

Creation Research Society Quarterly

Haec credimus:

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

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NUMBER 1



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Cover Photograph

This cover photograph by Robert L. Goette shows how Pine Creek (Pennsylvania) comes from the left and makes a sudden 90° change in direction. Several ideas have been advanced by Williams *et al.* to explain this sharp right turn and subsequent plunge of a river through mountains.

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CREATION RESEARCH SOCIETY

History The Creation Research Society was organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a real need for an association devoted to research and publication in the field of scientific creation, with a current membership of over 600 voting members (with graduate degrees in science) and over 1100 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is recognized as the outstanding publication in the field.

Activities The society is solely a research and publication society. It does not hold meetings or engage in other promotional activities, and has no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund is maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible. The Society operates two Experiment Stations, the Grand Canyon Experiment Station in Chino Valley, Arizona and the Grasslands Study Site in Weatherford, Oklahoma.

Membership Voting membership is limited to scientists having at least an earned graduate degree in a natural or applied science. Dues are \$20.00 (\$24.00 foreign) per year and may be sent to Glen W. Wolfrom, Membership Secretary, P.O. Box 969, Ashland, OH 44805-0969. Sustaining membership for those who do not meet the criteria for voting membership, and yet who subscribe to the statement of belief, is available at \$20.00 (\$24.00 foreign) per year and includes a subscription to the *Quarterlies*. All others interested in receiving copies of all these publications may do so at the rate of the subscription price for all issues or one year: \$23.00 (\$27.00 foreign).

Statement of Belief Members of the Creation Research Society, which include research scientists representing various fields of successful scientific accomplishment, are committed to full belief in the Biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution), both of the universe and the earth with its complexity of living forms. We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. In 1970 the Society published a textbook, *Biology: A Search for Order in Complexity*, through Zondervan Publishing House, Grand Rapids, Michigan 49506. All members of the Society subscribe to the following statement of belief:

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

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

3. The Great Flood described in Genesis, commonly referred to as the Noachian Flood, was a historical event worldwide in its extent and effect.

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

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Quote

When evolution is said to be a fact, not a theory, what is actually meant? That now-living things have descended from ancestors, with modification, over time? Or that the modifications came by chance, not by design? Or, in addition, that all living things ultimately had the same ancestor? Or, still further, that the "first living thing" had as its ancestor a nonliving thing? Context indicates that when evolution is asserted to be a fact, not a theory, the view actually being pushed includes that of common origin, ultimate inorganic ancestry, and modification through nonpurposive mechanisms: a set of beliefs that goes far beyond the mountain of fact that is actually there, which consists largely of fossils that demonstrate some sort of relationship and some sort of change over time (p. 65).

Bauer, Henry H. 1992. *Scientific Literary and the Myth of the Scientific Method*. University of Illinois Press. Chicago.

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ANNOUNCEMENT: The Third International Conference on Creationism will be held in Pittsburgh, PA on July 18-23, 1994. For information, contact: Creation Science Fellowship Inc., P.O. Box 99303, Pittsburgh, PA 15233-4303 or call 412+341-4968.

Editors' Comments

The CRSQ editors serve by appointment of the Board for a period of five years. This has been the pattern for all editors except the late Harold Armstrong who willingly held the position for ten years. Don DeYoung and Emmett Williams have passed their tasks along to us and have set high journalistic standards for us to maintain. They have also left to you, the readers, a diversified backlog of articles filling this issue and spilling over to some extent into the September Quarterly.

Writers are hereafter encouraged to send all book reviews directly to Don DeYoung who has assumed the newly created post of Book Review Editor—see address on the masthead. All other manuscripts should be mailed to Eugene Chaffin, the new editor. The editor will continue to subject all submitted material to a peer review process which improves the quality of articles and is a practice widely followed in professional societies. Authors are encouraged to read and follow instructions on page 6 of this issue. George Howe, the new associate editor, will oversee the process of the page layout and design of Quarterly issues.

We congratulate Wayne Frair on his long and productive period of service for the C.R.S. We are proud to dedicate this June issue to a man who has served as Board member, Secretary, Vice President, and President. We also salute the new individual who was elected as President of CRS at its recent meeting at the beauti-

ful and functional CRS Van Andel Research Center, Chino Valley, AS—Emmett L. Williams. Dr. Williams was the key Board member involved with selecting this choice location just 12 years ago. Readers will learn more in future issues of John Meyer's effective labors to establish this center for creationist research.

Our "Editors' Comments" section would become unwieldy if we began commenting on each of the features in this issue. There is material here for people of many interests—geologists, biologists, anthropologists, astronomers, physicists, historians, and others. If a picture is worth a thousand words, then the June publication is a whole "library." River action, muscle function, turbidite strata, flagella rotors, and more can be visualized from the more than 60 illustrations here.

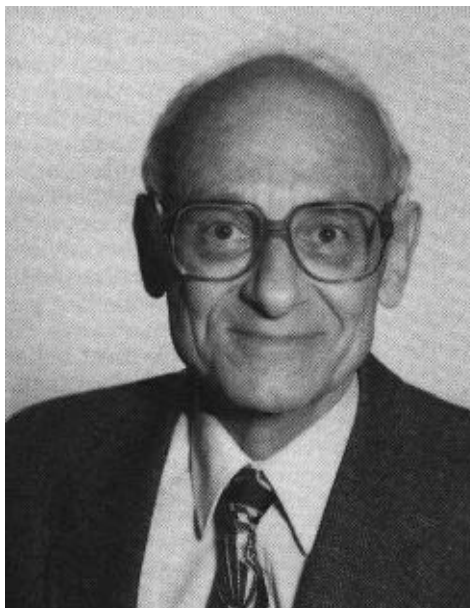
Studies in creation science should be objective. But a proper perspective keeps in sight the Creator's role in creation and redemption, as Bolton Davidheiser wisely points out in his letter. In the days of Isaac Newton, the word "science" involved a study of God's world, and in no way implied a study in which all mention of God was to be avoided. CRSQ is one of the few scientific publications in which God's proficiency in creating and sustaining the universe is extolled. We want to keep the Quarterly that way.

Eugene Chaffin
George Howe

INSTRUCTIONS TO AUTHORS

1. Manuscripts shall be typed and double spaced.
2. An original plus two copies shall be submitted to the editor of the Quarterly.
3. All submitted articles will be reviewed by at least two technical referees. The editor may or may not follow the advice of these reviewers. Also, the prospective author may defend his position against referee opinion.
4. The editor reserves the right to improve the style of the submitted articles. If the revisions of the editor and referees are extensive, the changes will be sent to the author. If the changes are not suitable to the prospective author, he may withdraw his request for publication.
5. Due to the expense involved, manuscripts and illustrations will not be returned to authors.
6. All references (bibliography) must be presented in the style shown in the Quarterly. If a prospective author is not familiar with the CRSQ format, the editor will furnish an example reference page.
7. All figures and drawings must be prepared professionally. No sloppy hand drawings or freehand lettering will be accepted. The editor reserves the right to approve submitted figures. Unacceptable illustrations will result in rejection of the manuscript for publication. Do not send slides.
8. Any manuscript containing more than 25 pages is discouraged. If a topic cannot be covered to the author's satisfaction in this length of pages, the author must divide his material into separate papers that can be serialized in the Quarterly.
9. The Quarterly is a journal of original writings. Only under unusual circumstances will we reprint previously published manuscripts. Never submit an article to two or three journals, including ours, hoping all of them will publish your work. When submitting an article, please state if the material has been published previously or has been submitted to other journals.
10. Book reviews should be limited to 560 words or fewer.

DEDICATION TO WAYNE FRAIR



Occasionally the Quarterly is dedicated to someone who has made important contributions to the Creation Research Society. This issue honors Dr. Wayne Frair, CRS president for the past eight years. Many descriptions of Wayne come to mind: A leader with quiet humility and humor; a writer, traveler, and turtle expert.

Wayne spent two years in the Navy during WWII, after high school. Then he graduated from Houghton College (AB), Wheaton (BS), The University of Massachusetts (MA), and Rutgers (Ph. D). His doctorate concerned turtle biochemical taxonomy. Continuing research has made Wayne a recognized expert in turtle blood chemistry. He has traveled widely, including a 1969 trip to Surinam, South America, sponsored by the National Geographic Society (1978). There he studied the world's largest living turtles, the giant leatherbacks. This year Wayne plans to donate his valuable collection of thousands of frozen turtle blood samples to the Louisiana State University Museum of Zoology.

Wayne Frair has more than 100 publications; 40 are original research articles. A co-authored book, *A Case for Creation* (1983), has gone through three editions and 60,000 copies. His CRSQ writings have been helpful to many of us: Life in a test tube, The Freiburg Skull, Original kinds and turtle phylogeny, etc. The turtle studies document the lack of an ancestor or evolutionary change for turtles. A significant article in *Science* (1972) reported the first so-called "warm blooded" reptile following temperature studies of leatherback turtles. Wayne belongs to dozens of science societies. Among them he holds life memberships in Sigma Xi and The American Association for the Advancement of Science. These credentials resulted in the invitation to be a witness at the 1981 creation/evolution trial in Little Rock, Arkansas. Wayne Frair's career clearly shows that creationists make good scientists, with a positive impact in research.

Wayne has enjoyed 39 years of biology teaching at The King's College, NY. His colleagues have twice

voted him Faculty Member of the Year. And Wayne can still surprise us: he married Elizabeth (Betty) in 1987 after 61 years as a bachelor. Naturally, turtle soup was served at the wedding reception! Visitors to Wayne's college lab will see a pet black rat snake that hatched in the lab eleven years ago. For a while the collection also held the largest known Eastern Box Turtle, just over three pounds (Cook, 1972). There was also the oldest known razor-backed musk turtle, at 26 years. Wayne presently keeps a 35 pound alligator snapping turtle in a large laboratory bathtub, a research animal and pet for 25 years!

Wayne and Betty live in New York high on a hillside overlooking the Hudson River. They have both recently retired from The King's College, he with emeritus status. Wayne and Betty will continue with turtle research, travel, creation speaking/writing, and managing conference book tables. They have active ministries: Wayne teaches adult Sunday School; Betty speaks at women's seminars and also leads popular afternoon forums during summers at Camp of the Woods in Speculator, NY.

Thanks, Wayne, for your faithful leadership in the CRS. Your life encourages all of us toward excellence in exploring the creation.

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Don B. DeYoung

LETTERS TO THE EDITOR

What is "Creation Science"?

The term "scientific creationism" was promoted by a book by the same name published in 1974 by members of the Institute for Creation Research. Soon "creation science" became popular among creationists and it still is. That evolutionists would have a heyday with these terms could have been predicted from the start, but even with the advantage of hindsight, creationists continue to use the term "creation science," while evolutionists pile ridicule and abuse upon them for calling creation scientific.

Creation was by supernatural acts of God. Creationists believe this. How, then, can creationists call creation scientific? They don't.

Knowledgeable evolutionists must be aware of this but apparently the temptation to take advantage of a *faux pas* on the part of the adversary is too strong to resist.

The public school edition of the aforementioned book explains on page iv, "The purpose of *scientific creationism* is to treat all the more important aspects of the subject of origins and to do this solely on a scientific basis [that's the rationale for the terms "scientific creationism" and "creation science"], with no reference to the Bible or to religious doctrine. The treatment is positive rather than negative [but there are negative aspects in the issue, as when evolution is seen to be an inadequate explanation of the facts], showing that the creation model of origins and history may be used to correlate the facts of science at least as effectively as the evolution model."

Thus "scientific creationism" and "creation science" do not imply that creation was scientific but instead that creation versus evolution may be discussed on the basis of the "scientific" evidences without reference to Scripture. The Bible itself supports this, saying in the first chapter of the epistle to the Romans that the evidences of creation are so evident in nature that the heathen are without excuse for their idolatry.

The evolutionists also made a *faux pas*. In their case it is the term "micro-evolution," for something purporting to be evolution but is not. A difference between the case of the creationists and that of the evolutionists is that the rather unfortunate term of the creationists has a corrective explanation while, in contrast, the one of the evolutionists is *intended* to mean what it implies. Thus a charge can be made, whether it is able to be substantiated or not, that the term "micro-evolution" originated as a deliberate deception. At best, the interpretation is that "micro-evolution" leads to what really would be evolution and is called "macro-evolution." However, there is no evidence for this.

There are many examples of "micro-evolution," but the classic example is the case of the light and dark moths in England. Before the Industrial Revolution these moths were predominantly light in color and blended with the lichen-covered trunks of trees as the moths rested in the daytime, making them difficult for predatory birds to see. There were some mutant dark moths of the same species. They contrasted with the background and were easily seen and captured by birds. Thus the dark moths remained few in number. Then, with the industrial Revolution, contaminants darkened the trees in the industrialized areas, resulting

in the light moths being conspicuous and the dark moths protected. As could have been predicted, in a short time the dark moths predominated in numbers.

So what? In popular books and articles for the public and in textbooks for students this was hailed as an outstanding example of evolution! Actually there was no evolution here. The moths were still moths. They were not becoming anything else. This is a good example of Darwinian natural selection but all it does is demonstrate that natural selection is not the same as evolution and it does not necessarily lead to evolution. However, it made an impression on the public, and conservative Christians asked speakers for creation, "We must believe *some* evolution, must we not?" For evolutionists the trick worked.

Charles Darwin is, and no doubt always will be, the hero of evolutionists. He gained fame by supplying a mechanism for evolution, his natural selection theory. However, this still is questioned by evolutionists as to whether it is adequate. Several things have been added, particularly mutations, to bring about variations for natural selection to select. But mutations do not supply the kinds of changes required for evolution, "macro-evolution."

Evolutionists introduced the concept "micro-evolution" as evolution and got away with it. Creationists introduced the term "creation science" and have been ridiculed for it ever since.

Although creation versus evolution can be discussed from the creationist point of view without reference to religion, it must be admitted that the religious aspect is what motivates creationists, and doctrine is basic. Most evolutionists are not particularly interested in religion and probably very few of them are even aware of the doctrinal connotation. It seems almost everyone thinks of the creation-evolution conflict as having to do only with historical aspects of the Genesis account of creation. But the doctrinal implication is basic to Christian faith. If evolution is true, we are improved animals ("man and other animals" is a common expression in evolutionary writing) instead of fallen representatives of a perfect creation. God demands perfection, of which we now are not capable. The way out of the dilemma is provided by the offer to us of accepting a sinless substitute for the punishment deserved by us. The Lord Jesus Christ, as Deity, came and offered Himself as the final and all-sufficient sacrifice in atonement at Calvary, so that those who believe and receive this sacrifice for themselves, not relying on good deeds or ceremonies, are saved unto everlasting life with Him. This is the Biblical doctrine of salvation. If evolution is true, we are improved animals instead of fallen sinners. Then there is no occasion for the Redeemer.

This is the basic issue which makes the conflict between creation and evolution so crucial.

Bolton Davidheiser

13530 Fonseca Ave., La Mirada, CA 90838

Aguja and Javelina Formations — Lithostratigraphic Disagreements

Williams and Howe (1993) gave a brief description of the Aguja and Javelina formations in which they found petrified wood. Froede (1994) kindly expanded

the discussion emphasizing the problems with stratigraphic correlations. It was noted in Williams and Howe (1993, p. 47) that there is disagreement between field workers on the Cretaceous-Tertiary boundary in Big Bend National Park involving the two formations (Schiebout et al., 1987; Lehman, 1988; Schiebout et al., 1988). This is a typical geological debate which illustrates the difficulty of placing stratigraphic boundaries between formations in a gradational sequence.

One possible interpretation using the Flood model would involve rapid sedimentation of the Upper Aguja and Lower Javelina formations under similar conditions such that it is difficult to distinguish between them. Possibly the actual time span during deposition of the two formations was quite brief?

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Solubility of Silicate Minerals and the Petrification of Wood

A young earth model for the petrification of wood was suggested by Williams (1993, pp. 106-111). Among the various factors that were discussed, it was noted that certain woods have an affinity for silica and that slight decomposition of wood may encourage silicification in an aqueous-silica environment. Other observations on the silicification of wood were offered by Froede (1994, p. 187).

Bennett et al. (1991, pp. 328-331) found that anoxic, microbially-active, organically-rich environments in a peat bog enhanced the apparent solubility and dissolution rate of quartz and silicate minerals (p. 331). Relate these findings to the possible petrification of wood during the Flood. Assume that submerged, waterlogged wood could be buried under Flood-deposited, silica-rich sediments. Likewise waterlogged wood could be covered by bentonite in an early post-Flood period (Williams and Howe, 1993). The presence of water, anoxic conditions and slight decay of the wood structure by microbial activity possibly could increase the amount of dissolved silica available for silicification. If an early post-Flood environment existed as proposed by Oard (1990), humid conditions would insure an ample supply of water necessary for the continuing silicification of wood in silica-rich sediments.

Possibly some laboratory studies duplicating these suggested conditions would enable the investigator to determine the nature of the processes needed for the rapid petrification of wood.

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 Emmett L. Williams
 5093 Williamsport Dr., Norcross, GA 30092-2124

Failure of Natural Selection

The article by Bergman (1993) concerning the greater rate of extinction of higher life forms was an excellent refutation of natural selection and evolutionary theory. As the author mentioned, the natural selection that does occur simply changes the frequency of existing possible phenotypes and does not create new life forms. For example, in deer and turkey populations in the eastern United States, specimens from the northern latitudes are larger in size than those to the south, particularly Florida. Wildlife biologists believe that the lower ratio of body weight to surface area of the southern animals permits their bodies to dissipate more heat in the warmer summers whereas those in the north can retain more heat in the colder winters.

Bergman's observations on the scarcity of higher plant species is perfectly illustrated by the insectivorous Venus Fly Trap, *Dionaea muscipula*. This species has folding leaves with perpendicular bristles on the leaf margins and lures insects with an attractive secretion. The leaf snaps shut to capture the insect, where it is slowly digested. Some believe this adaptation evolved to allow growth in nitrogen-poor soils. Surely this must be considered one of the most highly developed plants on the planet, yet historically this species was found only within a 100-mile radius of Wilmington, N.C. One would think that with this advantage the plant would be highly successful, yet the exact opposite was the case even before ecological disturbance by the colonization of America.

If one considers the operation of a man-made machine, the greater the complexity, the more parts required which could break and render the machine useless. This is analogous to a more highly developed species which will become extinct when a specific requirement is absent. These are just a few examples of the 2nd Law of Thermodynamics and the universal increase in entropy, that impenetrable barrier which evolution can never traverse.

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 Jeffrey West
 3226 Danfield Dr., Columbia, SC 29204

Editor's Note: Other creationist comments on the Venus fly-trap can be found in Howe, G. F. 1978. The Venus flytrap—a cagey plant. *CRSQ* 15:39-40.

Expansion of Space

Dr. Bolton Davidheiser (1993, p. 62) raised an interesting question in his letter to the editor. He noted that cosmologists claim the universe expanded from 10^{-28} cm in diameter to about one meter in 10^{-30} seconds; about 1.67×10^{21} times the speed of light! If cosmologists believed that the Minkowski metric modeled the early universe, then Dr. Davidheiser might have found a contradiction. However, this is not the case. It is easy to justify the claims of the cosmologists by considering a rubber sheet model of the universe. Suppressing one space dimension so that we may picture what is going on, the universe may be thought of as a spherical rubber balloon which is currently expanding (Rindler, 1969, pp. 237-238). A ray of light may be thought of as an ideal bug which moves at uniform speed and only as straight as possible on the surface of the balloon. Apparently, the size of the balloon (i.e. the universe) is independent of the speed of the bug (i.e., light). Without going into equations, I believe that this discussion explains the apparent paradox Dr. Bolton Davidheiser was so astute as to notice.

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Editor's Note: The question of this letter has also been addressed in Talcott, Richard. 1994. Everything you wanted to know about the big bang. *Astronomy* 22(1):30-35.

"Eve Theory" Comments

Paleoanthropologist Martin L. Lubenow criticized creationists in a letter to the editor in the December 1993 issue of *CRSQ* for using the "African Eve," "Out of Africa," or mitochondrial "Eve" theory as support for the Genesis account of creation (Lubenow, 1993, p. 124.) This theory was proposed by evolutionary biologists at the University of California, Berkeley (Hedges et al., 1992). It suggests that all modern humans came from one woman in ancient Africa.

Lubenow correctly states that there is *no connection* between the evolutionist's "African Eve"; and the creationist's Biblical Eve. This imaginary "Eve" of the evolutionists does not fit the facts, and could not exist. Because: (1) The tribe coming from this woman had to have been isolated from other humans: which is not likely. (2) These other humans (Outside the "African Eve's" line) had to become extinct; which is also not likely. (3) And this tribe would likely become genetically weak from inbreeding and would not survive.

In spite of all this, the creationists who used this theory are not entirely wrong. The problem here is to rightly divide the facts from speculative explanations.

These objections are only valid against the evolutionary interpretation, from an evolutionary viewpoint. These objections falsify the speculative story; not the possible truth found in the results of the research.

Lubenow argues that this origin does not include "the origin of *all* humans; but only the origin of *modern* humans" (Lubenow, p. 124).

From the creation viewpoint there is no such thing as primitive humans and modern humans: there are only apes and men. In fact, Lubenow believes some of the

Homo erectus fossils are humans; which I believe are chimpanzees.

Lubenow goes on and says that evolutionists Chris Stringer (British Museum of Natural History) and Stephen Jay Gould have urged to make Neandertals a separate species. This is typical of evolutionary thinking. If you read evolutionist slanted articles you will find that most of them try to emphasize the "primitive" nature of Neandertals. Evolutionists suffered a blow to their theory when it was found that some of the "primitive" features of Neandertals was caused by rickets, and a biased interpretation. And they continue to try and hang onto this wrong interpretation.

Returning to the Eve controversy, Lubenow also points out that the research done by the Berkeley chemists is now being questioned. One of the creators of the theory, Mark Stoneking (now at Pennsylvania University) admits that the results were based on an improper interpretation of the results from a complex computer program (Lubenow, p. 124).

As creationists we should take this news with a "grain of salt," realizing that (no doubt) when the creationists started using these results, pressure was put on the evolutionist researchers to retract their original conclusions.

It is strange, but whenever evolutionists discover something, and it is later found to support creation: the results are called into question!

In conclusion. As far as the results of the experiments made by the Berkeley chemists, the evidence against their results was based on the inability for their interpretation of the evidence to fit known facts. Whether their experiments were right or wrong, as creationists we know that their conclusions **are correct**; but it was not an "African Eve," but the **GENESIS EVE!**

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Reply to Auldane

Auldane grants the validity of my basic thesis—that creationists should not use the "Out of Africa" theory as proof or support for Genesis 1 and 2 because (1) that theory deals with the origin of *modern* humans, not the origin of *all* humans, and (2) that theory has since been shown to be flawed.

Auldane, however, seems to argue that creationists can use the results of that research without regard to the "speculative explanations." He misses the fact that Genesis and the "Out of Africa" theory are addressing two completely different issues. It is unethical—to say nothing of being bad methodology—to try to use scientific research dealing with origin of "modern" humans to support the Genesis account of the origin of all humans. The fact that both Auldane and I agree that there are no primitive humans (in the evolutionary sense of that term) does not detract from the fact that

"Out of Africa" and Genesis are talking about two different things. It is not just a matter of interpreting the research two different ways.

Further, the "Out of Africa" theory has been shown to be flawed because of the improper use of a computer program. Auldane suggests that evolutionists are discarding the theory because creationists are using it to support Genesis. It would be foolish for anyone to reject good research just because someone else is using it (they think) improperly. All that the evolutionists have to do is to point out that we stupid creationists are using their evidence for something they were not even addressing. And they will do just that if we persist in making that evidence say what it is not saying.

The point, however, is that that evidence is flawed. Why use it at all? The scientific evidence for Special Creation is, I believe, very strong. I think we are very unwise to use any evidence that is tainted or questionable. I do not see how God or his Word can be glorified in that way.

The "Out of Africa" situation seems to be a case where the self-correcting concept in science has worked. In my book, *Bones of Contention* (Baker Book House, 1992), I point out that the self-correcting concept in science has worked very poorly. However, to work poorly does not mean that it never works at all. We can afford to give credit where credit is due.

Auldane's statement that I believe that some of the *Homo erectus* fossils represent true humans is false. I believe that *all* of the *Homo erectus* material represents true humans. Auldane's idea that some of it represents chimpanzees is out of the question. The cranial capacity of *Homo erectus* goes from about 700 to about 1200 cc—within the lower range of true humans. No chimpanzee—living or fossil—ever reached that range. The average cranial capacity of chimpanzees is about 400 cc.

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Asteroid Hypothesis for Dinosaur Extinction

Michael J. Oard tells us in a Panorama Note in the December 1993 issue of the CRSQ that the iridium anomaly in the Cretaceous-Paleocene (K-T) boundary was more likely produced by volcanic eruptions (Oard, 1993, p. 163), rather than by asteroid impacts.

As in most cases of a controversy, the answer is seldom a clear and simple yes, or no.

I presented a paper at the Twin-Cities Creation Conference at Northwestern College in Minneapolis on July 30, 1992 based on literature and field research at numerous fossil and meteorite crater sites. In the course of these investigations I have acquired a significant collection of fossils and meteorites, as well as first hand knowledge. Naturally, as a creationist, I became interested in the possibility of meteorite impacts as a cause of the Flood of Noah (Auldane, 1992 and reprinted in 1993).

The majority of creationists and creation scientists (having no previous knowledge or interest in meteorites) are skeptical of these new ideas coming from evolutionists. The strange part is, most of these creationist skeptics have sided with the conservative evolu-

tionists who are trying to hang onto the uniformitarian theory. These creationists repeat the evolution based arguments against the cataclysmic asteroid impact hypothesis (Officer, 1993).

Oard states, "While this flurry of research has been proceeding, other scientists have been discovering evidence that volcanos can explain the observations attributable to an impact" (p. 163).

The scientists for the impact hypothesis are in a "flurry of research"; and those against are "discovering evidence." This implies that those for the hypothesis are trying desperately to find evidence to support their preconceived conclusions; and those against it have simply and unbiasedly "discovered" evidence? Wrong! Those against the hypothesis are just as biased, and in a "flurry of research" to discredit these controversial ideas.

This is the same situation as the mitochondrial "Eve" hypothesis (we all came from one woman) of the evolutionists. See Auldane, 1994.

Oard points out that iridium has been found in airborne volcanic ash in eruptions on Hawaii, Kamchatka, and Reunion Island, which was also deposited in layers (Oard, 1993, p. 163 from Officer, 1992 & 1993).

Charles Officer and his group of evolutionary skeptics do not point out the fact that there are two types of eruptive material: (1) Basaltic (mostly iron and related metallic minerals); and (2) Rhyolite (mostly silicon glass and feldspar).

Most eruptions today are basaltic, like those common in Hawaii. These eruptions are usually basalt lava flows, which only rarely explodes when water flows into the magma tube.

In the fossil record (including the K-T boundary) most of the volcanic eruptions were explosive, produced from rhyolite lava pulverized into light colored "rainbow" deposits of bentonite or montmorillonite (pulverized glass) (Williams and Howe, 1993, p. 47).

Basalt contains most of the iridium; rhyolite contains very little (Williams, Matzko, Howe, White, and Stark, 1993, p. 172).

As I said, there are no simple answers. According to the geologic record there were huge, massive worldwide volcanic upheavals, and these no doubt were the main cause of the extinction of the dinosaurs other animals, and plants. And it formed most of the iridium layer, but meteorite dust was also an ingredient. Both volcanic and meteorite iridium are no doubt mixed.

"Soot" from "volcanic eruptions"? (Oard, p. 163). Not very likely. How come geologists do not suggest that most of our coal and oil is volcanic in origin? I have seen lots of soot with plant shapes.

Oard says that no iridium is associated with known meteorite impact craters (Oard, 1993, p. 163 from Officer, 1992, p. 313).

These craters are formed by iron meteoroids. Iron does not break up and explode into dust; therefore they do not spread rare elements in the atmosphere, to fall and produce a layer. However, carbonaceous chondrites do. One of these exploded like an atomic bomb in our atmosphere over the Tunguska region of Siberia in 1908, leaving a layer of rare elements similar to the K-T boundary. These chondrites, when they are filled with explosive gases, explode or they break up into small pieces; either way, they leave no craters.

The geologic evidence indicates the Flood was caused by world-wide volcanic upheaval. But what triggered the volcanic upheaval? The breakup of an asteroid composed of mostly stoney carbonaceous chondrite with some iron would do the trick. Evidence continues to mount in favor of this hypothesis. And this evidence is best explained from a creation viewpoint.

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Response to Comments on the Asteroid Hypothesis for Dinosaur Extinction

In my Panorama of Science article (Oard, 1993), I pointed out a well-reasoned case by Charles Officer for the volcanic hypothesis of dinosaur extinction. From a creationist perspective, the Flood caused dinosaur extinction. The problem is how are the observations at what is called the Cretaceous-Tertiary boundary to be explained within the Flood model. Since massive volcanism was part of the Flood, it is logical that volcanism is a possibility. Charles Officer makes a good case that volcanic eruptions can indeed account for most, if not all, the observations, such as the high level of iridium found at a small number of supposed K/T boundaries. However, this does not mean that meteorite impacts did not occur during the Flood.

I did not mean to imply that the proponents of either hypothesis have not produced evidence in a "flurry of research." Of course, both sides are biased. What I have noticed in this controversy is that the meteorite hypothesis has received most of the research grants, journal space, and press. Little space has been devoted to the volcanic hypothesis. I also see a "band wagon" effect (Gold, 1989, p. 247), or a reinforcement syndrome (Oard, 1985, p. 178-179), in this area of research, as well as in many other areas of the historical sciences. It appears to me that those favoring the meteorite hypothesis have overlooked data contrary to their hypothesis and have neglected to consider alternative hypotheses. The data is equivocal and their case seems far from proved. As Charles Officer (1993) says: "But the controversy about the K/T boundary is an illustration of how hypotheses develop in an observational science where hard facts are rare."

In my opinion, Jeremy Auldane's hypothesis (1992) that large meteorites started the Genesis Flood is quite reasonable. Impact craters are common on the inner

planets and our moon, which implies that the earth probably was bombarded at some time in the past. We find very few impact craters on the surface of the earth, indicating that catastrophic meteorite bombardment would have occurred either before the Flood or during the Flood. If the pre-Flood earth was a time of climatic and geographic stability, it is doubtful that the meteorite bombardment was before the Flood. The only possibility left is that the event occurred during the Genesis Flood.

I can accept that meteorites also produced some of the iridium layers. Within the Flood model, both mechanisms could explain the layers with a high amount of iridium, not only at the end of the Cretaceous, but also in other layers of their geological column. (I bet that if scientists looked harder they would find many more iridium layers.) Therefore, we agree that both mechanisms could be responsible for the iridium anomalies. I personally am not concerned which hypothesis is from conservative evolutionists or neo-catastrophists. I believe each should be evaluated on the "raw data" within the creation-flood paradigm.

I thank Jeremy Auldane for pointing out that basalt eruptions produce the iridium, and that the Tunguska event left a layer of rare earth elements similar to the K-T boundary. He is probably correct, but I would like to see documentation of this interesting information. I would also like documentation that the altered volcanic ash in the rocks is a product of only plinian volcanic eruptions. It is well known that large subaerial basalt eruptions do produce large ash plumes that penetrate the stratosphere (Stothers et al., 1986).

The "soot" claimed by some scientists at the K/T boundary appears to be a layer with a relatively high carbon content. The problem is to identify whether this carbon is really soot from wildfires. According to Officer (1993, p. 37) the carbon isotope ratio does not support this deduction. Besides, in a Flood model with plenty of rain and a partially to totally flooded earth, it would be very difficult to start a wildfire, from either a volcanic eruption or a meteorite impact.

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NOT SO BLIND A WATCHMAKER

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Abstract

Structural and operational principles underlying the organization of the vertebrate retina and bacterial flagellar apparatus are reviewed in the context of William Paley's classic intelligent designer vs. Richard Dawkins' contemporary "blind watchmaker" interpretations of biological origins and diversity. The significance of inverted retinal microanatomy and retinocytophysiology is diagnosed. In the process, Dawkins' riposte to Paley is refuted. The second example is more contemporary. In terms of biophysical complexity, the bacterial rotor-flagellum is without precedent in the living world. To the micromechanicians of industrial research and development operations, it has become an inspirational, albeit formidable challenge to the best efforts of current technology, but one ripe with potential for profitable application. To evolutionists, the system presents an enigma; to creationists, it offers clear and compelling evidence of purposeful intelligent design.

Introduction

Among the most prized pieces of evidence for the historical presence of human beings that can be found in an anthropological dig are tools. A skilled investigator can readily distinguish such artifacts (man-made objects) from natural objects, e.g., curiously weathered rocks, by indications of manufacture (chipping, beveling, etc.) and of purposeful design (i.e., preconceived utility). The indicated parameter is *intelligence*—in this case, the capacity to conceive in the abstract the need for the implement, thus its application, to engineer a design appropriate to the task, to identify the suitable material(s), and to devise the technique(s) for its construction; in a word, *invention*.

In the earth's biosphere, intelligence of that sort is arguably unique to human beings (Morris, 1984). Occasionally we witness "tool using" animals—an example would be otters using stones to crack the shells of the mollusks they eat [while floating on its back, the otter pounds the shellfish against a stone it has placed on its chest]. However, it is likely that otters acquire this behavior empirically. Certainly there is no creative process involved (on the otters' part) where the production of the instrument itself is concerned, though the activity may strike the observer as "intelligent." The same might be said for nest building by birds, the constructions wrought by social insects, etc. But where the interpretations of some animal behaviorists on this subject of intelligence are concerned, and others who would take it to the cellular level, even, let us be wary of anthropomorphisms (Lumsden et al., 1992, 1993). Evidence of intelligence lies more in design—the inventive aspect—than use alone. As Augros and Stanciu (1987) note, the executor of a purpose need not have an intellectual understanding of the phenomenon. Zoologically, many purposes are executed from a pre-programmed intrinsic cause, are a prescribed function of endogenous anatomy and physiology, or are directed reflexively by sense perception [see Tinbergen, 1989, for many pertinent examples]. In any event, here the rocks remain unadulterated rocks; in the otter's paws they do not become contrived mallets or anvils. The dexterous otters only use the rocks, albeit cleverly, that are available. The same would be true of an *Ammono-philus* wasp that uses a pebble to seal its nest, even though it literally uses its head to hammer the pebble into place.

Thus, tools, fashioned by design to one degree or another of intricacy, are diagnostic of creative intelligence, therefore of an *intelligent cause*. It follows that the more sophisticated the tools are, the greater the intelligence behind them. Thereby do Archimedes, Leonardo, and Edison warrant our accolades. From the engineering standpoint at least, the wheel, considering all its formats, might be regarded as the penultimate product of innovative endeavor. Imagine the excitement if a wheel—of any kind—were one day found beneath the sands of Mars. Assuming it would not be litter traced back to an earth-based exploratory mission, SETI (Search for Extraterrestrial Intelligence, budgeted for the present decade at \$100 million) would be vindicated. Irrespective of its elemental material composition or size, or how it might have been used, no one would conclude that a wheel, on Mars or anywhere else, merely happened. Now what if the wheel was found as a component of a complex entity, i.e., one of multiple, integrated components, and therein accomplishing definable work? Physical happenstance would be even less credible an explanation.

Biologists who contend that life is solely a product of stochastic, purely naturalistic, physico-materialistic processes are faced with the paradox that nowhere is sophistication more apparent than in the intricate construction of living things. If the discovery of wheels on Mars would be greeted as proof of intelligence other than earthly humankind, how about finding powered wheels—spinning at thousands of rpms—in biological systems as components of an engine? Should not this set one's intellectual wheels turning, so to speak, where biological origins would be pondered?

Argument from Design vs. the Panda Principle

William Paley was appropriately impressed (well before the advent of electron microscopy) with the high complexity, specificity, and low probability of the living world. Paley, seeing that it all required a special explanation, began his treatise on *Natural Theology* (Paley, 1802) with an anecdote—that of stumbling across a watch while crossing a heath. Paley rhetorically asked how such an intricately formed object—replete with finely honed gears, sprockets, and springs (all predicated on the principle of the wheel)—could have come to be in a natural setting. Besides the owner of the lost watch, of what would it be evidence? Why, irrespective of where the watch was found, or how it got there, the very preciseness and intricacy of its works would be

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immediate and clear evidence of the existence of a *watchmaker*. Watches (ergo wheels) do not just happen.

Following this analogy, Paley went on to extoll the structure and function of the human eye—as an instrument for vision, surely it had an intelligent designer, just as telescopes, microscopes, and spectacles had been intelligently designed to assist it. A more apt analogy would have been the camera, but that had yet to be invented. The “Argument from Design” for the existence of the Creator God (Romans 1:19-20) behind nature was compelling at least for a time to all but the most hardened skeptics [see, e.g., Mackie’s (1982) discussion of 18th century philosopher David Hume’s view of theistic causation as an unnecessary, even counterproductive superstition, the view that Paley would rebut]. Even Charles Darwin, who 50-odd years later would otherwise argue for a purely natural (vs. supernatural) origin of biological entities and their diversity, was perplexed by the example of the eye (Darwin, 1859, 1888). Yet it has been said (see Dawkins, 1986, p. 6) that Darwin made it possible to be an intellectually fulfilled atheist.

Apparent ingenuity in biological structure still persists as an argument for purposeful design (e.g., Denton, 1986; Augros and Stanciu, 1987), especially when incorporated in solutions to problems comparable to those confronting our own technology. Not the least of the examples cited remains the eye (see Denton, 1986, pp. 332-333). And doctrinaire evolutionists persist in derisive analyses of creationist teleology. Thus does Oxford’s Richard Dawkins (1986) present a contemporary “rational” (Hume-anistic) alternative to Paley’s Watchmaker—viz. the purposeless, mindless, sightless forces of physics, chemistry, and natural selection. He, like Peter Atkins (1981), argues that the evolution of complex things is inevitable once the requisite physical conditions are in place. Thus, it was inevitable, we are to suppose, that one day dinosaurs would take to the air and cows (more specifically, one of their ungulate ancestors) would go submarine (reference scenarios for the evolution of birds and whales, respectively). Sooner or later, eyes would develop from the primitive photoreceptors of “lower organisms.” And what else but naturalistic trial and error would account for what Dawkins (see also Gould, 1980, 1986) identifies as the *imperfections* in biological structure including that of the human eye, but a “*blind watchmaker*”? Surely, an omnipotent, omniscient Creator would not have gotten the layout of the human eye so confused, as Dawkins contends is the case for the microanatomy of the retina (Figure 1). Paley’s respect for *intelligent* design of the eye was misplaced—the photoreceptive processes of the rods and cones face away from the incoming light toward an *opaque* pigment layer at the back of the eye! Light first strikes not the photoreceptors but a tangle of neurons lying *between* the lens and layer of rods and cones; the placement of the neurons transmitting the visual signals to the brain is thereby *backward*. Dawkins (1986, p. 93) conjectures that with such restricted passage “. . . through a forest of connecting wires” the light “. . . presumably [suffers] some attenuation and distortion . . . [a] principle . . . that would offend any tidy engineer!”

Professor Dawkins (1986) patronizingly refers to Paley’s argument as made nonetheless “. . . with pas-

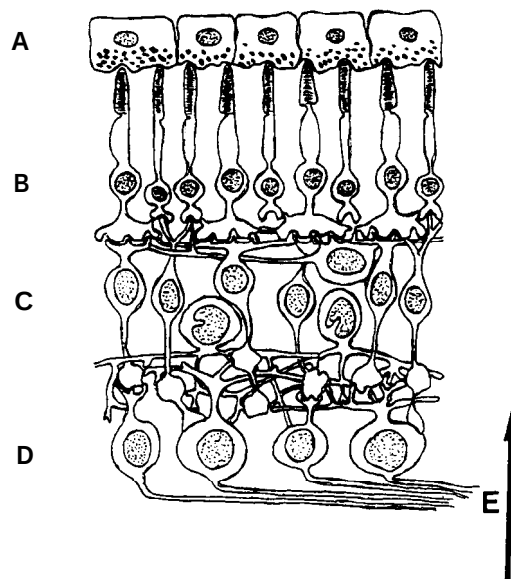


Figure 1. Microanatomy of the mammalian retina. A, pigment epithelium; B, photoreceptors (rods and cones); C, interneurons; D, ganglion cells; E, axons (to optic nerve). Arrow denotes direction of the incident light. After Alberts et al. (1989) and Bloom and Fawcett (1975).

sionate sincerity and . . . informed by the best biological scholarship of his day . . .” (p. 5), as he goes on to remark that “Natural selection . . . which we now know is the explanation for the existence and apparently purposeful form of all life, has no purpose in mind” (p. 5, emphasis added). But, of course, the eye works. Evolution makes the best of things after the fact. Per Harvard’s Stephen Jay Gould (1980, p. 13) “the proof of evolution lies in its imperfections that reveal history,” the view expounded in his “panda principle” (Gould, 1986). Paraphrasing Francois Jacob, he remarks (1980, p. 26) that nature is an “excellent tinkerer, not a divine artificer” and takes “. . . paths that a sensible God would never tread” (p. 20).

The Eyes Have It

Where the best biological scholarship of our day is concerned, we are fortunate indeed that Dawkins was not commissioned to design our eyes, since given the optical physics, photochemistry and neurobiology involved, their present construction is, in fact, the best way they could have been put together! While a rod cell is responsive to single photons (Baylor et al., 1979), visual receptors have a threshold of intensity below which light is an ineffective stimulus. But more is not always better. The human eye is only weakly sensitive (respective of discrimination) to *direct* bright light compared to indirect (therefore lower intensity) light, even when appropriately focused by the lens and apertured by the reflexive iris/pupil diaphragm (see principles of the Abbe condenser); thus the significance, from a design standpoint, of light at reduced intensity off the pigment epithelium impinging onto the “backward-facing” photosensitive elements of the rods and cones. The pigment granules receive the light after its transversal of the *translucent* neuronal layers (Hamilton, 1987) that overlie the rod and cone layer and photoreceptor layer, thus preventing its scattering from the

external ocular tunics and confusion thereby of the image. Moreover, the human eye works within the 700 down to 400 nanometer (nm) wavelength range, thus short ultraviolet (uv) can be filtered (by passage through the overlying neural components) without consequence [note, the penetrating power of uv light is markedly inferior to that of white light]. Many invertebrate eyes, however, operate as well in the 300 nm range, and their microanatomy is oriented accordingly (forward-facing receptors, etc.). Dawkins opines that the eye of cephalopod mollusks (octopi and squids), while otherwise resembling that of vertebrates, is constructed “right side” (vs. “inside” or “wrong side”) out [there are also some significant differences in the structure of the photoreceptive cells (Figure 2) and many other anatomical features (Duke-Elder, 1958)]. This is hardly perplexing, Where its verted orientation is concerned, the octopus retina needs all the light intensity it can get—consider the animal’s habitat! See also the “shadow-reflex” of these and other invertebrates (i.e., escape movements in reaction to changes in light intensity—vs. imagery—perceived as the harbinger of a predator). In these instances, then, the verted retina could be an arguable case for proper design, or as Dawkins would have it, the luck of the draw.

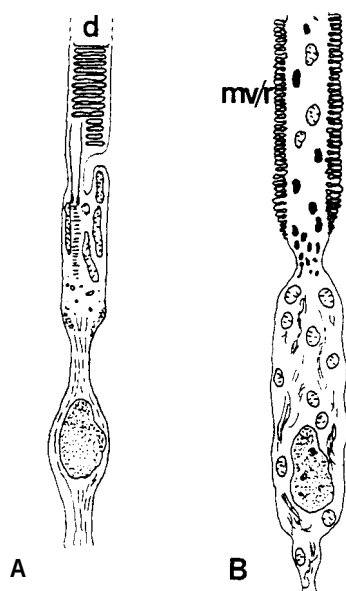


Figure 2. Photoreceptor cells. A rod cell, vertebrate retina. The photosensitive membranes are internal discs (d) packing the outer (apical) segment. B. Retinula cell, squid eye. The photosensitive elements are the microvilli (rhabdomere, mv/r). In both A and B, neural synapses are located at the opposite (basal) pole of the cells (not shown). After Eakin (1963) and Zonana (1961).

But is the inverted anatomy of the vertebrate retina supportive of Dawkins’ thesis of accidental imperfection during its evolutionary development? Is it indeed “wrong side out”? Or is it an instance of designed specialization derived from a general theme? First of all, there is no evidence that the neural elements overlying the photoreceptors in the human eye are significantly diffractive, occlusive, or perturbing otherwise of the image (Hamilton, 1987). In this respect, the

vertebrate retina is no less “sensibly designed” (Dawkins, 1986, p. 85), engineering aesthetics (p. 93) notwithstanding, than any other. Where the “illogic” of a nexus between the pigmented epithelium and the photoreceptor elements is concerned for the human eye (Figure 3), Dawkins might be surprised to learn that this also occurs in the mollusk eyes he diagnoses as being assembled correctly (i. e., having the receptors facing the primary source of the light vs. back on the pigment layer) and in the eye structure of many other invertebrates (Figure 4) (Wolkins, 1958; Zonana, 1961; Eakin, 1963). Upon illumination, the pigment granules migrate within amoeboid cytoplasmic processes entwined among the photoreceptors (rhabdomeres), thus effectively screening scattered light, and return to the rearwardly (or in some cases laterally) placed cell body in the dark.

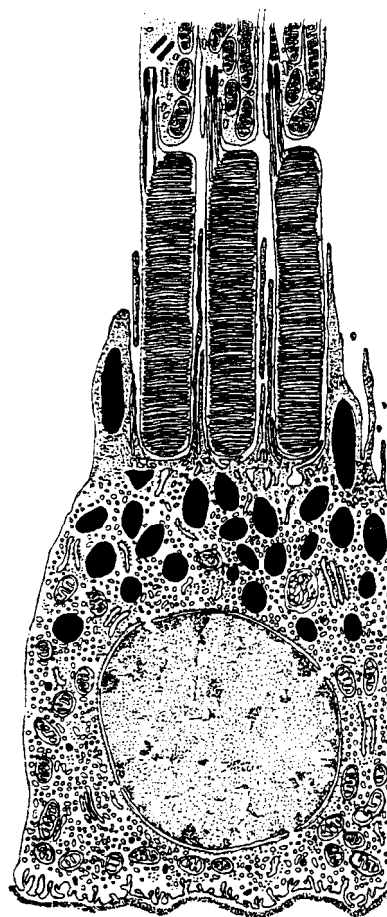


Figure 3. Mammalian retina illustrating the intercalation of the photoreceptor processes of three rod cells with a pigment epithelial cell. Appropriate to their physiological support of the photoreceptors, a high rate of metabolic activity by the pigment cells is indicated by the numerical density of mitochondria and wealth of other membranous ultrastructure; this metabolic activity is sustained by the basally approximated (subjacent) choriocapillary network (not shown). Drawn from electron micrographs; see, e.g., Kristie (1979).

The functions pertaining to the allegedly “imperfect design” behind this interaction in the human eye are detailed by Bloom and Fawcett (1975). Besides those mentioned above is the shielding of the photoreceptive membranes from cytotoxic metabolites, turnover of

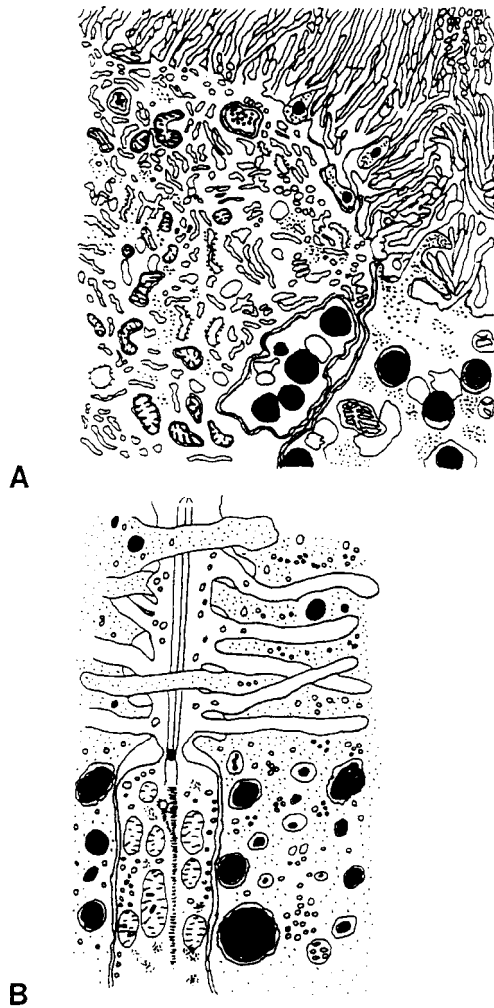


Figure 4. Invertebrate photoreceptor-pigment cell interaction. A. Longitudinal section through the distal tip of a photoreceptor cell (left) and adjacent pigment cell (right) in the molluscan retina; note pigment cell processes woven among the labyrinth of photoreceptor cell microvilli and apico-lateral surfaces of the photoreceptor cell body. B. Distal tip of a coelenterate photoreceptor cell, flanked by two pigment cells; note pigment cell interdigitating with photoreceptor microvilli. Drawn from electron micrographs; see Eakin (1963).

the outer rod segments (phagocytosis of shed discs), and the regeneration of rhodopsin. The latter most critical function occurs only if the photoreceptive processes maintain the intimate relationship with the pigment epithelium shown in Figure 3 [it is at this interface that clinically significant "retinal detachment," resulting in partial blindness, takes place]. If the rods and cones faced the incident light, the same relationship would have to obtain, but then the pigment layer would have to lie between the photoreceptive processes and the light; the photoreactive processes would thus be occluded by the opaque pigment epithelium! Meanwhile, were such a bizarre orientation to obtain, the pigment cells would lose in the process their necessarily intimate proximity to the physiologically supportive vascularization in the subjacent choroid [the importance of this feature is emphasized by the condition of diabetic blindness which results from impairment of this circulation].

I am reminded that in our lectures on the eye to freshman medical students, we begin with the sort of hyperbolic discourse Dawkins iterates to "bait" their interest, but then go on to show how, in fact, the inverted construction of the retina is not abstruse after all. It is altogether consistent with the physiology attendant this productively highly complex visual system *cf.* that of invertebrates. Dawkins should have stayed for the whole class!

That Oxford evolutionists could stand more training in cell biology (at least before writing on the subject) is further exemplified by Dawkins explanation for the maternal inheritance of human mitochondrial DNA—"Sperms are too small to contain mitochondria . . ." (p. 176). But there is no imperfection in design here either—these sperms do, in fact, contain mitochondria, and among the better developed mitochondria in existence are those that form the helicoidally arranged periaxonemal mitochondrial sheaths in human spermatozoa. The correct explanation is that the sperm tail, containing this mitochondrial structure (which supplies the chemical energy for its flagellar motility), is shed as the nucleated head enters the egg. Dawkins may be aware of that, but his discourse in this instance is fatuously misinformative. Along with Dawkins' obtuse account of the eye, is this another example of what Francisco Ayala, quoted in the publisher's book-cover review, exalts as ". . . the relevant zoological detail" on which "The . . . design of organisms and other apparent objections to Darwin's theory are met head on"? Or, as Isaac Asimov put it ". . . answering, at every point, the cavemen of creationism"? The devil remains in the details.

The fallacies in Dawkins' presentation generally have been reviewed elsewhere (Hamilton, 1987; Watson, 1988; Johnson, 1993), and addressed before the fact by Denton (1986) and Augros and Stanciu (1987), among others. Meanwhile, neither Paley nor Darwin could have had our appreciation of ultrastructure in the microworld; nor, apparently, does Dawkins. Besides the *faux pas* cite above, he avoids mention altogether of the example to be reviewed below [though its elucidation (Abrams et al., 1965; Cohen-Bazire and London, 1967; de Pamphilis and Adler, 1971 a, b) and subsequent additional descriptions had been in print—even in student textbooks—for some time prior to the publication of Dawkins' 1986 treatise].

Bacterial Motility

From the presumption of biological diversity by descent with modification, prokaryotic organisms—exemplified in the present by bacteria—are considered evolutionarily primitive to eukaryotes. Thus, structure in bacteria would be expected to be relatively simple, antecedent to the complexity manifested in the protists, fungi, and the cells of plants and animals. Superficially, that anticipation holds. The prokaryotic cell's plasma membrane, for example, serves all of the functions the nuclear envelope, endoplasmic reticulum, Golgi apparatus, mitochondria and chloroplasts assume in eukaryotic cells, with few permanent morphological specializations. When it comes to specializations for cell movement, however, biologists were in for a surprise.

Some prokaryotes move over solid surfaces by a yet unclarified mechanism of gliding (Stanier et al., 1980)

reminiscent of gregarine protozoans (Maxwell, 1977). Hildebrand and Vinckier (1975) indicated that ectoplasmic annular myonemes (Pitelka, 1963) and cytoplasmic streaming are involved in the gliding of gregarines; the electron microscopy studies of Stebbings et al. (1974) identified pellicular microtubules as key elements in the process. However, typical of prokaryotes generally, comparable cytoskeletal elements (actin microfilaments, tubulin microtubules) do not appear to be present in gliding bacteria (vs. gregarines, which are eukaryotes). Spirochete bacteria effect a sinuous swimming motion which seems to involve bundles of filamentous structures running in the periplasmic space, i.e., that between the cell membrane and the cell wall (Bharier et al., 1971; Bermudes, Fracek et al., 1987).

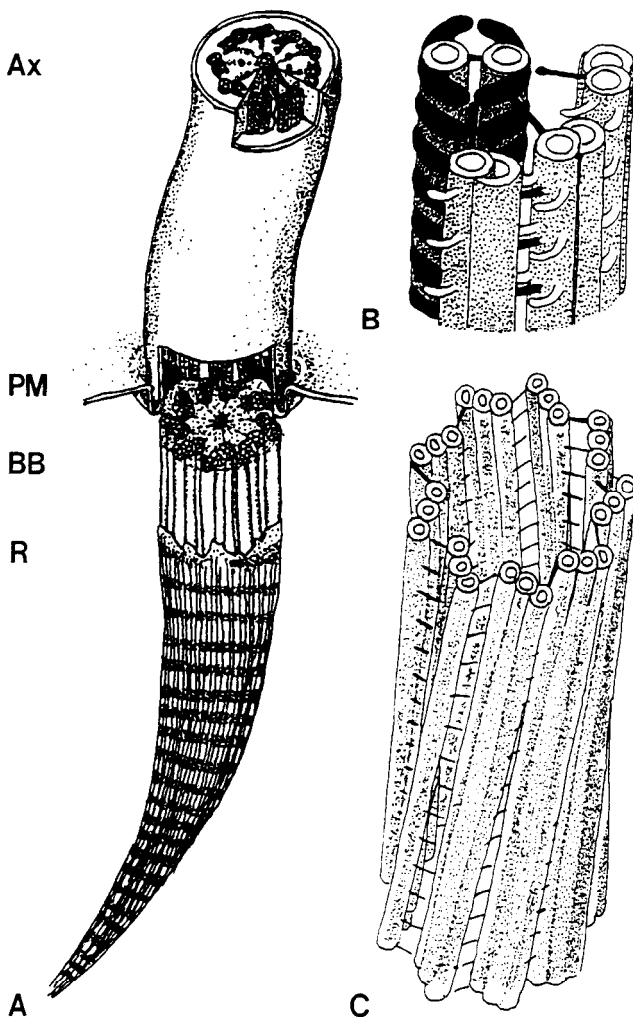


Figure 5. Eukaryotic cell flagellum. **A.** The motile axoneme (Ax) is composed of 9 peripheral doublet microtubules orbiting a central pair of singlet microtubules; these axonemal microtubules arise from the basal body (BB), composed primarily of 9 triplet microtubules; a structurally supportive fibrous rootlet (R) extends into the cytoplasm; PM, plasma membrane. Refigured from DuPraw (1968). **B.** Details of the axonemal microtubules; various proteins interconnect the doublet microtubules to one another and transiently cross link them to the pair of microtubules in the center. Energy is provided by the ATPase activity of *dynein*, a protein associated with the "ears" of the peripheral doublets. Refigured from Holtzman and Novikoff (1982). **C.** Interconnected triplet microtubules of the basal body. Refigured from Alberts et al. (1989).

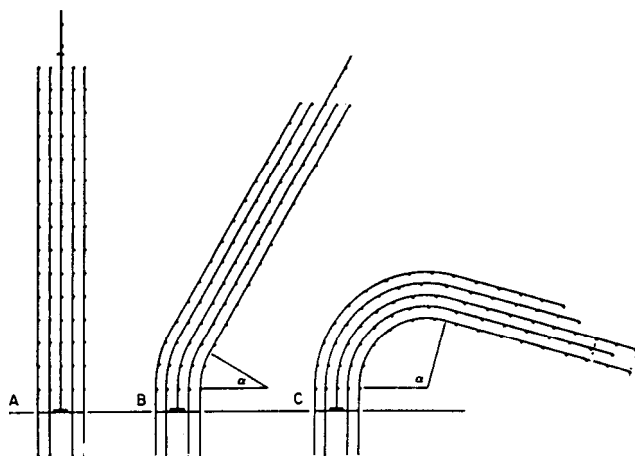


Figure 6. Movement of the axoneme is accomplished by the sliding of the microtubular doublets past each other, which results from the alternate making and breaking of cross-bridges between them and the central microtubules. The relative displacement of microtubules during an "action stroke" is shown sequentially; **A**, the process "at rest"; **B**, beginning flexure; **C**, at maximum flexure, poised for the "recovery stroke." Refigured from Satir (1967).

Though Bermudes, Fracek et al. (1987) present data suggestive of a tubulin-like component, these filaments do not seem to be homologous to the ubiquitous microtubules of eukaryotic cell ultrastructure (Bharier et al., 1971; Bharier and Rittenberg, 1971). Otherwise, many bacteria possess motile flagella, but these are quite unlike the microtubular flagella/cilia of eukaryotic cells.

The mechanics of eukaryotic flagella are predicated on the structure of multiple soda-straw-like assemblies of *tubulin* subunits (forming microtubules per se) and ancillary linkage proteins (Goodenough and Heuser, 1985), collectively constituting the axoneme (Figure 5). A slide-and-catch mechanism of microtubular movement is believed to be the basis for its motility (Figure 6). Individually, microtubules average about 25 nm (nanometers, 10^{-9} meters) in diameter. The axoneme is about 200 nm in diameter. Otherwise, the size of eukaryotic flagella/cilia is variable from one cell type to another [such processes, when relatively large and singular to few in number are conventionally termed flagella; when smaller and numerous, they are referred to as cilia; the lesser used collective term is *undulipodia* per Margulis and Bermudes (1985)]. The axoneme arises from a microtubule-constructed basal body which serves as a nucleation center for the polymerization of tubulin subunits in the formation of flagella/cilia, comparable for the most part in structure and function to centrioles and their role in forming the mitotic spindle and microtubular arrangements otherwise (Karsenti and Maro, 1986).

A bacterial flagellum measures 10-20 nm in diameter and up to 10 μ m (micrometers, 10^{-6} meters) in length. It is a single fiber formed of helically arranged subunits of protein (*flagellin*) molecules [altogether distinct biochemically and with no known relationship otherwise to eukaryotic tubulin], arising from a basal, granule-like structure anchored in the cell wall/cell membrane complex (Figure 7). Unlike the motile flagellum/cilium of eukaryotic cells (Figure 6), the bacterial flagellum

does not bend, but *rotates* (Figure 7) about its long axis (at rates of 5-10 or more turns per second); collectively, the flagella generate sufficient torque to move the bacterium at speeds up to tens of μm per second. That velocity is impressive, considering that the bacterium is only one to a few μm long [when pondering bacterial structure, we have to think small!]. When the flagella are all rotating counterclockwise, they form a coherent bundle that pushes the bacterium in a straight trajectory; when the rotation is reversed (to clockwise), the flagella fan out causing the bacterium to tumble, and thereby change direction (Berg, 1975; Adler, 1976) (Figure 8).

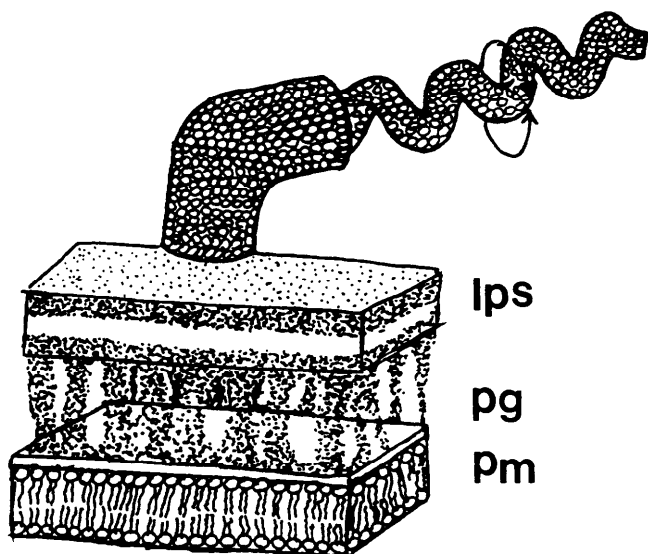


Figure 7. Bacterial flagellum arising from the cell wall/plasma membrane complex: the flagellum proper is a helical, relatively rigid structure that moves by rotation rather than bending, cf. the eukaryotic cell flagellum (Figure 6); circular arrow denotes plane of flagellar rotation; lps, lipopolysaccharide layer of cell wall; pg, peptidoglycan layer of cell wall; pm, plasma membrane.

So equipped, bacteria are not only remarkably quick and agile, they are responsive to a number of ecologically significant stimuli. The conformations of a variety of proteins located in the cell wall and/or membrane are affected, e.g., by chemicals in the environment, light, and magnetic fields; signals are thereby generated which are translated to changes in rotational direction of the flagella (Adler, 1976). Specifically, it is a cascade of protein phosphorylations and, for long-term conditioning, methylations (Terwilliger and Koshland, 1984), that couples receptor activation (by chemical ligands, radiation, etc.) to rotational direction of the flagellar motor (below). Nutrients (e.g., sugars, amino acids) elicit a positive chemotaxis, while noxious (bacteriotoxic) chemicals (e.g., phenol) are repellants (Koshland, 1981; Russo and Koshland, 1985). Similarly, photosynthetic bacteria swim toward light of a wavelength appropriate to the function of their photosynthetic pigments, but reverse field on encountering potentially lethal ultraviolet radiation (Mason, 1991). Some bacteria (e.g., *Aquaspirillum magnetotacticum*) contain iron particles (*magnetite*, Fe_3O_4) within a sheath associated with the plasma membrane (Blakemore and Frankel,

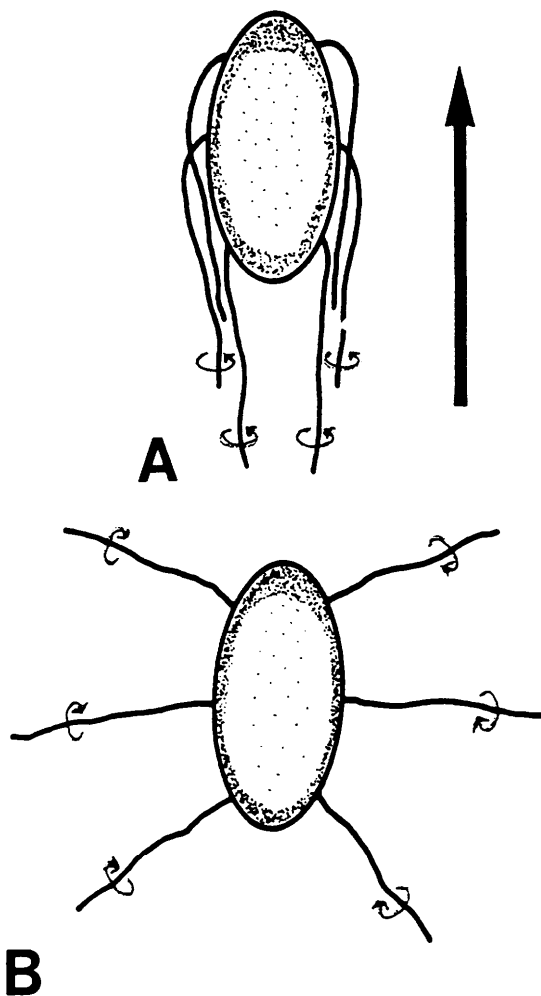


Figure 8. Bacterial swimming. A. When flagella are rotating counterclockwise, the bacterium is propelled in a straight line (in the direction of the arrow). B. Reversing the rotation to clockwise causes the flagella to splay out, resulting in a tumbling motion of the cell. After Berg (1975) and Becker (1986).

1981). Magnetic fields give an orientation to the particles which in turn directs the bacterium to move along the lines of force. This positive geotaxis guides the bacteria toward the optimum habitat—for this species in particular, which is microaerophilic, one with low oxygen tensions such as exist at the bottoms of bogs and marshes.

The Bacterial Flagellar Rotor

By far the most remarkable feature of the system is the rotor mechanism (Figure 9) that drives the flagellum. As biomechanics go, it is first of all the penultimate of miniaturization—equivalent in diameter to a single eukaryotic microtubule. As resolved by electron microscopy, it consists of a series of flanges, grooves, and wheels (yes, wheels!) mounted on an axle and turning on bearing surfaces with an efficiency that would be the pride of any industrial research and development operation. Indeed, such concerns as Stanley Electric's Hotani Molecular Dynamic Assembly Project (who could care less how the mechanism evolved or did not) are intensively researching its molecular structure and

properties. These include the ability to turn at speeds as high as 18,000 rpm, without lubricants (Koppel, 1991; Freedman, 1991) [A reduction principle in the "universal joint" translates this rate to the torque effective rotation, at slower speed, of the flagellum per se]. More than academic curiosity is driving Hotani's research; it is being funded at a level of about \$2 million per year by Japan's Exploratory Research for Advanced Technology (ERATO) program.

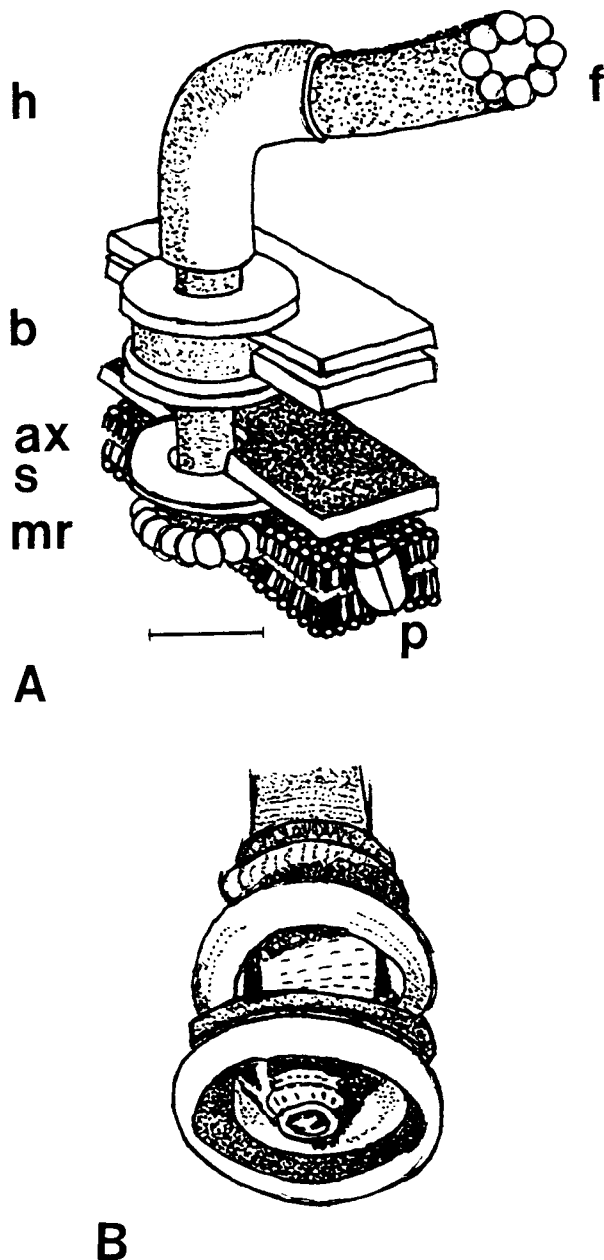


Figure 9. Motor-rotor complex of the bacterial flagellum. **A.** The basal-most element (motor ring, mr) is turned by electrical energy [from proton (H^+) flux across the plasma membrane] against a stationary ring (stator, s) embedded in the peptidoglycan layer of the cell wall, providing the torque transmitted to the axle (ax) and, in turn, the flagellar filament (f); p, proton transport site in the plasma membrane; b, bearing; h, connective hook ("universal joint"). Semi-schematic, after de Pamphilis and Adler (1971 a, b). Scale bar = 25 nm. **B.** Basal structure of the motor-rotor, drawn from a computer enhanced electron micrograph (Freedman, 1991).

The bacterial rotor mechanism is powered by electrical energy. Its basal-most wheel, inserted into the plasma membrane, operates just like the rotor of an induction motor in conjunction with a stator. The electrical current is derived from the flow of ions and attendant gradients across the membrane, most significant of which is the proton (H^+) gradient. This establishes what is referred to in cell physiology as the proton motive force (pmf, $\Delta\bar{\mu}_{H^+}$). The electrical work potential so generated is expressed as follows (Mitchell, 1961):

$$\Delta\bar{\mu}_{H^+} = \Delta\Psi - 2.3RT/zF\Delta pH,$$

where $\Delta\bar{\mu}_{H^+}$ is the pmf in millivolts (mv), $\Delta\Psi$ is the overall membrane electrical potential (in mv), R is the gas constant, T the temperature (Kelvin), z is the ion valence, F is Faraday's constant (coulomb/mol) and ΔpH is the differential chemical concentration of protons across the membrane (expressed as $\log 1/[H^+]$).

This parameter (pmf) has heretofore been implicated in the chemical work functions of oxidative phosphorylation and photosynthesis (Hinkle and McCarthy, 1978). Here, in the case of the bacterial flagellar apparatus electromotive potential is transduced directly to mechanical work, analogously to what intelligent R & D has produced in the electrical induction turbine—but one operating in the bacterium at an efficiency unheard of at General Electric.

The details of how the structural components interface with the electrical aspects of the system, accomplishing thereby the rotational force and direction of spin, are as yet unresolved. One idea is that the ions associate with the proteins at their insertion in the plasma membrane. Movement would be generated by repulsions/attractions between the electrical charges on the rotor ring and surrounding components. Alternatively (or coordinately) the ionic gradients might set off conformational changes in the proteins that propel the flagellum.

Like any design destined for wholesale manufacture, the structure of this molecular machine has a blueprint—in the genetic apparatus—which the bacterial cell follows in its construction. Indeed, molecular biologists are identifying the specific genes involved, isolating the protein products [there appear to be at least 10 in the motor structure per se, additional proteins comprising the proton channels, etc.], all in the effort to learn the details of their operation and attempt to replicate the system in various formats for technological applications (Freedman, 1991; Koppel, 1991; Stix, 1991). Overall, ultramicromechanics are becoming serious business. In 1991, U.S. investment in this type of research totaled \$15 million, \$30 million in Japan, and \$75 million in Germany; funding of Japanese R & D in this area is expected to rise to \$180 million over 10 years (Stix, 1991).

Evolutionary Considerations

Finally, consider the scale on which this marvelous apparatus has been developed. Its dimensions are measured in nanometers (billionths of a meter!) A group of M.I.T scientists recently got star billing in the pages of *Scientific American* for their construction of an electronically powered microwheel (Stix, 1992a). A similar project is underway at Case Western Reserve

University (Stix, 1992b). But this albeit extraordinarily clever bit of engineering is of *micrometric* dimensions—impressively small, to be sure, but some tens of thousands of times more bulky than “nature’s own.” Now, if we are to credit the intelligence at M.I.T. and Case Western for their devices (Figure 10), is it logical to discredit the possibility of intelligent origin for the bacterial rotor-flagellar complex simply because it is “natural”? Where it comes to creating a micromachine forceful enough to move another object, Bell Laboratories’ Kaigham Gabriel observes (quoted by Stix, 1991, p. 168) that these man-made micromotors “. . . barely have enough power to get over their own frictional loads” [hence the limitations on their technical applications to date]. Getting real work from these machines is a target, not yet a reality. On the other hand, the bacterial nanomachine moves the organism up to 30 “body” lengths per second! Note, moreover, where this astonishing example of biological complexity, efficacy, and efficiency has been found—according to the evolutionary view, in cells putatively representative of the most primitive of life forms. In its operational principles, however, the bacterial rotor-flagellar apparatus is considerably more sophisticated than the flagella/cilia of “more highly evolved” eukaryotes the latter operate on linear mechano-leverage forces linked to conformational changes in proteins energized by ATP hydrolysis] which in their ratchet mechanics (Figure 6) are not much more sophisticated than a car jack. This of course is not to disparage the remarkable complexity of eukaryotic flagella/cilia in their own right, but to point out the the Creator has not respected phylogenetic hypotheses in terms of relative intricacy. One could argue at the outset, as do Bermudes et al. (1987), that where the ultrastructure of the flagellar process per se is concerned, the eukaryotic type is the more complex; however, when all structural and biophysical features are considered, I think the present view holds. Becker (1986) notes:

Requiring, as it does, the structural equivalents of a rotor, stator, and rotary bearings, such a mechanism [for the bacterial flagellum] was originally considered unlikely, and [is] certainly without precedent in the biological world (p. 685).

Would God use His wisdom to confound the “wise”? The bacterial rotor-flagellar complex does not make a case for teleonomy (below).

Not surprisingly, evolutionists have yet to hazard any specific speculations on how the bacterial flagellar rotor complex might have arisen by the postulated mechanisms of chance mutation and natural selection. What physiochemical principle would prescribe the information for its structure spontaneously? While Margulis has proposed a model for the evolution of eukaryotic “undulipodia”—according to the serial endosymbiotic theory (Margulis and Bermudes, 1985; Bermudes et al., 1987)—and Cavalier-Smith (1982) has one predicated otherwise on endogenous mechanisms—direct filiation within the eukaryotic cell itself—no structure primordial to bacterial flagella as they exist in the present has been identified or suggested, imperfect or otherwise. It could be argued that with putatively billions of years at their disposal, bacteria could have evolved complex rotary flagella from rankly

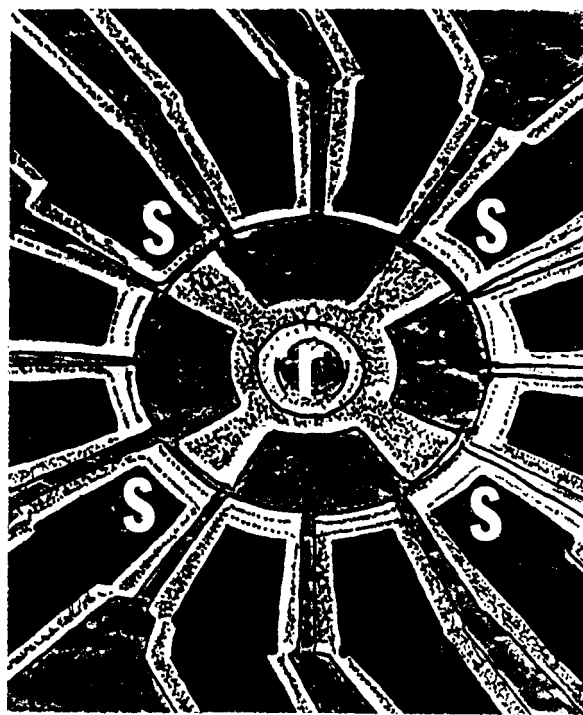


Figure 10. Man-made micromotor wheel. Voltage applied to four stator elements (s) aligns each of the four rotor blades with the respective stator poles; switching the voltage to the other poles causes the rotor (r) to spin. The rotor (including blades) is approximately 25 μm in diameter; the thickness is about 2 μm . From a photomicrograph (Stix, 1992b).

primitive ancestry, obliterating in the process of selection such imperfections the “panda principle” would predict. However, it is clear from the details of their operation that nothing about them works unless every one of their complexly fashioned and integrated components are in place. Gould’s “panda principle” has no application here, at least in the evidence. Nor does the systematic distribution, taxonomically, of flagellated *cf.* non-flagellated bacteria correlate with any of the postulated phylogenetic relationships for the prokaryotes. And, so far as it has been ascertained, the structure/function of this device is virtually the same wherever it is manifested [There are some minor differences between rotor structure represented in gram-positive *cf.* gram-negative species noted by de Pamphilis and Adler (1971); not surprisingly, this correlates with the differences in cell wall structure that distinguish gram-positive and gram-negative forms in the first place]. Thus, if evolution is the answer to its origin, the bacterial flagellum had to have come into being by chance not just once but several times, independently, albeit by the same sequence of mutations and phenotypic consequences no less than 10 megadalton sized and precisely integrated protein components, etc.). And quickly, if credence is to be given the re-estimations of the time frame in which prokaryotic origin and diversity, evident in Archean sediments (Schopf, 1993), occurred (Overbeck and Fogelman, 1989). Then imagine the effects of natural selection on those organisms that fortuitously evolved the flagella and rotor mechanisms, torque-ing along at 18,000 rpm, but without the concomitant control mechanisms! Mechanisms coordinated, in terms

of positive selection pressure, with sensory receptors in tune with a myriad of environmental considerations specific for each of the myriad kinds of organisms possessing these flagella . . . as Kurt Vonnegut would remark, "so it goes." For a process which would be proved by imperfections, a lot is expected of evolution otherwise.

Augros and Stanciu (1987) perceptively diagnose teleonomy, the thrust of Dawkins' (1987) thesis, as:

. . . linguistic subterfuge . . . invented to deny the evidence of purpose in natural things. Thus we are unable to see what nature is, and we imagine her to be many things she is not. This is the anti-thesis of good science (pp. 230-231).

[*Teleonomy* is a term which has been coined to denote the pseudo-purposeful functioning of biochemical systems; the *illusion* of design (Luria, 1973, p. 80)].

Meanwhile, researchers with better things to do than fantasize about evolutionary origins are learning, or attempting to learn, a great deal of practical science from the microworld, referring to the endeavor as *bionanotechnology*. Says Stanford chemist Steven Boxer, "Biomolecular systems have such fantastic properties in and of themselves . . . We've decided that since we can't beat them, we should join them" (quoted by Freedman, 1991, p. 1308). Becker (1986) writes (p. 684) ". . . we must credit nature with the *invention* of the wheel . . ." (emphasis added; see **Introduction**). Now, that is intellectually healthy humility. Pray that the next step would be a reverence for nature's Source.

Conclusion

As science would push back the frontiers of our ignorance, there remain archaic concepts (dating at least to 1859) of how things in the natural world have come to be that only a professorial Ph.D. could accept and blindly defend from the pulpit of pedagogy. So much for "blind watchmakers" and the theories they would contrive. See John 12:40 and 43, in reference to Romans 1:19-20.

Physicist-philosopher Paul Feyerabend asserts (Horgan, 1993, p. 36) that:

Scientists develop and adhere to theories for what are ultimately subjective and even irrational reasons" and that modern scientists can be ". . . every bit the equal of ancient myth-tellers, troubadours and court jesters (p. 37).

Feyerabend, by the way, has defended in principle the attempts to have the creationist version of origins taught alongside the theory of evolution in public schools [though as far as I know, he is not a creationist himself]. In a 1987 treatise *Farewell to Reason* he warns against "tyranny of the mind," finding that "The best education consists in immunizing people against systematic attempts at education" (Horgan, 1993, p. 36).

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PANORAMA NOTE

Reprinted CRSQ Volume 16

Introduction

The *Creation Research Society Quarterly* has been published since 1964 (30 complete volumes). In an effort to make these volumes available, all of the missing issues have been reprinted. Brief synopses have been written on volumes 1-15 and have appeared in the previous 15 Quarterlies. In each synopsis, major articles are reviewed to give a person interested in scientific creationism a general idea of the contents of that volume. Many of the articles are of continuing interest and value.

Archaeology

John Schmich (1979, pp. 17-21) discussed the dispersion of man throughout Asia Minor after the Flood. Items included were topography after the Flood, slow and fast migration, agriculture after the Flood and headwaters of many of the post-Flood rivers. David Tyler (1979, pp. 47-58) wrote a comprehensive article on megaliths and neolithic man. He claimed that the evolutionary concepts of cultural development are inaccurate. Actually evidences of an advanced culture have been found. He presented all topics including Stonehenge within a Biblical framework of history. The rivers of Eden were the subject of a brief article (Bedigian, 1979, pp. 169-170,153). The rivers mentioned were the Batin, Karun, Tigris and Euphrates.

Astronomy

An interesting treatise employing electromagnetic fields was written by Akridge (1979a, pp. 68-72, 83) in defense of a mature creation at the beginning. The author (p. 68) noted that "As part of this mature electromagnetic field, light from the distant stars was created enroute from the star to the earth." Using classical Newtonian mechanics and general relativity, Akridge (1979b, p. 176-181,192) stated that the big bang model cannot be used to determine the age of the universe. He derived a modified Hubble's law and employed it to discuss quasar distances. All postulates were examined within a recent creation framework. The final article in this volume by the same physicist (Akridge, 1980, pp. 207-208, 196) concerned Jupiter's Galilean moons from the findings of the Voyager I space flight. It was suggested that volcanism on Io and the craters seen on the moons indicated a recent creation.

Biology

Anatomy

Phylogenetic development of sweat and mammary glands (Kaufmann, 1979, pp. 75-77) were compared from an evolutionary and a creationist viewpoint. It was explained that sweat glands are unique to mammals and that "... there is an up-and-down variation of complexity of sweat glands among the orders of mammals ..." (p. 75). Mammary glands do not follow evolutionary phylogenetic predictions. The author

claimed that the observational data correlate with predictions from the creation model.

Botany

Biogeography from a creationist perspective was examined by George Howe (1979, pp. 38-43). Taxonomy, geography and plate tectonics in relation to angiosperms were reinterpreted within a creation model. The author attempted to account for "... the strange disjunctions and bizarre juxtapositions of diverse floral assemblages found today" (p. 43). Klotz (1980, pp. 202-203) asked if destruction of parts of a plant is death in a Biblical sense? Then he outlined reasons for his answer to the question.

Genetics

A provocative question was asked by Tinkle (1979b, pp. 151-153), "Does an embryo climb its tree?" He discussed the discredited recapitulation theory which occasionally still appears in textbooks. The author explained (p. 153):

Actually, the meaningful resemblances are found, not between embryos and their supposed ancestors, but between adult individuals of different species. Such resemblances are viewed by Creationists as only what is to be expected, seeing that the different species were made by the same Creator.

A more detailed article on this subject appeared in the Quarterly previously (Rusch, 1969, pp. 121-126). Anderson (1980, pp. 197-202) discussed the evolutionary model of cellular origins and suggested that the available data would better fit a creation model. Subjects included were *Prokaryotae*, *Eukaryotae*, RNA, *eubacteria*, *urkaryote* and *archbacteria*.

Natural Selection

Over the years many articles have been written from a creationist viewpoint on this subject. Following this tradition, an analysis of Darwin's natural selection ideas were noted. There is no analogy between natural and artificial selection upon which Darwin heavily relied. Hedtke (1979, pp. 89-97, 131, 148) discussed some of Darwin's other theories, Malthus's principle of population, analogy vs. observation, *Biston betularia* and wolf predation. This carefully reasoned paper deserves attention. Briefly Tinkle (1979a, pp. 100-101) examined what mutations and selection can accomplish. Jerry Bergman (1979, pp. 174-175) explored the limitations of the struggle for existence argument. Often predators do not hunt and kill weaker animals and most of the time they are at peace with other creatures. At best natural selection is a mechanism for preserving the status quo.

Miscellaneous

Harper (1979, pp. 136-139) claimed that Lyell did not accept many of Darwin's postulates. Lyell actually was more of a progressive creationist. The origin of insect flight only can be satisfactorily explained within a creationist model (Butt, 1980, p. 195). This volume of the Quarterly contained a suggested unit on biological origins for the secular classroom (Licata, 1979, pp. 60-

63). The author attempted to achieve an objective presentation of both the creation and evolution models.

Canopy Theory

Morton (1979, pp. 164-169) calculated that the environmental conditions that would have existed under a proposed pre-Flood vapor canopy for the earth were impossible for the existence of life. Dillow (1979, pp. 171-173, 175) stated that Scripture does not prohibit the concept of a vapor canopy around the earth. A canopy of ice particles about the earth before the Flood was suggested by Westberg (1979, pp. 182-184). Obviously some difference of opinion on canopies was expressed.

Geology

Considerable material on geology was featured in this volume. Lubenow (1979, pp. 3-7) wrote an interesting article on Surtsey, a volcanic island off the coast of Iceland that was "born" in 1963. It was noted that the development of a mature landscape in days or weeks occurred on the island! The author explained that the natural forces behind the rapid formation of the landscape, water action and volcanism, would have been active during the Flood. Thus ancient appearing landscapes could have formed quickly. Also the terms, ancient or mature landscapes, employed in geology may be useless.

Continental drift, sea-floor spreading and plate tectonics were discussed by Tippetts (1979, pp. 7-15). Rapid sedimentation and rapid burial of fossils were presented in this essay within the framework of a young earth model. A proposal for the comparison of evaporite formation models within a creationist framework was presented by Strate and Christensen (1979, pp. 65-67). The discovery of a charcoallified branch in Cretaceous rock was briefly examined by Beierle (1979, p. 87). Three world views, creationism, uniformitarianism and secular catastrophism were compared (Strickling, 1979, pp. 98-100).

A detailed treatise by Woodmorappe (1979, pp. 102-129) on radiometric chronology is abstracted as follows:

The use of radiometric dating in geology involves a very selective acceptance of data. Discrepant dates, attributed to open systems, may instead be evidence against the validity of radiometric dating (p. 102).

Three hundred serious discrepancies were tabulated. The Phanerozoic time scale was examined carefully. The use of radioactive dating of rocks as an absolute time scale was seriously questioned. Cox (1979b, pp. 154-162) attributed the formation of drumlins to diluvial currents rather than to a glacial origin. Evidence against the index-fossil system of dating and against correlation with other strata by using fossils was presented by Lammerts (1980, pp. 204-206). A "gold mine" of data against the postulates of uniformitarianism and evolutionism was compiled by Woodmorappe (1980, pp. 209-219). Topics included examples and types of mixing of fossils in the geologic time scale, the subjectivity of fossil species and genera, "ancient"

fossil reefs are not reefs, “ancient” sedimentary environments and evidence against the validity of the geological column.

Ice Ages

Douglas Cox (1979a, pp. 21-29) opposed an ice age immediately after the Flood and proposed that Flood currents caused the erosion often attributed to ice movement. Michael Oard (1979, pp. 29-37, 58) suggested a mechanism for a rapid post-Flood ice age. In the last 15 years Oard probably has written more on this subject than any other creationist. In this article he covers the following subjects:

- Requirements for a rapid ice age
- Cooling mechanisms
- Volcanic dust
- Snow cover
- Warming mechanism
- Post-Flood climate
- Abundant source of moisture
- Effects of a universally warm ocean
- Available moisture
- Present continental ice sheets
- Melting of the northern hemisphere ice sheets

Thermodynamics

In recent years there have been attempts to structure thermodynamic equations to allow for the “creation” of order in spite of the natural tendency for degeneration to occur. Generally some type of perturbation or fluctuation, often violent, is theoretically introduced and then “order results.” Williams (1979, pp. 132-136) pointed out the defects in such reasoning. The only way to have an ordered universe is to have a Creator that designed and established the initial order. Armstrong (1980, pp. 226-227, 206) used the process of crystallization and briefly discussed open and closed systems to illustrate that the evolutionist counter argument against creationist use of the second law of thermodynamics is not valid.

Ark and Flood

The processes that occurred in the Ark during the Flood were briefly examined by Bray (1979, pp. 16-17). The apocryphal traditions of Noah and the Flood were discussed by Von Wellnitz (1979, pp. 44-46). Burdick (1979, pp. 130-131) suggested that the stories of Atlantis may have originated from Flood traditions.

Panorama of Topics

Schirmmacher (1979, pp. 73-74) considered whether music was a result of natural processes or an ability given to man by a Creator. Several discrepancies between theistic evolution and the Biblical account were presented by Niessen (1980, pp. 220-221, 203, 232). Strickling (1980, pp. 222-223) offered some insights on the confusion of languages at the Tower of Babel. A defense of Bishop Samuel Wilberforce, known as “Soapy Sam,” was given by Wrangham (1980, pp. 224-225). This volume of the Quarterly contained an amazing variety of articles as well as many notes, letters and book reviews.

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THE EVOLUTION OF GEOLOGICAL ORIGINS THEORIES: PART I—THE HAYMOND INTERBEDS, MARATHON BASIN, TEXAS

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Abstract

In this paper we demonstrate that rock sections, settling tank experiments, fossil reevaluations, and paradigm changes have been the basis for producing several different and conflicting theories concerning the origin of interbedded sandstone and shale strata known as the Haymond flysch. We show that when new models arise, old geological explanations may still remain viable. Debate and uncertainty ultimately prevail and this is perhaps the way it ought to be since no one can observe ancient origins.

Introduction

The Nature of Theories for Rock Genesis

In historical geology it is not possible to observe the synthesis of ancient strata. Likewise it is impossible to perform experiments directly on how any given rock formation was deposited. Its origin was a unique occurrence and perhaps differed from comparable events that we might presently study.

In order to deduce the time and the means by which various rock layers formed, historical geologists measure the extent and the rates of contemporary phenomena such as sedimentation. Then they attempt to decide which processes, working when and at what rates were involved in the production of existing beds. Quite often historical explanations are based on field and laboratory analyses of fossil and rock samples. When new analytical techniques are devised, more sophisticated origins scenarios are deduced, often differing substantially from the earlier views.

From the standpoint of philosophy, historical geologists also rely heavily on ruling hypotheses called paradigms, which are exemplified by the geosyncline theory, the plate tectonics paradigm, and others. When new paradigms are envisioned, pre-existing origins models are revised or apparently discarded in favor of new ones having greater fit with new paradigms and new data analyses. After various scenarios have been devised, however, certain workers may notice weaknesses in the latest models and may return to one of the earlier views that seemingly had been abandoned. At any particular time, several explanations may retain a limited and lingering popularity with a segment of scholars.

Studying proposals for the synthesis of the Haymond formation can serve as an example of how explanations change in response to all of the foregoing factors. In the case of the Haymond, no particular origins model has emerged as permanently triumphant. Here we discuss the Haymond flysch and in a future publication we intend to explore the various theories for the genesis of the phenomenal Haymond boulder beds.

The Marathon Basin Described

In Brewster County, West Texas, near the city of Marathon, lies a famous series of geological strata about 5,000 meters (m) thick called the Marathon Basin.

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These many layers are exposed in a roughly rectangular basin (McBride, 1970, p. 67). The rocks of the basin are deformed, being strongly folded and trending NE to SW

All of the strata in the Marathon Basin are assigned to the Paleozoic era of theoretical geologic time. They are capped by an alluvium which has been judged to be from the supposed Quaternary period of the Cenozoic era. Paleozoic strata to the north of this opening are not visible because they are covered by layers attributed to the Permian period. Paleozoic rocks lying to the east, south, and west are obscured by overlying Cretaceous beds. P. B. King (1937, p. 1) noted that the Marathon Basin is thus a window or opening into the Paleozoic amidst areas where the Paleozoic is otherwise obscured from view:

... the region is a broad dome of Cretaceous rocks, from whose central part the Cretaceous cover has been stripped away, leaving an area of low country in the center, the Marathon Basin.

This basin is part of a much larger unit called the Ouachita Geosyncline which extends westward from Mississippi across central Arkansas, southeastern Oklahoma, and into Texas: The Marathon uplift is a topographic low situated on an uplifted part of the Ouachita Geosyncline. (McBride, 1970, p. 67)

Moving consecutively from bottom to top, one encounters the following rock members of the Marathon Basin: Dagger Flat, Marathon, Alsate, Fort Pea, Woods Hollow, Maravillas, Caballos, Tesnus, Dimple, Haymond, and Gaptank. The Tesnus, Dimple, and Haymond formations are designated as Mississippian while part of the Haymond and the overlying Gaptank have been relegated to the Pennsylvanian period (McBride, 1969, pp. 1-3). Although models for explaining the origin of the Tesnus and other Marathon Basin strata hold interest, we center here on only the Haymond formation, particularly the Haymond flysch.

The Haymond Interbeds Described

On various trips to the Marathon Basin between 1985 and 1992, the authors have examined an exposure of the Haymond formation particularly at a roadcut cliff adjacent to Highway 90, about 24 km east of Marathon, Texas. The cliff exposure reveals nearly vertical strata (Figures 1 and 2). We also examined other road cuts and outcrops. Excerpts from a nearby Texas Department of Highways sign are as follows:

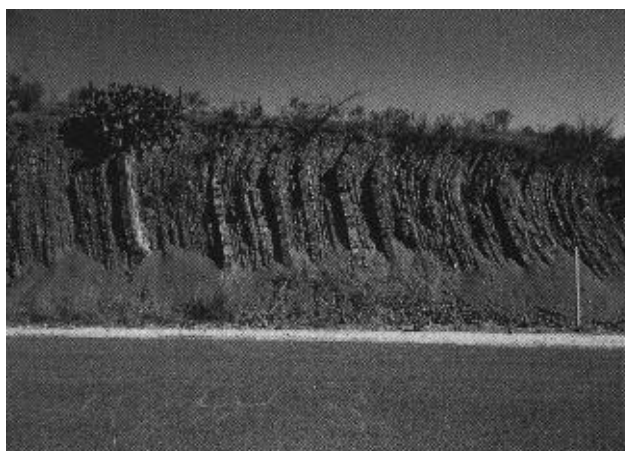


Figure 1. Haymond formation layers. In this view one is looking northward at a road cut along Highway 90, about 15 miles east of Marathon Texas. Note soil creep caused by gravity. Photograph by E. L. Williams.



Figure 2. Another view of the Haymond formation. Photograph by E. L. Williams.

In highway cuts toward the east are excellent exposures of almost vertical rock layers, part of the Ouachita Fold Belt—northeasterly trending, folded and faulted mountainous range which was uplifted about 275 to 290 million years ago. The deformation is comparable in age to the uplift that formed the Appalachian Range of the eastern United States.

In the hillside toward the northeast, the highly deformed strata are overlaid by almost horizontal layers of younger rock—formed about 135 million years ago. Erosion wore down the old mountains, and when the area was again covered by the sea, the horizontal layers were deposited on the sea floor. Later uplifting earth movement comparable in age to the forming of the Rocky Mountain Range gently elevated this area, exposing it to erosional forces which have shaped the topography seen today.

The lower and middle members of the Haymond consist of repeating interbeds of sandstone, siltstone, and shale (Flores, 1974, p. 709). It was estimated by McBride (1969, p. 15; 1966, p. 1) that there are more than 15,000 such separate sandstone beds in this alter-

nating Haymond series. In its entirety, the Haymond has a composite depth of about 1,300 m (Ross, 1981, p. 139). McBride described the interbed layers as involving "... fine and very fine-grained sandstone and dark gray shale less than one foot thick" (1966, p. 88).

A repeating series of sandstone and shale strata like these is called a **flysch** (Dietz 1970, p. 124) and the sequence visible in Figures 1 and 2 is known as the **Haymond flysch**. The Haymond flysch and other sections of the Haymond formation crop out along the southeast, east, and northeast areas inside the Marathon Basin.

McBride (1970, pp. 80-81) gave a brief review of the use of the word flysch for various Texas strata. He noted that Waterschoot van der Gracht (1931, Table 3) was the first to call some Marathon Basin beds flysch by applying the term to the Tesnus and lower Haymond. King (1931) also started to use the word flysch for Haymond beds and the Tesnus. In 1964 Thompson and McBride classified portions of the Dimple formation as flysch.

The Tesnus and Dimple Formations which lie stratigraphically below the Haymond are also largely flysch interbeds. Whatever can be said about the parade of changing explanations for the origin of the Haymond may possibly apply to the Tesnus and Dimple as well. In the upper Haymond are several amazing boulder beds also known as **wildflysch**. McBride (1966, p.59) was the first to call these boulder beds wildflysch. We shall consider data and viewpoints concerning the origin of the boulder beds in a subsequent report.

The Geosyncline Theory Reviewed as Background

The geosyncline paradigm was originated by Hall in 1859 and popularized by Dana in 1873. It involves the belief that great sinking basins fill gradually with sediment under conditions of shallow water (Kummel, 1961, p. 65). The sedimentation was believed to be followed inexorably by folding, faulting, and uplifting so that mountains arose in areas where sedimentary basin originally prevailed.

"In spite of the great thickness of rocks in geosynclines, there was the belief that *at no time was the water very deep*" (Foster, 1971, p. 355, emphasis ours). Geologic deposits attributed to geosynclines often show such phenomena as cross-bedding, ripple marks, mud cracks, and fossils of shallow water life forms. These characteristics were interpreted to mean that the strata in the geosyncline were deposited in shallow water. It was imagined that shallow water prevailed for eons and it was also postulated that a geosyncline subsided at the same rate that the sediments were deposited in its shallow water (Kummel, 1961, p. 65).

According to the paradigm, mountains arose later, after the thick wedges of sediment had accumulated. It was not clear in the model how the basin sediments became converted into mountain ridges, or what caused the uplift. Kummel (1961, p. 65) offered the following succinct definition by which a geosyncline is called a "surface that subsides as additional layers accumulate." We shall see how this ruling hypothesis influenced early attempts to explain the Haymond interbeds. Then we shall note how other historical geological theories about the Haymond flysch were devised from 1940 to the present.

The Haymond Formation, Shallow Water Origins Theories, And The Original Geosyncline Paradigm—The 1930s

The early opinions of P. B. King (1937, pp. 88, 91) concerning how the Haymond strata might have formed were undoubtedly influenced by the prevailing geosyncline theory and its shallow water corollary. King believed that: "the Pennsylvanian rocks of the Marathon were laid down in a geosyncline" (p. 87), as evidenced by their great thickness and other geological features. Concerning the Haymond strata King also asserted that the "water in which its sandstones and shales were laid down was brackish or *fresh*, rather than marine" (p. 89, emphasis ours). By a study of the enclosed plant remains, which he judged to be land plants and to be water-worn, King proposed that they had been "washed for considerable distances from their place of growth" (p. 87). He reasoned that the plant remains (and by extension, the entire Haymond deposit) "might therefore have been laid down in a *shallow sea*" (p. 87, emphasis ours).

Six years earlier, Van Waterschoot Van Der Gracht (1931, p. 1040) had briefly reported the views of Powers concerning the shallow origin of the Haymond as follows: "Powers believes that the entire deposit is a *deltaic* or beach formation" (emphasis ours). Two years prior to that, P. B. King and R. E. King (1929, p. 911) had already gone on record attributing the Haymond formation to a geosyncline. Shallow water basin or deltaic schemes of development for Haymond strata were popular at first and were based on the prevailing paradigm which also stressed deposition in freshwater. But even then there was a certain amount of unrest with this generalized idea and that dismay was registered by P. B. King (1932, p. 148):

The peculiar character of the mudstone matrix, and of the associated arkoses and regularly bedded sandstones and shales is suggestive of unusual conditions of sedimentation, and perhaps an unusual climate (Emphasis ours).

Enter an Understanding of Turbidity Currents, Graded Bedding, and Deep Water Marine Sedimentation—The 1940's and 1950's

In the late 1930s Kuenen had already begun to study submarine canyons in the ocean. He espoused a different view of sedimentation involving deep water and he initiated a series of classic laboratory experiments to test the mechanism. Likewise Migliorini independently found field evidence to support sedimentation in deep water. References to Migliorini's early papers and an excellent history of the development of this new paradigm is in Kuenen and Migliorini (1950).

"Current bedding" is known to occur when sediments are deposited in shallow water. It entails cross-bedding and ripple marks, as we previously noted. By way of contrast, "graded bedding" generally manifests few or none of these current marks but instead shows a gradual transition in grain size from coarse below to fine above in each one of the repeating members. Often such graded beds occur in a series which may be quite thick. Each member of the series may also have a vast lateral extent.

Graded bedding is characteristic of sedimentation in deep water and was shown by Kuenen to originate

experimentally when water currents containing particles of a wide size range were periodically injected into deep standing water. Similar bursts of sediment laden water can come in nature from dust storms, storm waves, volcanic explosions, spring runoff, and flood water entering sea water. Strata with repeating interbeds such as sandstone and shale are thought to have been formed by turbidity currents entering deep standing bodies of water and hence the rocks themselves are known as **turbidites**.

Kuenen and Menard (1952) published results of their outstanding experiments in which water charged with sediments was repeatedly released through a channel into water which stood within a settling tank. By this means they were able to produce deposits in the lab which closely resembled turbidities in nature. Kuenen and Migliorini (1950, p. 9) concluded that naturally occurring turbidities had been produced this way.

Bouma (1962) reported on turbidities found in certain beds in the Alps and devised a series of lithologic criteria for identifying and classifying these strata microscopically. Bouma's criteria have been accepted and widely used by geologists. Kuenen (1967) continued his experimental studies and concluded that only turbidity currents in deep water (not normal currents in shallow water) can account for flysch type sandstone beds.

Turbidity Currents Applied To The Origin of the Haymond Formation—The 1960s

McBride began using this information about graded bedding and turbidity currents to propose a new theory for the origin of the Haymond flysch of the Marathon Basin. Casting aside the earlier shallow water ideology, McBride saw Haymond beds as turbidities that must have been deposited in deep water (1969, pp. 16, 86-90). He noted (1966, p. 1) that in the 15,000 separate Haymond layers, "no fossils indicative of shallow water" could be found. Incidentally, McBride (1966, p. 8) also stated concerning the fossils of the entire Haymond series that (with only two exceptions) they were of no stratigraphic value. After careful lithologic study, the many sandstone members of the Haymond ranging in thickness from about 25 centimeters down to a few millimeters, were attributed to "deposition from waning currents of high initial velocity" (McBride, 1966, p. 1).

Dean and Anderson (1967) showed that these turbidity currents had evidently been quite widespread. Using the criterion of thickness, they successfully correlated siltstone and claystone couplets between two Haymond flysch outcrops that were separated from each other by 10.5 km.

Johnson (1962) had discovered grooves, flute casts, and bounce casts (all characteristic of true turbidites) on the lower surfaces of alternating couplets in the Tesnus formation and he therefore attributed the genesis of the Tesnus strata to turbidity currents as well.

McBride (1966, p. 1) theorized that the Haymond beds were produced in a **marine** basin "that was from **several hundred to several thousand** feet deep,"—emphasis ours. The Tesnus and Dimple formations lying beneath the Haymond were also labeled as deep water flysch deposits. In his brief but instructive history of this topic, Flores (1972, p. 3415) noted that McBride had based his conclusions on "internal struc-

ture, bedding surface structures, and grain size of sandstone beds.”

McBride (1966, p. 18) believed that Haymond rock sections manifested the expected graded bedding under the microscope. McBride confessed, however, that true graded bedding (in which grain size itself changes from large below to smaller above) was not as common in the Haymond flysch as was a peculiar form of bedding in which the quartz grain size remained relatively constant (from the bottom to the top of a given bed) but the clay content increased as one approached the top section of the sandstone bed.

Still, McBride clung to the mechanism of turbidity currents and rested his case as follows:

- (1) they are interbedded with shale that is best interpreted as a deep-water deposit, and (2) internal structures suggest that they were deposited by waning currents that initially had high velocity . . . the sandstones have sole marks, graded bedding, and convolute bedding that are typical features of alleged turbidites. (1969, p. 89)

This new origins view was a distinct departure from the shallow, freshwater, and deltaic explanations popular in the 1930s. The stimuli that fostered the change apparently were the data from the experimental settling tank and Bouma's field and microscope work on graded bedding. Consequently the geosyncline paradigm was coupled with deep water (rather than shallow water) sedimentation and a marine, rather than a freshwater, environment. By 1958 even R. B. King had modified his stance and had converted to a deep water Haymond origins scenario (1958, p. 1734). King expressed the predictive belief (1958, p. 1732) that the mechanism found for the Marathon Basin strata would ultimately fit with the studies of Kuenen and his students (meaning Bouma and others).

Further Information Concerning Turbidity Currents and Sedimentation

There is much evidence that turbidity currents occur in lakes and oceans whenever dense, turbulent, and sediment-containing water flows under the standing water which is less dense (Hamblin, 1975, p. 92; Shelton, 1966, p. 35). A cross section of Lake Mead in Figure 3 shows the effects of such currents. This is a cutaway view along the Colorado River in the western Grand Canyon and Lake Mead area. It shows deposition which occurred during the first 11 years after the lake was

formed. The arrow below indicates the mouth of the canyon at Grand Wash Cliffs; the western Grand Canyon is to the right of the arrow whereas Lake Mead is to the left. The ordinate represents the relative abundance of sediments. As it loses speed and energy, the turbidity current deposits and sorts the heaviest particles first, and the successively lighter ones later. After the current has dropped its heavier particles, (presumably, forming a sandstone layer called a *turbidite*) a layer of much lighter particles (silt and mud) is deposited, forming shale, as McBride thinks has happened in the Haymond interbeds. Such a shale layer above a sandstone member is called a *pelagite*. The whole process is repeated with the next pulse of sediment-laden water flowing into the standing water and producing the next bed of turbidite sandstone followed by more of the shale (another pelagite).

Turbidity currents have been studied in Lake Mead where they have been observed to travel distances of up to 125 km (Scheidegger, 1961, pp. 23-24). In the ocean, turbidity currents caused by earthquakes have traveled with speeds measured as great as 52 miles per hour and with enough force to break telegraph cables on the ocean floor 300 miles from the epicenter (Hamblin, 1975, p. 319; Roth, 1975). The calculated volume of sediment in just one such current generated by the earthquake off the Grand Banks of Newfoundland in 1929 was 100 km³, carpeting 20,000 square miles of sea floor with sediments up to one meter in depth (Sullivan, 1974, pp. 44-48).

Concerning this same earthquake, Hodgson (1964, pp. 23-24) noted that the resulting turbidity current had:

. . . tremendous erosional powers. The fact that an earthquake triggered this particular current is not to imply that they can be started only in this way. Any accident which starts material moving down the continental slope can cause a current, although perhaps only an earthquake can cause such a big one.

Strahler (1977, p. 148) observed that:

On continental shelves and deltas of large rivers, mud is continually accumulating and may form precariously situated deposits that are easily disturbed and sent sliding by storm waves or earthquake shocks.

Longwell and Flint (1964, p. 298) reported that turbidity currents occur frequently. Concerning the

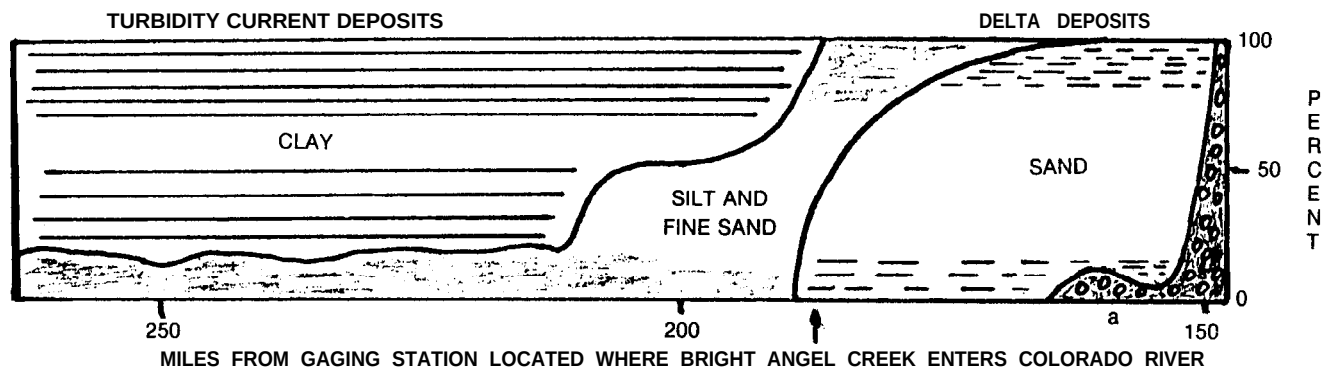


Figure 3. Idealized diagram of turbidity and delta deposits, Lake Mead. a = course sand and gravel. Figure by E. L. Williams after Shelton (1966, p. 35).

same 1929 current mentioned earlier, they indicated that: "similar events have occurred at least twice at each of 40 localities around the world within the past 74 years."

Were Turbidity Currents Associated with The Flood?

We believe that the Haymond deposits may have been produced by a series of turbidity currents generated in a relatively short time span by volcanic, meteoric, or tectonic processes. A rapid formation of Haymond interbeds is also suggested by the general conformity of these many layers to each other. This rapid and catastrophic role of turbidity currents in the origin of strata was stressed by Roth (1975) and more recently by Howard (1992).

One wonders what conditions might have prevailed to set the stage for turbidity currents which may have produced the Haymond formation. Moore (1989) speculated that during the Paleozoic Era an inland sea called the Ouachita trough covered this area of Texas and extended northeastward into Arkansas and Oklahoma. This deep-sea trough is thought to have received vast quantities of sediment from the north. Turbidity currents pouring into this large body of water might have deposited the sedimentary beds that eventually became the Haymond Formation. Catastrophists could argue that the Ouachita Trough developed near the end of the Flood. If so, it may have served as a site through which flood waters moved from the north to cause turbidity currents that deposited the sediments of the Haymond flysch.

Whitcomb and Morris (1960, p. 269) spoke of the possibility that turbidity currents operated during and after the Flood:

The newly-deposited sediments were still relatively soft and unconsolidated, and the imposition of new gradients and currents over them when the lands began to rise would have immediately induced scouring action on a large scale. The mixture of water and mud thus formed would, in flowing downslope, itself cause tremendous submarine erosion and ultimate redeposition. The great sedimentary competency of these turbidity currents . . . has only been appreciated in recent years but has been adequately demonstrated both by field data and laboratory studies.

They also speculated that rapid action of turbidity currents may have caused the banding or laminations evident in certain other deposits such as the Green River oil shales—(Whitcomb and Morris, 1960, pp. 427-428).

Surprise—A Return to A Shallow Water Haymond Scenario in The 1970s!

During the six years from 1969 to 1975 Flores turned the tables by reinterpreting most of the data to support what he called a "short-headed stream delta model" for the Haymond. After a brief preview (1969), in 1970 Flores published a larger work in which he asserted that:

Present studies . . . of this formation suggest that the Haymond need not have been of deep water origin but that a deltaic origin is equally likely. (1970, p. 621).

Flores argued (1970, p. 626) that the flysch could have formed at a delta front which continually ". . . received pulse-like influxes of sediments during periods of heavy rainfall in the source area." He believed that the turbidite interbeds were of slightly deeper (delta front) origin and he attributed the upper, coarse grained, Haymond sandstones to the delta plain (1975, p. 2288). He supported his reinterpretation by gathering monumental amounts of field data and performing numerous laboratory rock analyses (Flores, 1972, 1974).

He envisioned a shallow-water deposition in a delta, as Powers had done and argued that:

the origin of the turbidite portion of the sequence is not necessarily deep water, and the presence of carbonaceous shale, coal, and "seat rock" type sandstone favor a very shallow and perhaps sub-aerial environment. (Flores, 1970, p. 622)

Upon analysis of rock sections, he consistently noted such features as cross-bedding, an upward increase of quartz grain size, and other phenomena which he believed to be in direct conflict with the classical Bouma criteria for true deep-water turbidites (Flores, 1974, p. 709).

In his concluding and summary report of 1975, Flores compared modern day delta deposits to his delta-based Haymond scenario. Modern day deltas often consist of fine deposits below, made at the delta front. The deltas have coarser sediments above because delta plain sediments eventually bury the existing delta front strata. This pattern, Flores argued, also applies in general to Haymond strata. Flores observed, however, that Haymond rocks differ in some ways from ordinary delta deposits. He attributed all of the Haymond flysch sandstones to the delta front and the coarse sediment plus boulder beds of the upper Haymond to the delta plain sediments. Flores admitted that with flysch below and boulder beds above, this supposed Haymond delta would have been different than typical modern deltas such as those of the Fraser, Niger, or Orinoco Rivers. These differences, Flores concluded, arose because the source area for the theoretical Haymond delta was "much closer to the site of deposition than in modern deltas" (1975, p. 2297). The extreme proximity of source area to delta deposition site, he believed, explains the unusual resemblance of the lower Haymond strata to deep water turbidites (which he labeled merely "flysch-like"). He supported these conclusions by field analyses of the delta produced by a short-headed stream which empties into Lake Erie in western New York (Flores, 1970).

While some other workers had imagined that the source area for Haymond sedimentary material was from the north, Flores argued that it came from an adjacent river to the southeast. The issue of sediment source and dating of rocks in the boulder beds will be discussed in Part II.

Life after The Delta Debut

During this flurry of revisionist thought concerning the Haymond genesis, McBride (1970, 1973) appears to have continued stressing the Haymond features which he believed to support the deep water turbidity view. Where Flores appealed to a present day delta in

a New York river, McBride described the Var, a river in France which enters the Atlantic and has a deep submarine channel through which continental debris can flow into deep ocean water to create turbidity currents (McBride, 1970).

McBride (1970, p. 80) did briefly mention Flores' 1969 presentations and described Flores' proposed deltaic environment with water that was shallow enough to permit plant growth. Although Flores' work is discussed on p. 80, a reference to Flores' 1969 abstract was missing in the reference list, p. 82. This was apparently an inadvertent publishing omission.

The turbidity current concept was also still very much alive in the thinking of Ross (1981) who treated the Haymond formation as a turbidity deposit. Curiously, Ross made no mention of any of the papers by Flores regarding the deltaic view; one wonders if Ross ignored them or if he was completely unaware of Flores' work. In 1975 King again discussed the origin of the Haymond from a deep water standpoint but he likewise avoided reference to any of Flores' papers.

In a brief abstract appearing more recently (1982, p. 559) McBride asserted once again that the entire series of Marathon Basin strata (except the Gaptank) "is best interpreted as slope and basinal deposits." Thus despite Flores' persuasive rationale for a delta front and delta plain mechanism, McBride, Ross, and King appear to have remained firmly convinced that the Haymond interbeds were of deep water turbidity current origin, paying little or no attention to Flores, except to mention his abstract (1969) once—McBride (1970, p. 80).

In 1992, Howe wrote to Flores asking what was presently happening in the Haymond debate. In a cordial reply, Flores (1992) indicated that since 1975 his own research emphasis had changed and that he had temporarily ceased from further investigations of the Haymond. Flores supposed that the Haymond origins debate still continued. He indicated having heard from former coworkers that his original delta view for the Haymond had been turned into a similar alluvial fan delta concept.

Future studies might center on apparent conflicts lingering in the evaluation of scientific data. Does microscopic analysis generally reveal the Bouma signs for turbidites (as McBride believed) or does it show a strange type of bedding best explained by the delta deposition of Flores? Do the plant fossils betray a shallow water environment (as Flores maintained and as was claimed in the 1930s) or are these fossils of little stratigraphic significance or even nondescript as McBride implied? An open field of continuing scientific and theoretical study beckons those who possess the skills, energy, and insight required.

Summary and Conclusions

Early concepts of Haymond interbed formation were based on shallow water and freshwater deposition, in close keeping with the original geosyncline paradigm. Deep water turbidity currents were then discovered and their profound effects were noted in the 1940s and 1950s. Shallow water ideas gave way in the 1960s to the concept that Haymond strata were actually a series of deep water turbidites. Such conclusions were based on rock analyses and application of the diagnostic criteria that had been advanced by Bouma or the identification of turbidites.

Extensive scientific analysis of the same beds, however, led Flores in the 1970s to the opposite conclusion that Haymond strata do not actually satisfy established deep water turbidite criteria. He maintained that they were probably produced in shallow water by the delta of a short-headed stream. The origin of the Haymond interbeds still remains an open question.

Catastrophists are fascinated by the rapid sedimentation rates made possible by turbidity currents. Yet we realize that if a deltaic model for the Haymond ultimately gains greater scientific credence, rapid delta formation could have occurred during the intense draining of inland seas toward the end of the Flood. Even at present it is recognized that delta formation on major rivers can occur with astounding speed. Consult Seeman (1942, p. 196), Miller (1948, p. 218), and Thronbury (1969, p. 169) who recognized rapidity in delta formation but still imagined that in many cases the process took millions of years. Some young earth catastrophists have also written about the speed of delta deposition (Allen, 1972; Mehler, 1988).

Hopefully in the future geologists will devise new scientifically-based technologies to help distinguish which of the Haymond models is most credible—shallow water geosynclines, deep water turbidity currents, short-headed stream deltas, or possibly other models that have been or will be offered. Such an array of viable origins theories illustrates the tentative and speculative character of historical geology in general. An admonition to creation scientists might go as follows: "If a certain geological model seems not to fit with catastrophist biblical concepts, wait a few years; the theory will most likely change."

While the ephemeral nature of geological origins schemes is familiar to specialists in that field, the reading public needs to be reminded periodically that any new theory (or any old one, for that matter) which purports to account for rock genesis is always subject to revision or abandonment. Furthermore, non-geologists should know that if geological theories (which are based on direct scientific observations and experiments) are at best uncertain, then the geologic "dates" applied to the strata are even more speculative.

People will probably never deduce the Creator's past geological activity with finality and assurance. In all of the sciences, but especially in historical geology, workers ought to heed the words of Isaiah 55:8

For my thoughts are not your thoughts, neither are your ways my ways, saith the Lord. For as the heaven is higher than the earth, so are my ways higher than your ways, and my thoughts than your thoughts.

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Whitelaw’s Reply, by Robert L. Whitelaw, 123

PANORAMA NOTE

Carlsbad "Signs Off"

Caves and cave deposits (speleothems) such as stalactites have long been of interest to creationists because of the implied long ages for such structures at popular tourist sites. In particular, it has been tempting for some to estimate the ages of stalactites by assuming constant rates of accretion over vast periods of time. However, such attempts at dating are known, even by uniformitarians, to be invalid because of the frequently documented cases of nonuniform conditions (Lange, 1975; Nicholas, 1993). Nonetheless, the myth persists. The length of time for formation of the caves themselves is equally elusive. For example, a catastrophic storm can produce more work within a cave than can centuries of uniformitarian erosion (Doehring and Vierbuchen, 1971). These and related matters have been discussed in earlier volumes of *CRSQ* (Williams, 1987; 1992). Reference to other creationist works can be found in these citations.

A remarkable illustration of the folly associated with such age determinations is evinced in an article recently published in *Arizona Highways* (Taylor, 1993). Jerry Trout, a geologist and an employee of the U.S. Forest Service who has spent a significant portion of his life studying cave formations, is quoted as follows:

From 1924 to 1988, there was a visitor's sign above the entrance to Carlsbad Caverns that said Carlsbad was at least 260 million years old. In 1988, the sign was changed to read 7 to 10 million years old. Then, for a little while, the sign read that it was 2 million years old. Now the sign is gone.

Mr. Trout confirmed in a telephone conversation that he was accurately quoted. He also indicated to me that the maximum rate of stalactite growth he has observed is seven inches in 10 days, and that growth rates of several inches a month are common. Conditions must of course be just right for the rapid growth of stalactites (e.g., a plentiful supply of groundwater; see Williams, House, and Herdtklotz, 1981), but the point is that long periods of time are not required. It is likely that such conditions were common during the post-Flood period.

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BOOK REVIEW

Remember Thy Creator by G. Richard Culp. 1990. Historic Christian Publications East, P.O. 1187, Middlebury, IN 46565. 207 pages. \$8.00.

Reviewed by Don DeYoung*

Richard Culp practices osteopathic medicine in an Amish-Mennonite region of Northern Indiana. He holds several graduate degrees; the book relates many of his graduate school experiences. Dr. Culp became first a creationist and then a Christian during university studies. The book was initially written in 1975, and this is a 1990 revision. Parts are somewhat dated—the most recent reference is 1981. Still, much of the material is uniquely written and of continuing value.

The book is a good survey of the entire creation-evolution issue. For example, there is helpful discussion of ape-men, vestigial organs, and pleochroic halos. Dr. Culp's medical background shows in several areas: five excellent pages are dedicated to design in the human eye (pp. 34-38). It is explained that sore backs do not result from our rising up from an ancient four-footed ancestry. "Actually, the lower animals are sub-

ject to the same ills" (p. 62). Regarding vestigial organs, the functions of the tonsils, appendix, and the thymus are discussed (pp. 63-66).

Dr. Culp has a special interest in botany, and also the geographical distribution of plants and animals (Culp, 1988). (The Culp residence itself has become a place of research, with several highly unusual plantings.) The book gives the 224 year-old testimony of American botanist John Bartram. The words were chiseled in a Philadelphia windowsill by Bartram himself (p. 165):

It is God alone almyty Lord
The holy one by me adored.

There is another strong testimony in the book, that of Richard Culp. He presents creation data and also the gospel in a most refreshing manner.

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- Culp, G. Richard. 1988. The geographical distribution of animals and plants. *Creation Research Society Quarterly* 25:24-27.
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ANATOMICAL EVIDENCE FOR CREATION: DESIGN IN THE HUMAN BODY

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Abstract

The human body is designed for precise, efficient functioning. In our human realm, creative inventors and engineers design and develop simple and complex machines that perform work more efficiently. A review of examples of pulley systems, wheels and axles, friction-reducing sacs within joints and compression/tension abilities of bones in the human body is presented. The functional superiority of the human brain over lower animals is cited. Since designs infer a designer, an unbiased observer would have great difficulty denying the rationality of inferring that these highly designed mechanisms in the human body had to be designed by an outside, suprahuman intelligent agent (Logos), the Creator.

Introduction

In the real world a design logically infers a designer. The human body abounds with such intricate designs. The pulley is one of man's most work-saving machines; 13 examples of pulleys in the human body which are grouped into five classes will be discussed. The functioning of the shoulder girdle, ribs and vertebral column and pelvic girdle as a wheel and axle system is also presented. The purposeful function of friction reduction by bursae in the human joints is reviewed, along with an explanation of how bones are designed to resist tension and compression. Finally, the creative superiority of the human brain over animal brains is discussed. To the reasonable person, it is logical to conclude that these complex, efficient, purposeful mechanisms in the human body did not evolve by consecutive random accidents of unthinking molecules reacting together but are the result of the planned thinking and workmanship of a Divine Designer.

When one of my anatomy students who has just comprehended one of the intricate designs in the human body asks me "How did this happen to evolve?" My usual reply is "All intricate designs in the human body cannot be explained by gradual mutations over vast periods of time. God must have gotten into the act." Since in the real world, the existence of a watch demands the mind and effort of a watchmaker, likewise the existence of an intricate design in the human body demands the existence of the mind and effort of a brilliant Designer. Complex designs do not originate by random raw material accidentally meeting a random energy system over an everlasting period of time. To put it in collegiate slang, "How can nobody make everything?" There must be a Grand Designer behind every grand design.

I compare this argument to the field of automotive production. Some autos are better than others because of better design and quality workmanship. There has to be a "thinking force" behind every designed part. Automobiles are not made by unthinking randomness. Holroyd (1975, p. 95) has stated it succinctly, "When changes are made in good designs by accidents, it is practically certain that the designs will be damaged or destroyed."

At one time as an immature student of science, I had great admiration for man-controlled secular science. But after more than 25 years of scientific experience, I

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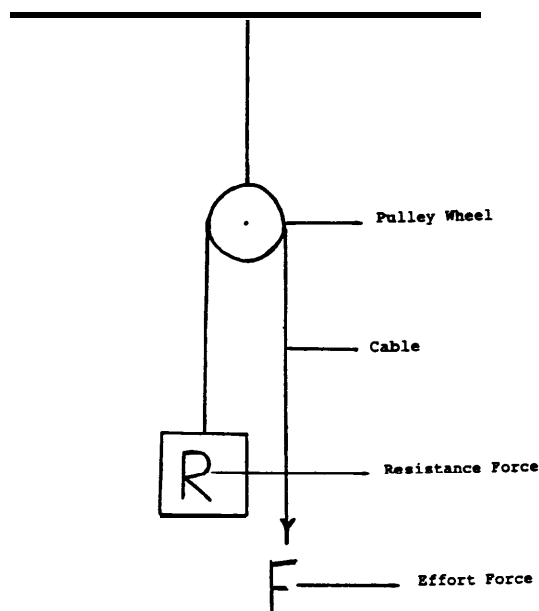


Figure 1. Simple pulley.

realize how weak and limited man-devised science is. It is very easy to distinguish between man-made and God-made designs. The more you magnify man-made designs, the cruder they appear; but the more you magnify God-made designs the more complex and precise they appear. One of the giants of science has said it clearly:

It is not to be conceived that mere mechanical causes could give birth to so many regular motions . . . this most beautiful system of the sun, planets and comets, could only proceed from the council and dominion of an intelligent and powerful being (Newton, 1952, p. 369).

Pulleys in the Human Body

Earlier (1974, pp. 91-94) I cited some examples of mechanical designs in the human body. In this article I would like to cite some further examples of well-designed pulley systems in the human body that obviously infer the planned thinking and workmanship of a Divine Designer. A pulley can be defined as a wheel, sometimes turning in a block, with a grooved rim in which a rope or chain runs that can raise or lower a weight attached at one end by pulling on the other end. It is

one of the simple machines of mechanics, a subdiscipline of physics. Other simple machines are the lever, the inclined plane, the wheel and axle, the gear, the wedge, and the screw. From these simple machines most more complex machines can be devised and built. In general, these simple machines either give a resistance force a higher velocity at the expense of an effort force or gain magnitude of effort force at the sacrifice of magnitude of velocity.

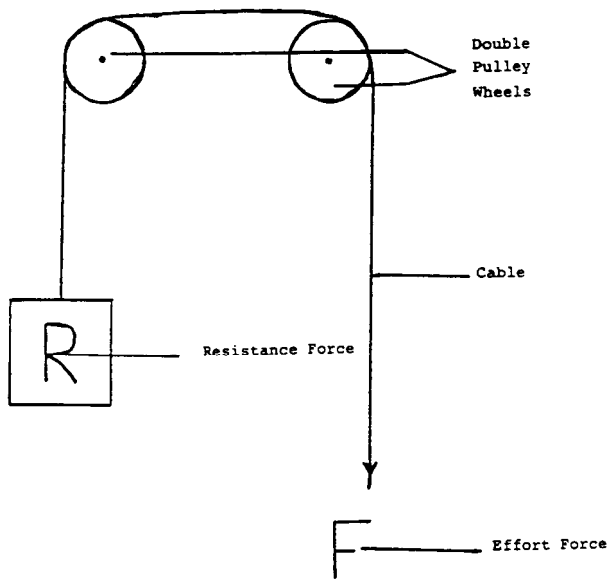


Figure 2. Double pulley.

There are two basic types of pulley systems. First is the "block and tackle" system which has both fixed and moveable pulleys. In this system, greater magnitude of force is gained at the expense of applying a lesser magnitude of force over a greater distance. Second, pulleys are used to change the direction of an applied force. Figures 1 and 2 depict two basic types of pulleys devised by "intelligent" man. There are a number of bone-joint structures in the human body which simulate the pulley action of changing the direction of an applied force. In most cases a rounded bony part acts as the pulley wheel, the tendon acts as the cord, the muscular contraction supplies the effort force and the weight of the bone (limb) located at its center of gravity acts as the resistance force.

An anatomical pulley has two mechanical purposes. Some pulleys will completely change the action of a joint. Other pulleys will alter the angle of muscular insertion giving the muscle a mechanical advantage. Figures 3 and 4 demonstrate the difference between a muscle with a small angle of insertion and a muscle with a large angle of insertion.

Classification of Pulleys

Coleman (1978, pp. 63-73) has grouped pulleys into five classes. These classifications with examples in the human body are clear signs of simple mechanical devices that had to be designed by a Divine Designer.

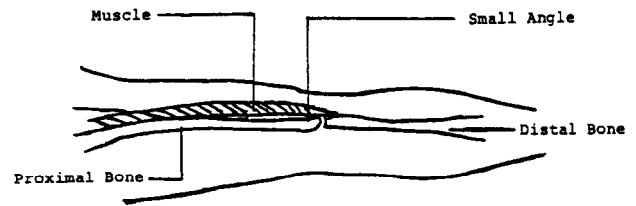


Figure 3. Muscle with small angle of insertion.

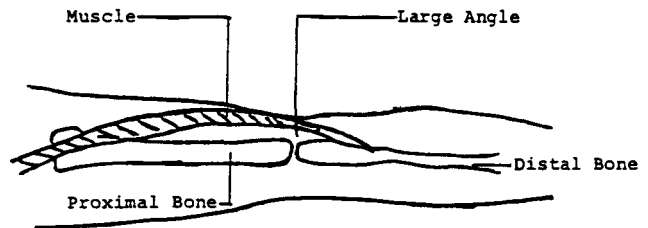


Figure 4. Muscle with large angle of insertion.

Class I Pulleys

In this class an improved joint action results from the muscle tendon passing over an external structure which serves as the pulley wheel.

Example 1: The knee joint is the most obvious example (Figure 5). In reality, the patella is not necessary for the quadriceps muscle group to extend the tibia bone. But the patella is necessary to change the angle of insertion of the patellar ligament (which is an extension of the quadriceps tendon) into the tuberosity on the tibia. This hemispheric bone increases the angle of insertion of the patellar ligament which increases the trigonometric sine relationship which increases the magnitude of the applied force on the tibia.

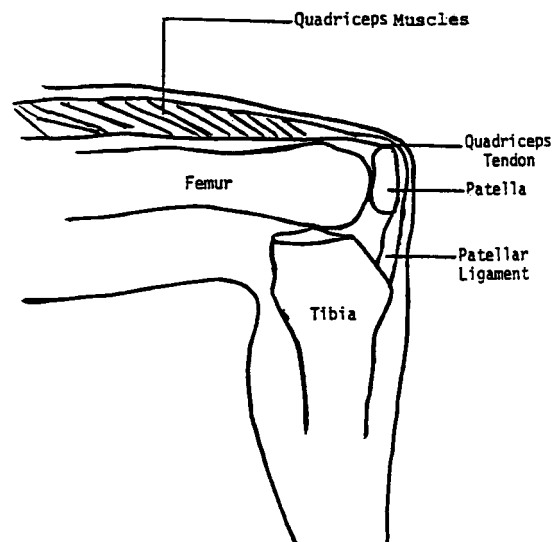


Figure 5. Patella acting as pulley at knee joint.

Example 2: At the hip joint the psoas major muscle passes over the brim of the lesser pelvis (Figure 6). As a person lies on his back, both the origin on the lumbar vertebrae and the insertion on the lesser trochanter of the femur are posterior to the brim of the lesser pelvis.

The elevated brim of the lesser pelvis increases both the angle of origin and angle of insertion of the psoas major. If the trunk is flexed on the femur or femur flexed on the trunk, both movements have a greater magnitude of applied force because of this increase in angular pull. This pulley device at the hip joint causes two major kinesiological results. First, if the brim of the lesser pelvis did not improve the angle of pull of the psoas major, this muscle could not be a major hip flexor. Second, the psoas major would not be the main muscular culprit in promoting the prevalent postural disorder lordosis (hollow back).

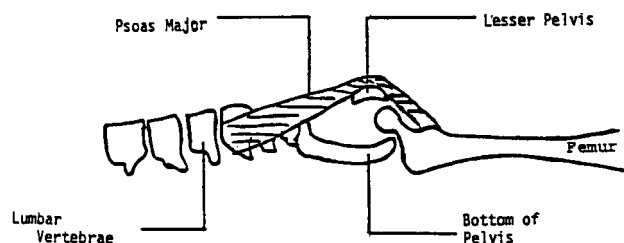


Figure 6. Brim of lesser pelvis acting as pulley for psoas major muscle at hip joint.

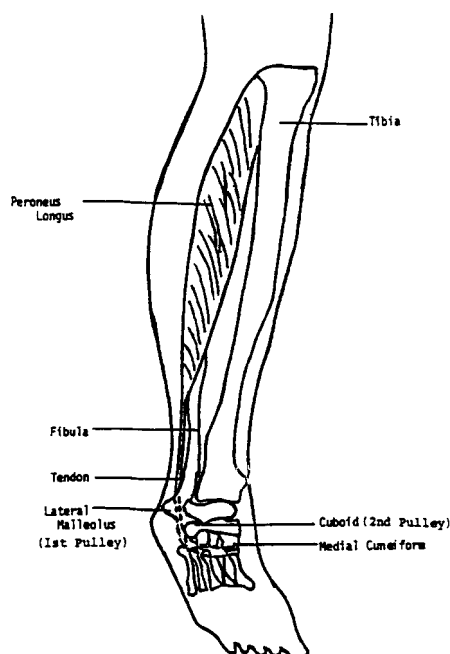


Figure 7. Lateral malleolus and cuboid acting as double pulleys for peroneus longus muscle about ankle joint.

Class II Pulleys

In this class the action of the muscle at the joint is altered because of the pulley.

Example 1: Figure 7 depicts the tendon of the peroneus longus muscle proceeding down the lateral calf behind the first pulley, the lateral malleolus of the fibula, curving forward and under the foot, passing along the groove in the second pulley, the cuboid bone, and finally inserting on the lateral side of the medial (first) cuneiform bone. The first pulley causes the applied force to plantar flex the ankle (extending the foot as in pointing the toes), and the second pulley

causes the applied force to evert the ankle (as moving the lateral border of the foot away from the midline of the body in a frontal plane). Without these pulleys this muscle would insert in front of the ankle and on top of the foot, and its action would be limited to only dorsiflexion at the ankle joint (moving the instep toward the tibia in a sagittal plane).

Example 2: Figure 8 depicts the action of the superior oblique muscle of the eye. The tendon of this muscle passes over a small cartilaginous bridge called the trochlea (Latin for pulley). This change in angle of pull causes this muscle to rotate the eyeball either clockwise (right eye) or counterclockwise (left eye).

Example 3: Figure 9 depicts the omohyoid muscle pulling on the hyoid bone, a horseshoe shaped bone in the anterior neck. The pulley is a ligamentous sling which directs the applied force downward rather than backward.

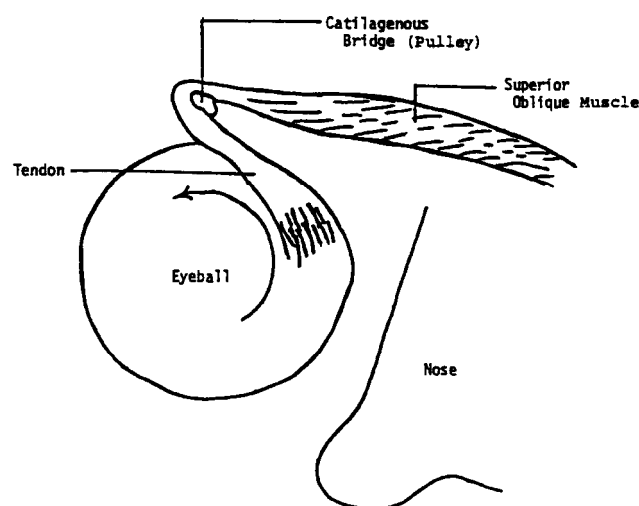


Figure 8. Cartilaginous trochlea acting as pulley for superior oblique muscle of eye.

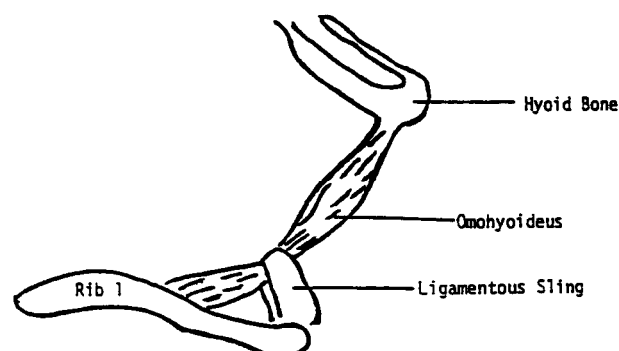


Figure 9. Ligamentous sling acting as pulley for omohyoides which pulls downward on hyoid bone on anterior neck.

Class III Pulleys

In this class the joint framework serves as the pulley.

Example 1: Figure 10 depicts the flexor digitorum profundus passing over the knuckles of the distal interphalangeal joint. Similarly, the tendon of the gracilis muscle on the medial thigh gains a favorable angle because of the size of the medial epicondyles of the femur (Figure 11).

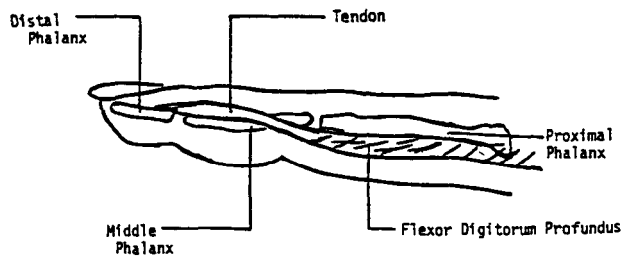


Figure 10. Distal interphalangeal joint acting as pulley for flexor digitorum profundus on anterior fingers.

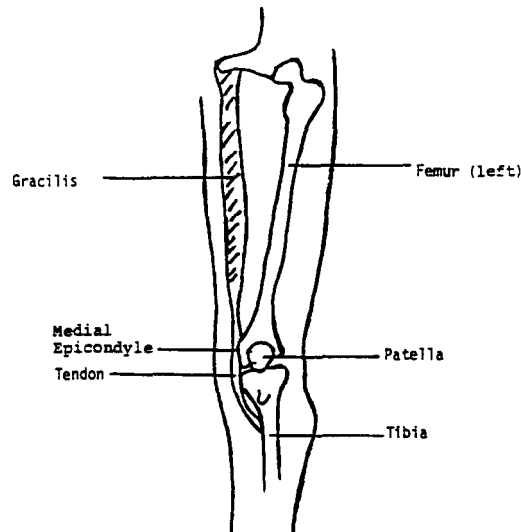


Figure 11. Epicondyle of femur acting as pulley for gracilis tendon which pulls on tibia.

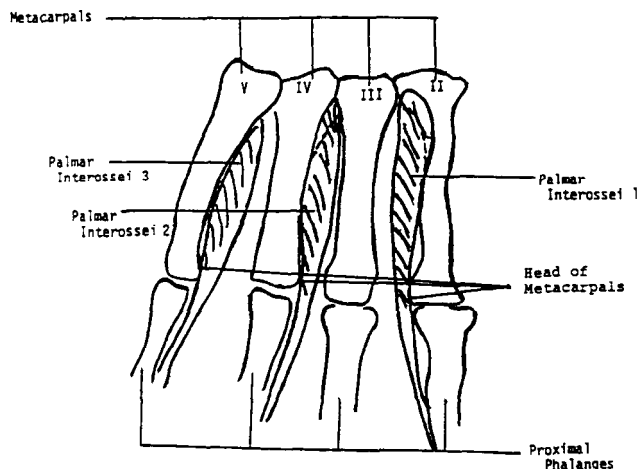


Figure 12. Metacarpophalangeal joint acting as pulley for Palmer interossei muscles on anterior fingers.

Example 2: Figure 12 depicts the tendons of the palmar interossei muscles as they pass over the metacarpophalangeal joints. The heads of the metacarpals alter the angle of pull of these muscles causing the applied force to adduct the fingers (pull fingers II, IV, and V toward finger III in the frontal plane).

Example 3: Figure 13 depicts the belly of the middle deltoid muscle as it passes over the shoulder joint. The head of the humerus causes an improved angle of

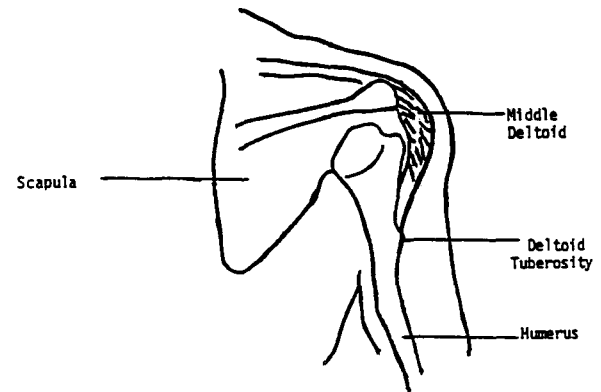


Figure 13. Shoulder joint acting as pulley for middle deltoid muscle.

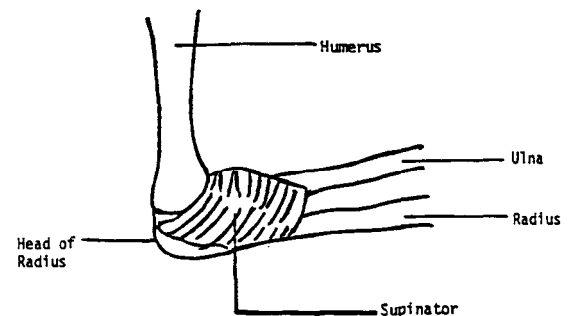


Figure 14. Head of radius acting as pulley for supinator muscle as it pulls on radius.

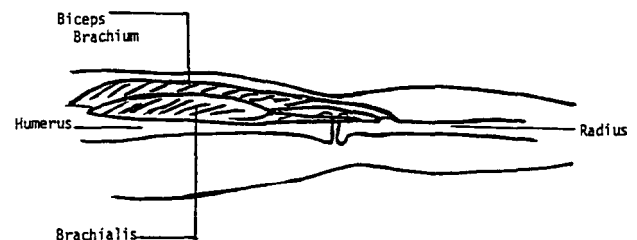


Figure 15. Increased size of brachialis and biceps brachium acting as pulley for biceps brachium.

insertion on the deltoid tuberosity of the humerus resulting in abduction of the shoulder joint (lifting the upper arm away from the midline of the body in a frontal plane).

Class IV Pulleys

In this class the muscle wraps around the pulley causing the pulley to rotate. Figure 14 depicts the supinator muscle wrapping around the head of the radius. In this example the pulley action is not to gain a more favorable mechanical advantage, but to cause the pulley to rotate. Mechanical advantage can only be increased here by having a bone with a larger cross sectional area (radius).

Class V Pulleys

In this case the muscle acts as its own pulley. Figure 15 depicts the biceps brachium muscle with the elbow extended. As this muscle increases in size, it not only becomes stronger but the angle of insertion increases slightly. Added to this is the probability that when the brachialis, which is a bulky muscle underneath the biceps brachium, is increased in size and strength, this also will elevate the biceps brachium slightly.

Summary

Five classes of pulleys which increase the mechanical actions at certain joints have been discussed. Is it not reasonable to conclude that these advanced, complex devices did not develop by random accidents by unthinking molecules, but are the result of the planned thinking and workmanship of a Divine Designer?

Wheel and Axles in the Human Body

Many of us depend on our automobiles daily. We would never arrive at our destinations if it was not for the wheels and axles functioning in our cars. The "designing" of various wheels and axles provides us with an enormous mechanical advantage in performing physical work.

In the human body there are also examples of the bones functioning as wheels and axles. The following is one bodily example:

1. The shoulder girdle (top wheel). This oblong ring of bones consists of:
 - A. the two scapulae (shoulder blades)
 - B. the two clavicles (collar bones)
 - C. the manubrium of the sternum (breastbone)
2. The rib cage. This consists of 12 pairs of ribs which are attached to the sternum in front and the vertebral column in back.
3. The vertebral column (axle). This is a row of 26 bones which attaches the skull to the pelvic girdle.
4. The pelvic girdle (bottom wheel). This consists of two hip bones and the sacrum bone of the vertebral column.
5. The muscles that attach to the shoulder girdle, vertebral column or rib cage and pelvic girdle (pulling force).

Figure 16 depicts the shoulder girdle, vertebral column and pelvic girdle acting as a wheel and axle.

The shoulder girdle with its accompanying rib cage acts as the top wheel. The vertebral column acts as the axle. The pelvic girdle acts as the bottom wheel. In trunk twisting exercises, the oblique abdominal muscles pull on the trunk as though it were the rim of a wheel, and the trunk rotates in the direction of the pull. This permits various pivots and twists to be performed by dancers, gymnasts, divers and workers. The wheel and axle system in the human body is even more versatile than the wheel and axle in our automobiles, for the wheels in the human body can twist in opposite directions at the same time.

This is just one of the examples of the bony structures acting as a wheel and axle in the body. Actually, all rotation movements around joints with two exceptions (protraction and retraction of the shoulder girdle) are wheel and axle movements. Movements like forearm pronation in badminton and medial rotation of the shoulder joint in throwing are sport-related activities utilizing a wheel and axle mechanism. Use of the wheel and axle arrangement by body structures is a great advantage in producing speedy segmental movement for all throwing and striking activities. These examples of wheel-axle mechanical advantages of human move-

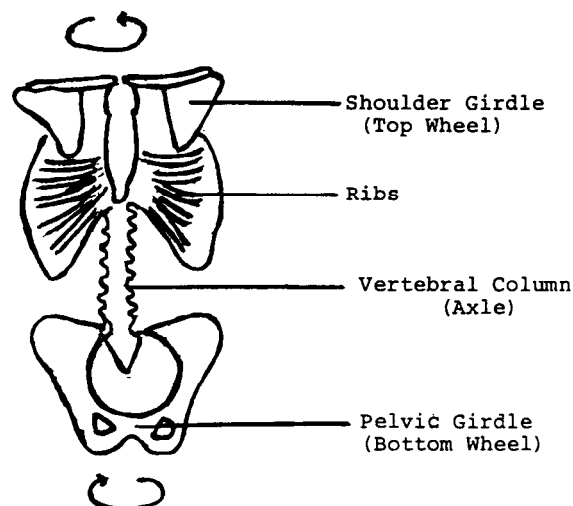


Figure 16. Shoulder girdle, vertebral column and pelvic girdle acting as wheel and axle.

ment are indications of planned design and purposeful function by a Designer rather than the unplanned, random reactions of unthinking physiochemical forces over alleged vast periods of time.

Reducing Friction in the Body

You might remember a television commercial by Shell Oil Company in which their representative tells how their engineers have developed discs of lubrication that are placed between the body and chassis of giant railroad freight cars. As the joints are pressed together, the lubrication squirts out and decreases the friction of the joint system. The Divine Designer has devised this same principle in certain joints of the human body. Tiny sacs containing synovial fluid are situated in certain joints to perform the same function of the lubricating discs of the Shell Oil Company. These discs are called bursae, and if anyone has ever had bursitis, they know how important these discs are. These bursae are situated where ligaments, muscles, skin, tendons or bones overlie each other and rub together. They perform the exact same function of the Shell lubricating discs of railroad cars, i.e., reduce the friction from rubbing.

It is logical to conclude since some brilliant engineer devised and made functional these lubricating discs that reduce friction in giant railroad freight cars, that some Supreme Being Engineer devised and made functional the lubricating bursae that reduce friction in the joints of humans. If the lubricating discs in man came about by chance factors over a long period of time, why did not the Shell Oil Company just wait for the same thing to happen in lubricating the chassis of railroad freight cars instead of hiring an analytical and creative human engineer to design the system? They could have saved considerable money if this were possible. Of course, it is impossible, and this is why the creation model is best for explaining both the complex functional apparatus in both railroad freight cars and the human joint system.

Tension and Compression in Bone Tissue

When an engineer designs a structure to withstand disrupting and crushing forces, he devises the structure to include stays which resist tensile forces and struts to resist compression forces. Human bone is so constructed that it can resist both tensile forces and compression forces. Its marrow cavity, endosteum and compact bone system provide for resistance to tensile forces while its periosteum with its outer fibrous layer and inner osteogenic layer provides resistance to compression forces. Hence, bone shows considerable structural advantages over many constructional materials, such as cast and wrought iron and wood, which are strong in resisting tensile forces but weak in resisting compression forces. Bell (1941, pp. 298-317) has shown the tensile strength of bone by experimental studies on rats to be 35,000 lb/in² in average breaking stress to bending as compared to 40,000 lb/in² for cast iron. Bone has an advantage over cast iron, because it is three times lighter and much more flexible. Clark (1971, p. 102) has claimed that bone material is three times as strong as timber and half as strong as mild steel. In comparing bone to other materials, Shipman et al. (1985, p. 53) reported that "porcelain and other ceramics have tensile strengths ranging from about one-third to one-half that of bone." In light of these facts, a person must ask himself, "If a civil engineer designed the superior structures of steel beams and the like, did not some Super-human Engineer design the superior material and structure of our human bone system?" Also, the mineral and protein components of bone tissue, taken separately, are both weaker (both in compression and tension) than the actual combination of these components. How could a slow process of evolution lead to this combination? How would animals survive maximal stresses on their bones over billions of years of a snail's pace development of compression and tension?

The Creative Superiority of the Human Brain

Animal brains and human brains have many structural and functional similarities. However, there are some large, significant differences. First, the human brain has a larger and better developed frontal lobe—approximately one-half of the volume of the cerebral cortex consists of the frontal lobe. The frontal lobe in humans regulates muscular and mental functions. Therefore, it can be divided into motor, pre-motor and pre-frontal areas which are immediately behind the forehead and eye sockets. It is this latter pre-frontal area that give humans mental superiority over lower animals. The pre-frontal cortex barely exists in rats and mice; in cats and dogs it makes up 3.5 and 7 percent of the cerebral cortex respectively. The pre-frontal cortex of chimpanzees consists of 17 percent of their cerebral cortex. In humans the pre-frontal cortex consists of a "whopping" 29 percent—almost one-third of the entire cerebral cortex. It is this expanded, well-developed pre-frontal area that makes humans superior to other animals in memory functions, planning controls, feed-back and inhibitory controls on behavior.

Second, the human brain has a significant enlargement and development of areas known as the association cortex. It is these areas located within the cerebral cortex that allow humans to connect the experiences of life into a meaningful whole and relate them to self for

a greater perception of the world and personal awareness. Sensations and memory are integrated and soon connect reason, language and ideas into meaningful experiences.

Third, the human brain has a unique area (Broca's area) designed to produce and perceive speech. A speech area has never been discovered in any animal, and, indeed, no animal possesses the language and communication abilities of humans.

Evidence of the evolutionary development of lowly developed animal brains into highly developed human brains is non-existent. The vast jump of development from non-human primate brains to the complex frontal lobes, highly specialized association areas and unique speech areas of the human brain is so great that it defies any comprehension of evolutionary logic.

Cosgrove (1987, p. 164), a professor and chairman of psychology at Taylor University, has summarized the situation as follows:

Without the evidence of gradual approximations of the human speech center in the animal world, the development of human speech from the animals is a mystery to biologists. Though weak, the best explanations are that gestures were replaced by single sounds or that men began to imitate sounds in their natural environments. The complexity of all human languages (past and present), the neurological complexity required to produce grammatical knowledge in the child, and the complexity of neurological control over auditory and musculature systems required for speech make these explanations appear absurd. If we are honest, we will face the facts and admit that we can find no evolutionary development to explain our unique speech center.

Common Sense and Scripture

If a precise-working automobile presupposes an automaker, surely the infinitely more complex and intricate structures of the human body infer a body maker. The psalmist says: "Understand, ye brutish among people and ye fools, when will ye be wise? He that planted the ear, shall He not hear? He that formed the eye, shall He not see?" (Psalm 94:8, 9)? Here Scripture infers that the eyes and ears were planned and created to provide accurate sensory function for us humans. It also infers that the evolutionary concept of undirected, random particles evolving into organized structures is humanistic foolishness (brutish, unwise). Solomon, the wisest king, stated, "The hearing ear, and the seeing eye, the Lord hath made even both of them" (Proverbs 20:12).

The most basic of all scientific laws—the law of cause and effect (no effect can be greater than its cause)—becomes foolishness to those who believe that matter can organize itself into highly functional living structures by chaotic chance factors.

Every organism, from the single-celled microbe to the amazing human body carries the imprint of intricate planning and construction. The idea that such complex structures did evolve by random mutations and natural selection is clearly a measure of the arrogance of human rebellion against common sense and the absurdity of humanistic logic. Such things never happen in the real world, and there is little or no real scientific evidence

whatever for “upward” evolution from one kind of lower organism to a higher organism. The only genuine force for the belief in evolution is the fact that the intellectual leaders want to believe it. The main reason they believe it is their fanatic desire to escape the idea that there is a Creator Who is more intellectual than they. “Professing themselves to be wise, they became fools” (Romans 1:22).

The ear did not accidentally “evolve” into its design; it was designed by a Master Architect. The eye did not “occur” by chance: it was planned by a Master Planner. Common sense and Scripture both point to the development of living organized structures by creative acts of a Superhuman Intelligence.

Anatomy and Scripture

There are over 100 references to the word “body” in the Bible, but most of these references are not in an anatomical sense and hence will not be noted. However, there are two significant anatomical references in the Scriptures.

We observe that the human body demonstrates an organized plan of symmetry with a certain degree of variation from symmetry. When my students stumble across some violation of symmetry, for instance the azygos vein, which is an unpaired vein on the right side of the thorax, and ask why there is only a miniature hemiazygos vein on the left side of the thorax my typical reply is “That’s the way God made it.” If we look at I Corinthians 12:18, we learn “As it is, however, God put every different part in the body just as He wished? Here the Creator tells us that He designed the structures of our bodies and placed them into an organized plan with a certain degree of variation for his own purposes. We humans do not know why he decided to place a large azygos vein on the right side and only a miniature hemiazygos vein on the left side. But we do know that he planned our bodies for His own individual reasons. He did not allow it to develop by chance factors as evolutionary theory maintains. The answer I give my students not only answers their question with some satisfaction, but it is scripturally correct. The students realize that there are some academic questions that the best scholars do not know, and we realize that our bodies were created or conserved this way because our Divine Designer just decided to do it this way. Science has very real limitations, and once we realize this, our emotional and spiritual lives receive a certain degree of enrichment.

Another specific reference to anatomy in Scripture is Colossians 2:19b, “Under Christ’s control the whole body is nourished and held together by its joints and ligaments, and grows as God wants it to grow.” Here we are told that the power of Christ has set up the principles of nutrition and growth. The structure and function of the joints and ligaments were made to suit God’s purpose, and were not due to some chance happening. Here again supernatural design is clearly emphasized. The earlier context (Colossians 2:16-19a) claims that making strict rules about eating, drinking, and holy days are not in accord with God’s purpose and should be avoided by the Christian. However, the Creator has given us, the Body of Christ, certain rules of nutrition and growth to live by, and we are not to violate them. . .

Argument for a Designer

It is ironic that the purpose of most scientific experimentation is to determine the mechanism or cause of some phenomenon, but when it comes to the origin of life and the universe most scientists abandon the principle of causality and adhere to the principle of randomness. Should natural phenomena be causeless, an infinite number of causes is an absurdity. Unless we abandon the principle of causality completely, we are driven to recognize an Infinite First Cause, the Triune God.

In all realms of science there is a recognition of laws and principles. In our human sphere, all civil laws are made by some lawmaker. Is it not logical to conclude that since persons and minds make civil laws here on earth, the existence of natural laws implies a Supernatural Lawgiver? How can a law make itself?

In essence, the argument for evolution is based on random physiochemical forces acting over immense periods of time; the argument for Creation is based on planned, purposeful design by a Divine Designer. In studying the human body anatomically one is impressed with its high degree of design. The greatest digital computers developed by our superior scientific minds are simple machines when compared to the very complex human nervous system.

Summary

Anatomy, the study of the structure of the body is a dynamic academic discipline. In the mechanical area of the world, thinking, creative human engineers design and develop newer, better forms of simple machines that perform work more efficiently. Human anatomists have discovered in the body examples of pulleys, wheels and axles, friction reducing fluid filled sacs within joints, compression and tension abilities of bone, and the creative superiority of the human brain. The question is, “Could undirected, randomized energy (chaos) through physio-chemical laws design and develop these precise functioning examples of simple machines in the human body? An unbiased observer would have great difficulty denying the rationality of inferring that these highly designed mechanisms were designed by an outside intelligent agent (Logos) which we would call the Creator of the universe. There certainly is anatomical evidence for the creation model of origins.

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THE EFFECT OF CHARLES DARWIN ON THE ENGLISH VICTORIAN WRITER, THOMAS HENRY HUXLEY

JAY E. LONG*

Received 25 August 1993; Revised 9 September 1993

Abstract

*The writing of Charles Darwin on evolution had a profound effect on the writings of some of the English Victorian writers, especially Thomas Henry Huxley. This article presents a brief summary of that effect.***

Introduction

The publication of Charles Darwin's *Origin of the Species* had a profound effect on several writers of the Victorian Period of English literature. Some of the Victorian writers were considered to have seldom been aware of their own limitations and would therefore attempt to deal with realms of thought, emotion, or behavior with which they were not fitted to deal. Examples of this would be Alfred, Lord Tennyson in poetry dealing with the slums or Matthew Arnold in his essays dealing with theology. The Victorian Age was one of floundering. The writers searched their hearts and wrote, but what they often faced was a confusion that their heads could not clarify. One point of confusion was that of Darwin's publication.

Huxley

Thomas Henry Huxley (1825-1895) was one Victorian writer who was especially affected by Darwin's *Origin of the Species*. It was in 1859 when that work was published and the theories of science seemed for once to become comprehensible to the great mass of people. The idea of evolution, until then little known by the public, strongly reinforced the agnostic element of some writers of the age. Huxley was one of those writers who for the next decade or two made the literary and thoughtful world resound with fury. He stands for the Victorian agnostic mind.

A scientist of distinction, Huxley devoted himself largely to maintaining Darwin's doctrine and combating Christian dogma. He became a popular figure, standing for the new enlightenment. As a humanist, he did not accept such doctrines as those that deal with original sin and the fall of man. Darwin and Huxley together shocked the faithful. The designations "unbeliever" and "atheist" carried a stigma; and in Victorian society it was important not to have such designations if one expected to be accepted socially. The motivating force that drove Huxley was his feeling of animosity towards the clergy who at the time had much greater status than the scientist (Taylor, 1984, p. 365).

Huxley did not agree with all that Darwin said, but *Origin of the Species* gave him the opportunity he needed to do public battle with church authority. He made quotations that were actually deceptive arguments, assuming evolution to be proven. The publication of Darwin's book became a great event for Huxley who was to become the great champion of Darwinism.

Using excellent powers of thought and expression, Huxley explained and supported Darwin's views before various kinds of audiences. He wrote essays, he debated, he lectured. His clear and forceful presentations of Darwinism were declared by Darwin himself to be "simply perfect" (McComb, 1910, p. xii). Huxley did much to advance the cause of evolution, having become the expositor for the theory developed by his friend, Darwin. He earned himself the title of "Darwin's bulldog" (deBeer, 1974, p. xiii), and he spoiled all attempts of the Church of England to discredit evolution.

Theism and Agnosticism

Darwin, well aware of the sharpness of his friend's power of analysis and the speed of his thought, suggested that Huxley put some of his lectures in essay form. Huxley's opinion of Darwin was one of great admiration and respect. The two men were alike in some respects; but one difference between the two was that Huxley, in spite of his uncompromising defense of evolution and his denial of divine design in nature, advocated the teaching of the Bible. Huxley was a deeply religious man but could not bear theology with its dogmatism and its clutter of "scientifically disproved assertions." Huxley took his own position when he wrote, "There is no evidence of such a being as the God of theologians," while he asserted that atheism is, on purely philosophical grounds, untenable (deBeer, 1974, p. xvii). In place of both views, he advanced the principle of agnosticism, by which he meant the subordination of belief to evidence and reason. Darwin also acknowledged himself as an agnostic. Darwin made the following statement about the Old Testament:

I had gradually come to see that the Old Testament from its manifestly false history of the world . . . was no more to be trusted than the sacred books of the Hindoos [sic], or the beliefs of any barbarian . . . I gradually came to disbelieve in Christianity as a divine revelation . . . disbelief crept over me at a very slow rate, but was at last complete. The rate was so slow that I felt no distress, and have never since doubted even for a single second that my conclusion was correct (Farrington, 1966, pp. 93-94).

He referred to such accounts as Noah's Ark as "old oriental tales" and "imaginative truth." He regarded the ennobling belief in an omnipotent God as a product of biological evolution. The effect of Darwin's work was supposed to have brought to an end the practice of using the Bible as an authority on physical and biological science.

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**Editors note: Creationist material which further explores the humanities in depth may be found in the Quarterly published by the Creation Social Science and Humanities Society, 1429 N. Holyoke, Wichita, KS 67208.

In abandoning Christianity Darwin did not become an atheist. At one point he says he reverted to the theism of his father and grandfather (Farrington, 1966, p. 96). The conclusion that he was a theist was strong in his mind when he wrote *Origin of the Species*, but gradually became weaker. He finally came to the conclusion that "agnostic" would be the more correct description of his state of mind. The clash between religion and science has left its mark on our history. Thomas Huxley stated that he would rather be descended from a humble monkey than from a man who employed his eloquence misrepresenting earnest men who were wearing out their lives in the search for truth (Farrington, 1966, p. 10).

Conclusion

Huxley, regarding heresy rather than orthodoxy as the hallmark of truth, deliberately flaunted his views. He insisted that his zeal never reduced him to the role of a mere advocate or blind partisan. He did have some reservations about Darwin's theory, but these were more than made up for by his enthusiasm in other directions. He was considered Darwin's chief agent in England. There were many who agreed with Huxley that one of the great merits of the theory of evolution was its complete and irreconcilable antagonism to that vigorous and consistent enemy of the highest intellectual, moral, and social life of mankind—the Catholic church—and not Catholicism alone, but all religion (Himmelfarb, 1959, p. 388).

The basic religious quarrel provoked by the *Origin of the Species* was between the reconcilers and irrecon-

cilables—those who believed the Origin to be compatible with Christianity and those who thought it was not. Huxley stated,

There must be some position from which the reconcilers of science and Genesis will not retreat . . . Agnostics and believers alike objected that such a god who is the final reason of everything is the scientific explanation of nothing (Himmelfarb, 1959, p. 397).

He called the question of questions for the nineteenth century—"man's place in nature" (Tillotson, 1978, p. 58). Huxley lost his faith long before he discovered the theory of evolution and apparently out of a temperamental repugnance to the idea of the supernatural.

Charles Darwin, the man who supposedly shattered the creationist views taught by the Church on the basis of the first two chapters of Genesis, greatly affected writers of the Victorian Period of English literature, and one of the most greatly affected was Thomas Henry Huxley.

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BOOK REVIEW

God, The Big Bang and Stephen Hawking by David Wilkerson. 1993. Monarch Publications. Kent, England. 156 pages. Paperback Price £ 7.99.

Reviewed by Don B. DeYoung*

Dr. David Wilkerson is one of those few with solid training in both science and theology. His Ph.D. is in theoretical astrophysics; he is a Methodist minister and currently chaplain at Liverpool University.

For creationists, the book is rather frustrating to read. On one hand, Wilkerson rightly challenges the arrogant origin pronouncements of secular science. At the same time, he greatly diminishes the literal creation message of Genesis.

Wilkerson gives very clear presentations of black holes (p. 34), the anthropic principle (p. 108), chaos theory (p. 59), and Stephen Hawking's view of cosmology (p. 86). It is rightly said that Hawking's sought-after physical "theory of everything" does not answer every question—there is still room for God. Physicist Everetts' bizarre idea that new universes are constantly forming in abundance, like a runaway chain reaction,

is also discounted. The book illustrations are unique and helpful; the writing is technically accurate.

With this hopeful beginning, the book unfortunately turns out to compromise creation, like so many others. Author Wilkerson is too saturated by science to question its conclusions. Hence he accepts the big bang (p. 141), biological evolution (p. 18), and vast ages. Wilkerson also accepts the comfortable but false view that Genesis describes the "why" (p. 127) of creation but not the "how" (p. 136). This old "Double Revelation" view manages to *undervalue* Scripture while at the same time it *overvalues* the ability of science to explain first causes. Wilkerson achieves this feat, in his mind, by concluding that Genesis is not history at all, but instead some other kind of literary form (p. 152). He uses the term "complementary accounts" for Bible and science data.

The book is not without value in understanding modern science. Dr. Wilkerson even recognizes and respects the British organization Creation Resources Trust (p. 144). To appreciate the wonderfully detailed biblical account of Creation, however, the book needs to be supplemented by creationist material. The book contains just 32 references and no index.

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PINE CREEK GORGE, THE GRAND CANYON OF PENNSYLVANIA: AN INTRODUCTORY CREATIONIST STUDY

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Abstract

The origin of Pine Creek Gorge in Pennsylvania is discussed from a young earth perspective as well as from a uniformitarian viewpoint. Field work in the region of the gorge is presented. Uniformitarian and creationist conjectures on the formation of the Appalachian Plateau, where the gorge is located, are reviewed.

Key Words: Pine Creek Gorge, Appalachian Plateau, Catskill Formation, Lock Haven Formation, Delta Deposition.

Introduction

When one accepts a recent Creation and Flood model of earth history, obviously many natural events such as canyon formation are assumed to have occurred quickly. Involved in rapid canyon formation is rapid erosion, a topic often discussed in the Quarterly. For instance, three articles (Williams et al., 1991; 1992a; 1992b) presented various views on the formation of the Grand Canyon of the Colorado River (references to other creationist works on the subject can be found in the series). This paper on Pine Creek Gorge is another introductory study reflecting the continuing field work of the Society on the topics of rapid erosion and canyon formation, important aspects of Flood geology.

Pine Creek Gorge is located approximately 50 miles south of the Finger Lake region of New York state. Known as the Grand Canyon of Pennsylvania, this unusual gorge (Figures 1 and 2), starts in Tioga County at Ansonia and extends nearly 50 miles southward to the edge of the Appalachian Plateau about five miles north of Jersey Shore in Lycoming County. Located in a sparsely populated region of north-central Pennsylvania, the gorge has attracted the attention of geologists for over 100 years. Since many interesting scenarios of drainage diversion have been developed for some of the rivers and creeks of Pennsylvania, it should be of no surprise that fascinating accounts of how this gorge originated have been postulated as well. These theories will be reviewed and we will offer other suggestions concerning the origin of Pine Creek Gorge. All of our conjectures will be cast within a creationist young-earth framework.

Appalachian Plateaus Province

Pine Creek Gorge is located on the Appalachian Plateau (Figures 3 and 4). Hunt's description (1974, p. 252) of this physiographic province is helpful:

West of the fold mountains are the Appalachian Plateaus. The formations are nearly horizontal, a typical plateau structure, but they are so elevated and dissected that the landforms are in a large part mountainous. Thus the Appalachian Plateaus are mountainous with a plateau structure, . . .

A dissected plateau structure could have formed as illustrated in Figure 5.

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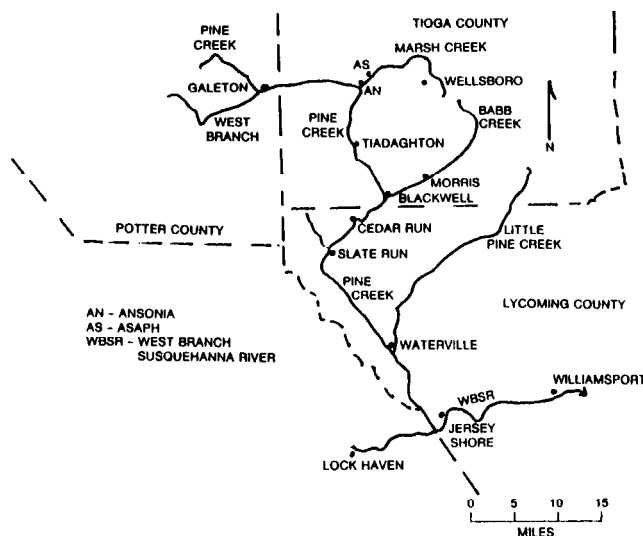


Figure 1. Pine Creek in north-central Pennsylvania; Pine Creek Gorge starts at the village of Ansonia and continues to the edge of the Appalachian Plateau approximately five miles north of the confluence of the Creek and the West Branch of the Susquehanna River near the town of Jersey Shore. Dashed lines represent county lines. Drawing by Emmett Williams.

The Appalachian Plateaus occupy an area equal to that of the Piedmont, Blue Ridge and Ridge and Valley Provinces combined (Hunt, 1974, p. 262). The Plateau region is:

. . . an elevated tract of nearly horizontal or gently folded strata. . . Altitudes range from about 1,000 feet along the western edges to somewhat more than 3,000 feet at the Allegheny Front (Hunt, 1974, p. 262).

The gently folded strata are sedimentary rock of Paleozoic age (Denny and Lyford, 1963, p. 2). The Province is divided into several sections based on differences in structure and prevailing erosion processes (Hunt, 1974, p. 262).

Stratigraphy

Pine Creek Gorge cuts through Upper Devonian rocks—mainly the Catskill formation (Figure 6). However from Ansonia to about one mile south of Tiadaghton, a distance of 10 miles, Pine Creek passes through rocks of the Upper Devonian Lock Haven formation (Berg et al. 1980). The Lock Haven formation (Figure 7), called the Chemung formation by previous workers,



2a.



2b.



2c.

Figure 2. Views of Pine Creek Gorge

- Aerial view of gorge looking NNW toward west rim, entrance of gorge at Ansonia is in upper right portion of figure, November 1991. Photograph by Robert Goette.
- Aerial view of gorge looking west, Pinafore Run is seen at lower left and Owasse Slide Run to the right two miles southwest of Ansonia, November 1991. Photograph by Robert Goette.
- View of the gorge from a vista in Colton Point State Park (Figure 9) looking NNE, July 1992. Photograph by Robert Goette.

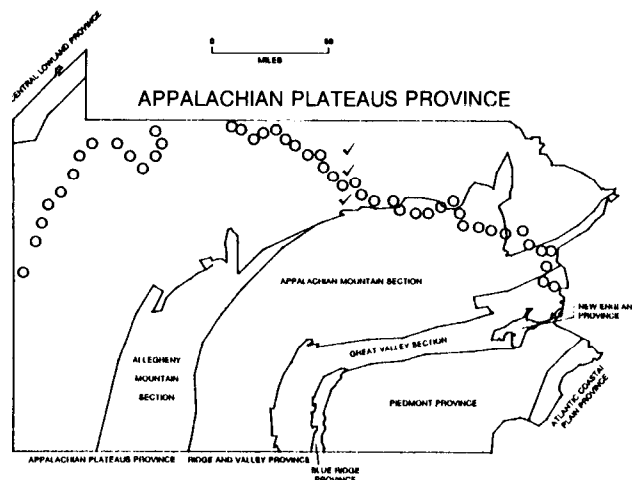


Figure 3. Simplified drawing of the physiographic provinces of Pennsylvania (after Berg et al., 1989). The Appalachian Plateaus Province extends from western Pennsylvania northeastward along the northern portion of the state. Only the Allegheny Mountain Section of the Appalachian Plateaus is shown on the figure.

○○○○ — late Wisconsinian glacial border

✓✓✓ — location of Pine Creek Gorge

was “. . . named to apply to the interval of rock between the Brailler and Catskill formations . . .” (Faill and Wells, 1977a, p. 32). There are no exposures of the Brailler formation in Pine Creek Gorge, nor is the base of the Lock Haven formation visible. Thus care must be exercised in the use of the Lock Haven designation at that location.

There is no published geologic map of Pine Creek Gorge (Faill, 1992). However, the Cedar Run, Slate Run and Waterville quadrangles have been mapped in the lower (southern) gorge region (Colton, 1963; Colton and Luft, 1965; Colton, 1968). These investigators simply noted the Upper Devonian strata informally as red-bed sequence and lower sandstone sequence. Colton (1963) explained that formal stratigraphic names have been used in earlier reports by other geologists “. . . although few if any rock units have been previously traced from their type areas in other parts of Pennsylvania into the north-central part of the state.” A brief description of the lithology of the Catskill and Lock Haven formations is given in Table I.

For possible correlation of these formations with other strata, see Sevon and Woodrow (1985, p. 4); Woodrow et al. (1988, p. 281). A description of the Catskill and Lock Haven formations in other parts of Lycoming County can be found in Faill and Wells

Table I. Description of Catskill and Lock Haven Formations (after Berg et al., 1980).

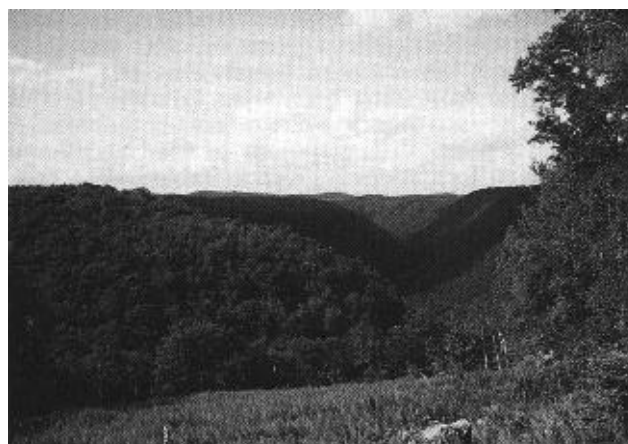
Formation	Thickness [feet] Tioga County, PA (after Sevon and Woodrow, 1981)	Lithology
Catskill	500 - 1400(?)	Succession of grayish-red sandstone, siltstone and shale, generally in fining-upward cycles; some gray sandstone and conglomerate
Lock Haven	2250 - 2900(?)	Interbedded olive-gray sandstone, claystone and thin conglomerate; marine fossils throughout



4a.



4b.



4c.

Figure 4. Views of the dissected Appalachian Plateau, north-central Pennsylvania. Note the almost flat plateau surface.

- a. Aerial view looking north along Pine Creek Gorge toward Ansonia in valley, November 1991. Photograph by Robert Goette.
- b. View toward the north from Grand Canyon airport west of Wellsboro, August 1992. Photograph by Emmett Williams.
- c. View looking north from Pine Creek vista on West Rim Road, 1.4 miles west of Tiadaghton, August 1992. See Anon. 1990. Photograph by Robert Goette.

(1977a; 1977b). Humphreys and Friedman (1975) provide another study of the Catskill formation in north-central Pennsylvania.

Uniformitarian Conjectures Concerning the Origin of the Appalachian Plateau

Pine Creek Gorge is incised in Upper Devonian rocks. Earlier in the century, uniformitarian geologists suggested that the Upper Devonian formations of the "Catskill Delta" were formed in a shallow sea located in a geosyncline. These sedimentary rocks in the delta were deposited at the edge of the Appalachian Basin by processes similar to those that form deltas today. Sevon and Woodrow (1981, p. 11) stated:

Throughout most of the Paleozoic, much of what presently constitutes the eastern half of North America was part of an inland sea which intermittently received elastic sediment from an eastern source area. The Appalachian basin was the central focus of this sedimentation.

The largest integrated wedge of elastic sediment in the basin was deposited by the Catskill delta system during the Middle and Upper Devonian.

Barren (1913, p. 466) explained that:

The uniformity in the character of the delta from northeast to southwest, its development marginal to the uplands, and the somewhat rapid gradation from gravel to sand and clay on leaving the mountains suggests the presence of a number of comparatively short streams which built flat coalescing fans rather than the debouchment of one or two great continental rivers.

Subsidence of the basin as the sediment collected is involved in the model. During the supposed formation of a delta complex from several sources, active orogeny was occurring to the east along with some local tectonic activity. Also erosion of the mountains to the east was thought to provide some of the sediment for delta formation. Later, uplift of the "delta" occurred. However as Sevon and Woodrow (1981, p. 19) explained:

Although the term delta has been applied many times to the origin of the progradational deposits of the Catskill delta, a specific model has never been established.

If there was delta formation many different types of depositional environments would have existed, particularly as the delta increased in size. Sevon and Woodrow (1981, pp. 22-23) list 21 different depositional environments that had been postulated from prior studies of the Middle and Upper Devonian rocks of New York and Pennsylvania (also see Williams, 1985). Recently Woodrow (1985) and Woodrow et al. (1988) have synthesized models employing many of the depositional modes suggested in past field studies. It is interesting to note that the delta formation hypothesis has been opposed by some field workers. Allen and Friend (1968) postulated deposition in a vast coastal alluvial plain rather than a delta. Walker and Harms (1971) and Walker (1971) offered evidence for deposition along a

quiet, prograding muddy shoreline. Gale and Siever (1986) contended that Middle to Upper Devonian Catskill sandstones in southeastern New York were "... part of a regressive alluvial plain sequence ..." (p. 592).

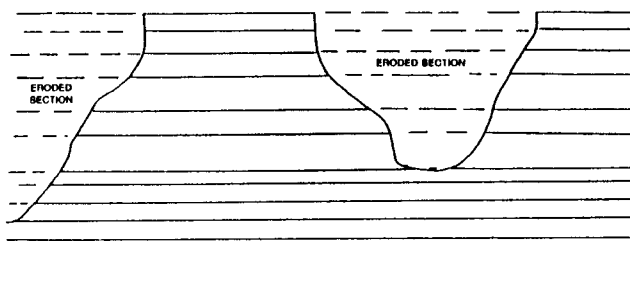


Figure 5. Representation of horizontal sedimentary rock layers forming a plateau. Solid lines represent strata still intact whereas dashed lines represent layers that have been eroded away. Plateau has been erosionally dissected, forming erosional mountains, after Mulfinger and Synder (1979, p. 334). Drawing by Emmett Williams.

Friedman and Sanders (1978, p. 186) argued for either or both a deep burial of horizontal Devonian strata in the northern Appalachian Basin or a past high geothermal gradient; the latter based on a discovery of anthracite in plant debris in the strata. Recently, Friedman (1987) offered more evidence for deep burial as did Gale and Siever (1986). If deep burial did occur, deposition in a shallow sea probably is not feasible unless one assumes rapid subsidence into an ever deepening basin.

The array of "depositional environments" to be incorporated into a uniformitarian model is formidable! A mention of some of the scenarios will illustrate this predicament concerning the formation of the "Catskill Delta." Dennison and Head (1975) emphasized transgressions and regressions that caused shoreline migration during deposition. Woodrow and Isley (1983) discussed the importance of deposition by turbidity currents. The model proposed by Woodrow (1985) combined alluvial processes, deltaic processes, wave-related processes, turbidity currents and slow deposition from suspension. Sevon (1985) examined deposition of non-marine facies by meandering or braided streams. Lundegard et al. (1985) considered turbidite sequences in the Appalachian Basin. Bridge and Droser (1985) postulated estuarine-brackish water coastal bay origin for certain Upper Devonian sedimentary sequences in Pennsylvania. Slingerland and Loulé (1988) presented evidence for wind/wave and tidal processes involved in deposition along the Upper Devonian Catskill shoreline. The relationship of tectonic processes affecting deposition was discussed by Ettensohn (1985), Faill (1985), Ferrill and Thomas (1988), Jackson et al. (1988), Miller and Kent (1988) and Rast (1989).

This brief survey indicates the considerable amount of detail that must be included in a comprehensive depositional model for the "Catskill Delta" if it is assumed that all of the above sedimentary modes operated in the past. For further details on the formation of deltas see LeBlanc (1975), Colella (1988) and Smith et al. (1990).

Creationist Conjectures Regarding Formation of Alleged Ancient Deltas

Henry Morris has criticized the concept of deposition in geosynclines (near-shore troughs) and ancient shallow seas with attendant subsidence (Whitcomb and Morris, 1961, pp. 144-150). He also discussed the weaknesses in attempting to identify ancient environments of sedimentation on the basis of imagined similarity with present deposition processes (Morris, 1966, pp. 52-53). Burdick (1964, p. 42) claimed that interbedding was difficult to explain by uniformitarian processes and it could not be caused by deltaic, flood or wave action in a shallow sea. He suggested that a Flood tidal wave moving in one direction, then a later reversal with a tidal wave moving in the opposite direction depositing the interbedded layers, was a superior mechanism.

Since there are red beds in the Catskill formation, creationist comments on the development of these sediments would be appropriate. In a paper on the red beds of western United States, Clark (1966, pp. 12-16) postulated that they were Flood deposits. He stated (p. 12):

A general lack of sources for these vast deposits of sandstone, shale and conglomerate is shown as critical to a satisfactory explanation of them from the viewpoint of uniformitarianism. Conclusions are (1) sediments were brought in from great distances, (2) great sweeps of water instead of local river or flood action were necessary to spread out these sediments over this vast area and (3) the various formations were laid down one after the other in rapid succession.

Clark (1971, p. 21) also briefly discussed the formation of a "vast series of deltas" in the Appalachian region as being a result of Flood action. In a paleoecological study of the black shales of the Pennsylvanian system of west-central Illinois, Peters (1971, p. 193) noted that, "All of the reported observations strongly support the Biblical tidal interpretation of fossil deposition and burial." This excellent field and laboratory work deserves serious study by creationists.

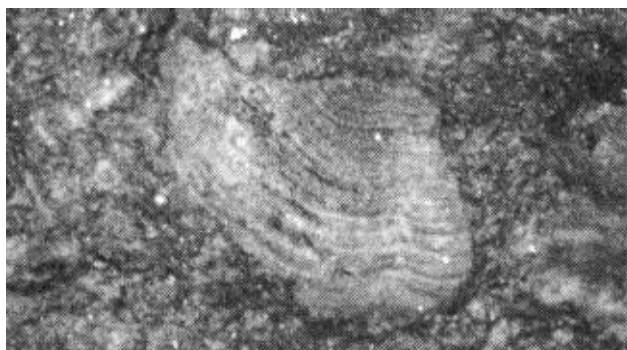
The Mississippi River delta has been studied and analyzed within a young earth framework (Allen, 1972; Mehlert, 1988). Allen (pp. 103-108) presented seven points of evidence that "apparently disprove the theory that delta sediments depress the crust of the earth" (p. 108). Also he considered that no river, estuary or normal ocean could have transported or deposited the underlying gravel stratum in the Mississippi River delta (p. 112).

In an extensive discussion of cyclic sedimentation (deposition of cyclothems), Woodmorappe (1978) examined the claim that most Paleozoic sedimentation occurred in shallow seas (p. 196). He noted that:

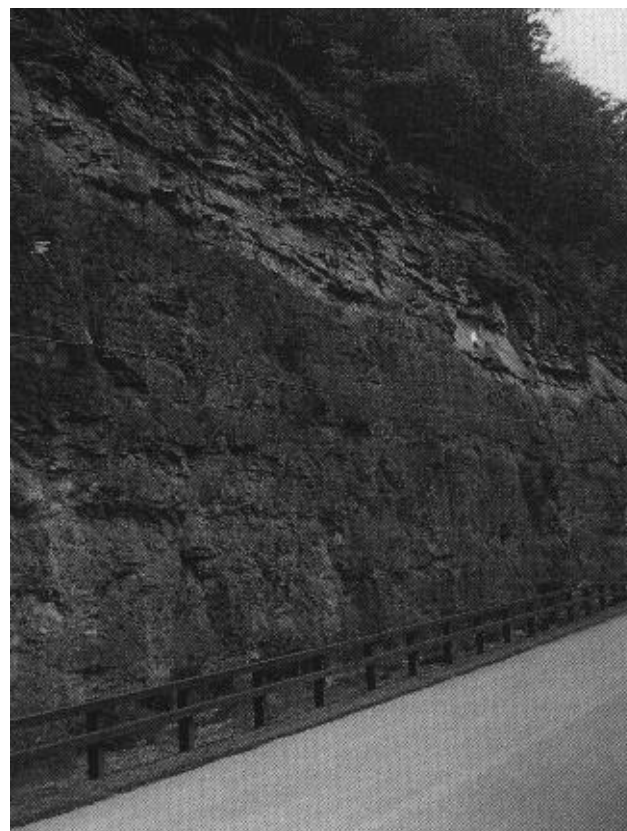
... uniformitarianism breaks down in its attempts to find *bona fide* examples of such shallow seas today. ... There simply is no existing models [sic] of epeiric sedimentation to guide our investigations ... (p. 196).



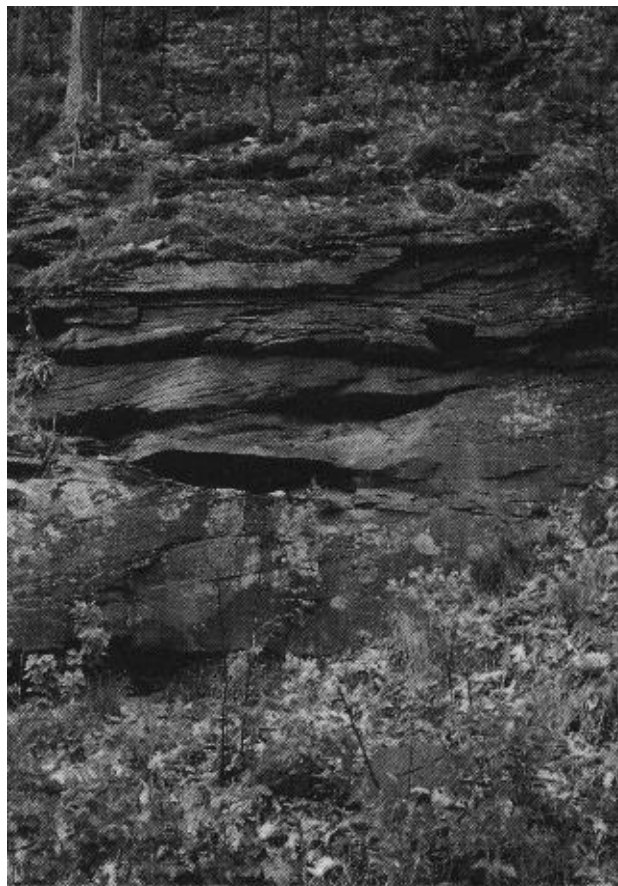
6a.



6b.



6c.



6d.

Figure 6. Sections of Catskill formation, north-central Pennsylvania

a. Road cut along US route 15, four miles northwest of Mansfield (Figure 9), above Tioga-Hammond Lake, August 1992. Photograph by Robert Goette.

b. A fossil pelecypod shell found in the Catskill formation at location in Figure 6a, Photograph by Robert Goette.

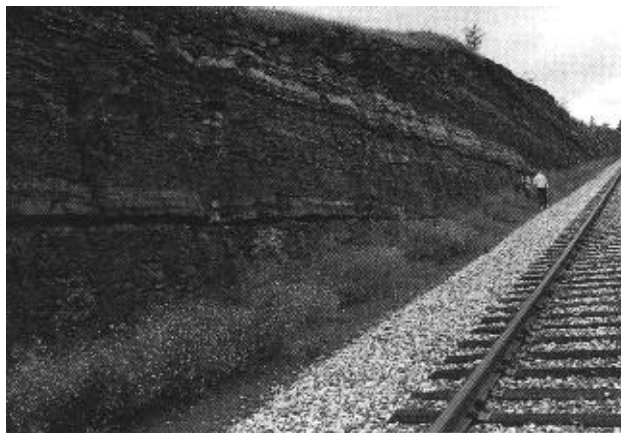
c. Road cut along PA route 414 at village of Cedar Run, lower sections of strata are "red beds" of Catskill formation, May 1992. Photograph by Emmett Williams.

d. Typical cross-bedding, Catskill formation, Pine Creek Gorge near Blackwell, May 1992. Photograph by Emmett Williams.

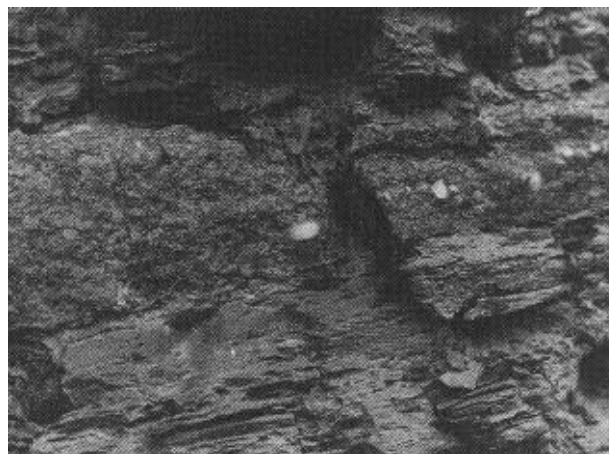
He suggested that the deposits are a result of the Flood and offered a Diluvial model to explain such sedimentation (pp. 197-199):

Two Diluvian conceptual terms are now coined: Floodwater Mass Movement (FMM), and Floodwater Depositional Milieu (FDM). For illustrative purposes it may be stated that a long, thin, narrow sandstone (which uniformitarians claim was laid down by an ancient river; hence—by definition—in a fluvial sedimentary environment) was actually laid down by a swift, longitudinal FMM; the sandstone therein deposited in a torrential FDM. . . . Also since it is claimed that "Ancient alluvial plains" may have ". . . wide lateral extent . . ." it can mean that, in reality it was a wide swiftly moving FMM which laid down the sedimentary rock.

The . . . "shallow Paleozoic seas" were actually extremely-widespread but stagnant FMM's (p. 199).



7a.



7b.



7c.



7e.



7d.

Figure 7. Sections of the Lock Haven formation, north-central Pennsylvania

- a. Railroad cut along PA route 287, 1 mile south of Tioga (Figure 9), west of Tioga-Hammond Lake, August 1992. Photograph by Robert Goette.
- b. Lens of conglomerate in Lock Haven formation, same location as a., August 1992. Photograph by Robert Goette.
- c. Road cut along PA route 3006 between Stony Fork and Thumptown (4.75 miles northeast of Tiadaghton), August 1992. Note flaggy layers of sandstone. Photograph by Robert Goette.
- d. Fossils found at location in Figure 7c. From right to left in the center of the figure, an exposed cross-section of a crinoid stem, a spiriferid brachiopod and a gastropod. Photograph by Eugene Chaffin.
- e. Another impression of a brachiopods found at the same location. Photograph by Robert Goette.

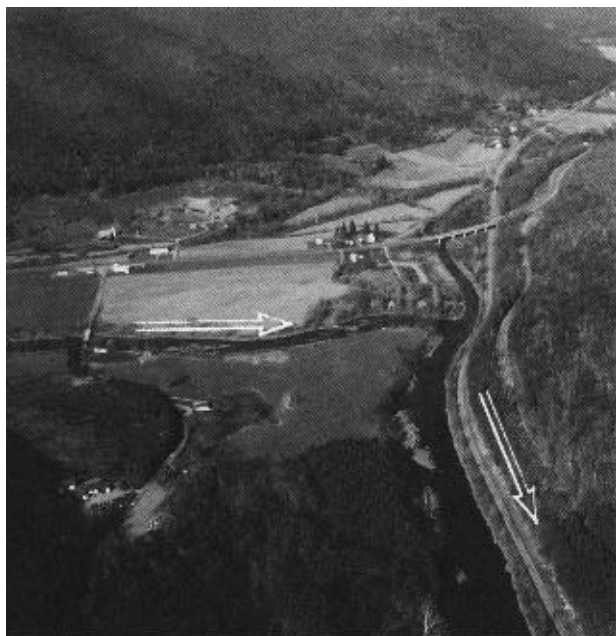


Figure 8. Pine Creek flows generally in an eastward direction (from left to right in figure), then turns south at Ansonia (right angle turn) and flows toward the Gorge (beyond bottom of figure). Marsh Creek flows generally from the north under the bridge joining Pine Creek. Arrows indicate direction of flow of Pine Creek, November 1991. Photograph by Robert Goette.

He concluded the discussion by stating that (pp. 199-200) :

Since "sedimentary environments" in ancient rock are "Imaginative," the Diluvialist can justifiably reject the entire concept of "Sedimentary Environment" . . .

Sedimentation in basins along with tectonic activity in a Flood environment was discussed (p. 200). Then Woodmorappe considered the source areas for the sediment which formed the "Catskill Delta" and claimed that the Flood transported material from a series of sources (p. 202). He proposed a Diluvian interpretation of cyclothem facies in a prograding FMM front. In a brief discussion of sandstone and shale sedimentation, the author noted that "FMM dynamics easily explain the different sedimentary / stratigraphic properties of sandstone" (p. 205). He concluded as follows:

The basic sedimentary, stratigraphic, and tectonic properties observed in cyclothem rock provide a picture of the recessional aspects of the Flood (p. 205).

This original Diluvian thinking should be studied when viewing the Catskill Delta as a Flood deposit. Later Woodmorappe (1980) again reviewed "ancient sedimentary environments" and offered commentary from a Flood sedimentation viewpoint. Concerning the Brallier formation found on the Appalachian Plateau, he stated that: "The prominence of turbidites is especially suggestive of large-scale Flood deposition" (p. 215).

Scheven (1990) briefly mentioned sedimentation in deep synclinal troughs and shallow basins (pp. 263-264). Tyler (1990) introduced a tectonically-controlled rock

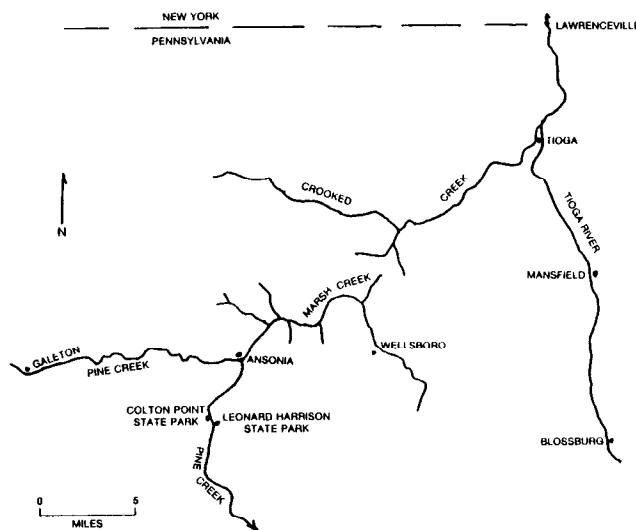


Figure 9. Map showing some drainage patterns in Tioga and Bradford Counties Pennsylvania (after Crowl, 1981, p. 40). Drawing by Emmett Williams.

cycle model which included deposition within a fault-bounded sedimentary basin. He claimed that the model:

. . . provides a framework for interpreting such distinctive features as good lateral persistence of beds, abrupt transitions between beds, regular and thick bed thicknesses, constant orientation of bedding planes, and planar unconformities (p. 297).

Austin et al. (1991) offered evidence against deltaic deposition of sandstones and shales in the Grand Canyon region (pp. 22-31). Sand wave deposition from ocean water and sources of the enormous quantity of sand needed to form the sandstone were presented within a Flood framework. Other creationists have written on certain aspects of Appalachian geology, e.g., McQueen (1986) and Chaffin (1990).

Speculations on the Origin of Pine Creek Gorge

Upper Pine Creek flows generally in a southeasterly direction in a low lying valley (Figure 8) until it meets Marsh Creek at Ansonia, where it makes a right angle turn and flows through the narrow Pine Creek Gorge (Figure 9) located in the highlands of the Appalachian Plateau. Such an unusual (unexpected?) change in direction has generated some conjecture as to "why."

Probably the first geologists to write about this change in direction of Pine Creek were Sherwood *et al.* (1878). We were unable to obtain their report, but in an early history (Anon., 1897) of Tioga County, this change in direction of flow of Pine Creek and its probable cause were briefly discussed.

Marsh creek which unites with Pine creek at Ansonia, is a remarkable stream, with a motion so slow as to be hardly perceptible. . . . Its direction is exactly the reverse of that pursued by Upper Pine creek—as if the waters of Pine creek once flowed up Marsh creek, straight on toward the Tioga river. . . . It is a remarkable summit, if summit it can be called, which divides the waters

flowing down Marsh creek to Pine creek, and those flowing down Crooked creek to the Tioga river. The idea is . . . quite popular, says Mr. Sherwood, among the inhabitants that Pine creek, instead of flowing south through the gorge . . . , flowed formerly through the valleys of Marsh creek and Crooked creek, into the Tioga river. . . . If Pine creek once flowed northward from Ansonia, what a mighty convulsion of nature must it have been that rent the mountain asunder and diverted its waters southward through one of the most weird chasms to be found in the chain of the Alleghenies?

Another theory is that a small stream once had its source south of the supposed wall, and, on account of a "fault" in the rocks . . . , worked a small passage down the mountain. When the breast of the dam was broken, by the tremendous pressure behind it, there was such a mighty rush of water down the rivulet that in time the great chasm was cut and the course of Pine creek changed to the south (p. 26).

It was mentioned (pp. 26-27) that a lake may have existed in the valley north of the divide at Ansonia before the dam was breached. Sherwood is quoted (p. 27) as stating that a dam, "fifty rods in length from mountain to mountain" formed possibly during a glacial period, could have acted as an effective drainage divide where Pine and Marsh Creeks join.

Alden and Fuller (1903a, 1903b) suggested that the processes of stream development and the advance of ice sheets caused a drainage diversion of Pine Creek at Ansonia. They claimed that a drainage divide existed about two miles south of Ansonia (the lowest altitude drainage divide in the area, see Figure 10). Before the advance of any ice sheet, Pine Creek flowed northeast into Marsh Creek at Ansonia, then into Crooked Creek and into Tioga River and eventually into the St. Lawrence River. The advance of the first pre-Wisconsin ice sheet blocked the flow of the Tioga River near Corning, NY. The outflow was blocked and the water gathered into long, narrow lakes similar to the Finger Lakes of New York. The dammed water from the branching lakes overtopped the drainage divide two miles south of Ansonia. (The attitude of the drainage divide is impossible to determine at the present time because of subsequent erosion.) The south-flowing streams, south of the drainage divide, had been eroding headward toward the divide and once the dam was overtopped these streams joined the surging lake water flowing southward into the west branch of the Susquehanna River and eventually into the Chesapeake Bay.

A second advance of a continental ice sheet (Wisconsin stage) again dammed the northeast-flowing drainage with the formation of finger lakes and the exiting dammed water flowed into Pine Creek south through Pine Creek Gorge likely eroding it to greater depths.

In 1933 George Ashley briefly explained the drainage diversion as follows:

Glacial deposits are likely to make many changes in the drainage of an affected region. Thus, in



Figure 10. View looking WSW in Pine Creek Gorge near the confluence of Pinafore Run and Pine Creek approximately two miles south of Ansonia, where the postulated drainage divide existed. Notice how narrow the gorge is at this location, August 1992. Photograph by Emmett Williams.

places, as the ice moved forward up a drainage basin, the streams flowing toward the ice were ponded against its front until the pond rose to such a height that it overflowed the edge of the basin into some other valley draining away from the front of the ice. This may have lasted long enough so that a new permanent outlet was established by cutting a deep gorge through the old rim of the basin. This happened, for example, with Pine Creek the headwaters of which were tributary of the Tioga River by way of Marsh Run. The gorge below Ansonia was cut through the rim of its old basin, making Pine Creek a tributary of the West Branch of the Susquehanna (pp. 41-42).

Ashley expanded his explanation in 1945.

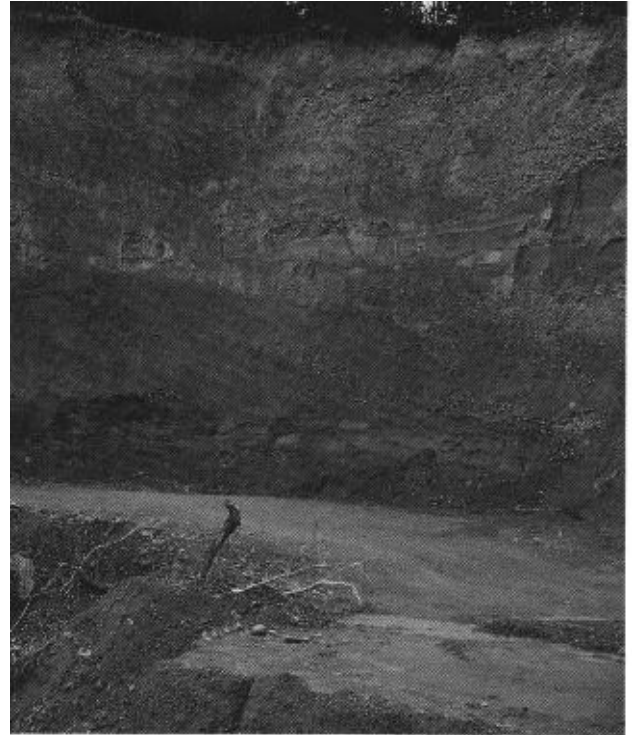
For simplicity . . . suppose we divide Pine Creek into Upper Pine Creek west of Ansonia and Lower Pine Creek south of Ansonia.

At one time Upper Pine Creek used to flow east and north past Ansonia by way of Marsh Creek, lower Crooked Creek and Tioga River, out of the State at Lawrenceville into New York State . . . Lower Pine Creek had its real source in Babb Creek . . . (pp. 3-4).

The old drainage divide separating the northward flow toward the St. Lawrence River and the southward flow toward the Chesapeake Bay ". . . crossed Tioga County in a northeast-southwest direction about through Mansfield and Wellsboro" (p. 4). The divide was a broad arch of rock separating the north and south basins. Upper Pine Creek followed the basin to the north whereas Lower Pine Creek followed the basin to the south. The arch was "worn down" after several million years of erosion and headward erosion from a south-flowing stream could have cut a deep gap in the divide (p. 6). Once the glaciation blocked the northeast flow and the dammed water overflowed the gap or col and "rapidly lowered the new channel" (p. 7) so that after the retreat of the ice, Pine Creek continued to flow south in the lower elevation channel (Pine Creek Gorge).



11a.



11c.



11b.



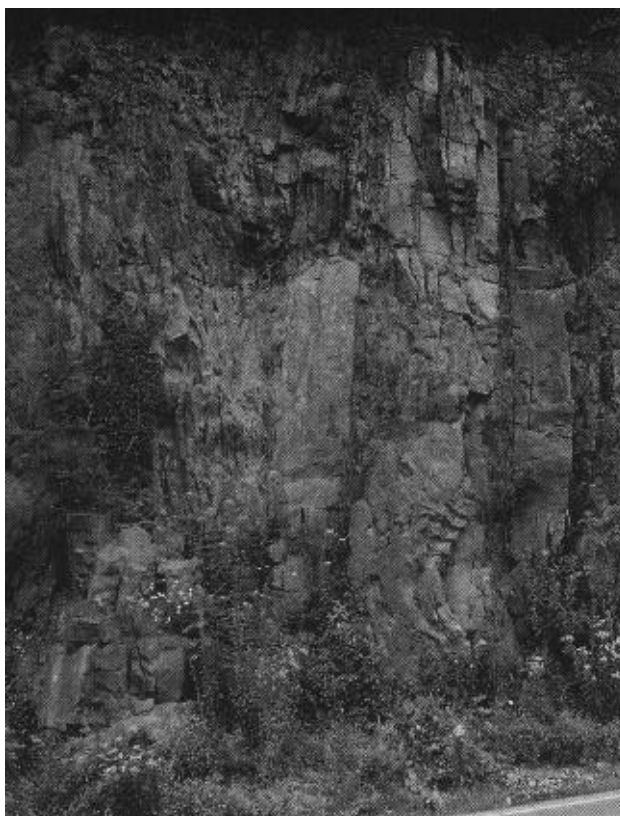
11d.

Figure 11 a. Soil profile above hammer in Pine Creek Gorge near Burdic Run, about four miles downstream from Ansonia, May 1992. Denny (1956) referred to the strongly weathered red drift as pre-Wisconsin paleosol. Photograph by Emmett Williams.

b. Kame northeast of Ansonia, May 1992. Photograph by Emmett Williams.

c. Cross-section of a kame, 0.5 mile east of Sabinsville, PA, May 1992. Photograph by Emmett Williams.

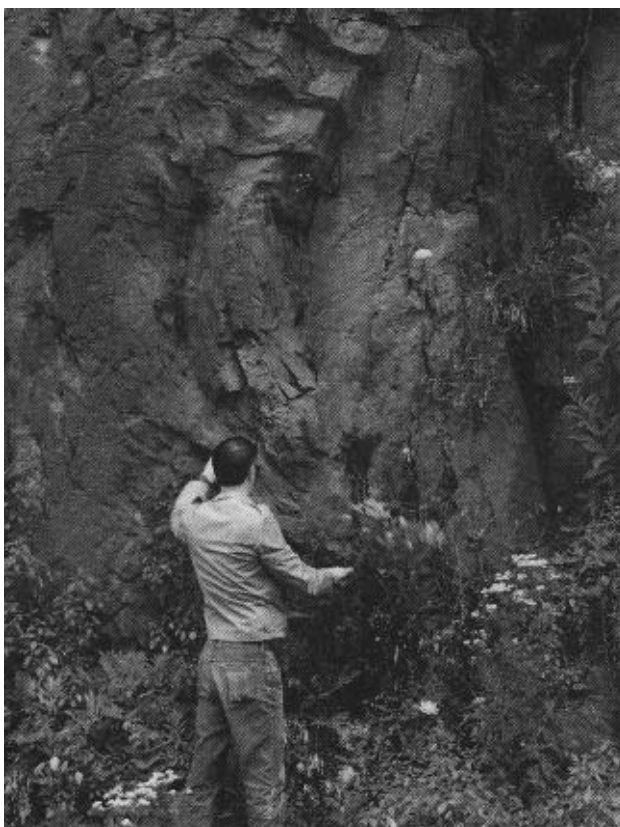
d. Likely a glaciofluvial deposit in the cut located at the west end of the bridge across Babb Creek in Blackwell, PA along PA 414, August 1992. Photograph by Robert Goette.



12a.



12c.



12b.

Figure 12 a. Steeply folded and vertical strata of Catskill redbeds, 2.8 miles north of intersection of US 220 and PA 44 along Highway 44, August 1992. Photograph by Robert Goette.

b. Closer view of folded strata shown in lower right of Figure 12a, August 1992. Photograph by Robert Goette.

c. Vertical flysch beds of Lock Haven formation approximately 1.4 miles north of intersection of US 220 and PA 44 on railroad cut (along old Penn Central Railroad bed). Note soil creep at top of flysch layers, September 1992. These strata are similar to the flysch beds of the Haymond formation in west Texas (Howe and Williams 1994). Photograph by Robert Goette.

d. Small brachiopods found cemented in one of the flysch layers along an old railroad cut, 2.1 miles north of intersection of PA 44 and US 220 at Torbert, PA, August 1992. Photograph by Robert Goette.



12d.



13a.

Figure 13 a. Portion of debris slide near Red Ledge, 0.75 mile south of Tiadaghton on the east slope of Pine Creek Gorge, May 1992. Photograph by Emmett Williams.



13b.

b. Small debris slide near Owasee (2.7 miles south of Ansonia) on the east slope of Pine Creek Gorge, August 1992. Photograph by Robert Goette.



Figure 14. A washout from a deposit along the east side of PA 414, 0.7 mile north of Blackwell village limits sign, August 1992. Photograph by Robert Goette.

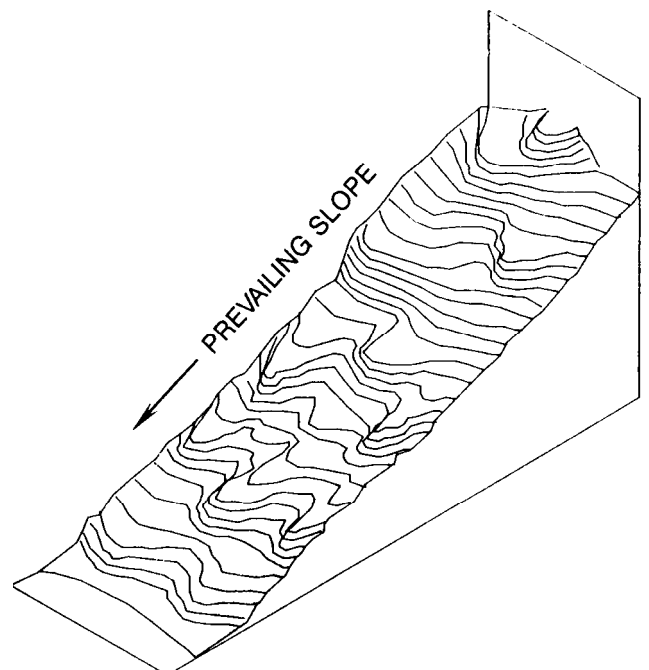


Figure 15. Computer simulation of slump terraces observed on the east slope of Pine Creek Gorge one mile north of Tiadaghton. Drawing by Eugene Chaffin.

Denny (1956, p. 53) and Denny and Lyford (1963, p. 18) studying the geomorphology, surficial geology and soils of the region, "dated" the time of the drainage diversion as follows:

The overflow [of the dammed water] cut down the divide, and subsequent erosion of both glacial and nonglacial origin has produced the present canyon. Since gravel dating from pre-Wisconsin time occurs in the valley of Pine Creek south of the Wisconsin drift border, the cutting of the gorge probably antedates the Illinoian stage . . . (Denny and Lyford, 1963, p. 18).

In a more detailed model, Crowl (1981, p. 39) explained:

The present drainage pattern of north-central Pennsylvania is the result of normal stream action modified by pre-glacial stream piracy and Pleistocene glacial ponding of streams with concomitant stream diversion across divides.

In discussing the pre-glacial drainage divide, he noted (p. 42):

. . . the divide between upper Pine Creek-Marsh Creek-Crooked Creek drainage to the north and lower Pine Creek to the south lay along the present height of land about a mile north of Leonard Harrison/Colton State Parks. . . . Presumably a col lay in the divide between the two streams.

Then the northeast drainage was blocked by "an early ice sheet." Meltwater lakes formed in the valleys. The lake in the valley north of the Gorge drained through the col into lower Pine Creek.

Abundant water flow, a steep gradient south of the col, and severe frost action associated with ice-marginal periglacial conditions would have severely broken these well-jointed rocks, and stream erosion would have been very effective at the site. Continued advance of the ice obliterated the lake, covered and scoured the divide (Crowl, 1981, pp. 42-43).

Then Crowl speculated that likely the drainage change occurred during the period of "Nebraskan" glaciation (p. 43). Later glaciations were postulated so that the erosion process outlined above continued until the establishment of "the present course of Pine Creek" (p. 43).

Since this view of drainage diversion was first suggested in the late 1800's and early 1900's when W. M. Davis' system of geomorphology exerted a strong influence on geological studies, a bibliography is given in Addendum I for anyone interested in examining the system to determine if it is compatible with a model of the Flood and its after-effects.

Coates (1974) and Coates and Kirkland (1974) proposed a different hypothesis for the formation of Pine Creek Gorge. Their view emphasized glacially-related erosion from meltwater to form the Gorge rather than any preglacial erosion. Referring to the region of the state where the Gorge is located as the open folds section, Coates (1974, p. 237) noted:

Some of the most important glacial effects in this section occur in the northern part where large proglacial lakes were ponded against the divides of north-flowing rivers. Not only were thick glaciolacustrine deposits left throughout many valleys and on some hillslopes, but spectacular spillways formed by overflow of the lakes through narrow cols. . . . The most awe-inspiring of these features is the Pine Creek Gorge, . . . Here the nearly vertical 700 ft. high walls of the 20 mi chasm were formed by meltwaters impounded in the Tioga and Cowanesque Rivers.

Coates and Kirkland (1974) suggested a sequence of landscapes developed by glaciation on the Appalachian Plateau. They stated (p. 116):

There is one series of events which has received inadequate coverage in the literature that is crucial to the evolution of the glaciated landscape and sets it entirely apart from the unglaciated part of the Plateau—the character of drainage divides. In the glaciated region there is an unparalleled development of an entire family of landforms that constitute a continuous series with many gradations of glacial cols, chute valleys, sluiceways, and through valleys. Erosion is the dominant characteristic of the first three, whereas the fourth is more dominated by transportation and deposition processes.

The first 16-20 miles of Pine Creek Gorge from Ansonia southward is classified as a single-cycle sluiceway formed by meltwater from a "single glacial episode" (p. 121). Sluiceways were defined as "elongated narrow valleys with steep walls that contain only minor tributaries due to the restricted width of the drainage divide that nearly parallels the valley" (p. 121).

The actual effect of glaciation, the southernmost extent of glaciation, various glacially-related features and the number of glacial stages on the Appalachian Plateau are definitely not closed subjects. For instance Braun (1989, p. 244) noted:

The only part of the Appalachians where there is a consensus that glaciers have transformed the landscape is in the Finger Lakes region of the Appalachian Plateau . . .

Interested readers may wish to consult the following sources for further insight into the subject—Berg et al., 1981; Braun, 1989; Clark and Ciolkosz, 1988; Coates, 1974; Coates and Kirkland, 1974; Crowl, 1981; Crowl and Sevon, 1980; Denny, 1956; Denny and Lyford, 1963; Hunt, 1974; Leighton, 1941; Leverett, 1934; Shepps, 1962. See Figure 11 for some possible evidence of glaciation around Pine Creek Gorge. In considering such evidence, it would be well to heed Denny and Lyford (1963, p. 5) in their discussion of local glacial drift:

Strongly weathered gravel, perhaps glacial outwash of pre-Wisconsin age, occurs along the West Branch Susquehanna River and its principal tributaries, Pine, Lycoming, Loyalsock, and Munsy Creeks. . . . Whether such gravels are indeed gla-

cial outwash or whether they are alluvial deposits of nonglacial origin derived from adjacent highlands has never been determined.

Also Crowl and Sevon (1980, pp. 48-51) did not always agree with Denny and Lyford on their interpretation of evidence for glaciation in the Pine Creek Gorge region.

Most creationists who have written on the subject prefer a single episode of continental glaciation after the Flood with possible regional advances and retreats which sometimes are interpreted as multiple glaciations. (See Addendum II for a selected bibliography of creationist writings on glaciation.)

Some speculation is offered on the formation of Pine Creek Gorge based on a Flood-related model. It is assumed that the sediments that formed the Appalachian Plateau were deposited rapidly and also that when the Plateau was uplifted, these sedimentary layers were not fully lithified. Other assumptions are that the uplifted Plateau contained many post-Flood lakes and the climate was such that considerable precipitation likely fell on the region (Oard, 1990). The presence of many lakes, soft sediments and high rainfall likely resulted in the incising of the Plateau (Figure 5) as the runoff began to flow to lower altitudes toward the retreating ocean. Likewise many of the existing lakes could have been emptied due to this drainage from the Plateau.

If these assumptions are valid, a lengthy erosion process would not have been necessary to establish drainage patterns on the Plateau. Steep-sided gulleys would have developed quickly. Runoff water containing abrasive matter removed from the soft sediments would scour the landscape as the water flowed to lower elevations. Thus Pine Creek Gorge could have started forming very soon after uplift.

Prior to a period of glaciation any cols or gaps, if in existence, were likely not very high due to rapid erosion immediately after the Flood. If the cols were completely worn away or nonexistent, the present drainage pattern in Lower Pine Creek would have been established before glaciation and any subsequent glacially dammed water would have flowed southward through the already-existing steep-sided gully south of Ansonia deepening it into the present gorge.

As one drives south on PA 44 toward Jersey Shore, the gently tilted Catskill rocks suddenly show steeper tilting and folding south of Waterville (Figure 12) as one approaches the Allegheny Front. The steep tilting is first noticeable on PA 44 at a location of 41°14'N, 77°20'W (Jersey Shore, Pennsylvania quadrangle, USGS topographic map). It is suggested that the uplifted strata could have formed a dam south of Waterville (the gorge is deepest at this village) blocking the south-flowing streams with the formation of small finger lakes in the lower Pine Creek drainage system. If glaciation blocked the northeast drainage out of Tioga County, this dammed water, plus the glacial meltwater, would have extended the postulated finger lake in Pine Creek Gorge to the north in the valley above Ansonia forming a large body of water in this region. The enormous pressure of water on the dam, the high amount of precipitation, the continued tectonic activity at the Allegheny Front along with the unlithified condi-

tion of the sediments in the dam would have contributed to the dam being breached. The subsequent erosion by the sediment-laden water draining toward the south would have scoured the already dissected Plateau even deeper along the path of Lower Pine Creek. This erosion would have eradicated the dam and destroyed any evidence of the postulated lakes. This tentative post-Flood scenario is offered as another possibility for the origin of the drainage system of Lower Pine Creek and Pine Creek Gorge.

Summary and Conclusions

Postulated mechanisms for the formation of Pine Creek Gorge have been reviewed. Also speculation for the development of the gorge within a young earth model has been offered. The latter model suggests the following possibilities:

1. Deposition of the sediments of the Appalachian Plateau in late stages of the Flood or immediately after the Flood.
2. Erosion of semi-consolidated sediments during or immediately after deposition.
3. Considerable precipitation and/or outflow water from the Plateau to cause (2).
4. Dam breaching or drainage divide overflow caused by (3).
5. Drainage patterns developed quickly with the subsequent lithification of sediments to stabilize these patterns.
6. Glaciofluvial water flow further deepened the drainage path in the gorge.

Appendix I

Debris Slides and Slumping in Pine Creek Gorge

Human activity in Pine Creek Gorge has been intense in the past. Many sawmills and logging railroads were active in and around the gorge. Hemlock (*Tsuga* sp.) was removed to be used in the tanning of leather and white pine (*Pinus strobus* Linnaeus) was cut for lumber (Taber, 1972). Until recently, the Penn Central ran trains through the gorge—the tracks having been removed a few years ago. Also a severe flood occurred in the area in 1832 (Clover, 1958, p. 10).

These activities probably disturbed much of the surficial geology in the gorge and any remaining evidence of a prior lake likely has been destroyed. During the logging era, much of the tree cover was removed. The roads, trails, logging slides, etc. probably encouraged debris slides and slumping during periods of heavy rainfall. While on the field trips to the gorge, we found evidence of recent debris slides (Figure 13), washout (Figure 14) and slumping (Figure 15). For other discussions of these geomorphic phenomena on the Appalachian Plateau, see Wilshusen, 1979; Jacobson et al., 1989.

Acknowledgments

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Glossary

- Clastic—pertaining to a rock or sediment composed primarily of fragments derived from pre-existing rocks or minerals and transported some distance from their place of origin
- Col—A saddle-like depression in the crest of a mountain ridge or the lowest point on a ridge
- Cyclothems—sedimentary cycles that include coal beds
- Epeiric—pertaining to an inland sea
- Glaciofluvial—pertaining to meltwater streams flowing from glaciers and the deposits made by such streams
- Glaciolacustrine—pertaining to deposits in glacial lakes
- Prograde—to grow seaward by the accumulation of sediments; deltas often prograde
- Turbidites—sediments deposited from turbidity currents

Addendum I

Geomorphic System of W. M. Davis

W. M. Davis developed his geomorphic system using the rivers and valleys of Pennsylvania as examples. This selected bibliography starts with his paper and the later references are in chronological order. These later papers have ample bibliographies for further study.

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- For a brief creationist evaluation of the Davis geomorphic system see Austin, S. A. 1983. Did landscapes evolve? *Impact* No. 118. Institute for Creation Research.

Addendum II

Selected Bibliography of Creationist Writings on Glaciation and Ice Ages

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- _____ 1972. Deep ice and the young earth. *CRSQ* 9:72-73.
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- _____ 1976. Volcanoes and glaciers: a connection? *CRSQ* 13:173.
- Burdick, C. L. 1978. Evidence of glaciation in Wisconsin. *CRSQ* 14:222-224.

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- _____ 1990. The evidence for only one ice age. *Proceedings of the Second International Conference on Creationism*. 30 July-4 August. Volume II. Creation Science Fellowship. Pittsburgh, PA. pp. 191-200.
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BOOK REVIEWS

Of Pandas and People: The Central Question of Biological Origins. Second edition by Percival Davis and Dean H. Kenyon. 1993. Haughton Publishing Company. Dallas, TX. 170 pages. \$18.00 hardback.

Reviewed by Wayne Frair**

Two types of pandas (giant and red) are native to the bamboo forests of southwest China. Both share many similar features including internal organs, behavior and sesamoid-bone "thumbs" for stripping the leaves off bamboo shoots. Even though the two pandas are alike in many ways, the giant panda is classified in the bear family and red panda in the raccoon family. Are the many similarities between the two types due to descent from common ancestry (homology), due to living in like habitats (convergence), or because they reflect design?

Using the panda as only one example the authors of this book authoritatively make an impressive case against evolution and the "intelligent design." This design would be "analogous" to the comparison of the head of a U.S. president on Mt. Rushmore in South Dakota with the Old Man of the Mountain in New

Hampshire. The former which was carved by man is evidence of intelligent design; whereas the latter is a natural rock formation which resembles a human head.

Various examples of design are explained in the six chapters which cover the origin of life, genetics, macroevolution, the fossil record, homology and biochemical similarities.

The book is well-illustrated with color drawings and photographs, has a helpful glossary and index, some word pronunciations in the text, a page with biographies of authors, and references at ends of chapters. Academic Editor for the book was Charles B. Thaxton. Two others, Mark D. Hartwig and Stephen C. Meyer wrote "A Note to Teachers," which is an 11-page chapter at the end of the text. I found this particular chapter to be especially valuable in supporting and justifying the purpose of the book and in conveying a good understanding of the scientific method.

Pandas was written to be used as a supplement to "standard" biology texts assigned in high schools and colleges. The book may be somewhat advanced for an unmotivated high school student in an entry level course. But upper level high school and college students should find it very helpful. Biologists in various fields, and even more importantly, teachers at all levels, should read this book. The authors say:

*Editor's note: The first edition of this book was reviewed by Trevor Major. 1990. *CRSQ* 27:38.

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By using this text in conjunction with your standard basal text, you will help your students learn to grapple with multiple competing hypotheses and to maintain an open but critical posture toward scientific knowledge. As students learn to weigh and sort competing views and become active participants in the clash of ideas, you may be surprised at the level of motivation and achievement displayed by your students (p. 154).

At this time many evolutionists with stress upon “natural selection” as a mechanism are proclaiming evolution to be a fact. But this book emphatically is opposed to evolution.

In sum, then, only in the most trivial sense—change over time—can evolution be considered a fact. Far from being a legitimate reason for avoiding alternative views, the alleged “fact of evolution” underscores precisely why a book like *Pandas* is so necessary. If students are to achieve true scientific literacy, they must learn to distinguish fact from supposition. A curriculum that blurs this distinction serves neither the students nor society (p. 157).

The authors indicate that evolution does not belong with observable, repeatable and falsifiable scientific theories.

... the events which produced the fossil record are historical (singular) rather than repeatable, like the motion of the planets, for example. Such scenarios about events that are done and gone win our allegiance by being reasonable in light of the total evidence, not because they are proven. Without observation or testing, as could be done for a theory of planetary motion, there is no “proof” or “disproof” possible (pp. 87-88).

With regard to Darwin’s view of human “evolution” the authors say:

It is interesting to note that in his book, *The Descent of Man*, Darwin did not cite a single reference to fossils in support of his belief in human evolution. Clearly his original idea of human evolution did not grow out of a study of human fossil evidence, but out of a previously held opinion about the origin of man. The same is true of many researchers today (p. 107).

The concept of intelligent design is not new, for it is the basis of the ancient concept of teleology. But Charles Darwin and more recently Richard Dawkins interpreted apparent design as illusory.

Like Darwin himself, Dawkins acknowledges that biological organisms appear to exhibit remarkable design. Yet both men claim that this appearance is an illusion, produced entirely by random variation and natural selection. Blind nature mimics intelligent design (p. 156).

Authors writing in *Pandas* want to turn thoughts back to what they believe very strongly is “a plausible alternative to the blind watchmaker thesis (p. 157). They say:

Intelligent design, by contrast, locates the origin of new organisms in an immaterial cause: in a blueprint, a plan, a pattern, devised by an intelligent agent (p. 14).

... the plausibility of apparent design has suffered, while the rationale for reconsidering real design has grown stronger (p. 126).

It is interesting that Charles Darwin and Alfred Wallace, who presented natural selection to a listening world in 1858, later had disagreements because “Wallace believed that the human brain was the result of intelligent design. Darwin disagreed . . .”, and he held “that man evolved by natural means from some nonhuman creature” (p. 107).

Intelligent design is responsible for the fully-formed organisms that appear in the fossil record without intermediates linking them to something else. In fact DNA, proteins, metabolic pathways, cells, interacting systems (chemical and physical), genetics and sophisticated adaptations all bear testimony to intelligent design. But just what is this “primeval intellect” which is a successor of natural selection? Is “it” God? The authors do not say, but they carry their discussion primarily on the back of observational data from the physical world. I see their text as a bridge between science and philosophy (religion). On the last page of the book it is said that:

... the concept of design implies absolutely nothing about ... the existence of the Christian God. All it implies is that life had an intelligent source. ... Even if the design hypothesis were religious, however, criticizing it on that basis begs the question of whether it is scientifically warranted. In science, the origin of an idea is supposed to be irrelevant to its validity. What matters is not the source but whether the idea is logically consistent and empirically supportable (p. 161).

The convincing quality of the evidence and the fairness and caution expressed by Davis and Kenyon is illustrated by their discussion of the polymeric macromolecules considered to be the chemical basis of life itself:

The experimental work on the origin of life and molecular biology of living cells is consistent with the hypothesis of intelligent design. What makes this interpretation so compelling is the amazing correlation between the structure of informational molecules (DNA, protein) and our universal experience that such sequences are the result of intelligent causes. This strong analogy leads to the conclusion that life itself owes its origin to a master intellect. One can talk about adding innumerable random mutations, but proponents of intelligent design still wonder: How were such impressive gains in functional information consolidated? It is a fair and crucial question (p. 85).

There have been many changes from the first to second edition of *Pandas*. For instance, errors have been corrected; the final chapter for teachers is new and stronger. There are more references to scientific literature; new and added material in the glossary covers biochemistry, fossils, mammal-like reptiles, the

fossil whale, *Basilosaurus*, *Archaeopteryx*, anthropology, blood clotting, and proteins. If you enjoyed the first edition, you will like this one better.

I spotted very few errors in this second edition, but with regard to Ostrom's view that *Archaeopteryx* was an insect catcher (p. 106), I understand that today Ostrom is somewhat less than zealous about promoting this view.

Two main prongs of the creationist movement are (1) emphasis upon a supernatural creator GOD and (2) the concept of separate unrelated created types (kinds) of plants and animals. The *Pandas* book strongly supports the latter with good science. With its stress upon intelligent design using good science, the book points in the direction of the former in a way that is acceptable in public schools and in a religiously neutral scientific community. I strongly recommend this book, and feel that it should be read by all teachers and be on high school and college reading lists.

Originations of Life from Volcanoes and Petroleum: A Scientific Theory Opposed to Evolution by Donald E. Tyler. 1983. Published by the author. 1092 SW 2nd Ave., Ontario, OR 97914 and printed by Ryan Gwinner Press. Portland, OR. 128 pages. \$10.95 paperback.

Reviewed by Wayne Frair*

When I first glanced at this book I became awed at the miracles it presents—not one but multiple miracles! I read the whole book more carefully—still awed—but thinking more and more that perhaps members of the scientific community should be challenged to probe at more depth the issues presented.

The author, a retired Doctor of Medicine, draws upon a wealth of information from molecules to biogeography in support of his "theory of multiple originations and creations." However, when he says "creations" he apparently means development because God is not mentioned in the book; nor are there references to the Bible or other "religious" writings. Tyler's conclusions are based upon observational data.

His originations begin with an early earth. Then:

1. Trapped bubbles of gases within the hot molten substance (or magma) inside the earth react to form chemical compounds composing petroleum.
2. Hot petroleum erupts or oozes (seeps) from young volcanoes.
3. This petroleum then reacts with water and other common chemicals to produce the stuff of life—DNA, RNA, and proteins.
4. Other chemical substances including fatty acids, phosphates, and porphyrins, which are necessary for life are present in the petroleum-nucleotide-protein soup.
5. When "conditions are right, cells including living organisms are formed.
6. "Some of these single-celled living organisms are germ cells of many types (p. 46).
7. The environment at this particular time determines what will survive.

8. In an atmosphere lacking oxygen, only anaerobic bacteria and plants can survive.
9. Anaerobic bacteria and aquatic plants will release oxygen into the water.
10. After subsequent petroleum seepages and more germ cells, the survivors can include aquatic animals with low oxygen requirements.
11. When there is adequate oxygen in the water, germ cells of sponges, worms, snails, crabs, shrimps, etc. can develop. Geologically, this would have occurred during the Cambrian Period.
12. Later, the atmosphere permits land plants to flourish.
13. The first land animals to survive will be ones which require little oxygen; later, those needing more oxygen can thrive.
14. During the currently-understood geological ages there would have continued to be an abundant supply of multiple varieties of petroleum-produced germ cells ready to develop in suitable environments.

Tyler has reached these conclusions inductively based upon observable information, for he recognized that scientific evidence does not support evolution. He says, "It is simply time that the theory of evolution was discarded" (p. 117). Also Tyler would hold to fixity of species and even lower taxonomic categories. For example, the honeycreeper birds in Hawaii developed independently with similar general morphology but different beaks.

Interestingly, in his new theory regarding humans, Tyler says, "some or all races of *Homo sapiens* originated separately on various land masses corresponding to the general areas in which they are natives" (p. 120). For example, Black Africans are from Africa, and "North American natives probably originated in Southern California where there are numerous petroleum seepages" (p. 120).

Tyler's book is printed on high quality paper and has a sewed binding. There is a table of contents at the beginning but no index. There are very few direct references to the literature. I counted only three footnotes. At the end are 2¼ pages of "Selected Bibliography" which interestingly lack currently popular creation or anti-evolution books.

Tyler's concept solves many evolutionary problems including why organisms in different parts of the world can be similar. When evidence of proximate genetic continuity is absent, the evolutionist is driven to concepts of parallelism or convergence—no problem for multiple originations! Mosaics like the platypus, kangaroo and kiwi merely developed from germ cells having DNA which led to development of organs characteristically found in diverse types of other organisms.

The author has written scientific papers and other books which are obtainable from him (see for example 1970, 1986). These works contain substantial observational data. Tyler is an incisive and independent thinker, avant-garde, and not shy about building speculations upon foundations which some critical readers will feel have uncertain sections. According to my knowledge, Tyler is not widely recognized by creationists, and his originations book should not be thought of as creationist except in the sense that it is supportive of separate

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origins of genetically unrelated organisms. The author appropriately recognizes the serious problems that scientists have fitting factual data into an evolutionary synthesis.

The position that living types originated from germinal material has been advanced previously by many people including Augustine (*ratio seminalis*, 4th-5th century AD) and James L. Baldwin (creo-evolution, 1957). The germinal concept even correlates with part of the Directed Panspermia view promoted by a nobelist and others in the 1970's, but not now popular.

Is Tyler possibly a prophet ahead of his time? I think his hypothesis is intriguing—and it does solve many evolutionary conundrums—but as presented in this book it still is quite soft. The breadth of coverage in the book has limited its depth in, for example, cytology, chromosome studies, and biochemistry.

Talk about miracles—just how could the tens of thousands of different appropriate polymeric proteins, including enzymes for building DNA, form and get together with thousands of other types of organic and inorganic molecules in functional cellular organelles? Just to produce all the human races these events would have had to have happened in almost identical ways multiple times. Tyler himself believes that the answers to these types of questions will be much simpler than we envision today. Maybe he is correct.

Personally, I favor all the empirical research that appropriately can be done to answer basic issues raised in this book. Whether we understand few or many details about what could have happened during early times of creation, it always will be appropriate to proclaim that, "In the beginning GOD created . . ." Genesis 1:1.

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Science and Biblical Faith: A Science Documentary by Thomas G. Barnes. 1993. Distributed by Creation Research Society Books. Kansas City, MO. 191 pages. \$12.00.

Reviewed by Emmett L. Williams*

This is an unusual and reflective Bible-science book well worth reading. The book contains testimonial-length biographies of Christian men of science as well as brief discussions of their scientific achievements. We live in a generation where creationists ignore the work of those who have gone before them; Tom Barnes' book is a remedy to this narcissism.

The scientific creationists recognized by the author are as follows:

Lord Kelvin — developed age-limits on the earth and sun as well as the absolute temperature scale.

Louis Pasteur — established the law of biogenesis, considered the "father" of microbiology, produced an inoculation for anthrax and one for hydrophobia.

Isaac Newton — the "father" of classical physics known for his establishment of the binomial theorem and calculus. Other work included the color composition of white light, new type of telescope, paths of comets, law of gravitation and the laws of motion as well as Scriptural commentaries.

Johannes Kepler — heliocentric theory, paths of planets around the sun and the moons of Jupiter.

Michael Faraday — noted for his experiments and demonstrations of electromagnetism, laws of electrolysis, electromagnetic induction and field theory.

James Maxwell — unified the fields of electricity, magnetism and optics and produced four electromagnetic field equations.

Ernest Rutherford — "discovery" of the nucleus of atoms.

Lord Rayleigh — pioneer work in acoustics and light propagation, found a new element—argon.

Joseph Thomson — "discovery" of the electron, neon isotopes; equated mass with energy and analyzed positive rays.

W. R. Thompson — refuted Darwinism in the introduction of *The Origin of Species*.

Walter Lammerts — Plant breeder and founder of Creation Research Society.

Harold Slusher — developed modern age-limits to earth and sun; offered some refutations of the view of an old universe.

Robert Gentry — work on radiohalos.

Donald DeYoung — refuted modern theories of the naturalistic origin of the moon.

Dr. Barnes prefers classical physics solutions as opposed to modern physics analyses. He feels the modern methods are too complicated mathematically and that classical physics offers simpler physically-visualizable models. Much of his work in the last 15 years has been devoted to this end. Thus he recognizes those scientists who have similar views as his.

Louis Essen — inventor of the atomic clock.

Petr Beckmann — editor of *Access to Energy* and *Galilean Electrodynamics*.

The author also presented some remarks by Harold Armstrong, a former editor of the Quarterly, on what went wrong in physics in the early part of this century (pp. 153-156). Some chapters in the book are devoted to Dr. Barnes' work on the young age of the earth, electromagnetic feedback and light propagation through a medium. Included are remarks on the creationist high school biology textbook written by members of the Creation Research Society and the legal situation in the United States in relation to the origins controversy.

Dr. Barnes realizes that Creation is the ultimate origin of science since it is the only view that is consistent with the first and second laws of thermodynamics (pp. 23, 180). Scientists who reject a supernatural view of origins and deny any creative activity by a supreme being philosophically "cut off their noses to spite their faces." The modern view that chaos and disorder can bring forth order naturally is absurd to the extreme and is basically hostile to science itself.

This is a delightfully readable book of biography and science offered in a palatable manner and even physicists who disagree with the author's emphasis on classical physics will enjoy reading it. Also the beautiful cover makes the book an attractive gift for science buffs.

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