Giberson includes much of interest to creationists, especially from page 111 onward, a need exists for a more extensive response to this work. Now that Giberson has laid down the gauntlet, I hope that creationists will take it up. I say this because my generally positive feelings about the Nazarene denomination tells me someone will accept the challenge. Possibly this book will be a catalyst for this task.

Notes from the Panorama of Science

Artifacts Fused in Natural Flow Stone

My son, William Tanner, who works for Exxon Oil in Public Relations in Wyoming, was “surfing the net” and came across a Duane Gish article (1989) in which there was mention of an article I had produced, together with Howe and Williams (1987). The Gish article also has a section concerning the work of Emmett Williams and others on the rapid formation of dripstone and stalagmites (Gish 1989, p. 165).

This dripstone reference was of special interest to me because I had recently read an archeological article about a limestone cave in Israel which was used as a burial site during the alleged Chalcolithic period (c. 4500–3500 B.C.); [Gal, Smithline and Shalem, 1998]. The site had been sealed for nearly 6,000 years. In Gal *et al.* there is a picture of a chamber wherein an ossuary and other artifacts have been fused by naturally deposited flowstone. On that same page there is the statement, “This burial space has been severely affected by geological activity; nearly all of the finds had melded with the flowstone becoming part and parcel of the natural environment.” It is obvious that the artifacts were placed in the cave. Then calcium carbonate waters dripping from the ceiling created the flowstone to meld with the artifacts on the floor.

The second item of interest in the Gal *et al.* article is as follows:

Among the burial offerings were objects made of bronze, such as axes, possibly used for ceremonial purposes, and standards for wooden staffs. These were most certainly considered luxury items during this very early period of bronze smelting and manufacture—especially considering that the Bronze Age was not to begin for another half Millenium.” [Italics mine.] (Gal *et al.*, p.61)

From where did these “Chalcolithic primitives” obtain their tin? Certainly they did not get it in Israel. Who

refined tin ore during Chalcolithic (copper) times and mixed it with copper to make bronze 500 years before the beginning of the Bronze Age?

Since currently accepted geological time is suspect by some creationists, and since archeological time is a mere extrapolation of geological time, must not archeological time be suspect also?

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Editor's Note

The cover photograph of the September 1971 issue of the *Quarterly* (volume 5, number 2) shows a bat that was cemented inside a stalagmite at Carlsbad Caverns in New Mexico. This illustrates very rapid dripstone growth rate. Also see Williams, E.L. and R.J. Herdtklotz. 1977. Solution and deposition of calcium carbonate in a laboratory situation II. CRSQ 13:192–199; Williams, E.L., K.W. House, and R.J. Herdtklotz. 1981. Solution and deposition of calcium carbonate in a laboratory situation IV. CRSQ 17:205–208, 226.

Call for Papers

The Second CRS Monograph on Astronomy

Due to the popularity of the first CRS monograph on astronomy, *Design and Origins in Astronomy*, edited by the late George Mulfinger, the CRS has decided to publish a second astronomy monograph. We are interested in original papers, but would consider revisions of papers that have appeared in the *Creation Research Society Quarterly*

in the past 15 years. Submissions on all topics of astronomy are encouraged.

For submissions or additional information, contact Danny R Faulkner, 1402 University Dr., Lancaster, SC 29720. H: 803-286-9781 O: 803-285-7471 e-mail: Faulkner@gwm.sc.edu

The Wetumpka Impact Crater, Elmore County, Alabama: An Interpretation Within the Young-Earth Flood Model

Introduction

The Wetumpka Impact Crater is located southeast of the town of Wetumpka, in Elmore County, Alabama (Figure 1). The crater was originally identified as an Astrobleme (Bentley, Neathery, and Lines, 1970), but was later redefined as a “crypto-explosive structure” (Neathery, Bentley, and Lines, 1976). The delay in publication and strange title of the final published work was due to the uniformitarian aversion to anything catastrophic (King, 1997, p. 27). All of this odd behavior is believed to have prevented the Wetumpka feature from becoming widely recognized as an impact crater (King, 1997; King and Neathery, 1998).

With evidence of a possible meteoric (or cometary) cause for the death of the dinosaurs at the Cretaceous-Tertiary boundary (postulated by Alvarez, Alvarez, Asaro, and Michel in 1980), the uniformitarian model was expanded to accept the possibility that features of extraterrestrial and catastrophic origin can occur across the planet in strata younger than the Proterozoic. Presently, the Wetumpka Crater is not listed as an impact crater in the Canadian-based official extraterrestrial crater registry as it exhibits no signs of shock metamorphism from its crater floor (King, 1997, pp. 34, 49). Some sceptics remain doubtful of its extraterrestrial origin. However, investigators continue to gather evidence which they hope will confirm this feature as an impact structure.

We believe the Wetumpka Crater to be of extraterrestrial origin¹. How then does it fit within the framework of the Young-Earth Flood model? We will review what is presently known of the impact crater and postulate it within our Biblical model.

The Geomorphology of the Wetumpka Impact Crater

The Wetumpka Crater occurs within the Coastal Plain geomorphic province which is composed of relatively

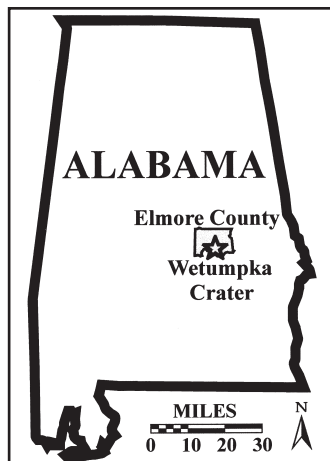


Figure 1. Map of the state of Alabama with the approximate location of the Wetumpka Impact Crater indicated by the star, within Elmore County.

unlithified sands, silts, and clays (i.e., clastic deposits). Underlying these clastic sediments are metamorphic and igneous basement rocks which are exposed along portions of the upturned rim of the crater (Figure 2). The diameter of the crater is approximately 3.5 miles (Figure 3). The highest point along its rim is at Bald Knob, located on the northwestern side with an elevation of 586.6 feet above sea level (approximately 400 feet above the surrounding coastal plain). The crater appears to exhibit a complex structure due to a central return peak (Figure 4). However, this feature may be an artifact of Holocene stream erosion (King, 1997, p. 37). Several creeks breach the crater rim, which suggests that they are antecedent. The rim is most pronounced along its northern flank with the southern section of the crater rim being barely discernable. The cause of this elevational difference is believed to be due to the angle of impact. According to Dr. David King (1997), at Auburn University:

...the Wetumpka impactor was on a northeast-to-southwest trajectory at a very low angle above the horizon.

The area surrounding the crater (consisting of coastal plain sediments) is of low relief, which enhances the topographic expression of the crater rim.

The Geology of the Wetumpka Impact Crater

The geology of the area around the Wetumpka Crater consists of coastal plain sediments which lie unconformably on metamorphic and igneous basement rocks. Uniformitarian geologists have proposed that the meteor or iron-bearing comet impacted a marine paleoenvironment during the Late Cretaceous. According to King (1997, p. 30), the timing of the impact event:

...points to a post-Eutaw, but pre-Arcola age (i.e., younger than 83 Ma, but older than 80 Ma) for Wetumpka's impact crater. ...Wetumpka's impact-

¹If additional investigations show that this structure is somehow of volcanic, rather than of impact origin (which we seriously doubt), it will not change the timing of its formation within the Young-Earth Flood model. Any new information about the origin of the structure would just change the method by which it formed. However, both authors have spent time in the field at the Arizona and Odessa Meteor craters, and we have noted many similarities with features found at the Wetumpka Crater.

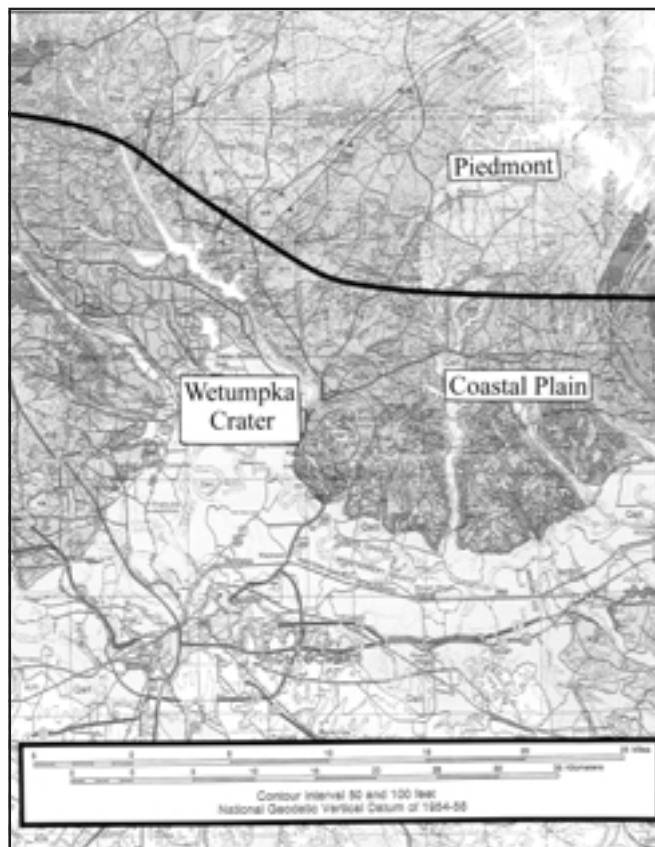


Figure 2. A geologic surface outcrop map with the Wetumpka Impact Crater located in its center. The black line defines the general boundary separating the igneous and metamorphic Piedmont province rocks from the clastic sediments of the southerly Coastal Plain province. The crater occurs within the coastal plain, but due to the upturned basement crater sidewalls (and the erosion of the overlying strata), the underlying piedmont rocks are exposed.

crater age should be somewhere in the older part of the age range 81.5 ± 1.5 Ma.

The extraterrestrial object is believed to have ploughed through the marine waters and penetrated into the marine sediments and underlying basement rock, creating a Tsunami 460 to 817 feet high (King, 1997, p. 44). The total depth of impact penetration from surface sediments to basement is estimated at 686 feet (King, 1997, p. 38). The impact compressed the basement strata, causing the uppermost layers to shatter and become part of the crater ejecta. The deeper lying basement rock was compressed downward, and never fully rebounded back to its original elevation (Figure 5). Likely, some of the broken metamorphic and igneous basement rocks were expelled from the crater at impact, along with most of the overlying marine clastics. Interestingly, uniformitarian investigators admit that this impact event had no known effect anywhere within

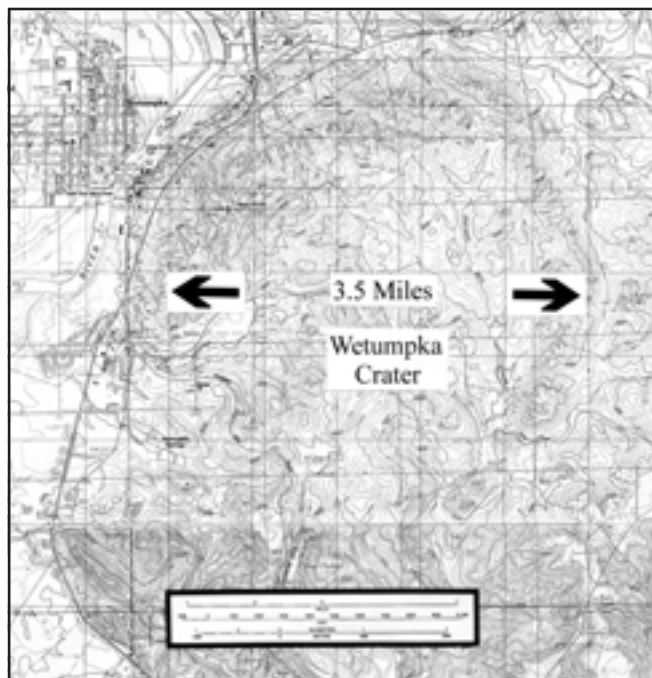


Figure 3. A topographic map (USGS, 1987) showing the general shape of the crater in relationship to the other coastal plain strata. Note the crescent shape of the northern portion of the crater, caused by the upturned and in some cases exposed underlying metamorphic and igneous basement rocks.

the Gulf Coast during this point in time, although some syndimentary disturbances might correlate (King, 1997, pp. 32, 35). This impact event is not presently considered an “extinction” event within the Cretaceous (see Froede and DeYoung, 1996). Today, the crater basin floor contains broken and contorted marine strata, some of which includes embedded blocks and boulders that were at one time the underlying metamorphic and igneous basement rock (Figure 6).

Implications Within the Young-Earth Flood Model

The Wetumpka Impact Crater is an interesting and unique feature on the Gulf Coastal Plain of the Southeastern United States. We believe that it clearly reflects what was a large-scale impact event at some point in Earth’s past (Figures 7 and 8). Several young-earth creationists have associated impact events with the Flood. Recent proposals have been made by Fischer, 1994; Fritzsche, 1998; Froede and DeYoung, 1995; and Spencer, 1994; 1998a; 1998b. This impact event might correlate to soft-sedimentary deformational features found within this general area, but not previously linked to this single event due to the different age of the strata within the uniformitarian time frame (e.g., see Appendix in Froede, 1998a).

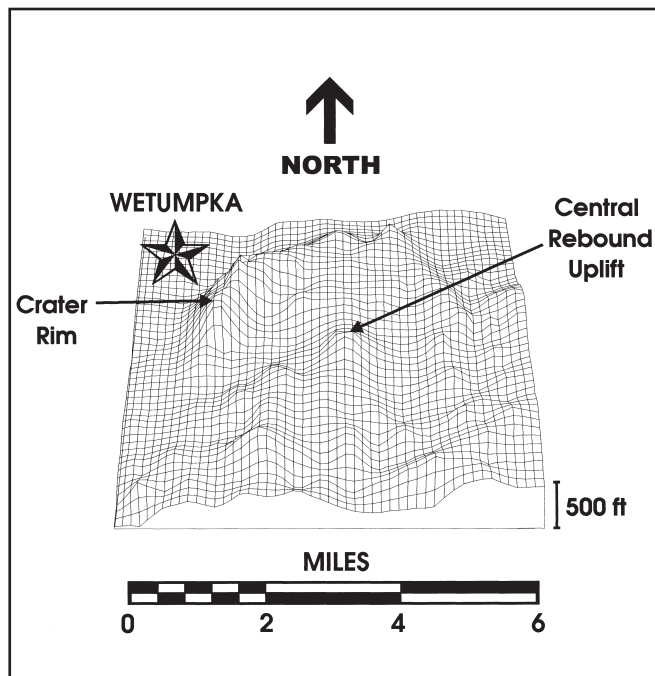


Figure 4. A computer generated surface map (data from contoured USGS topographic quadrangle–1987). Note the circular shape of the crater at the northern rim and how it almost disappears along the southern half of the crater. The area of elevation within the center of the crater might be a central rebound peak or more likely a weathering phenomenon.

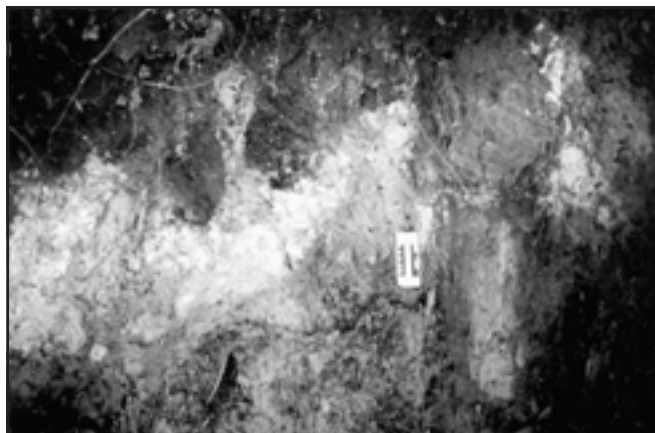


Figure 6. Chaotic metamorphic rocks of the crater melange in jumbled Cretaceous marine sediments, within the central rebound area. These blocks were once a part of the underlying basement rocks, but due to the impact they have been displaced into the overlying highly disturbed sedimentary strata. Two blocks are present just above the scale to the left and right.

The metamorphic and igneous (intrusive) rocks exposed north of the crater in the Piedmont province originally formed at depth, likely during the earliest stages of the Flood. The overburden which once covered these

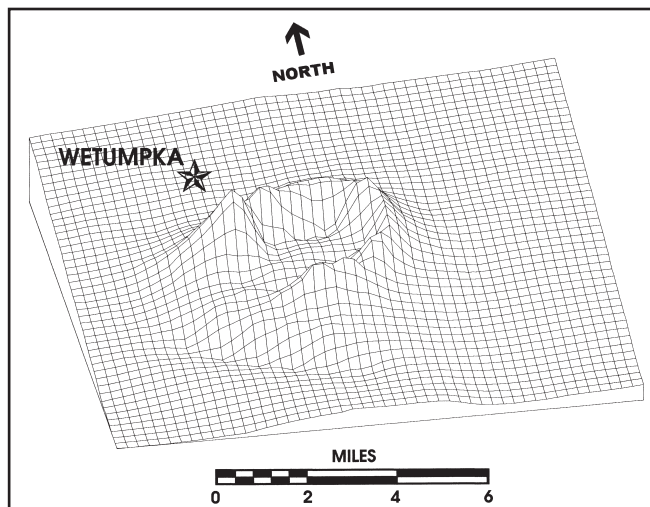


Figure 5. A computer generated basement map (derived from gravity measurements) showing the general shape of the igneous and metamorphic basement rocks within the subsurface. Only the uppermost sections of the northern section of the basement rocks extend to the surface forming the crater rim. Derived and adapted from Figure 3–Neathery, Bentley, and Lines, 1976.



Figure 7. Upturned medium-grained biotite-garnet-feldspathic schist and gneiss, quartzite, quartz-graphic-muscovite schist and graphitic-muscovite schist rim rocks along the outside northwestern flank of the crater.

rocks was later removed by high-energy Floodwater. With a decrease in erosional energy, and the waning of the Flood, the deposition of marine clastics began. These marine sand, silt, and clay deposits now cover the metamorphic and igneous basement rocks (unconformably) in the area around the crater. We would propose that the marine environment was just beginning to establish itself within this area with the decrease in Floodwater energy, and is this why there are few fossilized macro-marine creatures found (see Froede, 1998b; and Smith, Johnson, and Langdon, 1894, p. 551).



Figure 8. A closeup view of the upturned igneous and metamorphic strata showing a quartzite breccia block (*in situ*) within the sidewall, along the outside north-western rim of the crater. Scale is three feet long in six-inch units.



Figure 10. Chaotic beds of the marine deposited Gordo Formation of the Tuscaloosa Group within the impact crater floor. These layers are upturned as a result of the impact event. Additional coring of the crater floor might help to determine the full extent (both vertical and lateral) of chaotic bedding which has occurred within this area. Note person on right side for scale.

Uniformitarians believe that an extraterrestrial object impacted submerged marine deposits during the Late Cretaceous. In earlier articles within the *Quarterly*, we proposed that the uniformitarian Late Cretaceous epeiric seaway, identified across most of the North American continent, was in fact slowly retreating Floodwater (Froede, 1995; Froede and Williams, 1997). Hence, an impact within this marine setting model would reflect a period in Earth's past when an extraterrestrial object struck Floodwater, penetrating into the underlying marine sediments and basement rock (Figures 9 and 10). This is the setting we envision for the formation of the Wetumpka Crater.



Figure 9. A borrow pit within the impact crater where blocks of upturned and contorted Tuscaloosa Group marine deposited strata contain occasional embedded blocks of what was once underlying basement (blocks of schists up to one meter long have been found at this locale—Neathery, King, and Wolf, 1997).

Uniformitarian Stratigraphic Column		LITHOLOGICAL COLUMN	Creationist Stratigraphic Column	
HOLOCENE PLEISTOCENE	Terrace and Alluvial Deposits		Freshwater Deposits	LOWER to MIDDLE ICE AGE
UPPER CRETACEOUS	Mooreville Chalk		Marine Deposits	UPPER FLOOD EVENT
	Eutaw Fm.			
	Gordo Fm.			
	Coker Fm.			
EOCAMBRIAN TO PALEOZOIC	Crystalline Rocks		Heated, Pressurized, & Melted Rocks	LOWER to MIDDLE FLOOD EVENT

Figure 11. The stratigraphic column for this area showing the relationship between the uniformitarian units (spanning millions of years), and the creationist units (spanning possibly tens to hundreds of years—however, further refinement is necessary).

The stratigraphy of the crater basin and surrounding area suggests that no additional marine sediments were deposited on top of those affected by the impact. Hence, this would indicate a very shallow water event—possibly even a coastal subaerial setting. This proposed paleo-environment is in opposition to the present uniformitarian view of an outer continental shelf-deep water setting. Gravel and fluvial-derived clastics from the adjacent upgradient Piedmont province were deposited across the buried crater and surrounding area with the establishment of freshwater conditions associated with the onset

of the ice age (see Froede, 1997). Many of these gravel deposits may have come from the paleo-Coosa River as it was establishing itself within this area. The wet weather conditions associated with the ice age eroded and transported away (fluvial transport) much of the gravels and underlying soft marine sediments which formerly buried the crater (Figure 11). Erosion of the overburden around the northern sections of the crater resulted in the exposure of underlying upturned metamorphic and igneous basement rocks (which form the rim), along with broken and contorted marine-strata containing basement ejecta produced by the extraterrestrial impact.

Conclusion

The Wetumpka Crater likely formed due to an extraterrestrial impact. The only differences we have with the uniformitarian model for this unique feature are in its age and paleoenvironment. We agree that it was a catastrophic event. The occurrence of marine deposits across this area reflects Floodwater deposition. The lack of additional marine sediments capping the contorted and jumbled (impact affected) marine strata suggests a shallow Floodwater setting, perhaps even subaerial at the time of impact. The capping of much of the contorted strata by freshwater gravels reflects the complete withdrawal of Floodwater, and the onset of ice age freshwater deposition. If this impact occurred out on the submerged continental shelf in moderately deep water (possibly as deep as 492 feet), as has been proposed by uniformitarians (King, 1997, pp. 36, 44), then we should expect to find the impact-affected strata buried by additional flat-lying marine sediments. No additional flat-lying marine strata have been reported covering any portion of the crater or are found in the areas nearby. Hence, the lack of physical evidence in support of a deep-water depositional environment is a challenge to the present uniformitarian model. We believe that our proposal works well within the constraints of the Young-Earth Flood model, and is supported by the physical conditions found at the crater and in the surrounding area.

Acknowledgments

We are grateful to our families for allowing us the time to conduct field studies and report our findings. Glory to God in the highest (Proverbs 3:5–6).

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Book Review*

Origins: Linking Science and Scripture by Ariel A. Roth
Review and Herald Publishing Association. 1998, 384 pages, \$30.
Reviewed by Wayne Frair, Ph.D.

Here is a clearly-written comprehensive non-dogmatic work of value for a person in early or even advanced stages of learning about important creation/evolution issues. Author Dr. Roth, who is a professional biologist, has had years of experience in science as a professor with graduate students, and as editor of the respected scholarly journal, *Origins*. Roth's book deserves a place in suitable classrooms and on shelves of public and private libraries.

Matters covered include pertinent early and recent history, and "putting it all together" (3 chapters); life—biochemistry through anthropology (5 chapters); geology—fossils, catastrophies (including the Flood), and time (7 chapters); an evaluation of science, truth, and the Bible (4 chapters); some conclusions—condition of science, evaluations of 8 major models relating the Bible and science, and a recapitulation (3 chapters). The 22 chapters are relatively short (average 15 pages including references), and each has a respectable list of references (average of 42 references/chapter). There is a 7-page Glossary and 13-page Index.

This book has been carefully researched, written and proofread. However, I did notice errors with the Latin singular and plural (*lamina*, p. 250; *alga*, p. 314). It is becoming more acceptable with Latin words to anglicize plurals, for example formula to formulas (rather than formulae). *Origins* was published in December 1998, but most references are older than 1996.

It was refreshing to encounter the candor demonstrated by Roth as he wrestled with crucial issues in the ongoing tension between scientific and religious sectors. Macroevolution came out a loser, but where there are no easy answers he acknowledged this, and there was no ran-

cor toward his opponents. Roth challenges the current geological time scale and stresses his Bible-based view that creation occurred fewer than 10,000 years ago. He really does not believe that any other position is "creationist", but he deigns to submit that "little in the Bible precludes a very old universe" (pp. 233–234). In the extensive geology section he suggests that the Genesis Flood deposits began in the Cambrian and ended in the upper Tertiary. There were, he speculates, rapid plate movements especially during later stages of the Flood, and ice ages were post-Flood. Sedimentary layers probably were deposited rapidly.

Roth realizes that science needs a good revamping. The nature of science:

is finding truth and explanations about nature (p. 286). Science often prides itself on being open and objective, but evolution brings into question both attributes. How did science get into the conundrum of defending an idea for which there is little support and for which one finds major scientific problems (p. 333)? Science made its greatest error when it rejected God and everything else except mechanistic explanations (p. 334). Science should return more toward the philosophy it had when Western Civilization established sciences's foundations (p. 136).

Roth does not understand that the Bible and science are to be construed in opposition. He has written this book to harmonize them, and he encourages others to do the same.

*This review was originally published in an incomplete form in *CRSQ* 35(4):220. The book is available from Spring Arbor, 10885 Textile Road, Belleville, MI.

Minutes of 1999 Creation Research Society Board of Directors Meeting

David A. Kaufmann, Secretary

On Thursday 25 March 1999 a meeting of the Board of Directors (BOD) was held at the Days Inn, Albert Lea, Minnesota, from 1900 hours to 2045 hours to discuss where and when to hold the 2000 Board meeting. It was passed to hold the 2000 BOD meeting at Atlanta, Georgia, Thursday, May 18 to Saturday, May 20. On Friday 26 March 1999 between the hours of 0800 and 1700 the Research, CRSnet, VACRC, Membership, Quarterly Editorial, Constitution/Advanced Planning, Publications, Young Earth/Radioisotopes and Finance Committees each met separately for approximately two hours to plan for the Saturday business meeting.

On Saturday 27 March 1999 the closed business meeting of the BOD was called to order at 0800 hours. Present: T. Aufdemberge, E. Chaffin, D. DeYoung, W. Frair, R. Gentet, R. Goette, G. Howe, R. Humphreys, D. Kaufmann, L. Lester, G. Locklair, J. Meyer, E. Williams, G. Wolfrom.

The minutes of the 1998 BOD meeting were accepted as distributed prior to the meeting. Secretary Kaufmann reported that the following were elected for a three-year term: T. Aufdemberge, W. Frair, R. Gentet, G. Howe, and M. Oard.

The Treasurer's report by Gentet was presented and accepted.

The membership report by Wolfrom was given as follows: total membership for 1998/99 was 1652 (638 voting, 669 sustaining, 324 subscriber and 21 student). This is an increase of 75 over 1997/98.

The CRSnet report by Wolfrom was presented and accepted.

The Quarterly Editorial report by Chaffin was given as follows: 211 articles were received, 91 were accepted, 91 rejected and 14 were withdrawn.

The Creation Matters report was given by Wolfrom noting that we need to acquire more manuscripts.

The Membership Committee report by Kaufmann resulted in the following actions. The Membership Secretary was authorized to acquire a new computer/printer up to a cost of \$2500. It was passed to give Tom Hogan, a CRS member, and a one-time grant of \$500 to conduct a regional high school creation/evolution debate and report the results to Locklair.

The Young Earth Radioisotope Committee report by Humphreys was given and accepted.

The Quarterly Editorial Committee report by Williams resulted in the following. It was passed to appoint

E. Williams as Interim CRSQ Editor and the following as Associate Editors: E. Chaffin, Physics; J. Reed, Geology; G. Howe, Biology and D. DeYoung, Book Review Editor.

The Research Committee report by DeYoung stated there were 12 active projects in process (6 in Geology, 5 in Biology and 1 in Physics).

The Van Andel Creation Research Center (VACRC) report resulted in the following actions: 1. J. Meyer will continue as Lab Director through May 2000. 2. The printed VACRC budget for 1999 was approved. 3. The VACRC checking account balance cap was increased from \$6,000 to \$10,000. 4. The VACRC check writing limit was increased from \$2,000 to \$5,000. 5. Tom Trusler was hired as a part-time Planned Giving Consultant. 6. The VACRC Committee was designated the Lab Director Search Committee and was authorized to advertise for the position, negotiate the contract, and hire the person, based on a unanimous vote of the Lab Director Search Committee and the Executive Committee together. 7. The VACRC Committee was authorized to negotiate and offer a part-time contract for J. Meyer after May 2000.

The Constitution/Advanced Planning Committee report by Frair was presented and accepted.

The Publications Committee report by Goette was presented and accepted.

The Finance Committee report by Aufdemberge was given, and a 1999 budget of \$249,300 income and \$232,300 in expenditures was approved.

It was passed to nominate the following current Board members for the BOD election in 2000: E. Chaffin, L. Lester, G. Wolfrom.

The following officers were elected for 1999/2000: President: D. DeYoung, Vice President: E. Chaffin, Secretary: D. Kaufmann, Treasurer: R. Gentet, Membership Secretary: G. Wolfrom, and Financial Secretary: T. Aufdemberge.

It was passed to write a letter of appreciation to Dr. David Boylan for his many years of service to the CRS.

The meeting was adjourned at 1330 hours.

On Saturday evening 27 March 1999 approximately 1,200 people heard the following presentations in the Albert Lea High School auditorium: "From Grade School to Creation Research Scientist: How To do It?" By D. Kaufmann, "Astronomy and Creation "by D. DeYoung, "From Avowed Evolutionist to Convinced Creationist" by L. Lester, and "A Biologist Looks at Origins" by J. Meyer.

Letter to the Editor

Of Hen's Teeth and Dinosaur's Feathers

Two important fossil discoveries have come to light yet again in China. They are *Protarchaeopteryx* and *Caudipteryx*, which are described as feathered dinosaurs (Qiang, Currie, Norell, and Shu-An, 1998). Most of some ninety features possessed by these species are reckoned to be those of dinosaurs. Both contour feathers and downy feathers are involved in the fossils. I have no doubt that the arguments over these fossils will rumble on, but creationists have a number of options which should be considered.

First, they may turn out to be birds with more reptile-like features than other birds. These bird species were created by the Creator that way. Perhaps God created the potential for some dinosaurs to produce feathers. Such a view would not be unlikely. Before people run down either of these two options, let us recall that it was only last century that people considered "species" and Genesis kinds as being the same thing and no one believed that mammals could lay eggs. The only other option is that these two forms have had their fossil remains buried over remains of birds and now both look as if they were one and the same fossil. I think that to be unlikely. The age of these two fossils is unknown at the moment, but is thought to be younger than *Archaeopteryx*. These fossils could not have given rise to the wide variation of birds that were around at the time of 142 to 150 myrs. old for this range - (see Shipman, 1997). Either way creation is still able to answer the questions posed by these fossils from China. The kind is not only the phenotypic plan but it is also determines what variation potential the life form has. We think nothing of a bumble bee having hair because we are so familiar with it. It is the unfamiliar possibilities for which we should be prepared. We further papers on these two fossil discoveries. To lend enormous support to variation potential within kinds, recent work on chick embryos has shown that by controlling certain proteins, real teeth can be produced (Raymond, 1998, p. 19; Kollar and Fisher, 1980; Wang, Upholt, Sharpe, Kollar, and Mina, 1998). We know that in the past some birds had teeth, but we also know that not all birds had teeth and in this case these experimentally induced teeth are new to these birds. We should be prepared for the proposition that some dinosaurs may have had feathers, while others like the pterosaur (*Sordes pilosus*) had a hair-like plumage (Brown, 1996, p. 57) and some Marsupialia

may have laid eggs. Despite this obvious variation, none of these has extended beyond the boundary of their respective kinds. Those features were either created directly by God or the variation potential was implanted by God. The variational potential of the organisms could be expressed either through mutations or by modifying its development without mutations, like that done by man in the chick embryos. Either way, creationism is a powerful tool in explaining features that are not normally present in such types of life. Symmetric variation will, of course, maintain life forms within their respective kinds. Further data on this principle and on what I call a "gene theme" model were printed in Brown (1997, p. 13-15) and Brown (1987, p. 75-80).

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Photo Essay

Hoodoos of the Pyramides d'Euseigne in the Val d'Hérens, Switzerland

Rock stacks, rock chimneys, and hoodoos present interesting surface features that originate through diverse means. Their formation is typically due to preferential erosion along fractures and joints, or through drainage pattern development. A protective cap rock typically shields the underlying layers from erosion. These features can be interpreted as supporting the Young-Earth Flood model (Froede, 1997).

Hoodoos are defined as:

A fantastic column, pinnacle, or pillar of rock produced in a region of sporadic heavy rainfall by differential erosion... occurring in varied and often eccentric or grotesque forms (Bates and Jackson, 1987).



Figure 2. A closeup of the tunnel (opposing side) which has hoodoos above it. Note that the massive column of matrix to the right of the tunnel has lost its cap rock and will now weather in an accelerated manner.



Figure 1. A tunnel runs through a hoodoo ridge where large boulders cap and protect the underlying lithified matrix.

We have identified some hoodoos that formed through drainage pattern development at the Pyramides d'Euseigne in the Val d'Hérens, in southwestern Switzerland (Figures 1, 2, 3, and 4). The hoodoos are located approximately five miles (eight kilometers) southeast of Sion. A proposed manner of their formation is presented in Figure 5. The strata in which the hoodoos formed is identified as wildflysch, specifically a chaotic turbidite deposit. This particular wildflysch contains:

...a great amount of erratic blocs. These blocs, varying in size from that of a brick to that of a skyscraper ... (Rutten, 1969, p. 239).

Both uniformitarians and young-earth creationists would agree that the size and chaotic manner in which these blocks and boulders exist within the matrix reflect what must have been high-energy depositional conditions. We propose that these wildflysch deposits reflect the high-energy conditions associated with the global Flood (Froede, 1998a). The subsequent erosion of that wildflysch strata has exposed the blocks and boulders at the surface and allowed them to cap the underlying fine-grained matrix in a manner which resulted in the formation of hoodoos.

While the original wildflysch turbidite strata formed during the global Flood, the hoodoos likely developed under the wet-weather conditions associated with the single ice age. With a decrease in precipitation at the termination of the Ice Age Timeframe (Froede, 1998b), and the concomitant diagenetic hardening of the exposed wildflysch matrix, these hoodoos now exist in a relatively stable state.



Figure 3. A closeup of two hoodoos showing the chaotic nature of the wildflysch strata. The strata is lithified to the point where it is able to support the weight of the overlying large boulders (each approximately four feet in diameter). Intense weathering has resulted in the erosion of the wildflysch matrix everywhere except where the boulders cap and protect the underlying strata.

Acknowledgements

Mr. Wallace thanks Guido Suter and Markus Notter, who were his hosts while he was in Switzerland where the photographs were taken. Both authors thank Dr. E. L. Williams and Dr. J. K. Reed for providing review and comment on this photo essay.

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Figure 4. Looking down the Val d'Hérens, across some hoodoos in the foreground. The shape of the valley suggests that it was not significantly impacted by glaciers during the single ice age. The erosion of the valley, and more specifically the wildflysch, probably began with Floodwater withdrawal and intensified due to the wet weather conditions associated with the Ice Age Time-frame (likely spanning a few thousand years at this elevation).

Froede, C.R., Jr. 1997. Rock spires (pseudo-hoodoos) fit Flood model. *Creation Research Society Quarterly* 34: 128.

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Carl R. Froede Jr.
Timothy Wallace

Hoodoo Formation Via Drainage Pattern Development

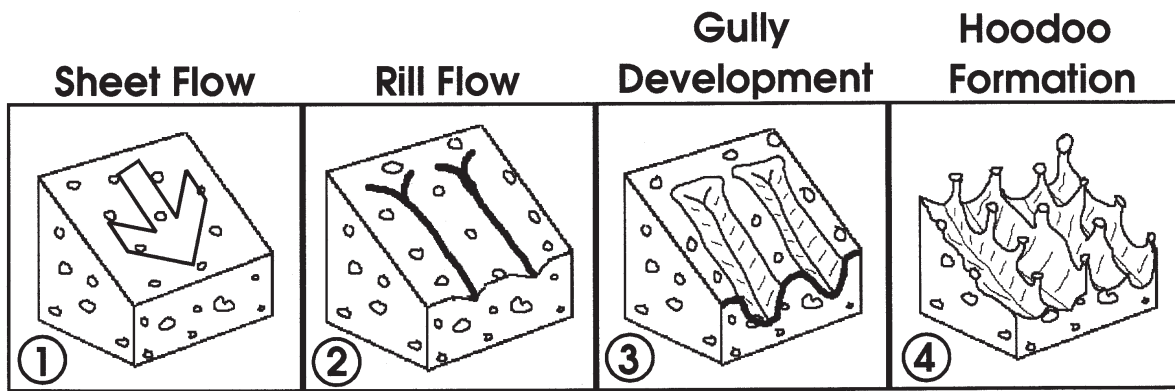


Figure 5. The formation of the hoodoos only occurred because the wildflysch strata contains boulders and blocks of rock within the semi-lithified matrix. Their initiation began as precipitation moved from uncontrolled overland/sheet flow (Box 1) to rill development (Box 2). Gullies ensued as the surface water formed drainage channels (Box 3). The blocks and boulders within the wildflysch matrix protected the underlying matrix from surface precipitation, and allowed them to form along the ridges of the drainage channels (Box 4).

Call for Papers The Second CRS Monograph on Astronomy

Due to the popularity of the first CRS monograph on astronomy, *Design and Origins in Astronomy*, edited by the late George Mulfinger, the CRS has decided to publish a second astronomy monograph. We are interested in original papers, but would consider revisions of papers that have appeared in the *Creation Research Society Quarterly* in the past 15 years. Submissions on all topics of astronomy are encouraged.

For submissions or additional information, contact Danny R Faulkner, 1402 University Dr., Lancaster, SC 29720. H: 803-286-9781 O: 803-285-7471 e-mail: Faulkner@gwm.sc.edu

Errata

CRSQ 35(4), March 1999, page 217. The two formulas at the bottom should have read:

$$\text{minimum} = \frac{100,000 \text{ m}^3 \text{ per year}}{5,000 \text{ m}^3 \text{ per year}} = 20 \text{ times}$$

$$\text{maximum} = \frac{200,000 \text{ m}^3 \text{ per year}}{1,000 \text{ m}^3 \text{ per year}} = 200 \text{ times}$$

CRSQ 35(4), March 1999, page 220. Two lines were omitted from the book review, and it has been reprinted in its entirety on page 37 of this issue.