

CRSQ

CREATION RESEARCH SOCIETY QUARTERLY



Volume 2

September 1998

Number 35

Creation Research Society Quarterly

Volume 35

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Celebrating Our 35th Year of Publication

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Back Cover by Carl R. Froede Jr., P.G.

Front Cover

Cover design by Michael Erkel, Michael Erkel & Associates, 1171 Carter St., Crozet, VA 22932.

The *Creation Research Society Quarterly* is published by the Creation Research Society, P. O. Box 8263, St. Joseph, MO 64508, and it is indexed in the *Christian Periodical Index*.

Send papers on all subjects to the Editor: Eugene F. Chaffin, 715 Tazewell Ave., Bluefield, VA 24605. Send book reviews to the Book Review Editor: Don B. DeYoung, 200 Seminary Dr., Winona Lake IN 46590.

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Haec Credimus

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

Editor's Comments

This September issue continues the 35th publication year of the *Creation Research Society Quarterly*. We are pleased to present in this issue some important articles illustrating the varied and diverse interests of CRS members. We hope that more will see the value of the *Quarterly*, and support the spread and credibility of the creation worldview by becoming dues paying members.

When you consider the geological and archaeological field work in which they get involved, Carl Froede and Brian Rucker certainly cannot be accused of being "arm-chair scientists." In this issue, they present results of exploration of coastal Florida for evidence of former sea level positions, and attempt to fit the findings into a history consistent with the rebound from the Global Flood. Their description of paleo-Indian sites, sand dune fields, and paleo-forests will surely be of interest.

Recently, the *Quarterly* has been blessed with a series of contributions exploring different techniques for identifying Genesis kinds. Celedonio García-Pozuelo-Ramos offers here some statistical studies of dog kinds and dog dentition and their implications regarding fossil primates.

Eric Penrose presents some enlightening discussion about the effect of antibiotics on bacteria, and the implications for the limits of variation of biological kinds. Mr. Penrose's graduate studies have helped delineate the question: does the actual picture illustrate Darwinian

natural selection, or what more realistic conceptions are possible?

All too often, evolutionism tries to portray creationist concerns as being "outside of science" and to present creation worldviews as being unacceptable. The realistic situation is that the roots of our knowledge systems are not complete without the proper view of the boundary between philosophy and science. Recently Associate Editor John Reed, along with others, has been involved in this continuing study. Jerry Bergman presents his viewpoint in this issue.

In some interesting "Notes from the Panorama of Science," Creation Research Society President Emmett Williams, along with CRS board member Robert Goette, presents a study of some trace fossils from Big Bend National Park, Texas, and they join Carl Froede and George Howe in trying to further our knowledge of some geological features peculiar to Texas and southeast Oklahoma. Could these features indicate the catastrophic sedimentation and tectonic movements along a former continental boundary?

Letters and book reviews continue to provide a source of friendly controversy for the readers. If you have something to contribute of this nature, we are certainly interested!

Eugene Chaffin
Editor, *CRSQ*

Book Review

That Their Words May be Used Against Them by Henry M Morris
Master Books, Green Forest, AR. 1977. 487 pages. \$22.
Reviewed by Don B. DeYoung

Twenty years ago Dr. Henry Morris was invited to Grace College in Winona Lake, IN for a Creation seminar. The only notes he seemed to use were quotes and references written on index cards. His collection of quotes has continued to grow over the years. Now these valuable gleanings from decades of books and periodicals are available in book form.

This compilation consists of about 3,000 quotes from evolutionists. Their words show the tentativeness and frequent contradictions of evolutionary thinking. The book title reminds one of Job 15:6, "Thine own mouth condemns thee, and not I, yes, thine own lips testify against thee."

These are not the most common quotes that have been somewhat overused by creationists. Instead Dr. Morris has provided us with much new material that had become lost in the library periodical and book stacks. The quotes are organized into 15 chapters and 45 subheadings. The cosmic evolution quotes date from 1953-1996; Fossil graveyards cover 1947-1993. Some technical quotes also include formulas.

A CD-ROM is included with word and author search engines. The included book index includes 1000 names. Many thanks to Dr. Morris for compiling this useful research tool.



Archaeological and Geological Evidence of a Recent and Rapid Sea-Level Rise from Sites Along Coastal Florida

Brian R. Rucker and Carl R. Froede Jr.*

Abstract

Uniformitarians propose that the last major sea-level rise began with the close of the Wisconsin Ice Age 14,000 to 18,000 years ago. Approximately three to five thousand years ago sea level stabilized to its near-present-day level. According to uniformitarian archaeological estimates paleo-Indian cultures have existed in Florida for 10,000 years. Many paleo-Indian sites have been identified across the state with some found underwater, both on and offshore. Large offshore submerged sand dune fields are believed to have become drowned with the last rise in sea level. Many of

these same subaqueous sand dune fields contain *in situ* tree stumps within the swales, reflecting once living maritime forests. These former forests existed on the continental shelf at various sea-level lowstands during the Pleistocene. We propose that the now submerged paleo-Indian sites, sand dune fields, and paleo-forests reflect former subaerial environments that were rapidly drowned with the last sea-level rise approximately three to six thousand years ago (associated with the close of the Young-Earth Flood Model—Ice Age Timeframe).

Introduction

Uniformitarian geoscientists believe that the Pleistocene Ice Age ended approximately 14,000 to 18,000 years ago with the termination of the last Wisconsin glacial interval (Andrews and Barry, 1978; Curray, 1961, 1964, 1965; Dolan and Lins, 1986). Global sea level position has risen from this period until a few thousand years ago. Today's sea level position is believed to reflect basically three to six thousand years of near constant levels (e.g., Coleman and Smith, 1964; Curray, 1965; Dolan, Hayden, and Lins, 1980; Dolan and Lins, 1986; Scholl, Craighead, and Stuiver, 1969).

The Young-Earth Flood Model does not support the current uniformitarian model of Earth history, rather we follow our own Bible-based timescale (e.g., Froede, 1995; Reed, Froede, Bennett, 1996; Walker, 1994). As Young-Earth Creationists we can accept the possibility that sea level has probably not changed drastically since the close of the single Ice Age approximately three to six thousand years ago. While we will report uniformitarian dates within this work we do not support or believe them to reflect actual Earth history. We support a six to ten thou-

sand year old earth, in line with what Scripture would have us believe. However, we acknowledge that further research is required to reconcile the disparity between the Pleistocene Ice Age eustatic sea level changes and ^{14}C dates, and our own Bible-based understanding of Earth history.

Dauphin Island Revisited

Dauphin Island, Alabama provides a working laboratory for gaining insight into the coastal geomorphic processes presently occurring along the northern Gulf Coast, and specifically the Florida Panhandle. Features easily observable at Dauphin Island are not as easily identifiable along Florida's barrier island coast due to commercial development. However, similarities between Dauphin Island and the Florida Panhandle barrier islands are expected with regard to changing environments (both past and present) and beach processes.

Previously, Froede (1995, 1996) discussed the occurrence of a paleo-maritime forest which he found exposed within the surf zone on Dauphin Island (Figures 1 and 2). English and Haywick (1996) also reported the occurrence of tree stumps in several feet of water around the end of the Dauphin Island Fishing Pier approximately 900 feet from the shoreline. Paleosols were also noted by Froede

*Brian R. Rucker, Ph.D., P.O. Box 284, Bagdad, FL 32530.

Carl R. Froede Jr., B.S., P.G., 2895 Emerson Lake Drive, Snellville, GA 30078-6644.

Received 30 January 1997; Revised 16 April 1998



Figure 1. A paleo-maritime forest exposed in the surf zone at Dauphin Island, Alabama. If sea level rises slowly then the sand dune field rolls landward burying the maritime forest only to expose it again along the surf zone. Wave action, currents, and boring creatures will destroy any unprotected wood exposed within the surf zone. In this case the *in situ* trees are only protected by burial in the beach sand. A rapid rise in sea level would likely spread migrating sand across the former paleo-maritime floor and bury at minimum the lower portions of the existing forest thus serving to protect this portion from erosion as sea level would rapidly move landward.

as exposed within the swash zone along sections of the southeastern side of Dauphin Island. These features suggest that sea level has risen somewhat rapidly as a function of the end of the recent single Ice Age, and also as a function of land subsidence (i.e., sediment/strata consolidation and compaction). Froede (1995) also noted other Gulf and Atlantic Coastal beaches where paleo-maritime forests are exposed within the surf zone. All of these now exposed paleo-forests reflect a dynamic beach/barrier island system which has been impacted by the recent and rapid rise in sea level.

Sea Level Still-Stand Indicators

Many sea level positions have been postulated using geomorphic data collected along the Florida Peninsula (Donoghue and White, 1995; Locker, Hine, Tedesco, and Shinn, 1996; Milliman and Emery, 1968; Scholl, Craighead, and Stuiver, 1969; Scholl and Stuiver, 1967) as well as other Atlantic and Gulf Coastal areas (Coleman and Smith, 1964; Curray, 1961, 1964, 1965; Kaye and Barghoorn, 1964; Schroeder, Shultz, and Pilkey, 1995). The reasoning behind the use of the Florida shelf is the belief that this area has been tectonically stable since the Pleistocene (at least from 35,000 years before present

[YBP]). Hence, sea level would change and the land surface would remain stable, thus providing a means of measuring relative sea level change over the proposed vast period of time. However, Otvos (1995) has cautioned against comparing the Atlantic sea level record with that of the Gulf Coast, and he suggests that sea level highstands lack significant means of correlation between the two areas. Additionally, he suggested that many surface features previously identified as sea-level highstand markers on the north central Gulf Coastal Plain are structural lineaments and not actual sea-level indicators (Otvos, 1981). Many questions and issues remain to be resolved in addressing and correlating various Pleistocene sea level positions, especially along the Southeastern United States Atlantic and Gulf Coasts.

Despite the potential for correlative error, many sea level highstands have been documented around the Southeastern United States by comparing relict shoreline features such as scarps, swales, and dune ridges (Brenneman and Tanner, 1958; Gremillion, Tanner, and Huddlestun, 1964; Healy, 1975; Ludwick, 1964; MacNeil, 1950; Tanner, 1992, 1994; von Drehle, 1973; Winker and Howard, 1977). What is missing are evidences which document sea level lowstand positions.

Various studies have lead to the recognition of older sediments (identified as "relict sediments") which lie submerged on the Gulf Coast continental shelf. These deposits formed at a lower sea level position during the Pleistocene (e.g., Curray, 1965; Donoghue, 1989; Emery, 1968; Gould and Stewart, 1955; Hyne and Goodell, 1967; Lawrence, 1974, p. 97; Kwon, 1969; Vause, 1959). These



Figure 2. Pine trees undermined with approaching surf zone. Without sand dune roll-over to bury and protect the forest it is subjected to direct undermining of its sand/soil support. In this case no trees of the maritime forest are preserved with the slow landward advance of the surf zone. Only rapid sea level rise would prevent the wash-out of this forest. Hence, finding tree trunks offshore underwater suggests a rapid sea level rise.

relict sediments remain unburied as a result of rapid sea level rise, and the resulting loss of additional sedimentary input (Boone, 1973; Emery, 1968; Stone et al., 1992). We propose that these subaqueous features (relict sediments in combination with the offshore paleo-maritime forests, buried peat deposits, and sand dune ridges) can provide us with valuable information about sea level lowstands when they can be properly identified and correlated. Additional evidence such as Indian relics and artifacts found both in now submerged limestone caves, along river courses, and in areas offshore, reflect human habitation before the last major sea level rise (Anuskiewicz, 1988a, 1988b; Bense, 1994; Clausen, et al., 1979; Dunbar, 1988a, 1988b; Faught, 1988a; Rucker, 1996; Rupert, 1988). We will review documented evidence which reflects a recent and rapid sea level rise (associated we believe with the end of the Young-Earth Flood Model—Ice Age Time-frame) for a portion of the submerged continental shelf along the Florida Coast.

Paleo-Indian Artifacts and Environments

The oldest physical evidence of human existence in the state of Florida comes from a wooden stake found 33 to 37 feet below the water surface at Little Salt Spring, near Sarasota (Figure 3). The piece of wood ranged in age (Carbon-14 method) from 12,078 YBP (Bense, 1994) to 12,030 YBP (Clausen et al., 1979; Stamm, 1994).

According to Bense (1994, p. 65) the environment of the Southeastern United States was different at the time of early paleo-Indian occupation:

The most important differences were vegetation and sea level. At the onset of the Archaic period (9998 YBP), sea level was 90 ft lower than today, and most of the Southeast was covered with an oak-hickory forest. (parenthesis ours)

There is mounting evidence which documents that paleo-Indians (early Native Americans) not only lived in areas which are today found onshore, but at many sites which are found offshore (Figure 3). An interesting comparison can be made between the dates when the paleo-Indians lived in Florida and the uniformitarian geological sea level changes during the close of the Pleistocene (Figure 4). The physical evidence appears to indicate that there was a recent and rapid sea-level rise likely caused due to Ice Age climatic phenomena. Interestingly, some of the Florida offshore paleo-Indian sites reflect a sea level rise event which is not currently recognized within the uniformitarian sea level curve¹.

During the Pleistocene, sea level was believed to have been vastly lower, ranging from 60 to 380 feet lower than today's sea level. At the lowest levels the western coastline of peninsular Florida possibly extended 40 to 70

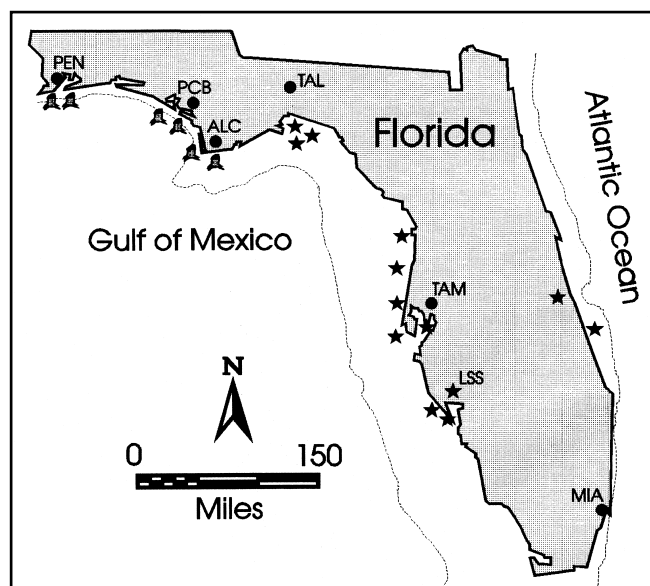


Figure 3. Map of Florida showing the areas with documented paleo-maritime forests (stump symbol) and undated archaeological sites (star symbol). Modified from Dunbar, 1988a and Burgess, 1977. Bathymetry contour value is 60 feet (Tanner, 1992, p. 14) and possibly represents the area available for habitation following a drop in sea level (during the Wisconsin Ice Age glacial). All of these underwater locations suggest a rapid sea level rise in the recent past. Abbreviations: PEN—Pensacola; PCB—Panama City Beach; ALC—Apalachicola; TAL—Tallahassee; TAM—Tampa; MIA—Miami; LSS—Little Salt Spring.

miles offshore exposing a considerable portion of the continental shelf (Doyle et al., 1984) [Figure 3]. Caribbean land routes, broken by relatively short water gaps, bridged Florida with South America (Bullen, 1975; Cockrell, 1980; Dunbar, Webb, and Faught, 1992; Garrison, 1992; Hyne and Goodell, 1967; Kraft, Belknap, and Kayan, 1983; Lazarus, 1965; Milanich, 1994; Stright, 1986; Thomas and Campbell, 1993; Wolfe, Reidenauer, and Means, 1988).

A recent announcement from anthropologists (who are not adherents to the Young-Earth Flood Model) for

¹Uniformitarians have documented several Holocene sea-level fluctuations along the Gulf Coast (Dolan, Hayden, and Lins, 1980; Stapor, Mathews, and Lindfors-Kearns, 1987). However, these features have not been formally linked together into a comprehensive Holocene sea-level curve for the Gulf Coast. This is because the individual indicators of sea-level change do not directly correspond to one another. Pleistocene sea level curves remain in a flux over the rate and number of changes which are believed to have occurred with the close of the Wisconsin Ice Age.]

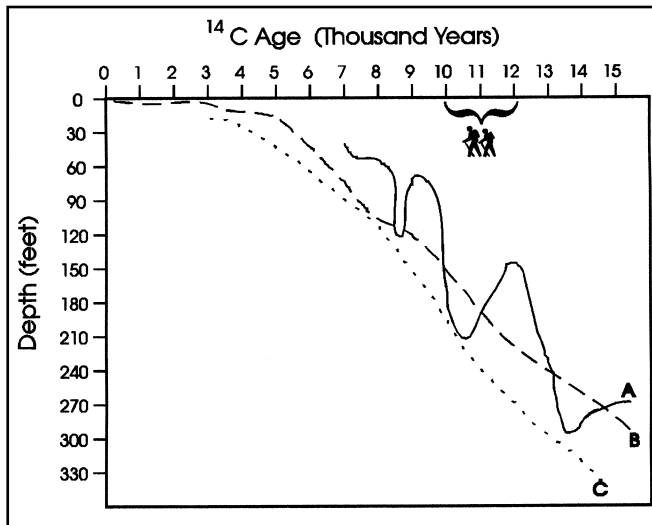


Figure 4. Three uniformitarian sea level curves for the Gulf of Mexico suggest that sea level has been rising for the past 15,000 years. This chart suggests that the Gulf Coastal sea level basically stabilized about three to four thousand years ago. However, inundated Florida paleo-Indian locales suggest a much more recent sea level rise. The human figure represents when man is believed to have appeared in Florida. Modified from sea level curves found in: A) Curray, 1960, B) Curray, 1965, and C) Fairbanks, 1989.

man's arrival in North America is ca. 14,000 YBP; scientists argue about the exact dates but generally agree that man arrived in North America between 15,000 to 11,000 YBP (Anderson, O'Steen, and Sassaman, 1996; "Big barbecue sets new date," 1996). For many years scientists questioned the whole idea of early man living in Florida during the Pleistocene. Proposals that these paleo-Indians once inhabited the then exposed continental shelf met with great skepticism. But field work over the last 20 to 30 years has conclusively shown that paleo-Indians lived in Florida and were coexistent with mastodons, giant ground sloths, saber-toothed tigers, and other Pleistocene megafauna. When human and Pleistocene fauna remains began to be excavated from rivers, springs, and sinkholes — which were oases when sea level dropped creating a higher, and drier Pleistocene Florida — researchers began to turn their attention to potential submerged sites on the continental shelf (Anderson, O'Steen, and Sassaman, 1996; Cockrell, 1980; Dunbar and Webb, 1996; Dunbar, Webb, and Faught, 1992; Lazarus, 1965; Leverett, 1931; Milanich, 1994).

Archaeologists began to predict where potential paleo-Indian sites could be found by correlating these features with early Indian patterns of subsistence. Ridges along relict river channels became possible sites for Indian middens (refuse heaps which accumulated at campsites). Sinkholes would have been utilized as freshwater sources;

and rock outcroppings would have been sites of weapon-producing quarries for these early Indians (Anuskiewicz, 1988b; Dunbar, 1988a; Faught, 1988a; Garrison, 1992; Hyne and Goodell, 1967; Jordan, 1951; Wolfe, Reidenauer, and Means, 1988).

Paleo-Indian Sites as Sea Level Still-Stand Indicators

Florida sites reflecting a lower sea level position during paleo-Indian times are numerous. On the Atlantic coast, submerged Indian remains have been located at Vero Beach, South Ponte Vedra Beach, and Douglas Beach. At Douglas Beach, near Fort Pierce, a site was found approximately 1,969 feet offshore from the beach, in water depths ranging from 10 to 39 feet. Radiocarbon tests at Douglas Beach have yielded dates ca. 5,000 YBP (Bullen, 1975; Cockrell, 1980; Stright, 1988). On the Gulf side of Florida, numerous Indian oystershell middens have been located in Tampa Bay, with artifacts and fossils continually being dredged from it, including paleo-Indian projectile points and other tools, Pleistocene vertebrate fossils, mineralized human bones, and even a mineralized wooden bird effigy (Cockrell, 1980; Dunbar, Webb, and Faught, 1992; Stright, 1988; Warren, 1971).

Early Native American artifacts have also been found in the shallow waters of Choctawhatchee Bay, in the Florida panhandle (Thomas and Campbell, 1993), but one of the best sources for the Pleistocene paleo-Indian remains has been Apalachee Bay, south of Tallahassee, where a number of inundated sites have been located 0.6 to 6 miles offshore at water depths ranging from 1.5 to 17 feet (Milanich, 1994). The St. Marks, Aucilla, and Econfinia rivers drain into Apalachee Bay, and this has allowed a favorable archaeological study site because alluvial sedimentation is minor to non-existent due to the lack of sufficient flow for sediment transport, and the abundant limestone source rock of the drainage basin (Faught, 1988a). A relict channel of the Econfinia River was identified in 12 feet of water, 2.5 miles offshore. Several submerged paleo-Indian chert quarry sites (in 12 to 16 feet of water - six miles offshore) have been located with artifacts (Dunbar, Webb, and Faught, 1992). Remains of cypress tree roots were also recovered, with radiocarbon dates assigned to ca. 5,000 YBP (Dunbar, Webb, and Faught, 1992; Faught, 1988a, 1988b).

Archaeologists have determined that numerous submerged Pleistocene sites exist in Apalachee Bay, but one of the most striking and potentially promising sites is Ray Hole Spring, 24 miles from the nearest Florida coastline, lying in 38 feet of water. This site is a drowned sinkhole that may have been utilized by early Native Americans. Archaeologists have recovered several large chert flakes

that may have been produced by paleo-Indians. Water-logged live oak wood and oyster shells were also located, and radiocarbon dates assigned to each; the wood was dated at ca. 8,200 YBP, and the oyster shell dated at ca. 7,400 YBP. The wood, and younger oyster shells found at the site, suggest that the spring was originally a freshwater site that later became subject to sea-level rise which eventually supported a shellfish population in a brackish water environment (Anuskiewicz, 1988a, 1988b; Dunbar, Webb, and Faught, 1992).

The excellent preservation of so many Pleistocene and early Holocene paleo-Indian remains from Florida is astonishing. At the Windover wet site in Florida numerous remains were located, and dated to ca. 7,000-8,000 YBP. This particular site also had preserved human brain tissue! Other sites, such as Warm Mineral Springs and the Page/Ladson site on the Aucilla River, have also yielded excellently preserved artifacts, the latter which yielded a deposit of mastodon digesta radiocarbon dated to 12,500 YBP (Anuskiewicz, 1988b; Cockrell, 1980; Cockrell, 1988; Doran, 1988; Dunbar, Webb, and Faught, 1992; Milanich, 1994; Stright, 1988). The offshore underwater sites have also yielded well-preserved remains. Various factors have allowed many of these sites to be preserved, as Cockrell (1980, pp. 140-141) aptly points out:

Common sense tells us that an advancing surf line will destroy a beach-front archaeological site. However, studies of primitive people today and our knowledge of later prehistoric cultures show that Stone Age people would have preferred to live on an estuary or lagoon than on an open beach. This is simply because unspecialized gatherers find more food in shallow estuaries and lagoons than they do on open beaches. Thus we should expect to find their settlements not there but on the inland waterways behind. By the time that a rise in sea level had drowned such a site, accumulating sediments and the depth of overlying water would have been enough to protect it from wave erosion and bottom surge. This supposition proved itself in the excavation of the Douglas Beach site—a site submerged in the Atlantic Ocean off a coastline pounded by surf for much of the year. Despite wave battering, the site is preserved, even to the Pleistocene tree stumps intact beneath the sand.

While on the surface Cockrell's statement appears sound, he assumes that the presence of these artifacts and preserved tree stumps validates where "common sense" would require their complete destruction. We propose that his concept of preservation can only occur when sea level rises in a rapid manner. Otherwise, the churning surf zone would have destroyed these sites (Figures 1 and 2). Various researchers have also reached the same conclusion regarding the need for a rapid sea level

rise (Garrison, 1992; Kraft, Belknap, and Kayan, 1983). At the One Fathom Site, half a mile offshore from New Port Richey, Florida, are the remains of a Deptford Period Indian site, dated to ca. 2,000-3,000 YBP (Lazarus, 1965; Stright, 1988). At Battery Point, near Bayport, Florida, is an inundated native American site dated to 2,998 YBP (Bullen, 1975). At Venice Beach, Florida, in 6.5 feet of water, is an Indian midden from the Formative Period, dated to around 2,000 YBP (Cockrell, 1980; Stright, 1988). All of these sites were preserved because of a rapid sea level rise.

On the Atlantic side of Florida, the evidence of post-Pleistocene rapid sea level rise exists as well, although the present uniformitarian sea level curve fails to reflect this late rapid rise. Inundated Indian sites have been located on the St. Johns River dating to 2,998 YBP. Vero Beach has an inundated site which dates to ca. 2,843 YBP. More evidence that both the Atlantic and the Gulf coastlines have encroached landward can be seen at Jacksonville Beach where the base of a cypress swamp was exposed after a hurricane, and at South Ponte Vedra Beach where clearing operations revealed that trees were once growing at lower elevations than at present (Bullen, 1975). Even more recent occurrences of sea-level rise can be found. Some Indian sites along the Crystal River in Florida were occupied between ca. A.D. 400-600, after which time portions of the sites were inundated (Bullen, 1975). The presence of submerged trees in the shallow water of Choctawhatchee Bay has provided evidence of sea-level fluctuation in historical times (Wolfe, Reidenauer, and Means, 1988). The archaeological excavation of the Spanish colonial city of Santa Rosa Pensacola on Santa Rosa Island in the Florida panhandle, occupied between 1723-1752, showed evidence of a water table lower by two feet for that period (Lazarus, 1965).

One thing is certain. The various dates offered by archaeologists working on early Native American sites in Florida show numerous discrepancies, but generally the recent research has helped to bring the dates for the end of the Pleistocene age closer to the present (Dunbar, Webb, and Faught, 1992; Garrison, 1992; Kraft, Belknap, and Kayan, 1983; Lazarus, 1965; Milanich, 1994; Stright, 1986; Thomas and Campbell, 1993; Wolfe, Reidenauer, and Means, 1988).

Subaqueous Dune Ridges

Offshore along the western portions of the panhandle of Florida are many large sand dune ridges. These submerged sand ridges remain relatively fixed and stable, and are presently beyond the reach of all but the most violent of tropical storms (Hyne and Goodell, 1967; Wolfe, Reidenauer, and Means, 1988). They are recognized as

once being wind-blown dune ridges by the composition and size of their quartz sands (Hyne and Goodell, 1967). They provide evidence of a former lower sea level position. A slow rise in sea level would have moved these sand dunes landward, or the surf zone would have eroded them down to the then existing sea level position. Only a rapid rise in sea level position would have left these sand dunes stranded offshore.

The Case of a Submerged Forest

Other features which support to our view of a recent and rapid sea level rise are *in situ* tree stumps exposed underwater in the swales of various sand dune ridges. These paleo-forests have been found offshore from Pensacola to Apalachicola (Burgess, 1974; Dietz, 1963; Hyne and Goodell, 1967; Lawrence, 1974; Salsman and Ciesluk, 1978) [Figure 3]. Tree stumps found within these areas are still held firmly in place by their roots. The fact that they still exist in a woody state testifies to their recent burial.

The following is a summary of one paleo-forest locale found offshore from Panama City Beach, taken from Burgess (1977). Additional background references and information are provided in parenthesis:

Top secret studies were conducted by the United States Navy off the coast of Panama City Beach in 1961. These tests were conducted to determine if a new device could be used to map the seafloor. This new device was a prototype of the side-scan sonar. During these tests it was noted that the seafloor out on the continental shelf contained a series of sand waves which could only have formed as a result of a lower sea level position. Additionally, it is suggested that these sand waves can only be moved if sea level were at a lower position (see Hyne and Goodell, 1967).

Navy divers were sent to investigate the seafloor in the areas off Panama City where the tests were conducted in order to document the accuracy of the instrument. During these underwater investigations it was noted that tree stumps appeared to be rising up from the seafloor in areas between these sand waves. Further investigation showed that these stumps were in fact the remains of actual trees which formed a forest when sea level was lower in Earth's past (i.e., the Pleistocene). The woody tree stumps were not mineralized or fossilized. Additional investigations further revealed a whole underwater "forest" of these tree stumps as similar to those found along the coastal areas of the panhan-



Figure 5. Photograph showing the ship channel to Saint Andrew's Bay adjacent to Panama City, Florida. The submerged trees were found exposed along the sidewalls of this ship channel following its dredging. Also tree stumps, roots, and humus were found offshore from this area in waters approximately 8 to 50 feet.

dle of Florida today. All of these stumps were found in waters 45 to 65 feet deep with their roots intact. Carbon dating of the wood was conducted by Shell Oil Company and Isotopes, Inc., with the wood age dates ranging between 27,000 to 35,000 YBP.

The age of the wood is older than the last recognized sea level lowstand. So it is proposed that a maritime forest existed immediately offshore of the present shoreline extending along the panhandle of Florida. Sea level then rose resulting in the burial of this paleo-maritime forest due to migrating sand dunes. Sea level then fell (not exposing the forest still buried in sand, rather preserving the forest for tens of thousands of years) then rose again to near present levels.

Woody tree stumps have also been noted during dredging operations associated with maintaining the ship channels at Pensacola and Saint Joseph Bay, to the east and west of Panama City, respectively.

In a Masters thesis project, Marc Lawrence (1974) took up the study of recently uncovered tree stumps associated with the dredging of the ship channel for Saint Andrew's Bay. While dredging the ship channel it was noted that tree stumps became exposed along the edge of the channel side-walls (Figure 5). These trees were found in 25 to 35 feet of water. Lawrence (1974) also documented tree stumps and peat layers in waters as deep as 55 feet.

In summary it has been documented that all of the tree stumps found were still held in place by their roots. The tree stumps were not mineralized in any manner. Carbon dating of the tree stumps has suggested that the tree stumps and woody material found in deeper water (from 20 to 60 feet deep) were part of a forest which existed 27,000 to 35,000 YBP, and was buried and protected from destruction by a covering of beach sand (Lawrence, 1974). The submerged tree stumps (protected from destruction by a covering of beach sand) in waters 10 feet deep were dated to 4.7 to 4.8 thousand YBP (Lawrence, 1974).

One factor which may help date the submerged Pleistocene forest found off Panama City Beach, Florida, is by an analysis of the varieties of trees found. Pines are the most dominant tree found submerged near Panama City Beach. Hardwood tree stumps such as oak, hickory, and elm are found underwater but in fewer numbers. The hardwood forest of the last glacial maximum now located just offshore on the submerged continental shelf is very similar to the vegetation of present-day stands located 20-30 miles north of Panama City (Burgess, 1977; Wolfe, Reidenauer, and Means, 1988). Ecologists theorize that during the last glacial stage the Gulf Coast was then char-

acterized by more hardwood forests, with pine forests becoming dominant only at the end of the Ice Age with the onset of rising sea levels (Thomas and Campbell, 1993; Wolfe, Reidenauer, and Means, 1988).

Young-Earth Flood Model Perspective

What are we to make of this information and its suggested interpretation? What does this information hold with regard to our model? First and foremost we must recognize the differences in time between our two competing models. The Young-Earth Flood model seeks to define Earth history within the span of six to ten thousand years. Following the global Flood, isostatic and diastrophic forces were still in operation which probably affected eustatic sea level position (e.g., isostatic rebound, tectonics, etc.). The single Ice Age (Oard, 1990), immediately following the Flood, ended approximately three to six thousand years ago. Hence, changes in eustatic sea level position are expected within our model, but would have occurred more recently and in a more rapid manner than is currently recognized by the uniformitarian model.

A drop in sea level position would have allowed the existing coastal flora and fauna to move into the recently exposed terrestrial areas. Ecological succession could then follow with an "Old Growth" forest developing in as little as 150 years (Odum, 1971). However, it should be noted that most of the trees identified in the now submerged paleo-maritime forests are comparable to what is found onshore today (i.e., mainly slash pine and scrub oak) [Lawrence, 1974; Marsh, 1966]. We suggest that the lack of any extensive numbers of hardwoods found as tree stumps reflect the short-lived nature of this paleo-maritime forest. A pine forest can reach maturity in 75 to 100 years (Odum, 1971). With the waning of the Ice Age, and the rising sea level, the hardwood forest would retreat northward, being replaced by the predominant pine forest characteristic of the panhandle today (Thomas and Campbell, 1993; Wolfe, Reidenauer, and Means, 1988). With these factors in mind, we would propose that the submerged forest off Panama City Beach would date from the later stages of the single Ice Age (approximately three to six thousand years old), and is much more recent than the uniformitarian scientists claim.

Slow Versus Fast Sea Level Rise and Its Impact on the Paleo-Forests

A slow rise in sea level would erode away most if not all evidences of a once existing paleo-maritime forest due to the churning surf zone (e.g., Bruun, 1962; Davis, 1994;

Dietz, 1963; Fischer, 1961; Komar, 1983; Leatherman, 1988; Swift and Palmer, 1978). This is occurring today along the surf zone at such places as Dauphin Island, Alabama (Figures 1 and 2). For some areas the slow rise in sea level would cause the beach sand dunes to migrate shoreward. As they moved shoreward they would migrate over existing maritime forests. These forests would be buried under the dune sands and would remain somewhat preserved until the beach dune migrated past this point and re-exposed the forest within the surf zone (see Leatherman, 1988, p. 45) [Figure 1]. The tree stumps exposed to the pounding surf and biological activity would not last for very long under these conditions. Mineralization (i.e., petrification) is also not likely to occur in this environment. In areas with no sand to bury and protect the tree stumps and roots, the surf zone would serve to erode away all evidences of the once existing maritime forest (Figure 2).

A rapid rise in sea level would create very different conditions such that not all sand dunes would be able to migrate shoreward at the same rate. In many cases these sand dune fields would be inundated, and only move as storm waves directed. However, some of the sand dunes would have moved shoreward with the rise in sea level quickly burying existing coastal environments. The rapid nature of sea level rise would also effectively move the surf zone landward. Once sea level stabilized it would erode and transport sand away from the surf zone, eventually exposing the formerly buried forest (e.g., Dauphin Island, Alabama).

Conclusions

The uniformitarian model proposes that sea level began to drastically change its position starting with the close of the Wisconsin Ice Age approximately 14,000 to 18,000 years ago. However, it is believed to have changed very little in the past three to six thousand years.

Today we find many paleo-Indian sites submerged both on and off the Florida coast. These locales suggest that humans once lived in areas we presently find unavailable to us. The identification of the offshore sites has depended on little to no sedimentary cover. A slow rise in sea level would destroy these sites due to the pounding surf zone. Hence, we propose that the very existence of these sites requires a rapid sea level rise.

Offshore from the Florida coastline are found submerged sand dunes. Some are found to contain paleo-maritime forest tree stumps within their interswale areas which infer both a recent and rapid rise in sea level. To suggest that beach sand can preserve woody material for 27,000 to 35,000 years (involving at least two separate and distinct sea level low- and high-stand events) defies

reason and is not acceptable to the authors. Additionally, it appears that there are still unresolved matters when it comes to selecting the appropriate woody material for carbon dating (Otvos, 1979).

The physical evidences (e.g., paleo-Indian relics, sand dune ridges, and paleo-maritime forests) suggest that sea level has changed both recently and drastically. We interpret the evidence to reflect and support the short amount of time that has elapsed since the end of the Young-Earth Flood Model Ice Age Timeframe, approximately three to six thousand years ago. Clearly other interpretations are possible and we welcome further discussion and investigation of these physical evidences.

Appendix

A reviewer noted that this work failed to address the seemingly rapid dispersion of people across the Earth following the global Flood of Genesis. While this was not the theme of this effort, we do feel compelled to briefly address this and several other related issues. First, the theme of our article is to document the rapid rise of sea level in a manner (using geologic and archaeological evidences) which has NOT been widely addressed within the uniformitarian literature. It appears to us that geologists and archaeologists are defining the close of the Pleistocene (specifically the end of the Wisconsin Ice Age) in different ways, using different dates. The physical evidence (both archaeological and geological) supports the Young-Earth Flood Model. We observe no evidence which requires long periods of time and slowly changing sea levels, as the uniformitarian model dictates. Rather, we note rapidly changing sea-level positions with subaerial environments occurring, in some cases, well offshore (and there are only a few of these—where many would be expected if hundreds to thousands of years were truly available for the development of paleo-environments). A simple test in support of the passage of long-periods of time can be demonstrated by noting the “age” of the trees composing the forests found in these offshore settings. Most of the tree stumps found submerged offshore do not reflect climax forests.

Secondly, we believe that the rapid penetration of the western hemisphere by the eastern migration of paleo-Indians is not spectacular, when compared with the tremendous ecological flux which occurred following the global Flood, and which continued throughout the Ice Age. A barren post-Flood Earth was quickly covered with grasses and vast savannahs before forests became more dominant. For large herbivores and many other animals it must have seemed like paradise, tempered by the onset of the Ice Age. As animals, such as mammoth, bison, etc., searched for new pastures (areas not threatened by clima-

tic changes associated with the Ice Age), nomadic human groups followed them, eventually into the western hemisphere. As the Ice Age diminished, continuing climatic changes pressed animals and humans ever onward in search of hospitable environments (Anderson, O'Steen, and Sassaman, 1996; Gunn, 1996; Oard, 1990).

Finally, dating the time of the first human settlements in the western hemisphere appears to be in a major state of flux, with the recent discovery (and supported by valid dates) of ancient human artifacts at Monte Verde, in southern Chile. This discovery raises the possibility that some humans might have crossed the Pacific from Southeast Asia, as much as 33,000 years ago (Toner, 1998). While this is an interesting discovery, it does not contradict Scripture (we reject the age dates of these artifacts on the basis, in part, of rapidly changing post-Flood climatic conditions and its impact on C-14 generation). We would counter that these new archaeological discoveries reflect that mankind was far more advanced than has been given credit (see Petersen, 1987). The ability to undertake an oceanic voyage across the Pacific Ocean reflects an intelligent group of people. Ignorant "hunter-gatherers" would have been unable to build a boat and supply it in a manner which would have allowed successful transoceanic travel. Again, none of this new evidence for the global migration of people from Asia to the Western Hemisphere contradicts the Bible. The Bible does not provide us with mankind's history apart from God's chosen people, and we must determine what happened to mankind as they spread across the globe following the Flood.

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Book Review

Where Garden Meets Wilderness by E. Calvin Beisner

William B. Eerdmans Publishing Company, Grand Rapids. 1997. 256 pages. \$16.

Reviewed by Don B. DeYoung

The Creation Research Society has always been interested in stewardship of the Creation. Former CRS Board member John Klotz (1918–1996) wrote the still-popular book *Ecological Crisis* three decades ago, in 1971.

Currently there are several conservative Christian environmental organizations including the Society of the Green Cross and also the Au Sable Institute. These groups are active in raising awareness of our responsibility to care for the created earth. While fully supporting Christian stewardship, author Calvin Beisner has taken the task of exposing some of the doubtful Scripture interpretation and faulty data used by well-meaning environmental groups. Beisner is a professor of interdisciplinary studies at Covenant College, Lookout Mountain, Georgia. His book is both controversial and carefully written.

In Beisner's view the original Garden of Eden was locally ideal. However the rest of the world was a wilderness that needed to be tamed. He believes Adam was commissioned to manage and transform (Genesis 1:28, subdue) the earth while cultivating and protecting the original Garden (p. 19). The Curse later complicated this task worldwide.

Beisner has an optimistic, non-alarmist view of population growth. His data shows that the world is far from

over-populated. Why then are people starving today? It is mainly because of incompetent governments and civil strife (p. 153). Beisner states that people in general produce more than they consume (p. 157). That is why real prices of nearly every resource on earth continue to fall as world population increases.

The book's many refreshing ideas, whether right or wrong, need to be considered. For example, entropy is said to apply only to the physical world, not the spiritual (p. 26). Beisner challenges the notion that "nature knows best" and should be left to itself (p. 21). He also presents data to show that global warming is not affected by man. Also, species extinction is not 100,000 per year as suggested by Vice President Al Gore (p. 218), but perhaps only one species lost per century (p. 163). If Beisner is correct, then Al Gore is in error by one billion percent! Beisner shows that there has been a positive reversal of the past decades problems of deforestation, soil loss, water degradation, and global toxification.

Beisner accepts a long time scale for earth history (p. 66). One minor swipe is taken at the creationist view of thermodynamics. Still, the book is a refreshing counterbalance to much of the current dismal environmental news. The book provides subject, Scripture, and name indexes.

Dental variability in the domestic dog (*Canis familiaris*) Implications for the Variability of Primates

Celedonio García-Pozuelo-Ramos*

Abstract

The dentition of a sample of *Canis familiaris*, the domestic dog, has been statistically analyzed using methods that have been employed by other workers to determine variability in other species. The results presented here suggest that the dog sample includes several species. If the domestic dog were extinct and we did not know all that we do about its progressive variation in historical times, we would probably view it as a group of species. Our knowledge about dog dentition may therefore be useful in determining the boundaries of other holobaramins (created kinds).

My results obtained from dog teeth suggest that the extinct Australopithecines and *Homo habilis* (which I have also analyzed here) manifest a variability in the first and second molar that is less than the variability found in dog molars. By these standards, therefore, the Australopithecines and *H. habilis* can be included as part of one and the same holobaramin.

Several *Homo erectus* fossils of diverse origin have likewise been subjected to similar analysis of variability. The *H. erectus* results do not support the division of *H. erectus* fossils into two or more different species but are compatible with the belief that they are all part of one species.

It has been possible here to use the variability in the dentition of a living monobaramin (the domestic dog), to show that the Australopithecines and *H. habilis* should be lumped into one kind and that a *Homo erectus* is in a holobaramin distinct from them. I intend to carry this analysis of dentition further to study the affinities between the extinct *Homo erectus* kind and living *Homo sapiens*. Whether these two groups would appear distinct or united by this method remains to be determined. The degree of variability in domestic dog dentition (a living monobaramin) can thus become an important tool for creationists in assessing the limits of extinct kinds.

Introduction

The process of morphological variation in the wolf (*Canis lupus*) that has led to the more than 400 races in the domestic dog monobaramin can shed light on the limits of variability within the human holobaramin and the boundaries separating it from extinct fossil primates. A study of variability in domestic dog teeth will assist us in knowing where the boundaries of the human holobaramin lie in relation to the fossils of various extinct hominids. In an artificial manner, the races in the domestic dog monobaramin have been separated for aesthetic and economic reasons. The effect of this has been equivalent in many aspects to a natural diversification event (Scott, 1968; Clutton-Brock, 1992).

In this article the dental variability in the dog, *Canis familiaris*, is studied with respect to other species in its holobaramin. The results, although limited, may be used to determine the range of variability in other kinds, living or fossil, but mostly mammals.

Teeth constitute the most abundant mammal fossil remains. Their natural hardness allows them to endure better than bones. This has made teeth items of special importance for the study of variability in fossil and living animals.

The post-canine teeth in the definite dentition are the best ones to study (Gingerich, 1974; Cope, 1993) and they are the ones studied here. The first and second molars are the least variable of all, showing hardly any sexual dimorphism even in species which manifest dimorphism otherwise (Simpson, Roe, and Lewontin, 1960; Gingerich, 1974; Gingerich and Shoeninger, 1979; Gingerich and Winkler, 1979).

*Celedonio García-Pozuelo-Ramos

Calle Camino Viejo de Pinto, no3-1ºD,
28903 Getafe, Madrid, Spain

Received 2 January 1998; Revised 13 July 1998

An analysis of variability in different teeth has been made by means of the coefficient of variation, the range expressed as a percentage of the average, and the index of the minimum and maximum value. The results point to a degree of variation in the domestic dog that is equivalent to, or greater than the variation otherwise found in crossing various near species. If we did not believe that domestic dogs are all in one species, then the amount of dental variability between the different varieties would suggest that they were a group of several distinct species.

When we mix the data from *Australopithecus* and the heterogeneous taxon *Homo habilis*, their dental variability is less than that which we find in domestic dog. The dental variability in the mix of *Australopithecus* and *H. habilis* does not exceed the variability (CV) which is generally considered the maximum for a single mammal species. In the same way, a group of *Homo erectus* from both Asiatic and African regions does not exceed in dental variability the range of the species. The *H. erectus* specimens were all evidently part of one holobaramin. In addition, the *H. habilis* specimens belong in the same species as *Australopithecus* and are not part of the genus *Homo*.

Materials and Methods

The set of dog teeth from which the measurements have been taken belong to the author. Similar dental measurements from other canids have been taken from the published work of Kurtén (1965, 1974) and Martin (1974). Both works provide the maximum and minimum values of different dental parameters, corresponding to the actual measurements of specific animals. From those minimum and maximum values I have constructed the "populations" with which I have compared the population of domestic dogs. The usage of maximum and minimum values involves a deficiency that is translated as a minor statistical distortion.

The data from both authors have not been mixed because possible errors could arise since different methods were used when taking the measurements.

For the dental measurements of the *Australopithecines*, *Homo habilis* and *Homo erectus*, the data have been taken from Wood (1991). The list of fossils studied is found in Table I, and the number of teeth analyzed for each case appears in the tables.

Whenever possible the measurements have been taken from the right side dental pieces of the canids and primates. Because of the lower variability, the post-canine teeth in the samples have also been analyzed so the possible existence of several species is made clear. The dimensions measured in the dog are chosen for their relevance and ease of handling, and are described in Table II and Figure 1.

Table I. List of primates included in this study.

<i>Australopithecus africanus</i> : MLD 6; SE 1508; Sts 1, 8, 17, 21, 22, 28, 32, 37, 52, 53, 56, 57; Stw/H 128; Taung 1; TM 1511, 1512.
<i>Australopithecus robustus</i> : SK 13, 14, 17, 46, 47, 48, 49, 52, 55, 83, 98, 102, 134, 826, 829, 831, 832, 834, 837, 838, 872, 1590, 1591, 14129; TM 1517, 1602.
<i>Australopithecus boisei</i> : KNM-CH 1; KNM-ER 403, 404, 729, 733, 801, 818, 1171, 1509, 1804, 1816, 1820, 3230, 3737, 3890, 15930; KNM-WT 17400; OMO 47-46; Peninj 1.
<i>Homo habilis</i> : KNM-ER 807, 808, 809, 1502, 1506, 1508, 1801, 1802, 1805, 1813, 1482, 1590, 3734; OH 6, 7, 13, 16, 21, 24, 39, 44; OMO K7-19, L26-1g, L28-31, L894, P933-1, SH1-17, 75s15, 75-14.
<i>Homo erectus</i> : KNM-BK 67; KNM-ER 730, 806, 820, 992, 1507, 1808, 3733; KNM-WT 15000; OH 22; Sangiran 1, 4, 5, 6, 8, 9; Tighenif 1, 2, 3; Trinil 4; ZKD AN 517, AN 518, A1-1, A2-2, A2-54, A3-56, B1-3, B1-63, B1-67, B3-9, B4-75, B4-79, C1-4, C2-62, C3-45, C3-53, D1-28, D1-43, D1-51, D2-50, F1-5, G1-6, G1-7, H4-83, I1-PA87, K1-96, L2-PA99, M3-310, N1-312, O1-PA313, O2-314.

For the analysis of variability we have used the variation coefficient, CV; the range, expressed as a percentage of the average, R%; and the index between the maximum and minimum value, $I^{\max}/_{\min}$. These statistics are used frequently in paleontology with the purpose of determining if there are different species included in a fossil sample (e.g. Gingerich, 1974; Cope and Lacy, 1992; Cope, 1993; Martin and Andrews, 1993; Teaford, Walker, and Mugaisi, 1993; Thomson, 1996).

The CV is frequently used when analyzing measurements of more or less homogeneous morphologic samples of mammal fossils remains. Some have doubted the usefulness of this statistic for assuring that a sample is made of the mix of several species (e.g. Plavcan, 1989; 1993). Even so, with random sampling from a mix of different present day species (Cope and Lacy, 1992), and the combined use of CV, R%, and $I^{\max}/_{\min}$ (Martin and Andrews, 1993), various workers have demonstrated the efficiency of the CV for discriminating between present day species. The criteria that have been used in this study to determine whether the variability in the domestic dog exceeds the variability of the species taxon, are based on the work of Martin and Andrews (1993); Thomson (1996) who uses mixes of species similar to the one being studied as reference; and Simpson, Roe, and Lewontin (1960) who give a value of 10 for the CV as the maximum value of variability belonging to a single species. We will be using this value of 10 later in this paper.

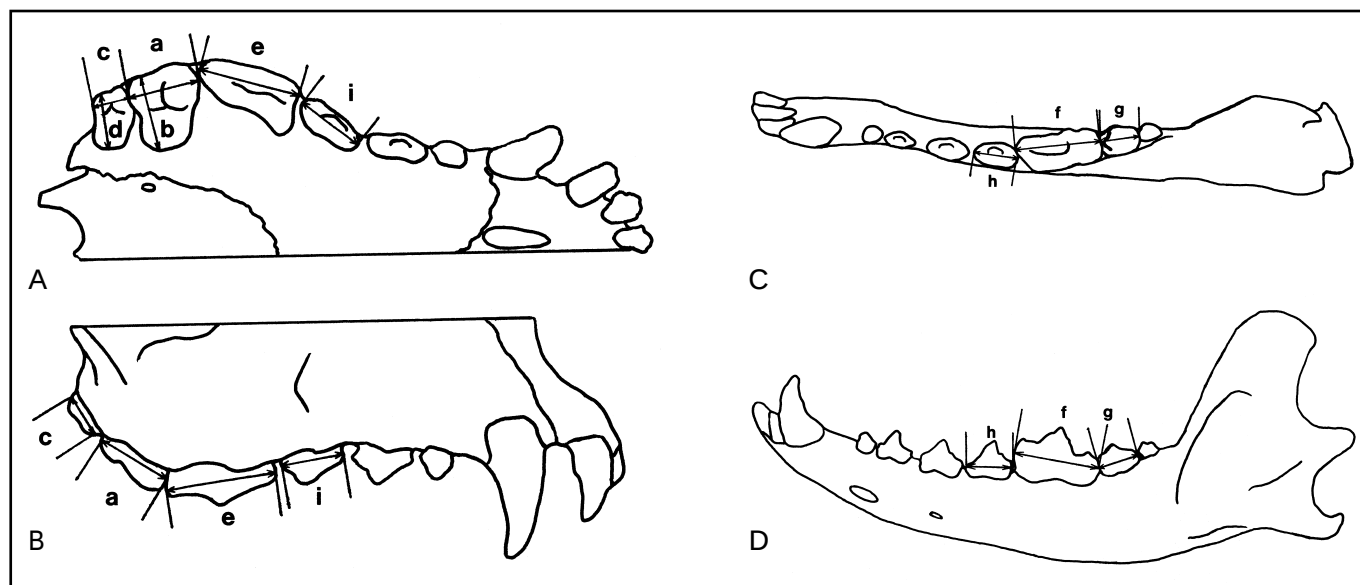


Figure 1. Dental measurements taken. A: Occlusal view in maxilla teeth. B: Buccal view in maxilla teeth. C: Occlusal view in mandible teeth. D: Buccal view in mandible teeth.

Table II. Description of the dental measurements taken from the domestic dog sample.

- (a) M¹L Mesiodistal crown diameter of superior first molar. Approximately coincide with longitudinal axis metacone to paracone.
- (b) M¹W Buccolingual crown diameter of superior first molar. Approximately coincide with longitudinal axis metacone to protocone.
- (c) M²L Mesiodistal crown diameter of superior second molar. Approximately coincide with longitudinal axis metacone to paracone.
- (d) M²W Buccolingual crown diameter of superior second molar. Approximately coincide with longitudinal axis metacone to the farthest point of the buccal edge.
- (e) P⁴L Mesiodistal crown diameter. Approximately coincide with longitudinal axis metastile to parastile.
- (f) M₁L Mesiodistal crown diameter.
- (g) M₂L Mesiodistal crown diameter.
- (h) P₄L Mesiodistal crown diameter.
- (i) P₃L Mesiodistal crown diameter.
- (j) P₃W Buccolingual crown diameter.

It is true that the statistics used in this study present different problems. In small samples, the CV can be distorted with respect to the CV of samples actually representative of the species (Sokal and Braumann, 1980). A value of 10 for the CV may not be applicable to every metric trait. In a small sample the variability is underestimated when analyzed through the R%. The R% is even less reliable than the CV (Martin and Andrews, 1993) and the same is true of the $I^{\max}/\min$. The use of all the three statistics together, how-

ever, provides an increase in the precision with which we can measure variability (Martin and Andrews, 1993). Despite these problems, from the data obtained in a sample we can recognize the presence of more than one species with more or less certainty. We can never say with absolute certainty that a particular sample is composed of just one species (Martin and Andrews, 1993).

Results

Table III compares the CV of different genera of canids. It is obvious that the domestic dog generously exceeds the dental variability of the species belonging to the genera *Vulpes* (red fox), *Alopex* (arctic fox), or *Lycaon* (African wild dog) with which it has been compared. Dog variability also exceeds that found in *Canis aureus* (the golden jackal), *Canis latrans* (the coyote), and *Canis lupus* (the gray wolf), the latter being a progenitor of dogs (Vilà, et al., 1997).

Table IV contains the comparisons between the CV of the dental measurements of dogs and of different mixes of canids. In the mix of *Canis lupus* and *Canis latrans*, the greater variability of the dog is evident (Table IV and Figure 2). In the mix of *Canis lupus* and *Canis aureus*, created from the data of Dyan, Simberloff, Tchernov, and Yom-tov (1992) (as proposed by Gingerich, 1974) for the combination of isolated data for males and females, the CV of M₁L is 14.8 which is similar to the mix of *Canis lupus*, *Canis latrans*, and *Canis aureus*, and similar to domestic dog (Table IV and Figure 3). Another mix of the genus

Table III. Comparison of the coefficient of variation between dental pieces of different canids.

CV	a	b	c	d	e	f	g	h	i	j
Dog	14.0	15.9	15.3	17.2	14.5	14.8	17.7	14.2	16.1	20.7
<i>C. aureus</i>	–	–	–	–	5.5(1)	4.0(2)	–	–	–	–
<i>C. latrans</i>	–	–	–	–	5.0(1)	–	–	–	–	–
<i>C. lupus</i>	5.1(3)	–	–	–	5.5(3)	4.6(2)	–	4.6(2)	–	–
<i>A. lagopus</i>	5.3(4)	4.7(4)	8.3(4)	8.0(4)	4.5(4)	4.9(4)	6.3(4)	4.9(4)	5.3(4)	7.1(4)
<i>L. pictus</i>	3.9(5)	–	–	–	3.4(5)	–	6.7(5)	5.1(5)	–	–
<i>V. vulpes</i>	4.0(6)	4.3(6)	7.2(6)	11.5(6)	3.7(6)	4.2(6)	5.3(6)	4.3(6)	4.9(6)	6.2(6)

(1) Morey, 1992. (2) Dayan et al., 1992. (3) Jolicœur, 1959. (4) Pengilly, 1984. (5) Girman et al., 1993. (6) Gingerich and Winkler, 1979.

The letters correspond to the teeth measurements given in Table II. The number of analyzed specimens is always greater than 20, starting at the 29 specimens analyzed for P⁴L of *C. aureus* and the 499 of M¹L and P⁴L in *C. lupus*. The only exception is in the case of *Lycaon pictus* where only eleven specimens are analyzed. The exact number can be found in the references.

Table IV. Comparison of coefficient of variation between domestic dog teeth and other different mixes.

CV	a	b	c	d	e	f	g	h	i	j
Dog	14.0(42)	15.9(42)	15.3(35)	17.2(37)	14.5(43)	14.8(37)	17.7(34)	14.2(36)	16.1(29)	20.7(31)
Mix1	12.1(15)	13.4(15)	–	8.4(12)	11.7(16)	13.3(14)	13.3(14)	10.3(14)	6.2(6)	–
Mix2	–	–	–	–	–	14.4(20)	13.9(20)	13.2(20)	–	–
Mix3	12.0(18)	11.2(18)	–	–	12.7(18)	–	–	–	–	–

The letters correspond to the teeth measurements given in Table II. The number of analyzed individuals for each case is in brackets besides the CV. Mix1 is formed by *C. lupus* y *C. latrans* (Kurtén, 1965; 1974). Mix 2 is obtained from *C. lupus*, *C. latrans*, and *C. aureus* (Kurtén, 1965; 1974). Mix3 is formed by *C. ayersi*, *C. milleri*, *C. armbrusteri*, *C. dirus* and *C. lupus* (Martin, 1974).

Canis, that includes five different fossil species was: *Canis dirus*, *Canis ayersi*, *Canis milleri*, *Canis armbrusteri*, and *Canis lupus*, (Martin, 1974), which shows a variability in three dental measurements, less than the CV of the dog (Table IV and Figure 4).

The analysis through the R% and the $I_{\max/\min}^{\max}$ presents the greatest variability in the domestic dog with respect to the mix of *Canis lupus* and *Canis latrans* in all the measurements compared, except in the M₁L. The analysis of variability executed through R% and the $I_{\max/\min}^{\max}$ exposes the lesser variability in the dog than in the mix of *Canis lupus*, *Canis latrans*, and *Canis aureus* for two measurements (Tables V and VI). The analysis through the R% and the $I_{\max/\min}^{\max}$ presents the greater variability in the domestic dog with respect to the mix that includes five species (Tables V and VI).

In the order Primates, the analysis of the mix of species *Australopithecus africanus*, *Australopithecus robustus*, *Australopithecus boisei*, and *Homo*

habilis presents a variability in the dental measurements M¹L, M¹W, M₁L, M₁W, M²L, M²W, M₂L, M₂W lower than that found in the sample of domestic dog, using the CV, R%, or the $I_{\max/\min}^{\max}$ (Tables III, V, VI, and VII). Only the CV of M₂L and M₂W are greater than 10. In a pongid (*Pongo pygmaeus*, the orangutan), M²L exceeds the variability of the mix of Australopithecines and *Homo habilis*

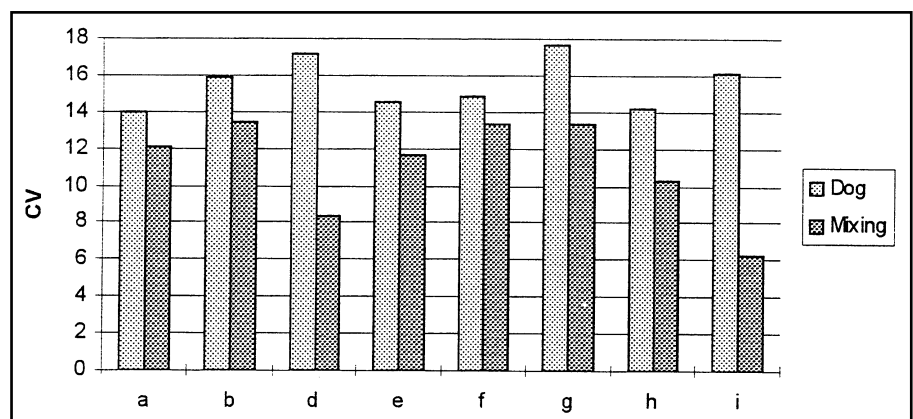


Figure 2. Comparison of the coefficient of variation between dental pieces of domestic dog and mix *C. lupus* and *C. latrans* (Kurtén, 1965; 1974). A: M¹L, b: M¹W, d: M²W, e: P⁴L, f: M₁L, g: M₂L, h: P₄L, i: P₃L.

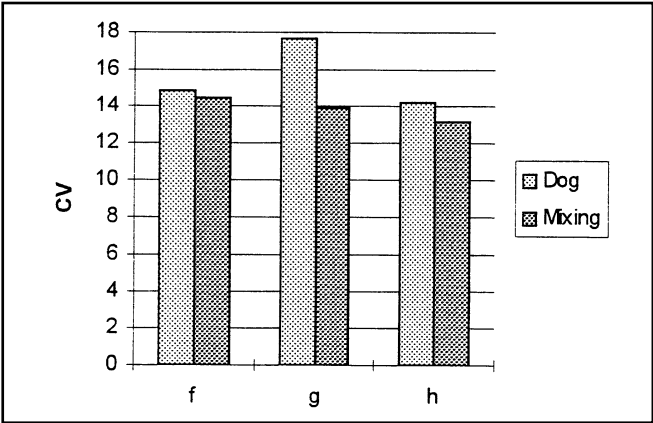


Figure 3. Comparison of the coefficient of variation between dental pieces of domestic dog and mix *C. lupus*, *C. latrans* and *C. aureus* (Kurtén, 1965; 1974). f: M_1L , g: M_2L , h: P_4L .

(Martin and Andrews, 1993). However, the $R\%$ and the $I_{max/min}$ are greater in this *Australopithecus* plus *H. habilis* mix with respect to any of the measurements taken in pongids (Martin and Andrews, 1993), and lesser than in dog (Tables V, VI, and VII). If we take a CV of 10 as a point above which a sample represents two or more species, then the CV for *Australopithecus* and *H. habilis* would support these being in the same species (Table VII).

In the case of the mix of *Homo erectus* I have studied, where the variables analyzed are the same as in the mix of Australopithecines and *Homo habilis*, a lesser variability in M_2L and M_2W than in *Pongo pygmaeus* is evident (Table VIII, Martin and Andrews, 1993). M_2L presents less variability than in orangutan and gorilla (Table VIII, Martin and Andrews, 1993). The rest of the measurements in *Homo erectus* are greater than the variability of the different pongids (Table VIII, Martin and Andrews, 1993). The CV values here for *H. erectus* specimens are

Table V. Comparison of the range, expressed as a percentage of average between domestic dog teeth and various mix.

R%	a	b	d	e	f	g	h
Dog	58	64	74	56	54	64	52
Mix1	45	48	25	45	57	50	36
Mix2	—	—	—	—	70	59	54
Mix3	51	38	—	49	—	—	—

The letters correspond to the teeth measurements given in Table II. The number of analyzed individuals for each case is in table IV. Mix1 is formed by *C. lupus* and *C. latrans* (Kurtén, 1965; 1974). Mix2 is obtained from *C. lupus*, *C. latrans* and *C. aureus* (Kurtén, 1965; 1974). Mix3 is formed by *C. ayersi*, *C. milleri*, *C. armbrusteri*, *C. dirus* and *C. lupus* (Martin, 1974).

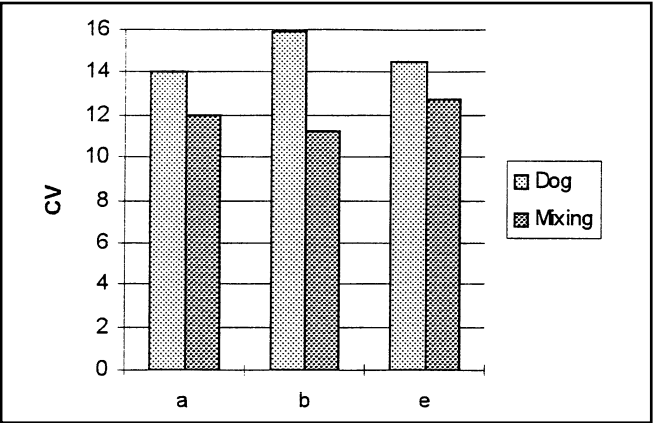


Figure 4. Comparison of the coefficient of variation between dental pieces of domestic dog and mix *C. lupus*, *C. milleri*, *C. dirus*, *C. ayersi* and *C. armbrusteri* (Martin, 1974). a: M_1L , b: M_1W , e: P_4L .

likewise all below 10, supporting that they are all part of one species.

The CV obtained by Wood (1993) in *Homo erectus* generally exceeded the ones I have obtained, although both are below those that can be compared with the dog (Table III and VIII). In this group of *Homo erectus* the $R\%$ and $I_{max/min}$ are lower in M_1W and M_2L with respect to *Pan paniscus* (the bonobo), *Gorilla gorilla* (the gorilla), and *Pongo pygmaeus* (the orangutan). In M_2W the *H. erectus* are lower than in *Pan paniscus* and in M_1L they are lower than *Gorilla gorilla*. In M_1W the variability expressed as $R\%$ is equivalent in *Homo erectus* and *Pan paniscus*. M_1L as well as M_2L present a greater variability expressed as $R\%$ or as $I_{max/min}$ in *Homo erectus* than in any of the pongids (Martin and Andrews, 1993). However, in *H. erectus*, the $R\%$ and the $I_{max/min}$ are lesser than in domestic dog (Tables V, VI, and VIII).

Table VI. Comparison of the index between the maximum and minimum value between domestic dog teeth and the various mix.

$I_{max/min}$	a	b	d	e	f	g	h
Dog	1.8	1.9	2.1	1.7	1.7	2.0	1.7
Mix1	1.6	1.6	1.3	1.6	1.7	1.6	1.4
Mix2	—	—	—	—	2.0	1.8	1.8
Mix3	1.7	1.5	—	1.7	—	—	—

The letters correspond to the teeth measurements given in Table II. The number of analyzed individuals for each case is in table IV. Mix1 is formed by *C. lupus* and *C. latrans* (Kurtén, 1965; 1974). Mix2 is obtained from *C. lupus*, *C. latrans* and *C. aureus* (Kurtén, 1965; 1974). Mix3 is formed by *C. ayersi*, *C. milleri*, *C. armbrusteri*, *C. dirus* and *C. lupus* (Martin, 1974).

Table VII. CV, R% e $I^{\max}/_{\min}$ of different dental sizes in the mix of Australopithecines and *H. habilis*.

	M ¹ L	M ¹ W	M ² L	M ² W	M ₁ L	M ₁ W	M ₂ L	M ₂ W
CV	6.8(50)	8.8(50)	8.2(38)	9.3(39)	8.3(49)	8.6(48)	10.2(52)	10.7(47)
R%	31	40	39	48	35	40	41	47
$I^{\max}/_{\min}$	1.4	1.5	1.5	1.6	1.4	1.5	1.5	1.6

The numbers between parentheses correspond to the specimens used in this study.

Table VIII. CV, R% e $I^{\max}/_{\min}$ of different dental sizes in a group of *H. erectus*.

	M ¹ L	M ¹ W	M ² L	M ² W	M ₁ L	M ₁ W	M ₂ L	M ₂ W
CV	8.0(10)	6.5(8)	8.9(12)	7.0(12)	7.7(29)	7.2(29)	6.4(24)	6.9(25)
R%	27	16	28	24	39	27	30	28
$I^{\max}/_{\min}$	1.3	1.2	1.3	1.3	1.5	1.3	1.3	1.3

The numbers between parentheses correspond to the specimens used in this study.

Discussion

Despite the difficulties that we find when interpreting the data, (because of the limited samples, which always seems to be the case when studying fossils), dental variability found in the domestic dog corresponds with what would be expected in a more than one species had been combined.

The CV of all the dental measurements that have been compared is greater than 10 in the dog and much less in the rest of canids (see Table III). A CV that is greater than 10, in lineal measurements, is generally considered as an indication of the existence of several species in the sample according to the proposal of Simpson, Roe, and Lewontin (1960). In this research the value of 10 has been used as a reference, even when it may not always be applicable for every measured trait.

The dental variability in the domestic dog is greater with respect a "population" composed of a mixture of data representing different species (Tables IV, V, and VI). The lower variability in the mix of *Canis lupus* and *Canis latrans* in comparison to that of domestic dog may be the result of the similarity in size of both species (Sheldon, 1992), in addition to the limited size of the sample studied. On the other hand, the greater difference in the sizes when *Canis aureus* is added to the mix does not determine a greater variability with respect to domestic dogs (Table IV).

The two statistics used as complementary (R% and the $I^{\max}/_{\min}$), generally, corroborate the degree of variability obtained by the CV. In the case of the mix of the *Canis lupus*, *Canis latrans*, and *Canis aureus*, the R% and the $I^{\max}/_{\min}$ highlights the greater variability of M₁L and P₄L in this mix compared to the domestic dog (Tables V, and VI). From the comparison of the dental variability in the dog and the corresponding variability of the different

mixes of species, it seems that in the domestic dog, dental variability is inside the limits of the genus.

These results support the idea that the Australopithecines and at least a few fossils attributed to *Homo habilis* all belong to the same monobaramin just as has been suggested by some authors (Mehlert, 1992, 1996; Lubenow, 1996; GarcíaPozuelo-Ramos, 1997). A recently found cranium of *Australopithecus boisei* which shares characteristics with *Australopithecus robustus* and *Australopithecus aethiops*, casts doubt upon the need to differentiate these as separate taxa (Suwa, et al. 1996), and supports (at least in part), the idea of mixing the data from *Australopithecus* and *Homo habilis* in this study to produce only one kind.

I have not studied data from *Australopithecus afarensis*, *Australopithecus anamensis*, *Australopithecus bahrelghazali*, or *Ardipithecus ramidus*. Nevertheless, the variability amongst the Australopithecines that I have studied in this research is still substantially less than the variability of the domestic dog (Tables III and VII). On the contrary, the variability expressed among the Australopithecines as R% and $I^{\max}/_{\min}$ is greater than the variability of any pongid (Martin and Andrews, 1993), but less than the corresponding variability we find in the domestic dog (Tables V, VI and VII).

The variability, expressed as CV, in *Homo erectus* is also less than that of the dog (Tables III and VIII) and is comparable to the variability found in the orangutan (Martin and Andrews, 1993). It is greater, however, than the variability of the gorilla and bonobo (Martin and Andrews, 1993). It is true that the geographical diversity of *Homo erectus* included in the analysis is much greater than the diversity of any pongid. On the other hand, in the measurements M¹L, M¹W, M²W, M₂W, the vari-

ability expressed as $R\%$ and $I_{\max}/_{\min}$ for *Homo erectus* is less than that of the great apes, (with only M_1L and M_2L presenting greater variability in *Homo erectus* - Martin and Andrews, 1993).

Kramer (1993) has also found that the variability of certain cranial measurements of *Homo erectus* is smaller than what is considered the limit of the species, being close to that found in modern man. Hence, the studied dental variability seems to accentuate the idea that *Homo erectus* does not need to be subdivided into several species as several authors believe (Jacob, 1976; Alexeev, 1986; Rightmire, 1990; Wood, 1992) but that it represents one coherent group.

A famous fossil, KNM-ER 1470, has not been included in the study as Australopithecine, *Homo habilis*, or *Homo erectus* because of the difficulty in assigning it with precision to any of these taxa. There is no agreement between evolutionist researchers concerning the status of 1470 (Brace and Montagu, 1977; Coon, 1984; Bromage, 1992), or between the creationist researchers (Hummer, 1977; Lubenow, 1992; Mehlert, 1994). We should not be surprised by the existence of remains that we cannot easily attribute to humans or pongids. Between the chimpanzee and man there is a likeness of 99% for their polypeptide sequences (King and Wilson, 1975; Bruce and Ayala, 1979). The chromosomal likeness between any of the pongids and man is also substantial (Yunis and Prakash, 1982). Hence, there can be a morphologic likeness between an extinct pongid and man. Moreover, if the fossil remains are scarce, or reconstructions are made from remains that are too fragmented and incomplete, the likeness will be exaggerated. Lubenow (1992) had already pointed out the possibility that the taxon *Homo habilis* could include Australopithecines as well as humans. Bowden (1984) has noted the possible mistakes of reconstruction in different taxa.

In any case, the metric dental variability is not enough to determine the holobaramins. It is necessary, therefore to perform a more in depth study of different traits, especially in the cranium. Studies must include not only the continuous metric traits that are measurable in a continuous sequence, but also those traits that are difficult to measure and that can only be described, or that must be scored as "present" or "absent".

The variability inside one holobaramin should be greater than the variability evident in the domestic dog. We have to keep in mind that possibly that all current canids may belong to only a single holobaramin (Crompton, 1993). Moreover, we have added fossils to the list of present day canids. This raises the question of whether the present variability is equivalent to the variability in the past. Some evolutionist researchers have challenged uniformitarianism and consider that there could have been different variability in some fossil spe-

cies (Kelley and Xu, 1991; Kelley, 1993). In the species of modern mammals it seems there is a constancy with respect to the variability of certain physical traits; this is the case in the dimensions of the first molar. This same constancy could have existed in prehistoric species, but I think that the limits of variability may have been different in the fossils. The variability we are interested in is the intrabaraminic, and in this variability we must include fossil species that have no current species equivalent.

From an evolutionary point of view, there are difficulties in delimiting any taxa when including fossil and living organisms. It is an evolutionary principle that life is a continuum from primeval beings to all current beings. Variability from a creationist perspective is different, since living beings are grouped in compartments or holobaramins that are discontinuous from each other. To delimit the holobaramins, the variation in the present and in the past have to be determined, and one must find the total variability. We know that prediluvian men and those that survived the flood, enjoyed a greater longevity than is true now. Other living animals may have also experienced greater longevity before the flood. This could have determined an ontogeny different in many cases from current living beings. Such longevity could have produced morphologic variations, as could have also happened with the different prehistoric human shapes, and sizes (*Homo erectus*, and *Homo sapiens neandertalensis*) (Beasley, 1992, 1995; Cuzzo, 1994). The gigantism in certain dinosaurs, as well as the huge size of the pongid *Gigantopithecus* and of *Carcharodon megalodon* in sharks (Froede, 1995) could be examples of what would have been an inordinate growth perhaps caused by greater longevity. However, the relationship between life span and species variability is uncertain and deserves further investigation.

I think we can delimit the different holobaramins with reasonable precision. The application of the baraminologic criteria of ReMine-Wise (ReMine, 1990; Wise, 1990, 1992) seems to be the most accurate methodology to establish a taxonomy in accordance with reality, especially through the use of hybridization criteria (Marsh, 1976; Scherer, 1993; García-Pozuelo-Ramos, 1997). The knowledge of possible hybridizations between species can allow us to calibrate other baraminologic criteria (García-Pozuelo-Ramos, 1997), including the morphologic criteria. But hybridization criteria are applicable only to present day species, not to fossils, and therefore these hybridization criteria have to be complemented by other criteria. Those criteria which refer to transitional forms in the fossil record and to traits that are shared by two or more taxa but are not primitive (Wise, 1992), are the criteria that can be of greatest help.

Conclusion

The study of the dental metric variability in a sample of domestic dog (*Canis familiaris*) makes it clear that: (1) the dental metric variability in the domestic dog corresponds with the variability we would expect in a combination of more than one species of wild dogs, (2) the dental metric variability of the first and second molars in Australopithecines suggests that these specimens should be grouped into a single monobaramin, (3) the dental metric variability of the first and second molars in a mixture of Australopithecines and the heterogeneous taxon *Homo habilis* suggests that they should all be grouped into a single monobaramin (even so, it is almost certain that some of the remains that have been attributed to *Homo habilis* really belong to *Homo erectus* or even to *Homo sapiens* - Lubenow, 1992), and (4) the dental metric variability of the first and second *Homo erectus* molars of different origins confirms the interpretation that they all belong to a single species. The problem of whether or not *H. erectus* and *H. sapiens* belong in one and the same species deserves further work using these same dental criteria.

Acknowledgements

I thank Benjamin Israel Galindo Robles for Spanish to English translation of the article. I also wish to thank the anonymous reviewers and editor of *CRSQ*, George Howe, for their constructive remarks on earlier drafts of the manuscript. I thank to my daughter Mónica García-Pozuelo-Sánchez for her technical assistance. My wife, Paqui Sánchez-Bravo deserves special thanks.

This work is dedicated to my parents: Celedonio García-Pozuelo-Alhambra and Rosina Ramos-Alonso who taught me to love the Creator and His work.

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Book Reviews

The Origins Solution—An Answer to the Creation Evolution Debate by Dick Fischer
 Fairway Press, Lima, OH. 1996. 382 pages. \$20
 Reviewed by Don B. DeYoung

Author Dick Fischer is retired from a distinguished military career. He holds degrees in both science and theology. The book title promises final answers to the origins question. The reader may evaluate the following barrage of statements from Fischer.

Once upon a time two sets of apes had strange looking offspring (Adam and Eve's evolutionary parents) who took a liking to each other (p. 27). Fischer calls his particular theistic evolution view *creaolution* (p. 370). He declares that young-earth creationists ignore the evidence

for billions of years (p. 25) and their Scripture interpretation is tortured (p. 18). Fischer calls creationists radical right, utter nincompoops (p. 43). Sticks and stones! Interpreting the creation days as 24-hour time periods somehow violates God's Word (p. 162). The Genesis Flood occurred only in the Mesopotamian valley (p. 284). Someone should have told Noah about this! Categorize this book under the key words *day age* and *confusion*. No index is provided.

There's a Hair in my Dirt by Gary Larson
 Harper Collins Publishers, New York. 1998. 63 pages. \$16.00
 Reviewed by Don B. DeYoung

This is a disappointing book for Gary Larson fans. His Farside comics have brought smiles to many of us. In retirement Larson now has written this illustrated children's novel. The Foreword by Harvard evolutionist Edward O. Wilson raises immediate questions. Wilson claims that all creatures including mankind live totally by mutual exploitation. As one example he says that we have made slaves of cows and dogs (shame!). Apparently Wilson is unfamiliar with altruism, veterinary science, and animal protection legislation.

Larson's story is about competition in nature as seen by a family of worms. With his zoology interest, the author teaches some basic biology. Several politically incorrect animals are vilified. These include aggressive Gray squirrels, Amazon ants, "winged-assassin" dragonflies, and Golden eagles which toss weaker siblings from their nest. The point seems to be that predators and victims are connected in an endless circle of life and death. The worm family, of course, recycles everything that hits the ground.

There are several people in the story, all uncaring of nature. Lumberjack Bob has little education and cuts down old growth trees. He dies beneath a fallen timber. Then a fisherman is eaten by bears. A lady named Harriet steps on insects and kills a snake. She then gets a viral infection from a rodent and dies. Larson attempts to incorporate humor throughout but some topics are just not funny. The final page shows Harriet's skeleton slowly sinking into the earth. Her hair gets into the worm's food, hence the book title. And this is a children's story.

This book is not like Larson's earlier comics. The evolutionary themes are clear: death is good and humans are dumber than animals. Any innocent enjoyment of the Creation is questioned. Flowers are said to have color to bring about a maniacal, sexual, reproductive battlefield (p. 17). Bird song is not an expression of joy but "an array of insults, warnings, and come-ons" (p. 23).

Your original humor is missed, Gary Larson. But surely you can do better than this effort to impress evolutionary biologists.

Bacterial Resistance to Antibiotics—A Case of *Un*-Natural Selection

Eric Penrose*

Abstract

Although the development of bacterial resistance to antibiotics is frequently described as classical Darwinian natural selection in progress, a closer examination reveals no such example. This evalu-

ation is based on a consideration of the basic tenets of “natural selection” in light of our current understanding of the development and spread of resistance mechanisms.

Natural Selection

Natural selection leading to the development of differentiation and subsequent speciation is a process in evolutionary theory which involves three key elements. First, the process requires the existence of genetic variation. This may be introduced to the population through an initial random mutation in one organism. Second, this variation is followed by competition, as a sorting mechanism. During this sorting, organisms expressing a ‘preferred’ or ‘superior’ variation are expected to out-populate their inferior counter-parts due to their inherent advantage. Third, the repetition of cycles of variation and competition will, over time, lead to the accumulation of superior traits, i.e. Darwinian gradualism, with the subsequent separation of new species, i.e. ‘evolutionary speciation’. If natural selection leads to evolutionary improvement in diversity or differentiation, the variations accumulated must in fact not just be ‘better adaptations’ of existing structures or processing systems, but must eventually introduce new structures or processes which the organism can utilize to its benefit, and selectively pass to its progeny.

Bacterial resistance to antibiotics has been touted in the scientific literature as a verified example of this evolutionary process. For example,

In many instances of acquired drug resistance natural selection, with its requirement for mutation and biological variation, is the most likely process to explain the resistant phenotype. The essence of this mechanism is the selection of individuals that can withstand the chemical insult and hence outgrow their susceptible counterparts....There are many examples of acquired drug resistance through natural selection. In *E. coli*, structural changes in penicillin-binding proteins can result in resistance to the anti-

biotics mecillinam or cephalosporin, changes in the structure of the β -subunit of RNA polymerase can confer resistance to rifampicin, and changes in the structure of DNA gyrase can confer resistance to nalidixic acid or novobiocin.” (Hayes & Wolf, 1990).

The question to be considered now, is whether the facts related to bacterial resistance mechanisms are consistent with this process of Darwinian natural selection as an explanation for their origin.

Resistance Mechanisms

Although several hundred commercially available antibiotics are now available, most of these compounds are based on just a handful of effective chemical architectures which target only a few critical bacterial structures or processes (see Table I).

In turn, resistance mechanisms can also be sub-grouped into 1) those which cause inactivation of the antibacterial agent, such as β -lactamase, 2) those which

Table I. Antibiotic Target Groups and Examples

Cell Wall	β -lactams, e.g., penicillin family, cephalosporins
Cell Membrane	e.g., polymyxin B, nystatin, magainin
Protein Synthesis	macrolides, e.g., erythromycin tetracyclines aminoglycosides, e.g., streptomycin
DNA Processes	quinolones, e.g., norfloxacin
RNA Processes	rifamycins, e.g., rifampin
Metabolic Analogs	sulfonamides, e.g., sulfanilamide
Other	pro-drugs, e.g., isoniazid (anti-tuberculosis agent) antisense RNA

*Eric Penrose, 53 Homewood Ave., Kitchener, Ontario N2M 1X1

Received 2 October 1997; Revised 18 July 1998

modify the target, such as ribosome methylating enzymes or structural mutations, and 3) those that reduce the effective concentration of the antibacterial agent in the cell, such as efflux pumps or overexpression / overproduction of the target (see Figure 1).

The Role of Mutation in the Process of Natural Selection

Mutations appear to play only a minor role in the development of resistance mechanisms since they only act on pre-existing genes.

Families of antibiotics have been developed based on a common structural theme. For example, the penicillins incorporate the β -lactam ring as the common molecular foundation (Figure 2). These molecules are bactericidal due to their interference in the normal synthesis process of the bacterial cell wall. The enzyme, β -lactamase, confers resistance due to its ability to cleave the β -lactam ring, thereby rendering the antibiotic inactive.

More than any other antibacterial agent, the β -lactam containing molecules have been extensively modified through the addition of 'side-chains'. Generally speaking, the side chains act physically or chemically to interfere with β -lactamase's function of cleaving the lactam ring, by interfering with the enzyme's ability to productively bind the antibiotic in its active site. However, each new drug variation has typically, in time, been rendered ineffective by the development and spread of a novel β -lactamase, which restores resistance to the bacterium. The novel β -lactamase is usually the result of a mutation acting on the β -lactamase gene which causes a substitution of one or more of the amino acids involved in the process of antibiotic binding and cleavage. The mutant

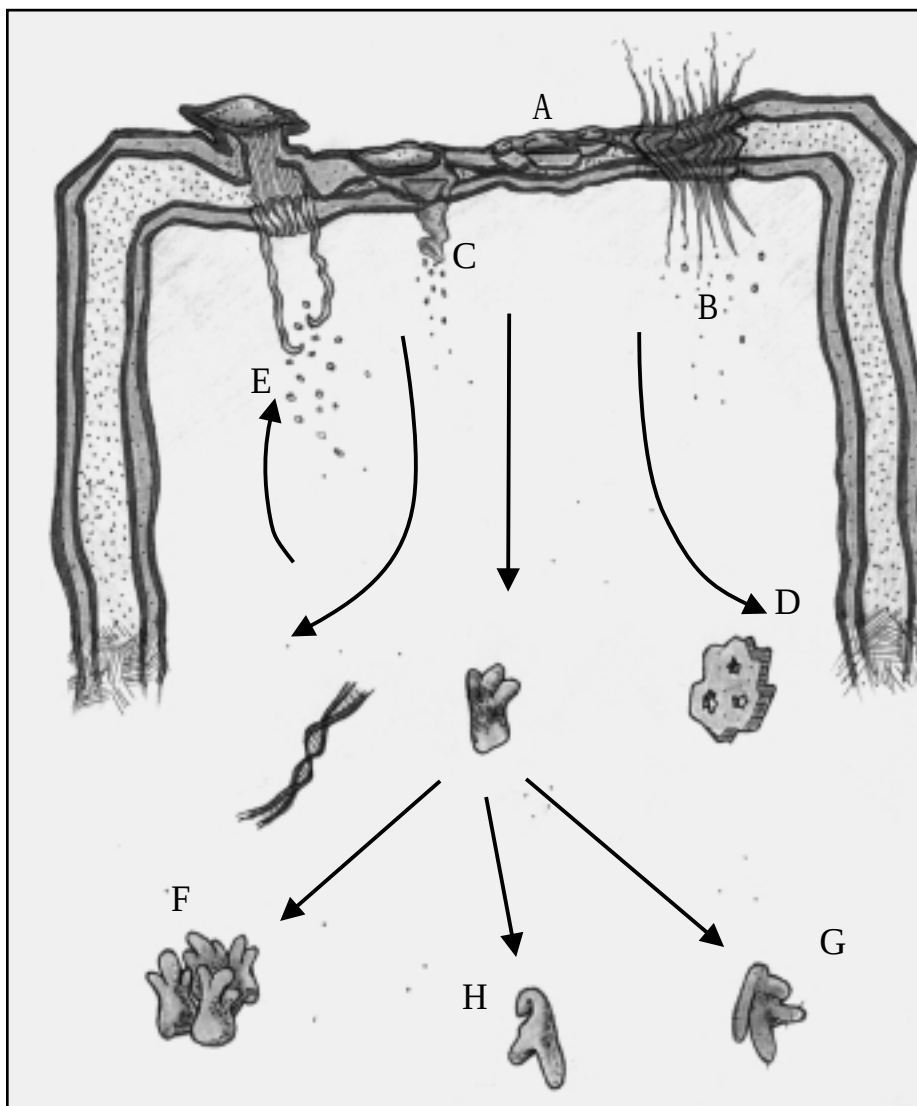


Figure 1. Illustration of mechanisms involved in antibiotic resistance: A) the outer membrane of gram negative bacteria serves as a permeability barrier—however, specific proteins in the outer membrane, called porins, serve as diffusion channels or gateways for some hydrophilic molecules—loss of porins increases the resistance to some antibiotics; B) hydrophobic molecules may diffuse through the membrane itself, but some mutations involving outer membrane biochemistry have an impact on such diffusion rates, thus the mutations potentially increase drug resistance; C) specific trans-membrane transporters serve to import various target molecules such as nutrients, but may also include some antibiotics such as metabolic analogues—mutation or loss of the transporter may increase resistance; D) antibiotics in the periplasm or cytoplasm may be inactivated through modification, isolation, or destruction; E) efflux pumps may apply metabolic energy to push antibiotics from the cytoplasm thereby reducing the effective concentration inside the cell; F) mutations may cause a significant increase in the quantity of the target enzyme, such that the therapeutic concentration of the antibiotic is no longer sufficient to halt that metabolic process; G) mutations may modify the cellular target such that the antibiotic is no longer effective; H) some antibiotics may be effective temporarily, but cellular repair mechanisms, redundant regulatory systems or subsequent protein synthesis later restore vitality to the bacteria.

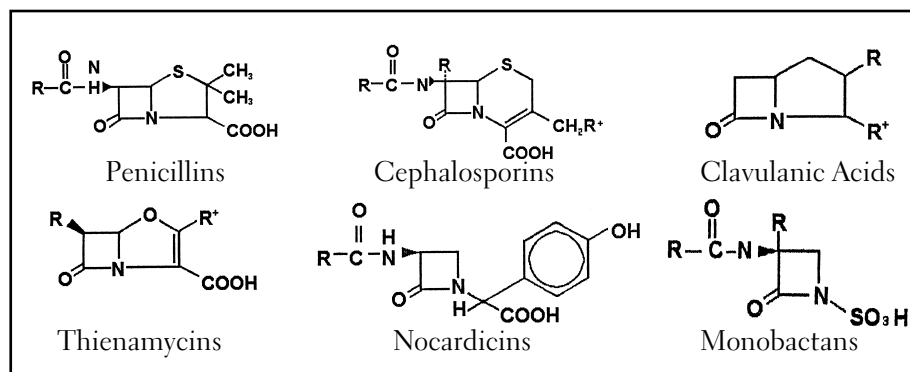


Figure 2. Examples of antibiotics based on the β -lactam structure, which is specifically represented schematically as the square "ring."

enzyme, due to its structural or chemical change, compensates for the changes made to the antibiotic structure, and thereby restores the ability of the enzyme to successfully bind the antibiotic and cleave the ring structure. Through this process, the β -lactamases themselves have become a large family of enzymes which are subdivided according to their specific antibiotic deactivating profile.

In the above example, the development of resistance to new antibacterial agents is based on the introduction of variation through genetic mutation. Thus, it appears that this may demonstrate the first requirement of the natural selection process. However, the 'functionality' of the resistance mechanism which is the true resistance determinant, i.e., the ability of the enzyme to break the β -lactam ring, did not change even though the specific shapes of the antibiotics the enzyme will deactivate has been slightly modified. Although an existing active catalytic site may tolerate a rare mutational event which modifies the binding pocket of the enzyme, it nonetheless does not represent the development of a distinct new mechanism of resistance. Noting that most antibiotics are, like the β -lactams, merely derivatives based on a particular antibacterial architecture, the statement can be extended to the majority of those in antibiotic families.

A similar form of resistance can occur when a mutation results in gene duplication for the bacterial structure or processing system targeted by a particular antibiotic. In this case, since the mutant bacterium now produces significantly more of the target, it will be more resistant than its normal wild-type relatives to a given dosage level of the antibiotic. In other words, it will take a higher dosage of the antibiotic to overcome the increase in the number of targets in the organism. Again however, it should be recognized that this mutation does not represent the development of a novel functionality, but in effect simply re-establishes the cell's normal operating status quo in the face of the antibiotic insult. The theoretical contribution of gene duplication events toward evolutionary development does not apply in the case of

resistance to antibacterial agents, since in this case resistance is conferred because of the stabilizing or restoration of a metabolic process or structure, rather than the introduction of an alternate process or structure with subsequent mutation and diversification.

In both of the above examples, the enzymes or structures involved require the pre-existence of a functional gene, and as a result of mutation, the organism has not gained any new functionality which may be useful to

the bacterium for other purposes. Therefore, no 'advancement' or functional diversification has occurred for the organism. Since no new functions or structures have been developed in either of these examples of resistant mutants, these types of mutations are inadequate in themselves as evidence to support Darwinian natural selection leading to speciation.

The origin of resistance genes is difficult to explain.

Mutation of a pre-existing resistance gene as discussed above, does not in fact address the question of how that gene originated in the first place. While some of the bacterial resistance determinants are carried on the bacterial chromosome, the majority of those which have been identified from resistant clinical isolates are carried in the cell as resistance plasmids (R-plasmids or R-factors). R-plasmids are small closed loops of DNA which contain the genetic code for one or more proteins, as well as the DNA promoter sequences necessary for its transcription. Further, for the resistance gene and the plasmid to be reproduced, the DNA must also contain a specific sequence called a replication origin. The replication origin is necessary because plasmid DNA is independent of the bacterial chromosome, and without this the plasmid will not routinely replicate during cell growth and division.

The evolutionary origin and development of R-factors is unknown. It was suggested over 25 years ago that some R-factors found in resistant bacteria may have originated from the genes of organisms that synthesize antibiotics, such as *Streptomyces* (Walker and Walker, 1970). Statements such as, "An ancestral β -lactamase cannot be identified, but *Streptomyces* are ancient and their β -lactamases presumably appeared early in evolution" (Couture et al., 1992) reveal this as a presumptive philosophical hypothesis, rather than an empirically demonstrated one. This concept continues to be promoted as an evolutionary explanation for R-plasmids (Cundliffe, 1989; Wilkins, 1996) despite the fact that, "...we can only speculate on the environmental and evolutionary factors

that play a role in their formation and maintenance” (Benveniste and Davies, 1973).

This explanation however, does not resolve the origin of R-plasmids, but simply defers it. The evolution of antibiotic production through natural selection faces a seemingly insurmountable problem if you consider that as soon as any variation which causes the biosynthesis of a new compound with antibacterial properties is introduced, that organism would in fact be committing suicide. The producing organism would be defenseless to new antibiotic, and the mutation would therefore be immediately lost as no mutant offspring would be produced. Thus, antibiotic production and the production of an applicable resistance mechanism are ‘**biochemically co-dependent**’ in the host. This means that the synthesis of antibiotics cannot occur without an effective resistance mechanism also being in place. It is possible for an organism to synthesize one of the antibiotics that it is not naturally susceptible to, but this is not the common scenario found in many of the wild-type antibiotic producers (Rodriguez et al., 1993). Instead, this problem is addressed for most of the producing organisms by the inclusion of a resistance gene(s) in the antibiotic’s biosynthetic gene cluster. This in turn means that the cell must have carried not only a developing system of genes for the antibiotic’s biosynthetic enzymes prior to the compound actually being functional as an ‘antibiotic’, but also the organism must have carried and maintained a system of resistance genes to protect itself, prior to their having any useful functionality. In this scenario, it would appear from an evolutionary perspective that either the fully functional resistance mechanism evolved first, which would be unlikely considering it would have no ‘selection value’ until perfected, or else the two systems ‘co-evolved’. The tight biochemical co-dependency of the two gene systems and their association in biosynthetic gene clusters within the antibiotic producing organisms argues against an evolutionary explanation based on natural selection.

The high level of complexity and unknown natural physiological function of some resistance mechanisms further complicates the evolutionary development problem. Many resistance mechanisms are not based just on a single gene, but require the expression of numerous genes to operate. In the case of Gram negative bacteria, the cell has both an inner and outer membrane, with an intervening space called the periplasm (Ferguson, 1992). The outer membrane is a particularly effective barrier which acts to slow the uptake of the antibiotic from the surrounding medium. However, according to the principles of diffusion, under steady state conditions the concentration gradient across the membranes will eventually reach an equilibrium consistent with the chemical nature of the antibiotic and the transmembrane pH gradient

(Thanassi et al., 1995). Slow uptake alone therefore does not confer a significant level of resistance. However, it can offer a resistance advantage if it is coupled with a second resistance factor such as an efflux pump system. Such efflux systems selectively collect the antibiotic molecules that do cross the outer membrane barrier, and efflux them back to the outer environment (Paulsen et al., 1996). If efflux is faster than diffusional influx, the internal concentration of the antibiotic can potentially be kept relatively low.

There is a problem however for efflux based resistance if the antibiotic is only pumped from the cytoplasm to the periplasm. In this case it may build up a concentration of molecules in the periplasm. In this situation the outer membrane would act as a diffusional barrier to contain the drug. Increasing the periplasmic concentration of the drug in this way would disturb the concentration gradient across the inner membrane, and thus also increase the rate of diffusion of the antibiotic back through the inner membrane into the cytoplasm. For efflux systems to be an effective resistance mechanism for many types of antibiotics, an additional system must be added. In many cases, such as the chromosomally based *Pseudomonas aeruginosa* MexA-MexB-OprM system (Poole et al., 1996), the efflux pump of the inner membrane (MexB), has been coupled to a protein which provides a bridging conduit across the periplasm (MexA), which in turn is coupled to an outer membrane pore (OprM). The result is the efflux of an antibiotic from the cytoplasm to the external environment in one step, after which the barrier of the outer membrane can then support the resistance gained by the efflux pump system by slowing the inward diffusion of the antibiotic molecules.

The development of an antibiotic efflux pump alone may not confer any practical advantage for the Gram negative bacteria unless it is specifically coupled to the proteins which allow for the complete export of the drug through the outer membrane. In the best known examples, the system is encoded together as a three gene operon, although the Acr systems of *E. coli* apparently share the outer membrane protein TolC. Therefore, even if the gene for one of the components, such as the efflux pump protein, was transferred intact from an antibiotic producer such as *Streptomyces* which is Gram positive and lacks the accessory conduit proteins, it would be ineffective as a significant resistance mechanism. Systems such as these which integrate several additional proteins are themselves biochemically co-dependent for resistance functionality as each single component has limited, if any, resistance activity (Yoneyama et al., 1997). In addition to this high level of complexity, it is interesting to note that the purpose of the family of RND efflux systems, which includes the *Pseudomonas aeruginosa* Mex efflux systems, as well as the *E. coli* Acr efflux systems, is

not known. The natural roles or metabolic substrates suggested to be involved in the efflux systems are at best speculative.

Some bacteria develop resistance due to the 'loss' of structures or genetic information, rather than through a gain of novel processes or structures.

In the case of Gram negative bacteria, the outer membrane contains water filled protein channels called 'porins', which serve as gateways to admit small hydrophilic molecules to the periplasm, including some antibiotics. Several different porins exist, and their channel sizes and shapes vary, which gives some degree of selective permeability for the outer membrane based on the size and shape or electrical charge of the molecule attempting to enter the periplasm (Hancock et al., 1990). In several cases involving resistant strains of bacteria, it has been noted that particular porin types are missing or greatly reduced in number (Medeiros et al., 1987). These mutants may appear to have gained a 'selective advantage' in being more resistant to the antibiotic challenge than their close relatives, but in fact the 'gain' is just the opposite — it is in fact a 'loss' of genetic information and structure. Another example of this type of 'loss' is reflected in the increased resistance conferred due to intrinsic antibiotic efflux systems. In cases such as the *Pseudomonas aeruginosa* MexAB-OprM three-gene operon, the system is transcribed more frequently due to a loss of negative regulatory controls caused by mutation in the negative control gene or genes. What needs to be demonstrated to vindicate the natural selection paradigm is not loss of genes or regulatory controls but evolution of new genes or controls.

A similar phenomena may occur with antibiotics that function as substrate analogues to produce competitive inhibition. An analogue resembles the natural substrate of an enzyme, but it causes metabolic interference when it competes with the natural substrate in binding to that enzyme, blocking its activity. Such types of antibiotics may tie up the enzyme in competitive but non-productive interactions, or may even disable it, thereby adversely affecting the growth of the bacterium. One form of resistance to these antibiotic analogues occurs when a mutation in the enzyme reduces the affinity for its natural metabolic substrate, and thus also for the substrate analogue antibiotic. Such a mutation may permit the bacteria to better tolerate a transient antibiotic insult due to its much slower metabolic rate in the targeted process, whereas its more robust relatives may be killed or severely damaged by the antibiotic. From the perspective of natural selection, not only has no new function been devel-

oped in this example, but worse, this mutation has taken a 'superior' form of an enzyme, i.e. one of higher affinity and processing capacity, and substituted through mutation an 'inferior' form of the enzyme, which lacks its predecessors more efficient structure. This cannot be considered an evolutionary advancement.

Competition

R-plasmids are promiscuously shared across species, but may be lost to progeny.

One of the issues which makes the spread of antibiotic resistance in bacteria a significant medical problem is the fact that the R-plasmids are often spread from one cell to many others. The spread occurs not only to these species, but also potentially across genus levels, and in some examples even beyond this taxonomic rank. This is accomplished through fertility factors which are often included on the R-plasmid itself, and which promote the transfer of the DNA from cell to cell. The end result of this promiscuous behavior is that the resistance mechanisms can be spread broadly, even in the absence of an ongoing antibiotic threat. The paradigm of evolutionary natural selection stipulates that a superior trait will more likely be passed to an offspring. A phenotypic change in the population occurs through out-populating the competition with numerous 'superior' progeny. The behavior of freely giving away ones 'advantage' would appear to be in direct conflict with natural selection. In this situation, the advantage of the resistance mechanism is lost as a superior trait over those other genetic lineages with which a bacterium is expected to be in close competition. The progeny of the resistant strain, therefore, have gained no competitive advantage.

An additional issue related to R-plasmids is the fact that their replication is not directly tied to the replication of the bacterial chromosome. When the bacterium reproduces, it divides its cytoplasm between the two daughter cells. If the replication of the R-plasmid is slower than that of the bacterial chromosome, it may in fact become diluted and lost to some of the progeny during the process of cellular fission. One of the challenges of biotechnology is establishing installed plasmids as 'stable' plasmids, so that they will not be lost or unfavorably over-replicated during cellular growth.

Thus, since an advantage carried on an R-plasmid is typically shared with those of a different genetic heritage, and further, since it may easily be lost to some of the progeny, it appears that R-plasmids are in direct conflict with the expectations of the natural selection process.

Selection is based on catastrophe, not competition.

When faced with an antibiotic challenge, possessing or not possessing the resistance mechanism is not simply a matter of ‘competition’—it is routinely the difference between life and death for the organism. While survival is logically a benefit to the individual, it does not specifically explain how evolutionary advancement occurs. Prior to the antibiotic challenge the resistance mechanism has no real selection advantage. Since there is therefore little control over which of the bacterial cells, or more specifically, which ‘genetic lineage’ passes along the resistance mechanism to its off-spring, in a given wild-type population the more ‘robust’ bacterial strains may be wiped out entirely, while the ‘inferior’, i.e. less advanced, may become the sole survivors. Thus, the determination of which genetic lineage will ‘out-populate’ is based on a single determinant which is completely independent of the organisms overall wild type robustness or developmental advancement. Many ‘superior’ traits in metabolism and physiology can therefore be completely erased from the population gene pool based on the organisms lack of a single determinant, i.e. the resistance mechanism, which had previously offered no fitness benefit. This is counter-productive to the natural selection process.

The ‘fitness cost’ associated with competition and sorting based on resistance factors has been recognized (Lammerts, 1967; Medeiros et al., 1987; Pan and Spratt, 1994) and is currently being studied (Schrag and Perrot, 1996). After the antibiotic insult, the population appears to ‘recover’ some of its lost genetic potential over a number of subsequent generations. The fact remains however, that the surviving bacteria are not as robust as the unchallenged wild-type. For example, in the case of *E. coli tonB* mutations, the bacterium is resistant to some antibiotics, but is typically avirulent as a result of its inability to take up iron in the host environment (Nikaido, 1994). Another example of the inferior nature of the resistant mutants can be seen from studies of the RND family of drug efflux systems. Difficulties in culturing laboratory strains have been encountered due to an undefined deleterious effect caused by overproduction of these proteins or their activity. This may be due to unfavorable changes in the membrane structures of the strains, or may be the result of the efflux pumps extruding needed metabolic intermediates from the cell. Similarly, Levy commented, “The resistant strain has no real advantage without the presence of an antibiotic...The strain would die out due to natural competition.” (Levy, 1997).

Obviously the mere survival of a few fortunate bacteria must be a better evolutionary outcome than a complete elimination of the species altogether. In this light, even if the species survival does occur through just the inferior strains, the possession of resistance mechanisms would

appear to be a bearable ‘fitness penalty’ for the forthcoming generations. However, resistance alone subordinates all the other aspects of ‘fitness’ in the face of a catastrophic antibiotic assault, thereby dealing a set-back to gene pool expansion and the speciation process. This pushes such resistance characteristics outside the normal expectations of the natural selection paradigm and Darwinian gradualism, into a separate theoretical discussion (Wilson, 1997).

The extensive application of commercial antibiotics has created an ‘un-natural’ environment for the development of resistant strains.

The following comments serve to emphasize just how ‘un-natural’ the antibiotic resistance environment really is. Firstly, the chemical architecture of the active agent, and the microbial targets for commercial antibiotic preparations are selected purposefully and by design, not by ‘random mutation’ letting nature run its course. Secondly, the compounds are often semi-synthetic, meaning they may be compounds that for practical reasons will never be synthesized by micro-organisms in the wild, i.e. they are not ‘natural’ molecules. Thirdly, in order to enhance their therapeutic effect, commercial antibiotic preparations are typically purified, concentrated and super-potent, i.e. they have been made to a very high strength, well beyond that normally found in a natural environment. Fourth, these designed, artificial, super-potent drugs are not only being used in therapeutic treatment of bacterial infections, but are being broadcast at large, for example in animal feed supplements. For example, in 1994 Denmark used approximately 24 kg of vancomycin for human therapy, while 24,000 kg of avoparcin, a glycopeptide antibiotic known to induce cross resistance to vancomycin, was used in animal feed. Similarly, from 1992 to 1996 Australia averaged annually 582 kg of vancomycin for human use, while an additional 62,642 kg per year of avoparcin was imported for agricultural applications (Witte, 1998). This is not the equivalent of a natural environment of close quarter competition in a tight ecological niche, between the antibiotic-producer and its so-called competitor. As a result, the resistance mechanisms are being found in a broad range of non-clinical / non-competitive settings where selection would not normally be expected to operate. Fifth, the ecology involving clinical pathogens is not necessarily the natural host / pathogen relationship. For example, a medical treatment including antibiotics may wipe out the microbial flora which are normal and helpful to the body. As a consequence, bacteria which happen to possess resistance mechanisms gain a free range to grow and cause clinical problems, even though they are normally not a problem. Resistance as expressed in its clinical set-

ting is therefore not being expressed in the natural environment, but in an ecological niche which lacks the normal competitive checks and balances of the wild-type population. Webb and Davies (1993) note,

Analysis of bacterial collections from the preantibiotic era indicates that although plasmids were present in some of the strains, they did not harbor antibiotic resistance genes. The conclusion is that the development of antibiotic-resistant microbial populations occurred after the introduction of antibiotics into clinical use.

Sixth, when antibiotics are produced from live cultures, the purification process will remove the living organisms from the final product. However, it has been demonstrated that not all of the cellular 'debris' or components from dead cells in the culture are removed. As a result, many antibiotic preparations have been contaminated with the DNA of the antibiotic producing organism, including their internal resistance genes (Webb and Davies, 1993). Clinical administration of antibiotic therapy therefore seems more like a domestic breeding program than a natural competition.

In considering the 'un-natural' development and spread of resistance mechanisms with respect to biotechnology, molecular biologists design plasmids or chromosomes to include drug resistance in addition to the gene under study as a tool for screening or isolating transformed mutants from the non-transformed population. While this concept might be thought of as an example of a 'gain in function' for the organism, i.e. picking up a new gene along with the resistance gene, it is still merely an example of horizontal gene transfer. Thus, in addition to being the result of 'intelligent design' in the laboratory as opposed to a natural selection process, biotechnology, as noted with the origin of antibiotic resistance mechanisms above, still does not answer the question of the actual 'origin' of the information content for the gene, i.e. nothing new has been developed — only transferred.

Evolutionary Speciation

In addition to failing the requirements for the first two steps in Darwinian natural selection, i.e. mutation / variation followed by a sorting of the new resistant phenotype through competition, the acquisition and spread of resistance genes also fails the third requirement, i.e., the formation of new 'species'. Resistant mutants share the species specific genome and therefore a basic physiology with their related non-resistant wild-type population. A novel mutation which confers resistance to an organism and subsequently to the population, in itself therefore, lacks any true 'advancement' on the species level. Identifying some minor variation or adaptation does not over-

rule the fact that the species genome is at best 'stable', or at worst 'degenerative' (Moore, 1974). Natural selection requires the accumulation of superior traits leading to a distinct species, however, even the collection of numerous resistance mechanisms in an organism will not alter the basic physiology of that organism. Further, it has been long recognized that a resistant mutant strain may actually have a loss of rather than an advancement of genetic information, or may be otherwise less robust than the wild-type non-resistant organisms (Lammerts, 1967). Thus, even if mutation and competition could be shown to be tools for working the natural selection process, the resulting population has not graduated to a new more complex form, but will simply continue to survive, at best only consistent with the current species genome and phenotype. An antibiotic challenge may therefore be an agent to force a 'selection' within the population, but that selection is not the kind that leads to the differentiation of new more advanced organisms or species. In other words, no 'evolutionary speciation' has been demonstrated due to the addition of resistance genes.

Summary and Conclusions

Natural selection does not provide a satisfactory explanation for the origin of even one gene for a functional resistance mechanism, further, it offers no means through which such an acquisition can make a population distinct enough to be considered a new species. If the development and spread of antibiotic resistance mechanisms were truly the result of Darwinian natural selection, there should be ample evidence of the introduction of 'mutation and variation', followed by 'competition' which favors the superior organism, resulting speciation. Instead however, we see that for each of these expectations, the evidence stands against natural selection. Mutation plays only a minor role, merely causing minor modifications of a pre-existing gene whose origin cannot be explained naturally. Further, some aspects of resistance are based on a loss of structures or processes, not the gain or addition of genetic information. Resistance mechanisms are often shared promiscuously amongst a species or genus, rather than conferring an advantage to one genetic lineage. Resistance is not a matter of gradualism through competition, but of survival in catastrophe. Finally, the environment for the development and spread of antibiotic resistance is 'un-natural'.

While embellished Darwinian stories, specific survival scenarios, or odd exceptions may offer interesting theoretical discussion, the facts confirm that antibiotic resistance is not an example of Darwinian natural selection. Bacterial resistance to antibiotics appears to be a case of "un-natural selection."

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 Erratum

In CRSQ volume 34, page 233, there is an error in the sentence:

“Although the Deluge appears to be the only reasonable explanation for the geologic conditions necessary to form the deposit, greater precision in historical placement of the deposit than that presented here does not appear justified by the scientific data is is probably unwise.” The word “is” is incorrectly repeated. Replace the first “is” by “and.”

Bridging the Artificial Dichotomy Between the Putative “Physical” and “Metaphysical” Realities

Jerry Bergman*

Abstract

A pervasive tendency now exists for scientists and writers to radically dichotomize the so-called “metaphysical” and “physical” realities. This position is a form of dualism and is not only artificial but is forced upon the real world and probably distorts our perception of reality. No compelling reason or logic requires the universe to exist as sharply divided “physical” and “metaphysical” realities. The source of this division can be traced to ancient Greek speculation and has become an assumption that is now a firm part of our intellectual tradition. Orthodox science’s rigid accept-

ance of the monist position, which argues that only matter exists, is actually a derivative of dualism: the dichotomy is accepted but the reality of one side of it is rejected. This dualism has resulted in the design view of reality being labeled metaphysical, then rejected as outside of science. In contrast, naturalism is called physical, and therefore within the realm of science. The view of the over 10,000 American scientists who accept the creation world view, including the belief that God created Adam and Eve less than 10,000 years ago, should be considered.

Introduction

In the creation-evolution debate, evolutionary naturalism is often termed empirical and the creation world view termed *metaphysical*.¹ The meaning of the term *metaphysical* has changed historically and its use is by no means consistent today. In most contemporary philosophy of science works, the term refers to that which is above or apart from physics. The term metaphysical is from the Greek *meta ta physika*, literally, “after the things of nature,” or that which exists apart from the physical world and is neither amenable to, nor readily understandable by, that research which is achieved through traditional laboratory methods. Weedon defines the term as follows:

The term, “science,” is ... “knowledge by causes,” where “knowledge” is contrasted with “opinion” and the term cause has the full signification of the Greek *aitia*. The “causes” which are the objects of metaphysical cognition are said to be “first” in the natural order (first principles), as being founded in

no higher or more complete generalizations available to the human intellect by means of its own natural powers. Secondary and derivative meanings: (a) Anything concerned with the supra-physical. Thus “metaphysical healing,” “metaphysical poetry,” Any scheme of explanation which transcends the inadequacies or inaccuracies of ordinary thought (1972, p.196).

Science not only studies the material world, but also investigates the events which manifest themselves through matter such as energy. In actuality, physical laws are human interpretations of apparent regularities in the natural world. Metaphysics, on the other hand, usually includes that reality which is more commonly understood as spiritual—specifically the study of God, angels, demons, and the “spirit” world (Hancock, 1972). The term metaphysics as used here is similar to that typically used by creationism critics; namely, all that is part of the non-physical “spirit” world including God and not the

*Jerry Bergman, Ph.D.
Northwest State College
22-600 State Route 34
Archbold, OH 43502

Received 3 December 1996; Revised 2 January 1998

¹The terms *creation* and *evolution* are defined in this paper generally as per Johnson (1991, p. 4) viz., *evolution* means naturalistic evolution not directed by purposeful intelligence, and *creation* means that a supernatural creator both initiated and controls the universe and that which it contains.

broad use now in vogue among some philosophers. In discussions of the contemporary views on the metaphysical-physical dichotomy, scientists are often inclined to conclude that the only reality which in fact exists is the physical, and consequently they dismiss all of that which they define as metaphysical as non-existent or unknowable. This paper argues that more consideration needs to be given not only to the reality of various aspects of that knowledge labeled metaphysical, but also to the interaction of the so-called physical and metaphysical worlds (Burt, 1954). At the least they share certain elements such as ontology while at the same time they are different in ways that need to be explored further.

Some dichotomies which are implied from a physical-metaphysical dichotomy include the following:

- physical vs. metaphysical
- body vs. mind
- secular vs. spiritual
- temporal vs. eternal

The fallacious nature of the physical-metaphysical dichotomy becomes apparent when one considers the possibility that secular scientists may well be distorting reality by deliberately ignoring that part of it which at our current knowledge level cannot be regularly predicted in response to the direct manipulation of physical events. This view is called *reductionistic monism*, and it is argued here excludes certain sources of knowledge and viable hypotheses. To fully understand all reality, though, all epistemologies must at least be considered. What is learned by the empirical method is not necessarily more real or valid than what is discerned by other methods. Many scientists concede that a God may exist, but the rules of science preclude our explaining anything by appealing to Him (Margenau and Varghese, 1992).

These self-imposed blinders may well prevent orthodox science from understanding all of reality. Is it not better to accept truth wherever one finds it, and let it take one wherever it leads? In actuality, both science and metaphysics focus on both “the apparent and the real” and are “commonly presented as the most fundamental and also the most comprehensive” methods of learning (Walsh, 1972 p. 301). An estimated over 10,000 American scientists (5% of the 200,000 scientists) accept the creation world view, including the belief that God created Adam and Eve less than 10,000 years ago (Madigan, 1997; Stewart, 1987).

The design argument is typically labeled metaphysical by many of the non-creation scientists, as are often all theological views as well, and consequently judged unacceptable as an area of research for science or even favorable discussion in a science class. Ironically, the arguments used to refute the design argument are very similar to those used to support it. Its supporters point out examples of efficiency, complexity, and economy as

proof of intelligent design, and its detractors point to what they consider examples of poor design, such as the placement of the rods and cones on the retina, to argue that a designer does not exist (Miller, 1994). Consequently, either both of those arguments are metaphysical or neither is metaphysical. Further, the implication is that a metaphysical reality does not exist, but is illusory.

The next step is for naturalistic evolutionists to label evolution “science,” and thereby presenting it as a world view that can—and should—be discussed in public school science classes without opposition. Opponents of the design world view often assert that it is inappropriate in science to appeal to a creator or any transcendent reality and therefore scientists *must* assume a strict atheistic orientation when doing science. They also claim that this world view is the only one which can be used to properly abstract laws from physical reality. They tend to ignore the contributions of those they label non-scientists even though many modern “metaphysicians have constantly aspired to ... determine the real nature of things; they have been preoccupied ... with the concept of existence and reality” (Walsh, 1972, p.301). Conversely, scientists use scientism to produce their own metaphysics, such as the conclusion that all life is the product of a mindless, algorithmic process of evolution:

...if mindless evolution could account for the breathtakingly clever artifacts of the biosphere, how could the products of our own “real” minds be exempt from an evolutionary explanation? Darwin’s idea thus also threatened to spread all the way up, dissolving the illusion of our own authorship, our own divine spark of creativity and understanding (Dennett, 1995, p. 63).

To this reasoning Johnson has replied that science has actually not disregarded metaphysics but reversed it and as a result:

it soon became as unthinkable within science to credit any biological feature to a designer as it had previously been unthinkable to do without the designer. Whenever seemingly insuperable problems were encountered—the genetic mechanism, the human mind, the ultimate origin of life—biologists were confident that a solution of the Darwinian kind would be found.... Although many aspects of evolutionary theory remain controversial, Dennett asserts confidently that the overall success of Darwinism-in-principle has been so smashing that the basic program—all the way up and all the way down—is established beyond question. And yet the resistance continues. Some of it comes from religious people, who want to preserve some role for a creator. Dennett just brushes aside the outright creationists, but takes more pains to refute those who would say that God is the author of the laws of

nature, including that marvelous evolutionary process that does all the designing. The Darwinian alternative to a Lawgiver at the beginning of the universe is to postpone the beginning indefinitely by hypothesizing something like an eternal system of evolution at the level of universes (1995, p.10).

Dennett argues nothing is real except that accepted by naturalistic evolutionists, yet the scientific establishment accepts many ideas that are nonempirical or metaphysical. The materialists teach a very clear metaphysical position as summarized by Shapley's conclusion "in the beginning, was hydrogen . . ." or Sagan's (1980, p. 4) "the cosmos is all that is or ever was or ever will be," both ideas which have been challenged by many findings of modern science. A major historical concern of philosophy is to integrate metaphysical and physical realities, including those that many dichotomize as science and religion. The field has helped to demonstrate that, while the science-metaphysical (or religious) dichotomy can be useful and although some differences exist, a dichotomy is artificial.

Further, we will argue that it can limit both "religious" understanding and scientific progress. The physical-metaphysical conflict has vividly surfaced in both the current creation-evolution controversy and the study of biological origins and cosmology in general. Elimination of this dichotomy implies examining the *source of all knowledge*, which demonstrates science relies not only on sensory input knowledge but also relies on the powers of reasoning, logic, analysis, and intuition, all of which are also important "sources of knowing" in the spiritual/religious sphere. The resurgence of popular interest in the so-called occult and such related areas as extrasensory perception (ESP) and transcendental meditation (TM)—fields in which both the scientific method and more traditional ways of knowing are used—may not say much about the validity of these theories but does illustrate the widespread concern that our knowledge sources should be expanded beyond the purely physical (Taylor, 1980).

A common assumption of the secular science establishment is the so-called non-material events and phenomena are somehow less "real" than the subject matter which physical scientists have traditionally studied (Johnson, 1995). No compelling reason exists as to why the logic of traditional science *cannot* be applied to the so-called "metaphysical" area. Phenomena that cannot be perceived directly by human senses are not necessarily less real or less testable by the scientific method than physical events. Although the scientific method is limited to testable phenomena, more complex procedures and a greater understanding of the physical and non-physical aspects of the universe may be required in order to understand that reality now labeled metaphysical. Metaphysical reality may be less obvious and more diffi-

cult to research, but this does not make it less real. Of course our present inability to measure something should not stop us from exploring it as Murphy makes clear:

When the logical positivists and their predecessors excluded "metaphysical" entities from science, they meant anything which couldn't be measured. This led Comte to claim that the composition of the stars was unknowable because it couldn't be measured—a few years before the beginning of astrophysical spectroscopy! Similarly, Ostwald and Mach denied the reality of atoms before Brownian motion was understood.

What led to those conclusions was basically a lack of imagination. Comte et. al. couldn't think of how things could be measured so they concluded that they couldn't be. But a more basic criticism of positivist arguments can be made. It just isn't true that every concept used at every stage of scientific argument has to be measurable. The wave function in quantum mechanics isn't directly measurable, but it isn't thereby excluded from consideration. Calculations made with the wave function do eventually lead to measurable predictions—energy levels, cross sections, etc., (1994, p.1).

Origin of the Physical-Metaphysical Dualism

The source of the dualism is from "centuries of sophisticated philosophizing" that have produced a "persistent mind/body..." dichotomy which lacks "a factual basis, and psychology would be much better without" this and other dichotomies. (DeWaal, 1996, p. 228). It is almost instinctive in Western society to view the world in terms of dichotomies, a distinction foreign to many other cultures. Many cultures, including the ancient Hebrews, did not divide reality into metaphysical and physical realms (Walsh, 1972). Some eastern philosophies, for example, still view all reality as one, or at least as harmonious and in unity instead of clearly separated in contrast to the Western concept of dualism. Other philosophers deny the physical and accept only the metaphysical. Western philosophy and beliefs are still strongly influenced, even today, by the pre-dualism theory of Plato and Aristotle which has colored—and probably distorted—our view of reality. Although we here argue that a physical-metaphysical dichotomy does not exist, at the minimum researchers should not assume *a priori* that it does and should endeavor to look at reality from *both* perspectives. Much of the difference is clearly artificial and may well prove to be a distortion of reality. It is now well recognized by those who study the issue that "the line between metaphysical and nonmetaphysical is exceedingly hard to

draw" (Walsh, 1972, p. 300).

Christian theology has often uncritically accepted this rigid dichotomy and has actually extended it to many areas (for a discussion of this see Reed, 1996; Sire, 1988; Kofahl, 1988; McGhee, 1988, 1987; Ancil, 1985; Armstrong, 1974). St. Thomas Aquinas developed his "nature-grace" dualism which divided human experience and all reality into two spheres: the *supernatural* (reality revealed to humans by God), and the *natural* (reality which is known to humans only by reason). Aquinas put the political state in the realm of the natural sphere, arguing that its structure, function, and nature could be explained only in purely natural terms. He then put the church in the supernatural realm, arguing that its structure can be explained only in supernatural terms (Halverson, 1981).

Murphy (1982) claims that dualism was actually given a new emphasis by many well-known Christian philosophers as part of their attempts to combat the rise of materialism. He notes that the church has historically adopted a position of "metaphysical *dualism*—a distinction between physical body and spiritual mind (soul) as fundamentally different kinds of substance" (1982, p. 32). According to Murphy, this explanation backfired and actually caused religion's retreat in the face of many new scientific views because the distinction influenced theists to uncritically accept naturalistic/materialistic explanations for phenomena which were formerly explained by theological propositions. A good example is the replacement of theistic creation with naturalistic evolution. In Murphy's words (1982, p. 33) "Darwin eliminated religious teleological explanations... by arguing that species arose, not because God planned or created them that way, but by purely causal [natural] processes." The rationale used by Murphy was as follows:

The world of physical bodies is to be totally explained by deterministic science; this poses no threat to true religion, however, since true religion concerns the realm of mind, soul, or spirit. As long as this realm is conceived as fundamentally different from the physical, what is essentially important...about human beings would be insulated from any threat posed by the march of science (1982, p. 32).

Murphy adds that the creation of this sharp dichotomy was only a "temporary holding measure" because "as long as religion and morality get to keep the mind and spirit (that which is essentially and importantly human), and as long as what goes on in that world is to be explained in terms of purposes (God's and our own), then what threat could be posed by a non-theological account of [the biological, living world]...?" But as science marched on, one side of this dualism, the spiritual side, was increasingly viewed as nonexistent. Thus, the reli-

gious response Murphy notes was to talk about "faith and mystery instead of evidence and reason." This ultimate extension of the Thomasian-Kantian dichotomy led not only to creationism's demise in science but also to theism's retreat and loss of credibility in the scientific world.

Christianity, as exemplified by apologetics, was historically dependent upon both reason and empirical evidence. Events such as the physical resurrection of Christ were used as empirical demonstrations and verification of the resurrection belief as contained in the Gospels. Thus, the radical fragmented position in vogue today among scientists tends to cause, not the acceptance of the purely physical, but only that so *labeled*, and likewise the rejection of that which is *labeled* metaphysical. The labeling is critical in both cases.

Acceptance of the conclusion that other phenomena could exist which are "real" aside from what has been the modern subject matter of science will lead to a broadening of both the interest and respectability of at least some of the research in certain so-called "metaphysical" domains. What is real cannot be determined by sensory impressions alone as often implied by the view called Scientism. The nuances of our processing system (the mind) and especially our *interpretation* of these impressions are both important. Both experience and reason are crucial in the mind's final interpretation of all sensory data. Kapp concludes from his study of the metaphysical-physical dichotomy that:

Progress in basic physics cannot be expected without careful attention to metaphysics. The scorn that is sometimes cast on this discipline is...usually misplaced. If the hypotheses that I have put forward very tentatively about curvature and anti-curvature prove valid, I shall regard them as having served the purpose if they direct attention to the crying need for bold and, I must add with emphasis, metaphysical thinking (1960, p. 282).

Part of the reason for his conclusion was the research in physics which around 1963 resulted in the theory that all matter is made up of fundamental particles called quarks and leptons which in turn, so far as known, consist of empty space. The forces by which matter seems to abide are metaphysical and cannot be, or at least have not yet been, fully explained in physical terms.

Challenges to the Metaphysical Monist's Position

The materialist's position has been challenged by numerous scientific discoveries. For example, increasing examination of what is termed "matter" finds that it is largely empty space. Magnification of gross matter reveals that it is made up of much empty space and molecules. Further

magnification reveals that the molecules themselves are made up of atoms which, again, contain much space between them. The atoms themselves consist of protons and neutrons packed in a nucleus surrounded by electrons and so much empty space that if an atom were the size of a football field, its nucleus would be smaller than a peanut. Magnification of each individual proton or neutron and other subatomic particles reveals even smaller subatomic particles called quarks which again consists mostly of empty space: "Neither quarks nor leptons show any sign of having an internal structure, though their anatomy has been probed on scales down to some 10^{-18} meter" (Ferris, 1988, p. 295).

This is why, if one fired an electron through the human body, it might never hit a material particle, but it could pass straight through the body and into the air on the other side. A charge-free neutrino can pass through miles of lead, or even an entire planet, without hitting a single piece of matter (Schechter, 1981). This finding of science has caused some to hypothesize that material matter *does not exist*. Each time that researchers have examined what first appears to be a "solid particle," such as a molecule, they find that the supposedly solid object contains large amounts of empty space and even smaller particles each which in turn is made up of much empty space and still more minute particles (Cartwright, 1983). No known reason exists for this progression to end, even with the particles now felt to be the most basic particles possible, quarks and leptons.

Superstring theory hypothesizes that all matter is made of infinitesimally small loops some 100-billion-billion times smaller than a proton (Green, Schwarz and Witten, 1987). Actually, the concept of a piece of matter that is not made of still smaller particles is difficult to comprehend. Many scientists hypothesize that they will probably never find a solid "smallest particle"—all particles must be made up of other smaller particles and empty space—and these particles in turn cannot be solid but must be made up of still other smaller particles and empty space. If this is true of matter as it is of numbers, then as one can forever divide a number into an even smaller number, likewise no end to this physical breakdown would logically exist. The end result of the search for the smallest particle may turn out to be only pure energy without mass, a metaphysical concept.

The big bang cosmology theorizes that the *entire universe* of billions of galaxies, each with billions of stars, evolved from a primordial "egg" smaller than the size of a pinhead (Weinberg, 1977). The fact that scientists are now able to convert matter into energy (and energy into matter as well) has crucial implications for the assumption that "matter exists." Before its conversion to energy, it has weight, mass and all of the other properties of matter, but *after* its conversion it has *neither weight, nor mass,*

nor any of the properties of matter. The matter literally "disappears" and in its place exists a certain amount of energy—a quantity summarized by Einstein's famous formula, $E = mc^2$, meaning mass and energy are, with some nuances, equivalent (Allen, 1973). From this, some hypothesize that a "physical" world does not exist. Reality, in other words, includes *only* the metaphysical or so-called "non-physical" world. Others conclude that matter does "exist" but not much exists, and yet others argue that matter that does exist is slowly disappearing. Schechter notes:

Marshak...[and] scores of other physicists are waiting in more than a dozen underground laboratories around the world to see whether protons—the particles basic to all the elements—fall apart. If the proton can fall apart, or decay, then so, eventually, will every last living thing, planet, and star, because they are made up primarily of protons. Even if the universe were to continue forever in the outward expansion that started with the Big Bang, not a single atom would endure to fill its vast reaches... Present theories about the newborn universe lead inexorably to the conclusion that if the proton is stable, equal quantities of matter and its mirror image, antimatter, would have formed. But matter and antimatter annihilate each other when they meet, leaving behind only the little bundles of light called photons, and assorted lightweight particles like electrons. Thus if the proton is immortal, the universe today should be a thin, lumpless soup, without planets, stars, life and, for that matter, without matter. But if the proton decays, scientists can account for the matter that fills the universe today (1981, pp. 80–81).

Many philosophers such as Hegel, whose work Schaeffer called the "doorway out of cause and effect thinking" were led to the monistic position that there is only one kind of substance and only one true substantial entity (Schaeffer, 1968, p. 20) His "one kind of substance," though, was an evolutionary pantheism, whereas I propose exploring the reality of that which is popularly termed metaphysical in order to understand what appears to be in many ways an artificial dichotomy of the physical and metaphysical.

Matter forces such as the "pull" acting on matter are now divided into four forces, namely gravity, electromagnetism, strong and weak nuclear forces, all which are "action at a distance" forces that have so far failed to reveal themselves in mechanical explanations. They are real in that they can be experienced, but they act only on other physical matter in ways that are not fully explainable by known mechanics (Sherwood and Sutton, 1991). Forces such as magnetism have even been "explained" by postulating tiny strings which, in the case of unlike poles, pull

other particles toward themselves or, in the case of like poles, push two particles away. This obviously involves metaphysics or at least not classical physics (Davies and Brown, 1988). Of the numerous explanations, none is fully satisfying or widely accepted, and most are tenuous guesses. Research such as this should cause us to reexamine the matter/metaphysics dichotomy. As stated by Walsh, “whether matter is the ultimate reality as materialists suppose, or whether it is itself a manifestation of spirit, as Hegel tried to argue” is still very much debated today (Walsh, 1972, p. 301).

Certain limitations, such as the necessity of interpreting sensory input, do not necessarily preclude an accurate understanding of reality nor an advancement of knowledge in this area. Observational uncertainties can be mitigated by utilizing multisensory input and other means of investigation to broaden the base of information upon which we base our conclusions. An example of a method used to overcome this limitation is the utilization of instruments that sense energy and translate it into data which can be analyzed. Thus, in spite of the human sensory problem, numerous largely metaphysical theories, which were held as valid for eons, have been falsified in the scientific sense. Examples include the ether, alchemy, abiogenesis, caloric and phlogiston combustion theories.

The goal here is to eventually better understand reality by moving beyond basic mathematical relationships by expanding the input used to draw conclusions. Thus, breaking the shackles of obverse reductionism could help us reach a fuller understanding of reality. Rejection of materialistic-naturalistic reductionism must not stop with evolutionary naturalism, but include all applications of this false worldview. This will thus encourage the acceptance of the whole of reality by integrating knowledge from all sources, whether classified as metaphysical (including the techniques of Biblical theology) or empirical (Burt, 1954).

When we react to the world around us, we generally depend on our individual perceptions, most of which we accept at face value. Some consistent reality exists, but our mind’s *perception* of reality is not always the same. One’s mind does *not* accurately perceive the “real world” but sees at least partly what it expects to see because the brain must interpret *all* sensory input (Restak, 1984). Input limitations include rapid scanning, misreading sensory cues, and problems involved in translating “reality” into “mind pictures.”

Beliefs are also critical in bridging the gap existing between reality and our minds’ view of reality. The process of forming conclusions about the world around us is a major aspect of the physical-metaphysical and mind-body problem. We do not react directly to the outside world but to *our perceptions* of it, and most of our conclu-

sions are a result of theorizing based on *reasoning*, which is an internal mental process and not necessarily empirical. This point is of major concern to those interested in science-religion issues.

The Problem of Labeling

A major problem in understanding the physical-metaphysical dichotomy stems from ambiguous terms. Words are not reality but only an attempt to abstract, simplify or communicate perceptions of portions of reality, and very few words—even scientific terms—are as precise as is necessary to comprehend reality. The broad terms *science*, *physical*, *religion*, *creation*, *evolution*, and similar are all general categories, and use of them often creates major communication problems by oversimplifying or even misleading. The recent discoveries in nuclear physics as discussed above, for example, have helped us to realize that it is far more difficult to understand what is and is not “physical” than once assumed.

Examples of words which create severe problems include such largely meaningless terms as *common sense* and even *instinct*. These concepts can convey helpful information, but more often they impede effective communication by their ambiguity and lead to confusion. Problems with *common sense* which argue against its use include the tendency to use the word to validate a conclusion in lieu of direct support. A person who makes a statement that is challenged may appeal to “it is common sense” instead of supporting the statement with a scientific study, valid reasoning, or the appropriate authorities. The claim “it is common sense” is alone asserted as valid justification for a conclusion (Bergman, 1981). Relying on the phrase “common sense” as support permits many incorrect statements to pass unchallenged.

The phrase “common sense” itself is a good example in that it often has a variety of meanings. It originally meant a special faculty of the mind which inevitably will come to the correct conclusion regardless of what sensory data are used. Today it means many different things, including a conclusion that is inescapably obvious (Bergman, 1977). Common sense is often nothing more than acknowledging that a belief, idea, prejudice, bias, misconception, etc., fits into one’s value or belief system. And many ideas are still held by the population as “common sense” even though considerable evidence against them now exists. An example is the belief that a gifted child will likely be maladjusted, sickly and, as a whole, physically “inferior.” In this case, the opposite of the “common sense” opinion is usually true (Feldman, 1986).

Although perception and individual reasoning are both extremely influential in arriving at most conclusions

(and probably are more important in science-religious issues than in most other areas), beliefs and general perceptions about the world around us are based both on early training and background. They are also dependent on the information presented when a child is receptive to philosophical/value-laden beliefs, usually from ages eight or nine to fifteen or sixteen. To understand *beliefs* in either the religious or scientific area, it is necessary to understand the process of perceiving ideas, facts and events, as well as the process of forming conclusions.

A major problem in both the metaphysical and physical domains is that, rather than thoroughly examining the data and then arriving at a position, many persons take a position and then attempt to support or justify it. They are looking for proof only, not knowledge or an accurate view of reality. For example, Cornman (1975) openly admits his goal in seeking knowledge is “to justify a particular metaphysical theory” and then proceeds to try to do just that. Many researchers in both the metaphysical and physical camps over rely upon “arm chair reasoning” that is not firmly grounded in empirical research. Clear empirical examples from the real world are needed to demonstrate an empirical conclusion, yet one must also recognize this approach has its limitations.

Where direct observation is difficult or impossible, a new or modified scientific apparatus must be designed and implemented. All scientific measurement produces additional uncertainty at every level. Firstly, the apparatus must be appropriate, capable of measuring the phenomenon in question to an estimable degree of accuracy. Secondly, it must be capable of calibration such that the estimated error corresponds with the actual error. The possibility of interference by other phenomena must also be evaluated and if necessary compensated. Thirdly, it must provide a readout of some sort to provide data so that cumulative error can be adequately estimated. The raw data are the numbers produced by the device as recorded by the observer, not the actual values in nature. Uncertainty and the required assumptions are often most serious in studies of the past, the very small (particle physics) and the very large (astronomy).

The tendency of some to wrestle concepts from the physical sciences into some philosophical framework without establishing clear, demonstrable logical relationships between data and ideas or theories is one reason why metaphysics has come into disfavor in science. In dealing with the so-called metaphysical world, it is often necessary to rely on (and especially begin with) concepts which are understood as “purely physical” because they are often more understandable, at least at present. An example is the Bible’s frequent use of terms like face, hand and foot to describe traits of God which help us understand metaphysical concepts.

In the mind-body debate, the need for an inclusion of

biochemical or other relevant data as part of one’s conceptual framework is imperative. A basic understanding of the biochemistry of learning, memory and perception is often helpful because of human reliance on processed sensory data. The empirical data may not support certain philosophical theories, but in going from the known to the unknown, these data should be brought into the discussion to help relate the two. Any comprehensive model must correspond to reality or be deemed false. Therefore these data, if accurate, must be accommodated within the model. The only true dichotomy is between reality and non-reality, or between true and false concepts of reality.

Empirical data illustrate and can help us to more fully understand metaphysical reality. Although abstract reasoning may at times predominate in some areas of science, such as theoretical physics, this is due more to our present lack of knowledge than a superiority of the explanative value of this mode of exploring reality. Our reasoning needs to utilize *basic observations and a reliance on “physical” data and research* to back up philosophical or so-called metaphysical conclusions. The physical science axiom that “if something exists it can be measured” would also seem to apply to the reality that is now included by some in the so-called metaphysical sphere.

A field of knowledge is scientific to the degree that it successfully quantifies the relationships it postulates. We should therefore in metaphysics strive to understand reality with the ideal goal of using mathematical concepts. The postulates of philosophers such as Russell, Kant, Locke, and Berkeley often try to do just this. In the physical sciences, mathematical relationships result in *laws* to which we believe there are no exceptions, only qualifications or influencing conditions. Some feel it is reasonable to use mathematical relationships to help understand all reality, including the reality that is presently labeled “metaphysical.”

Apart from a creator, there is no “reason” for the reality found in the universe to exist—or even for the existence of consistent natural laws (Sire, 1988). Likewise, no “reason” exists for the order that decades of research have found everywhere in nature, which is so consistent that we have been able to express it in words called “natural laws” and which science now has as its main goal of finding. Obviously though, without these laws there would be no life, no “matter,” and no universe—only absolute chaos ruled by one law only, the law of unpredictability (Yam, 1994). Yet natural laws *do* exist, although they are probably at our current level of understanding often an attempt to summarize the reality that emanates primarily from the conscious mind of humans. The complex law system that exists in the universe must likewise logically emanate from conscious direction. Fully comprehending

natural law requires hypothesizing a reason for both this law and order and their complex interaction which enables life to exist.

Some Implications of This Effort

The effort to establish a design world view as a valid science and a viable alternative to materialistic evolutionary science is supported by the discoveries that help to bridge the hypothesized gaps between the present artificial physical-metaphysical dichotomy. The question focused on here “is all reality a valid subject of science?” Thoughts that are translated into neural activity, an area which was once non-researchable, are now being empirically researched by positron emission tomography (PET) and magnetic resonance imaging (MRI) technology (Bergman, 1992; Kulynych, 1995, 1996). This supports the conclusion that what is commonly assumed under both the physical and metaphysical domains may have at the very least one element in common, their reality. Beyond this, although a basis exists for making distinctions between physics and metaphysics, the fact that they influence each other (as shown by physics research) demonstrates that they are interrelated and have a connection beyond their essential reality. To more accurately understand all of reality, research and scientific thought must look beyond its myopic examination of only the pure empirical physical realities that have been its preoccupation for the last century. Research needs to use existing data, methods, and experience to build a solid foundation in order to progress into the so-called metaphysical areas.

Some researchers prefer to call the science/metaphysics dichotomy problem “theological reflection vs. scientific interpretation.” Stockwell (1980, p. 579) notes, “Our frame of reference needs to incorporate both [of these] views, for God’s world is one. The division that seemingly separates science from theology is a purely human creation.” Much solid research that supports the unity of the physical and metaphysical sciences and reduces the influence of the platonic dichotomy has now been completed (Torrance, 1981). For example, Deloria (1979) bridges the two by showing that both science and theism are necessary to form an integrated complete view of the world and that “the sacred and sensual inhabit the same terrain.” He adds that both are necessary in order to produce a coherent view of reality.

Summary

A reexamination of the materialistic base of both our sciences and the philosophy of life in Western Society is

necessary. This requires a thorough examination of many of the assumptions of the currently rigidly materialistic science. The position that only that which can be perceived by the senses and is consistent and repeatable can be proven valid must be questioned. This does not imply that groundless speculation is to be given undue weight but rather that a firmly supported *reality picture* must be built, relying upon logic and vitalizing principles, laws and concepts resulting from empirical investigations. The Creator may in some ways be ontologically different from the creation, just as humans and plants are different; but the Creator also must have some commonality with the creation to interact with it. The creation resulted from and reflects the qualities of the Creator; thus, these spheres must be able to interact, and consequently must have elements in common.

Dividing reality into somewhat arbitrary physical and metaphysical divisions discourages scientists from looking at all of reality. Dividing also is used to label the naturalistic evolution position of origins as empirical and physical. This approach then labels another position on the same topic (that the universe is a product of design) as metaphysical (Toumey, 1994). The next step is for materialist monists to conclude that reality is that which is labeled physical, and that reality is not that which is labeled metaphysical. For this reason, they conclude that which is labeled metaphysical is not a proper subject for scientific study. The motivation for this ploy is not scientific or part of an effort to maximize an epistemology to better determine an accurate understanding of reality, but is often due to agendas which have little to do with science or efforts to determine truth (Johnson, 1995; Koster, 1989). It often has much to do with an attempt to try to discredit a theistic epistemology.

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Notes from the Panorama of Science

Trace Fossils in Petrified Wood—Big Bend National Park, Texas

Introduction

While collecting petrified (silicified) wood samples in the Dawson Creek region (Figure 1), we found termite borings and frass (fecal pellets) on the outer surface of a petrified log in the Javelina Formation (Figures 2, 3, and 4). The borings are in the form of elongate interconnected galleries that are parallel to the growth rings of the wood. The frass is preserved in the same manner as the wood. Earlier work on this project has been reported (Williams, 1993; Williams and Howe, 1993; Williams, Matzko, Howe, White and Stark, 1993; Williams, Howe, Matzko, White and Stark, 1995; Williams, Goette, Stark and Matzko, 1998).

Trace fossils of termites have been found in the Park previously (Rohr, Boucot, Miller, and Abbot, 1986a, b). For a creationist study of trace fossils, see Cowart and Froede (1994). A description of the structure of the wood in the log is provided in Wheeler, Lehman and Gasson (1994).

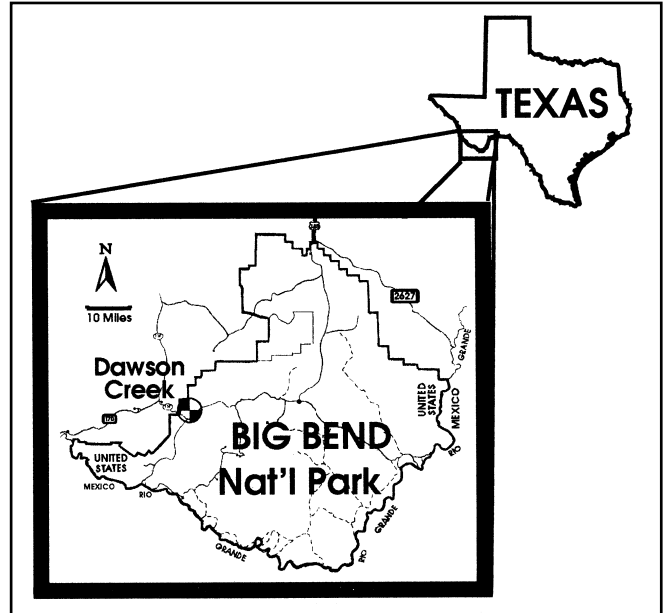


Figure 1. The location of the Dawson Creek region of Big Bend National Park, Texas where the field work in this report was conducted.



Figure 2. Silicified log in the Javelina Formation which contains trace fossils of termites. Scale on the end of the log in centimeters and inches.

Flood Model

Probably, the log with trace fossils was buried rapidly, and petrification occurred quickly preserving the termite galleries and frass. How did the termites which infested the log survive the Flood? Or did they survive the Flood? Some alternatives are considered herein.

1. The termites survived inside the log while it was subjected to water currents during the Deluge. Once the log was beached, the termites continued feeding on it. Later the log was covered by sediment (likely altered volcanic ash) and then petrified along with the termite borings and frass.

2. The termites could have survived on other floating vegetation (Woodmorappe, 1996, p. 155), eventually being beached near the log, then infesting it. Later the log and traces were covered by sediment and subsequently petrified.



Figure 3 Elongate concentric galleries on the surface of the silicified wood, likely the work of termite colonies which bored into the log shown in Figure 2. Scale in inches.

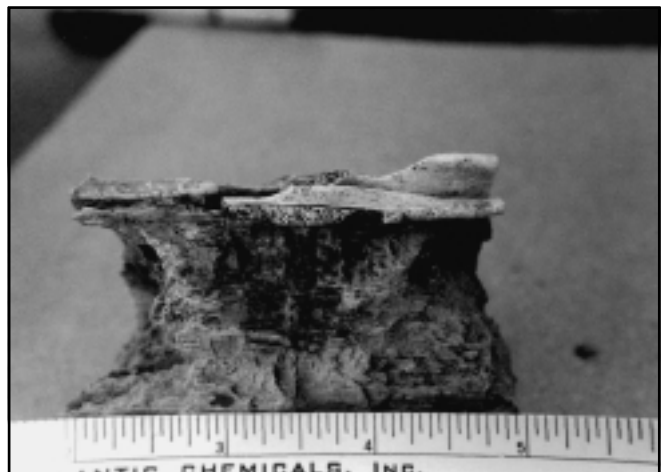


Figure 4 A view of galleries containing frass on the surface of the silicified wood, likely the work of termites. Scale in inches.

3. The log may have been, a pre-Flood tree infested by termites that was buried under siliceous sediment early in the Flood. The petrified log and trace fossils were exposed and possibly relocated in the late stages of the Flood, or after the Flood during a period of severe erosion in Trans-Pecos, Texas.

4. The log could have grown rapidly in a possible temperate post-Flood climate, sprouting from seeds or developing from plant material (branches, roots) that survived the Flood. The tree died and termites attacked it. Eventually the log and termite traces were covered by siliceous material eroded from sediments located north of the Dawson Creek region which resulted in petrification. Later the log was exposed and relocated by fluvial activity in the region. The Big Bend area has been subject to con-

stant erosion, likely during the Flood and post-Flood eras, continuing and decreasing in intensity into the present.

These four situations do not exhaust the possibilities, however we prefer explanations 1–3 since the opportunity for silicification seems to be greater in these scenarios than in the fourth one. The erosion and deposition of massive amounts of sediment and plant material appear more likely during or immediately after the Flood. Of the preferred suggestions, number three requires fewer fortuitous events to assume it happened. Further study of the region is necessary to test these hypotheses.

Acknowledgments

The authors thank the many donors to the Creation Re-

Flysch/Turbidite Deposits and Translational Sliding in Marathon Basin, Texas

Introduction

The Marathon Basin was formed due to tectonic downwarping, lateral compression, and thrusting during the Ouachita Orogeny (Reed and Strickler, 1990), and was filled by successive waves of turbidity-current-generated sediments¹(Figure 1). In previous articles in the *Quarterly*, Howe and Williams (1994; 1995) provided an overview, and touched briefly on some of the problems with the uniformitarian interpretations accepted to explain the purported paleoenvironmental setting, and resulting deposits found within the Marathon Basin. Competing depositional models are common in defining uniformitarian historical geology typically because the physical evidence often can be explained by one or more modern depositional settings. The solution to any particular paleo-depositional setting is usually resolved by the preponderance of evidence found to support it. With regard to the Marathon Basin, we continue to gather evidence that reinforces our position that the turbidity current depositional environment correlates best with the strata and sedimentary features found within the basin. It could be noted that this proposal is consistent with the turbidity current setting previously suggested by Howe and Williams (1994, p. 29).

Recent road work near the intersection of U.S. Highway 385 and U.S. Highway 90 just northeast of Marathon, Texas (Figure 1, Location 1) has resulted in the exposure of slump and slide features within the Haymond Forma-

¹A creationist overview of turbidity currents and their resulting deposits can be found in Froede, 1998. Submarine debris flows are described and discussed in Oard, 1997.

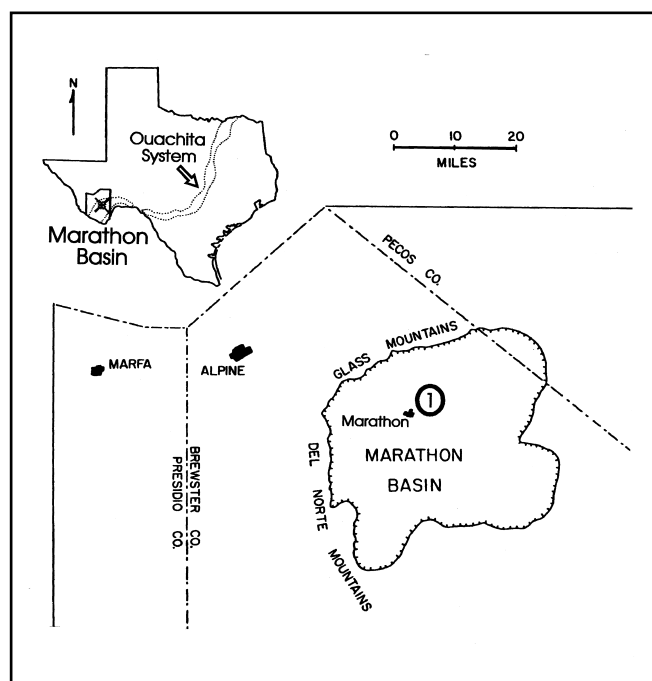


Figure 1. Map showing the Marathon Basin within the Ouachita System of deformed Paleozoic rocks. A translational slide is indicated along U.S. Highway 385 just north of the intersection with U.S. Highway 90 (Location 1). Excellent exposures of turbidite strata are also present along portions of U.S. Highway 90, on the eastern side of the basin. This figure is modified from McBride 1969 (p. 2, Figure 1).

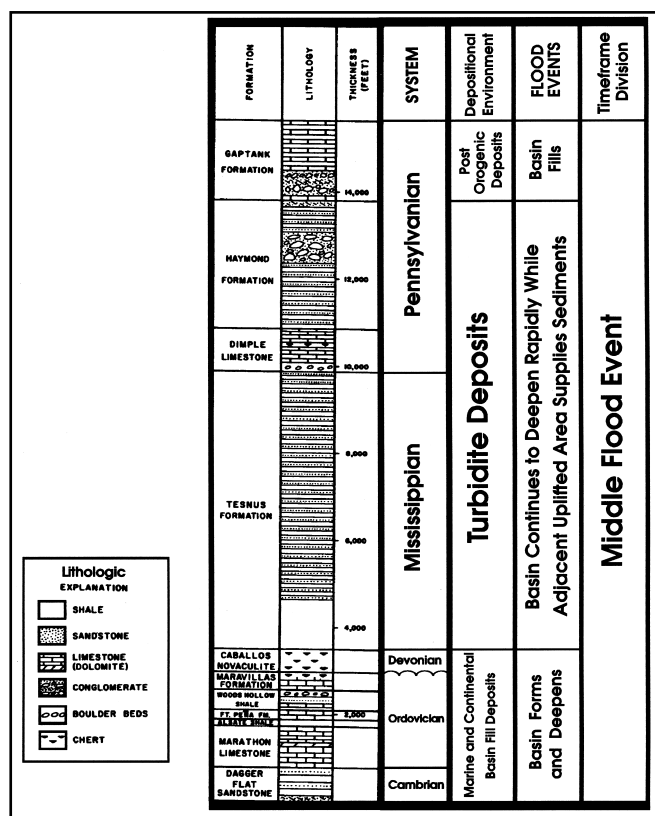


Figure 2. The generalized Marathon Basin stratigraphic section. These deposits span approximately 245 million years of uniformitarian earth history. The turbidites were purported to have been deposited over the course of 40 million years (McBride, 1969, p. 3). The various rock outcrops exposed across the basin fail to provide any physical evidence in support of these extended periods of time. This figure is a highly modified version of McBride 1969 (p. 3, Figure 2).

tion flysch which are indicative of the tectonic forces this area experienced in the past. We propose that these tectonically-derived features, composed of turbidity-current-generated strata, correspond to the short-term/high-energy time frame constraints of the Young-Earth Flood model.

Subaqueous Deposition

In an underwater setting, a rapid and steady rate of uplift coupled with lateral thrusting adjacent to a developing basin would provide an excellent setting for almost continuous flysch/turbidite deposition. The stratigraphic record found within the Marathon Basin supports this type of depositional setting (Figure 2). Surficial sediments immediately adjacent to the subsiding basin would have become unstable due to tectonic forces, and then moved under gravitational force into the basin. Immediately thereafter, the underlying (now exposed) semi-consoli-

dated strata would also have destabilized due to continued uplift and thrusting, resulting in the formation of debris flows, slides, and slumps along the upper margins of the basin (Figure 3). Some of these contorted semi-consolidated strata might have eventually disintegrated into turbidite deposits as they moved laterally into the basin (see Morgenstern, 1967).

Translational Sliding

Late Cambrian and earliest Ordovician² strata studied by Cook and Taylor (1977) and Cook (1979) in central Nevada are suggestive of former shelf and slope environments. We believe that much of the strata composing the Marathon Basin compares favorably to the sediments and sedimentary features noted by Cook in his central Nevada setting. Cook (1979) noted several instances where the previously semi-consolidated strata around the margins of the former basin had destabilized, forming slumps and translational slides. These slides occurred within the stratigraphically highest portion of his slope sequence, and are similar to features that we noted within the Marathon Basin.

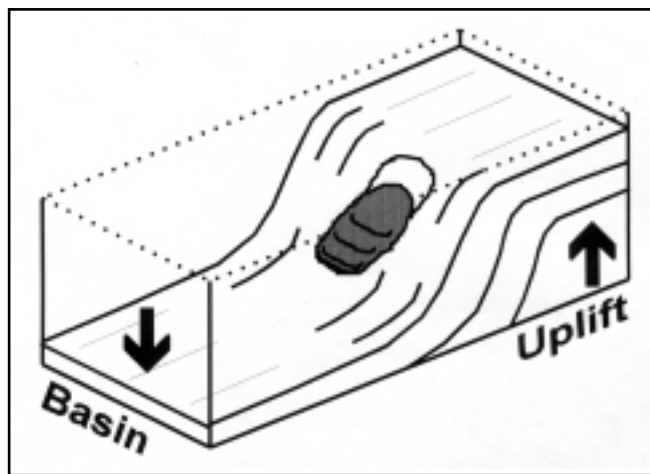


Figure 3. Diagram illustrating the possible setting associated with the rapid uplift and thrusting which occurred along the upper margin of the Marathon Basin, during the Ouachita orogeny. A slump/slide develops along the slope as the semi-lithified area destabilizes because of uplift (shaded area). This block then slides toward the basin floor. This movement deforms the layered block forming translational folded layers.

²The uniformitarian ages suggested by Cook (1979) and Cook and Taylor (1977) are not supported by the authors of this paper. Rather we propose that both the central Nevada and Marathon Basin sites reflect sedimentation and orogenic processes associated with the Flood (probably Middle Flood Event Division—see Figure 2).



Figure 4. Thin-bedded Haymond Formation flysch/turbidite strata exposed along U.S. Highway 385. To the right are flat-lying strata. To the left are upturned/folded strata which are part of a translational slide block which extends south for approximately 200 yards. The flysch layers display various orientations within the slump block, yet retain their original bedding. Scale in the center of the photograph is in six-inch units.



Figure 6. Looking down the rotational axis of the translational slide block. Note the present position of what were originally nearly horizontal semi-consolidated turbidite layers.

Within the Marathon Basin, we identified a recently exposed slump block along U.S. Highway 385 which reflects what we believe is a translational slide (Figure 1, Location 1: Figures 4–8). While the individual flysch/turbidite layers were preserved in both the slump block and underlying strata, the weight of the sliding block deformed the contact plane on which it moved. The formerly semi-lithified flysch/turbidite strata within the slump block rotated and folded as it moved along the fault contact with the underlying (also semi-lithified at the time of slump development) strata. The slump movement resulted in the formation of contorted strata indicative of translational sliding (Cook, 1979).



Figure 5. Closeup of the contact between flat-lying layers and folded layers. The slump/slide plane is not clearly defined because the strata were semi-consolidated at the time movement occurred. Note the large boulders along the bottom contact of the fold. Scale in six-inch units.

Flood Model Suggestions

A steady and rapid rate of uplift coupled with lateral thrusting (during the Flood) would provide the means of supplying unconsolidated and semiconsolidated sediments/strata (via turbidity currents, debris flows, slumps, and slides) into the adjacent rapidly subsiding³ Marathon Basin. As the basin experienced tectonic movements (including thrust-related compression), some of the semi-lithified flysch/turbidite deposits were uplifted and subjected to stratigraphic detachment forming slump and slide blocks.

The strata and tectonic features found within the Marathon Basin supports a short-term and high-energy setting expected and associated with the global Flood of Genesis. The translational slide block located along U.S. Highway 385, just north of the intersection with U.S. Highway 90, adds further evidence in support of this high energy paleoenvironment. We propose that all of the tectonic and sedimentological events associated with the formation and infilling of the Marathon Basin likely occurred during the Flood (Middle Flood Event Division).

Our studies on the geology of the Marathon Basin will continue in an effort to understand the tectonic forces and depositional history it experienced within the framework of the Bible-based Young-Earth Flood model.

³McBride and Thomson (1964, p. 19) stated this concept: "...flysch units, [were] for the most part deposited in relatively deep water *in a rapidly subsiding trough*." (emphasis and brackets are ours) However, their subsidence rate is viewed as much slower than what we believe occurred during the Flood.

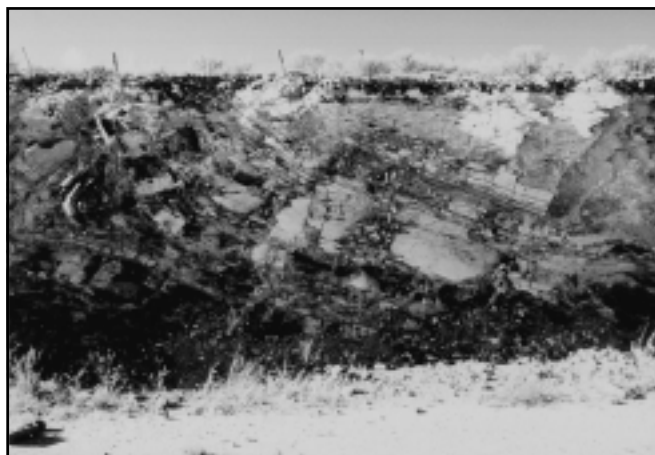


Figure 8. The deformed nature of the strata was caused by the slide/slump. The slide block moved as a semi-consolidated mass. The top of the slide has been sheared off—evidence that there are missing strata and significant erosion of this area occurred, following its emplacement. Scale in six-inch units.

Acknowledgments

We thank the donors to the Creation Research Society Research Fund, interest from which financed a portion of this study. The authors will gladly share the specifics of this locale with anyone interested in observing the site first hand. We are grateful to our families for allowing us the time to conduct field studies and report our findings. Glory to God in the highest (Pr 3:5-6).

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- Carl R. Froede Jr.
Emmett L. Williams
- George F. Howe
Robert L. Goette



Figure 7. Close-up of the folded Haymond Formation flysch/turbidite strata. Likely it was semi-consolidated when folded, otherwise the thin layers likely would have crumbled when stress was applied. Scale in six-inch units.

Letters to the Editor

Professor Maciej Giertych

Prof. Maciej Giertych holds a Master of Arts degree from Oxford University, a Doctor of Philosophy from Toronto, and a Doctor of Science from Poznan University. He is head of the Genetics Department of the Polish Academy of Sciences at the Institute of Dendrology in Kornik, Poland. He is on the editorial board of two international periodicals: *Silvae Geneticae* published in Germany, and *Annales des sciences forestieres* published in France. He is a member of the Polish Academie of Sciences Committee on Forest Sciences, and on the Forestry Council in the Ministry of Environmental Protection, Natural Resources and Forestry. He is the author of about 150 scientific papers in Polish and international periodicals.

Prof. Giertych is the Chairman of one of the 37 different political parties in Poland and obviously a staunch pro-lifer. He has translated and published (1989) a Polish edition of *The Crumbling Theory of Evolution* (by the late

Australian, Wallace Johnson) and has written several papers exposing the scientific fraud of evolutionism.

The following is a quotation from one of his writings:

A whole age of scientific endeavour was wasted searching for a phantom. It is time we stopped and looked at the facts. Natural sciences failed to supply any evidence for evolution. Christian philosophy tried to accommodate this unproven postulate of materialist philosophies. Much time and intellectual effort went in vain leading only to negative moral consequences. It is time those working in the humanities were told the truth. (Giertych, 1991, p. 2)

Wayne Frair
1131 Fellowship Road
Basking Ridge, NJ 07920-3900

Thirty Million Year Old Microbes?

I would like to add a technical comment about the article "Living bacteria and other living microbes have been isolated from the abdomens of fossil bees thought to be 30 million years old," by George F. Howe, on pp. 187-188 of the December 1997 issue of the *CRSQ*. In it, Howe points out the fact that these putatively 30 million year old microbes would have had to have some slow but non-zero metabolism during the supposed 30 million years of entombment, and that they would have run out of food long ago. I would like to add another nail in the coffin of the idea that these bees are any where near 30 million years old. This is that the optically-active components of the microbes' proteins would have racemized completely after a million years or so, leaving their proteins useless (Bada, 1998; Wieland, 1993; Helmick, 1975; Kvenvolden, Peterson, and Brown, 1970). Similar considerations hold for the other optically-active components, such as the nucleic acids, with different time scales. Therefore, unless the spores can repair their DNA and proteins while entombed, they would certainly have perished long before the 30 million years had elapsed, and would not be

viable. This repair would require active metabolism, and so compounds the difficulty mentioned by Howe.

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Michael "Mike" Kinnaird
3612 Courtland Drive
Durham, NC 27707
mgkinnaird@juno.com

Sequence Stratigraphy, Stratigraphic Time, And The Flood

In a recent article Mr. Allen C. Bartlett (1997) presented an excellent account of sequence stratigraphy, and its possible role in defining creationist geology. He raised some serious (and commonly ignored) questions about the links between uniformitarian philosophy and catastrophism.

The article discussed several very important issues within the “new” paradigm of uniformitarian-catastrophism as exemplified via the concepts of sequence stratigraphy. An excellent point was made by Mr. Bartlett with regard to how uniformitarians now claim that catastrophism is part of naturalism and long periods of time - when in reality catastrophism cannot be incorporated rationally in this manner. It is time for young-earth creationists to stand up and point out the gross inconsistencies within the naturalist paradigm as uniformitarians attempt to accommodate all philosophies and datasets within their worldview!

Mr. Bartlett’s article also raised questions about my own concepts and work within creationism and sequence stratigraphy, and I wish to respond. Basically, I take issue with Bartlett’s suggestions that: 1) a new creationist timescale is unnecessary, 2) sequence stratigraphy is not bounded by time, and 3) sequence stratigraphy is the death-knell for uniformitarian stratigraphy.

Creationist Stratigraphic Timescale

Mr Bartlett (1997, p. 6) states that a new system of rock/time reference (i.e., a creationist timescale) is “wastefully repetitious.” ***This is true only if one accepts the existing uniformitarian timescale.*** I contend that the creationist should not use the global evolutionary-uniformitarian construct, but rather we need to develop our own different approach. We have a different Bible-based framework/perspective in which we view Earth, and its history (Reed, 1996a, 1996b; Reed and Froede, 1997, Froede, 1998).

Presently, some creationists have suggested that we can take pieces and parts of the global uniformitarian stratigraphic column “conceptually,” and assign all (or most) of this same strata to the Flood (Snelling et al., 1996). However, the details of this methodology remain undefined and vague. I believe that this piece-meal approach to using the global evolutionary-uniformitarian stratigraphic column results in a confusing way of explaining or understanding Flood-generated strata. If, for example, the Cambrian, Devonian, Permian, and Cretaceous periods are not real (as defined by uniformitarianism) then why do we allow ourselves to be bound by an evolutionary global stratigraphic column that says that they were? Put more simply: ***If the chrono-***

logical aspects of these uniformitarian “periods” do not define real blocks of time for creationists, then their use to define rocks within our framework is meaningless. I see no need to conduct creationist research by following an imaginary global evolutionary-based stratigraphic timescale. I further suggest that anyone who does wish to operate in this manner should be very careful to explain exactly what these evolutionary eras, periods, epochs, and groups mean within ***their use*** of these uniformitarian terms and concepts. Although I have raised the issue, I still await an answer (e.g., Froede, 1997).

Uniformitarians contend that all of the periods (e.g., Precambrian, Mississippian, Permian, Jurassic, Oligocene, etc.) have passed sequentially on Earth over millions of years, and that in only certain areas is that time recorded in strata. ***Strata within this philosophical framework only serve to document the passage of time.*** If certain uniformitarian “periods” of strata are missing in a specific vertical column is it probable that this record of “nothing” is accurate? For uniformitarians the answer is YES! Young-earth creationists do not agree.

Unconformities within uniformitarianism mark time gaps. Within creationism they mark changes in energy/sediment-types and not necessarily missing time. Additional work is required to further define these stratigraphic features within the Young-Earth Flood model.

The unexplained/unqualified incorporation of the uniformitarian timescale into Flood geology only leads to confusion. For example, in his Figure 4, Mr. Bartlett superimposes his “supermegasequence” Flood sea-level curve over two uniformitarian “megasequences” and the imaginary uniformitarian timescale. If these uniformitarian time “periods” did not really exist sequentially across the globe (which this figure implies) then the validity of the curve needs additional support. Another possible interpretation using Bartlett’s megasequences and supermegasequence would combine (i.e., overlap) all of the megasequences into one curve (not end-on-end as uniformitarian periods). This might show how the Flood operated globally. However, even this possibility remains vague and undefined at present, but it provides an example of how to reexamine uniformitarian carry-over concepts (especially the sequential “periods” of uniformitarian time).

I believe that creationists need to abandon the global evolutionary-uniformitarian stratigraphic column and build our own - one outcrop/area/region at a time. My call for a “Commission of Creationist Stratigraphy” would be a body organized to set up stratigraphic sections first locally, then carried out on a regional basis, then on a continental scale, and eventually even globally, all in an effort to correlate Flood-generated strata based on changing

energy levels (Froede, 1994, 1998; Reed, Froede, and Bennett, 1996). This was the way that the early field geologists built-up the uniformitarian column (see Adams, 1938; Albritton, 1986; Gohau, 1990; Greene, 1982; Laudan, 1987; Oldroyd, 1990; Rudwick, 1985; and Secord, 1986) and we need to do the same in developing and comparing/contrasting our own stratigraphic Flood-based timescale. Field work, well cores, seismic lines, and electric logs all need to be examined and reviewed in reconstructing the depositional/erosional conditions associated with Flood sedimentation. Our work has only just begun!

At the end of his paper Bartlett (1997, p. 12) offers no means of defining Flood stratigraphy, either by creating a new approach or using the uniformitarian timescale, he states:

It does *not* fall to the Christian creationist to revise the uniformitarian timetable or to create a new timescale as Froede (1995) proposed. The uniformitarian-evolutionary timescale represents a corruption of and an affront to human reason offensive to creationists and secularists alike. (*italics in the original*)

While I would agree with his statement regarding the uniformitarian-evolutionary timescale, I continue to believe that creationists must define and refine our own means of interpreting stratigraphy within the Young-Earth Flood model. Bartlett's article when viewed as a whole, appears to propose that "sequence stratigraphy" can provide a method of defining strata outside of the uniformitarian timescale. I must disagree.

Sequence Stratigraphy and Time

Probably the most important issue raised by Mr. Bartlett is that sequence stratigraphy is not constrained by "TIME." Bartlett disagrees with an earlier suggestion put forward by myself (Froede, 1994) and Mr. Gordon Davison (1995) where we both asserted that sequence stratigraphy follows evolutionary-uniformitarian philosophy. This point of disagreement is brought out by Bartlett (1997, p. 5) where he states:

However, it may surprise Froede and Davison and Flood advocates in general to find that sequence stratigraphy is a non-time dominant method of doing geology.

I contend that sequence stratigraphy is an "event-driven" overlay on evolutionary-uniformitarianism, and nothing else. If 1) sequence stratigraphy's most fundamental unit is the parasequence, defined by Van Wagoner et al. (1990, p. 8) as:

A relatively conformable succession of genetically related beds or bedsets bounded by marine-flooding surfaces or their correlative surfaces.

and if 2) a parasequence is a vertical set of strata that reflect a succession of slowly changing environments and

associated flora and fauna, and finally, if 3) parasequence boundaries are defined within the context of evolutionary-uniformitarianism, then Mr. Bartlett is not correct in his belief that sequence stratigraphy is very useful to creationist geologists in an unmodified form. While events are allowed within parasequences, they are still defined as "short-term events" of thousands to millions of years by uniformitarian sequence stratigraphers. To the uniformitarian sequence stratigrapher, the individual parasequence represents a considerable period of time. Is there a real stratigraphic example (in the literature) where this is presented or stated otherwise?

At present sequence stratigraphy operates only within the paradigm of evolutionary-uniformitarianism. The Parasequence, Parasequence Sets, and Sequences are all defined by their respective sediments, flora, and fauna. While catastrophic sedimentary "events" are now more widely acknowledged within the concept of sequence stratigraphy, they continue to be viewed as short-term-events within the continuum of uniformitarianism.

I have previously stated (Froede, 1994) and continue to believe that creationists can use many of the concepts within sequence stratigraphy as a means to help define Flood-generated strata, but my use of this approach is one based on changing high-energy deposition and erosional processes. For example, I believe that most parasequences represent a rapid influx of sediments, flora, and fauna transported and deposited during a high-energy portion of the Flood (along the lines of Berthault, 1994, 1997). These parasequences (whether individually or combined into a larger Sequence) do not reflect any real paleoenvironment which existed over thousands to millions of years. Clearly, my concept of a parasequence (as defined by Flood-related sedimentation) is not the same as the uniformitarian parasequence.

Sequence Stratigraphy and the Death of Uniformitarianism

Toward the close of his article, Mr. Bartlett presents an outstanding section dealing with the philosophical constructs and contradictions of uniformitarianism as they relate to catastrophism. This work along with that previously put forward by Dr. John Reed (1996a, 1996b) is necessary and important in understanding the philosophical defects of the uniformitarian paradigm.

While I appreciate Mr. Bartlett's philosophic approach to sequence stratigraphy and catastrophism, I find myself in disagreement with his assessment of sequence stratigraphy's replacement of uniformitarianism. Sequence stratigraphy is simply window dressing which incorporates catastrophism into a uniformitarian framework. Nothing significant has changed within uniformitarianism (a similar conceptual event was her-

alded years ago when punctuated equilibria was touted as the end of gradualism and Neo-Darwinism; however, nothing changed then either). Bartlett (1997, p. 11) brings this out where he states:

...if periodicity (cosmic resonances or chaos theory) is demonstrable in the larger equation of catastrophe, then catastrophe as known by the revelationist is not catastrophic. Catastrophe becomes part of the naturalistic order of things.

This concept of "periodicity of events" is now accepted within most uniformitarian circles. Its main outgrowth involves determining the role that these "extinction-event drivers" had on the global stratigraphic record and the evolution of life (e.g., Brett and Baird, 1997; Donovan, 1989). Mr. Bartlett did point out that many of these events are viewed as being derived from extra-terrestrial sources. In an earlier article Dr. Donald B. DeYoung and I offered an explanation for these "space-invaders" within a creationist framework (Froede and DeYoung, 1996). We also reviewed possible and probable sources for both terrestrial and extra-terrestrial events which fit within the time frame and energy requirements of our model. Even "catastrophic" uniformitarianism would require these events to have operated over millions of years, with continuing input into the present via the imaginary Oort Cloud.

I do not see sequence stratigraphy within the same light as Mr. Bartlett. It may provide a new method for creationists to evaluate sedimentation, but the method must be divorced from its present philosophical framework. The high-energy associated with the Flood can account for the massive deposits and erosional indicators found within the physical (not global/conceptual) stratigraphic record. Sequence stratigraphy will continue to be useful to both uniformitarians and creationists, but we are likely to never unite in our common application of this approach due to our significant differences over Earth history and time.

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- Carl R. Froede, Jr.
2895 Emerson Lake Drive
Snellville, GA 30078

The Javelina—Another Look (Or Smell)

Sense of Smell

An introduction to the javelina (have-ah-lee-nah) and its dependence on its sense of smell was given in a recent photo essay (Williams and Goette, 1996). Day (1986, p. 28), after studying the behavior of javelina in Arizona, noted that:

Sense of smell is keenly developed in javelina... The olfactory system coupled with the dorsal scent gland is apparently important in the recognition of herd members, herd cohesion, and in establishing territory boundaries.

Feeding adults seem to have little difficulty in maintaining the location and direction of other herd members. Herd unity sometimes breaks down during periods of strong winds and under these circumstances the animals appear to become easily disoriented and lose herd contact and direction. A few may run around in panic trying to regroup.

One investigator suggested that herds are enveloped in a cloud of scent when moving and feeding... This is an excellent description since it is not unusual to detect the distinct odor of javelina on the currents of air drifting from a feeding herd or from fresh scent markings or droppings. Occasionally I have detected the odor of javelina over half a mile away.

Sense of smell is important to survival of the javelina. Herds can seldom be approached downwind... without disturbing or spooking them, and it was found... that the most successful stalks were made upwind... when the wind remained strong and steady.

My wife and I experienced the skunk-like odor of javelina in Big Bend National Park in December 1996 where I was doing some field work. We had just checked into our room in the lodge within the Chisos Mountains. Since it was a beautiful warm day, we sat out on our ve-



Figure 1. After two of the javelina found that my wife and I were not interested in feeding them from our lodge room in the Chisos Mountains, they decided to relax close by. After the mutual rubbing exercise, they laid down to sleep. Notice how they positioned themselves. This protective positioning allows the herd members to smell any approaching intruder from different directions. Also in cold weather, herd members sleep around and on top of each other in a "huddled mass" for thermoregulation.

randa off the rear of the room. Shortly we were visited by members of a herd of javelina. Obviously they were accustomed to being fed by Park visitors staying in the lodge. They stood about 15 feet away, patiently waiting for us "to get with the program." Realizing that we were unsympathetic to them, two adult members of the herd began a mutual rubbing of scent glands (head of one rubbing the scent gland of the other in unison) — an important behavior characteristic (Day, p. 26). The wind shifted and their scent drifted onto the veranda. This piercing odor caused us to retreat into the room to escape the unpleasantness! (See Figure 1.)

Sense of Sight

Slingluff (1990, p. 70) claimed that javelina "...are virtually blind." Day (p. 28) commented that the eyes of javelina "...are not designed for long-range viewing." Day explained that:

When javelina are preoccupied with feeding and are in areas with cover, individual animals may approach to within a few feet of a motionless person before becoming aware of the human presence (p. 28).. This would lead you to believe that such poor eyesight renders the javelina easy prey for a predator. However their outstanding sense of smell and herd instinct allows them to survive and flourish. Day stated, "Predation has been considered an important factor in limiting javelina populations, although there is little evidence to support this conjecture" (p. 75).

Urban-Dwelling Javelina

Although the human population explosion in Arizona has eliminated some javelina habitat (Day, p. 76), some herds have adapted quite well to the presence of humans (such as the herd in the Chisos Mountains in Big Bend National Park). The Arizona Game and Fish Department conducted a study on javelina dwelling in the city of Prescott (22 miles south of the Van Andel Creation Research Center). One of the conclusions of the study was as follows:

Javelina have adapted to Prescott by using the food, water, and cover sources provided by homeowners. It is apparent that homeowners have improved the habitat quality, thereby allowing javelina to survive in the urban setting (Ticer, Ockenfels, Morrell, and deVos, 1994, p. 29).

Thus if you build a house in a javelina habitat, plant some juicy ornamentals, provide water in a bird bath or in a shallow depression on your land, set up a well-stocked bird feeder, and leave some food scraps in your yard, then

possibly you may be adopted by a herd of javelina! These seemingly intelligent mammals have survived predation and appear to be reasonably able to cope with human presence. They can even be tamed. Seriously, if they lose their fear of humans, they can become aggressive, and if either wild or tamed, they will injure pets readily.

The javelina is one tough, bad-smelling southwestern character! Yet they are hunted for their meat and Slingluff (p. 70) noted that "Pit-barbecued javelina is one of God's gifts to the human tastebud."

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Acknowledgments

My thanks to John Meyer for the use of some materials in the Van Andel Creation Research Center library in writing some serious remarks and, at times, humorous comments about one of God's creatures.

Emmett L. Williams
7312 Club Crest Drive
Flowery Branch, GA 30542

Were the Colorado valleys cut during Post-Flood or Flood times?

I would like to compliment Mr. Michael Shaver (1998) on his geological perception of the Grand Junction, Colorado, area, and a fine article describing its Flood implications in the March, 1998, issue of the *Creation Research Society Quarterly*. What Shaver has observed in the Grand Junction area is similar to other areas of the western United States, as well as many other continental areas of the world.

One commonly observes across the earth thick sedimentary rocks that have been scoured by great erosion. Shaver noted the huge amount of sediment eroded from the wide Grand and Uncompahgre Valleys, and that this sediment is not found downstream, as would be expected assuming uniformitarianism or post-Flood catastrophism. The great thickness of strata that has been deeply

eroded is as expected from the Genesis Flood: the 21 weeks of "prevailing" and 31 weeks of "assuaging" of Whitcomb and Morris (1961, p. 4-7); the inundatory and recessive stages of Walker (1994); and the lower, middle and upper Flood divisions of Froede (1995). Walker further subdivides his recessive stage into the abative (sheet flow) and dispersive (channelized flow) phases. This subdivision of the recessive stage is a very reasonable sequence of events for the draining of the Flood, since sheet erosion would first dominate as the continents began uplifting out of the Flood waters (epierogenic movement). The currents during this sheet erosion likely would be very swift with coarse gravel employed for rapid erosion of poorly consolidated and consolidated rocks (Klevberg, 1998, Klevberg and Oard, 1998).

As mountains and plateaus emerged, the Flood water would be forced to flow around these barriers, becoming channelized in the process, forming large valleys and canyons. Stanley Schumm and Frank Ethridge (1994, p. 11) state that valleys form on an erosion surface during uplift or due to a concentration of kinetic energy: Valleys originate when streams incise. The incision is the result of an increase of potential energy following baselevel lowering or uplift, or an increase of kinetic energy following concentration of flow on an erosive surface. Schumm and Ethridge were, of course, thinking of small valleys within the uniformitarian system, but it would also work for large valleys during the Flood. The many flat erosion surfaces preserved at the tops of mountains and on the high plains of the western United States are strong evidence for the recessive stage (Oard and Klevberg, 1998). These erosion surfaces are sometimes large scale and truncate tilted sedimentary rocks, a phenomenon not observed in nature, except possibly on a local scale:

Flat, near-horizontal land cannot be seen to have been made at the heights at which most of it is now seen. Such landscape as flat-topped hills or high plateaus shows no process in action that might favour or maintain its flatness. Consequently, one cannot say that any geological work now observable has made it as flat and level as it is. The completion of its flattening appears to have been in the past (Crickmay, 1974, p. 140).

The erosion surfaces commonly bevel hard and soft rocks evenly, a powerful witness to rapid sheet erosion. Similar erosion surfaces are observed all over the world, attesting to the *global* nature of the sheet flow. The dispersive phase in Walker's model would account for the carving out of the western mountain valleys and the formation of canyons and gorges, as well as other valleys and canyons around the world.

Uniformitarian geologists commonly observe such a sequence of sheet erosion followed by channelized erosion and are hard pressed to explain it. For instance, Herbert Gregory (1950) summarizes the erosion that formed Zion National Park:

For convenience in description these two long [erosive] periods have been designated (1) the precanyon cycle, which records the history of the region before it was stripped of its Cenozoic strata and before the great canyons were formed, and (2) the canyon cycle, during which the present landscape has been modeled. In the studies so far made it appears that each cycle was initiated by a regional uplift...

He goes on to describe, using typical uniformitarian terminology and long periods of time, the precanyon cycle as stripping a huge amount of sediments from the area forming extensive erosion surfaces, which were subse-

quently dissected forming the canyons in the second period. This is seen as a general pattern during uplift that occurred during the *Tertiary and Recent* times. Of course regional and local tectonics, volcanism, and further erosion would be complicating factors in this general sequence, but the Flood would account for the first order features, such as flat-topped mesas and eroded broad valleys, as Shaver observes around Grand Junction.

Unweep Canyon and other canyons cut through hard rock in the area are more of a challenge to this Flood model. Unawweep Canyon is a long wind gap that according to uniformitarian thinking was supposedly formed when a river flowed in the channel while the Uncompahgre Plateau uplifted. (A wind gap differs from a water gap in that a water gap is not abandoned - the river still flows through a deep pass in the mountain barrier.) Cater (1966) believes the Unawweep wind gap was the ancestral Gunnison River, while Patton et al. (1991, p. 377) believe it was the ancestral Colorado River. The uplift of the Uncompahgre Plateau and the cutting of Unawweep Canyon supposedly occurred in the late Miocene to early Pleistocene of the traditional geological timescale (Patton et al., 1991, p. 377). Such wind gaps, as well as water gaps, are common in many other areas of the western United States, and also the rest of the world. For those creationists who believe the Flood/post-flood boundary is at the Cretaceous-Tertiary boundary or earlier in the uniformitarian timescale, Unawweep Canyon would have formed *after* the Flood.

Some of the best water gaps in the world are in the Zagros Mountains. Oberlander (1965, p. 1,9) describes the more than 300 water gaps that cut through barriers thousands of meters high:

The Zagros Highland, which occupies the borderlands of Iraq and Iran from eastern Turkey to the Gulf of Oman, is a most remarkable laboratory for the examination of one of the more perplexing and ubiquitous enigmas of regional physiography: the anomaly of through-flowing drainage that is transverse to the structure of an orogenic system . . . In all these regions of widely varying aspect the most exceptional features of landscapes frequently distinguished by the spectacular are the unusually precipitous defiles created by southwest-flowing streams and their tributaries, large and small, *whose courses appear to be developed in almost uniform disregard of their physiographic and structural matrix* [emphasis mine].

The Zagros Mountains rise higher than 4500 meter ASL. The ubiquitous transverse drainages have cut gorges as deep as 2500 meters. The Zagros Mountains rose in Cenozoic time according to the uniformitarian paradigm, like many other mountain ranges across the earth, and were folded and faulted. The transverse drain-

age of the Zagros Mountains developed in the late "Cenozoic" and "Pleistocene."

I believe the ice age had little to nothing to do with the cutting of wind and water gaps in western Colorado, large or small. Ice caps were located east of the area in Rocky Mountain National Park, the Sawatch Range, and the Mosquito Range (Richmond, 1965). They did not occur on the Uncompahgre Plateau and surrounding plateaus. Mountain ice caps mostly eroded high mountain areas and *deposited* the sediments in valleys and along the edge of the high plains as river terraces. Consequently, melting ice caps would mostly aggrade and form terraces in the deep mountain valleys of western Colorado. It is unlikely that mass wasting and cliff sapping would be more than local, small post-Flood effects. Most soft rocks in mountains, unless protected by a layer of hard rocks, should have been eroded by the receding Flood waters, leaving behind fairly consolidated mountains.

A much more likely explanation for the formation of Unaweep Canyon is that it was cut during the draining of the Flood waters (Oard, 1996, p. 270-271). As the Flood waters were receding, the flow accelerated where Unaweep Canyon now is located. The higher velocity would have resulted in higher erosion and an *incipient valley*. Once the receding Flood waters became more channelized, they would have continued to carve out Unaweep Canyon. For some reason the cutting of the valley stopped where observed today. Possibly the halting and diversion of the cutting of Unaweep Canyon was due to the slower erosion rate of the granite allowing other drainage routes to take over. The final channelized erosion would then erode the wide, flat-bottomed Grand and Uncompahgre Valleys from the level of the bottom of Unaweep Canyon. This Flood scenario is compatible with that envisioned by Shaver. The other canyons in the area can be explained similarly. Thus, the Unaweep Canyon would represent a "superimposed stream" during the recessional stage of the Flood.

Shaver astutely recognizes that the above Flood scenario implies that the Flood/post-Flood boundary is above the Miocene in western Colorado, since the great pile of sediments in the Grand Junction area includes a Miocene basalt cap at the top of mesas. From other areas of North America and the world, the boundary would be above the "Pliocene" in the uniformitarian geological timescale, since many of the erosion surfaces are dated as Pliocene or truncate Pliocene sediments: "In middle latitudes there are, however, almost everywhere locally planed surfaces that bevel moderately resistant terrains even as young as Pliocene" (Baulig, 1967, p. 925).

Shaver also noted that the erosion that produced the Grand Canyon is similar to the erosion that produced the Grand and Uncompahgre Valleys, and yet "Canyonland

Lake" cannot be invoked to erode the latter. This brings up the question of the origin of Grand Canyon. Why could not the erosion of Grand Canyon be just part of the same grand mechanism for forming erosion surfaces, valleys and canyons over the rest of the world - the retreating Flood waters? Although at first sympathetic to the dam-breach theory for the origin of Grand Canyon, I presented five geological problems with the theory (Oard, 1993). There are even more geological problems. For instance, there are thousands of water and wind gaps cut across mountain barriers over the world (i.e. the Zagros Mountains), mostly in *Cenozoic* time. Is a dam-breach theory going to be invoked to explain these also? We see a worldwide pattern for the recessive stage of the Flood that starts out with sheet erosion (abative phase), followed by channelized flow (dispersive phase) that carves valleys and canyons. The Grand Canyon is just another unique water gap within this scenario.

I thank Peter Klevberg for discussion of the above topics and correcting some of English.

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Michael J. Oard
3600 7th Ave., South
Great Falls, MT 59405

Comments on "The Big Sky Paving Gravel Deposit" CRSQ 34:225–235

I was pleased that Peter Klevberg (1998) attempted to place the Big Sky Paving gravel deposit historically. Such conclusions show the biblical geologic paradigm has practical use and provide reference points for future geological work. Peter concluded that the deposit may be "late diluvian or early post diluvian" and that greater precision in historical placement does not appear justified by the data.

However, a more precise placement of the deposit would be useful and give added relevance to the biblical paradigm. Possible reasons for the lack of precision include:

- Historical placement was not the main point of Peter's work so he did not consider relevant classification criteria in a systematic manner.
- One clearly defined classification scheme must be used. Although Peter referred to the two schemes currently published (Walker 1994; Froede, 1995) he ended by placing the deposit using terms that were not defined in either scheme or within the article itself.
- Peter's observations were at outcrop scale whereas larger scale regional investigations would be necessary to properly place the deposit.
- As noted by Peter, the end of the Flood event is difficult to identify due to a gradual decline in the rate of energy expended in geologic processes.

A range of criteria need to be considered when classifying a geological unit within a biblical geological scheme and these depend on the specific situation (Walker, 1996). In the case of the Big Sky Paving deposit useful cri-

teria would include:

- Regional correlations to establish the aerial extent and thickness of the unit (its scale). Is it part of a regional scale deposit or is it confined to more restricted flow channels? This will help decide between the Abative, Dispersive and Residual phases.
- The geomorphology of the region. This will help determine the timing of deposition with respect to erosion during the Recessive stage and any post Flood glaciation during the Residual phase.
- Fossils may be useful, particularly if affinities with modern fauna in the area are evident. This will help decide between the Recessive New-World deposits.

Much of this information would be available in the geologic literature. A systematic approach will help us agree where the geological strata belong biblically and open areas for further fruitful research. I hope that we will soon produce geological maps showing how the rocks in each area fit within a biblical geologic framework.

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Tas Walker
34 Fawkner Street
Chapel Hill, Queensland 4069
Australia

Response by Peter Klevberg

I am gratified that my research on the Big Sky Paving gravel deposit (Klevberg, 1998) has been of benefit to others. Tasman Walker, one of the most effective and innovative creationist researchers in the field of stratigraphy, has raised several issues which I shall attempt to address. In particular, he differs with my assessment that greater historical precision than “late diluvian or early postdiluvian” is probably not warranted by the data.

- Walker infers that historical placement of the deposit may not have been the primary purpose of my article and that I did not, therefore, consider chronostratigraphic classification criteria in a systematic manner. He is right on the first part of his inference. The main point of my article was the fact that interpretation of the depositional environment of the Big Sky Paving deposit based on paleohydrologic analysis was readily compatible with a biblical (diluvian) paradigm, but not with a uniformitarian or even neo-catastrophist paradigm. However, my reason for not including a detailed, systematic stratigraphic analysis should not be inferred to mean that I ignored this. Rather, I believe it would have been ponderous and detracted from the main point I wished to present. I would be glad to correspond with others who are interested in the specific stratigraphic issues raised by this research.
- Walker believes that one specific geochronologic paradigm must be used. I referred to both Walker’s excellent paradigm (Walker, 1994) and that of Froede (Froede, 1995). I disagree with Walker on this point; I believe more than one paradigm is helpful. For example, Walker’s is as detailed as biblical data permit (perhaps more than biblical data permit), while Froede’s is more general, with lower, middle and upper divisions. Froede’s is therefore less specific and perhaps less useful in detailed stratigraphic analyses, but more easily applied to the ambiguous situations that often exist in real field work. It is important to recognize that all of these are *historical inferences*, *not science*, and I therefore believe having more than one system will help us differentiate between our personal inferences and the actual data. What Walker has touched on is a huge “can of worms,” the field of stratigraphy, which must be addressed in depth elsewhere. As for Walker’s accusation that I used undefined terms (“diluvian” and

“postdiluvian”), I hardly think that warranted. I have encountered these terms (albeit derisively) in my college geology courses and books by evolutionists. It is admittedly somewhat imprecise to infer sediments were deposited in “late diluvian or early postdiluvian time,” but it is my belief that to go beyond this with the available data requires assumptions which may not be justified.

- Walker notes that my observations were at outcrop scale and suggests that regional studies might provide greater power of resolution from the perspective of historical geology. I think he might be right about this, and it may prove a worthwhile endeavor.
- A number of complex interrelations between the Big Sky Paving deposit and adjacent units were mentioned briefly in my article. I see here a danger with overenthusiastic application of Walker’s paradigm: the diagnostic criteria may be too gross generalizations to accommodate the complexities of local depositional environments. As a case in point, channel formation may not be restricted to cases of channelized flow; indeed, the channel must develop before flow can become restricted to it. This may have been the case with the formation of the Grand Canyon of the Colorado River, which is not amenable to postdiluvial explanations (Oard, 1993; Shaver, 1998). This suggests caution in application of Walker’s criteria, especially at smaller scales.
- It is not possible to evaluate an alleged stratigraphic order of fossils while using fossils as a criterion in stratigraphic analysis. In the case of the Big Sky Paving deposit, no fossil has been reported with the exception of snails in an unconsolidated sand unit topographically lower than the Big Sky Paving deposit.
- Walker envisions geologic maps, presumably resembling those produced currently by the Establishment but using his or Froede’s geochronologic paradigm. I used to share this vision, but am very concerned now that we carefully differentiate between *science* (empirical description) and *historical inference*. These maps may be useful, but only after the descriptive (empirical) maps have been created. My primary interest is in the former; Walker’s is apparently in the latter. As has been pointed out by Froede (1995), we need to work from the local data to the regional interpretation, not vice versa, and I think great potential exists for a mutualistic effort on the part of all of us diluvialists to reach Walker’s goal without extrapolating too far from the available data.

Walker and Froede are trailblazers in breaking free of the confinement of uniformitarian stratigraphy that still hamstrings so much creationist research in geology. Walker’s paradigm is the closest I have seen to what I and some colleagues were working on several years ago. He

has done a better job than I had in formulating his geochronologic paradigm. However, I have several criticisms/recommendations for its improvement. I would be glad to share these with interested readers. We should expect further refinements as we progress in these nascent fields of scientific (descriptive) stratigraphy and historical geology.

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Peter Klevberg
512 Seventh Avenue North
Great Falls, Montana 59401

Peleg and Plate Tectonics

In the June 1998, Volume 35 issue of *CRSQ* on page 46, I was stimulated by the questions raised in Carl Froede Jr.'s letter to the editor about heat dissipation and plate tectonics. I have heard similar speculations that movement of massive plates in the earth and the Flood were probably coincidental. Allow me to take the issue one step farther.

Looking at the coastal outlines there has also been occasional speculation that all basic land mass came out of one larger mass (Gondwanaland hypothesis). Interestingly enough after the Flood (Genesis 11: 1-9) God speaks of the Babel incident and dividing people by languages, but does not specify exactly when that happened in relation to the generations of Shem.

I raise this point because in Genesis 10:25 and 1 Chronicles 1:19 Peleg is discussed in the context of the earth being divided in his lifetime. Following the genealogies of Genesis 11 one can deduce that this event of division of the earth took place between 101 and 340 years after the Flood. From the loose fitting chronologies of these verses, it appears that after the Flood God observed the Babel building, confounded the languages, dispersed the people by language, then in the time of Peleg divided the earth to prevent rapid reintegration of the people.

Such a hypothetical order of events could explain to some degree 1) current coastal outlines; 2) the vast dispersal of people around the globe; 3) diversity of languages around the globe; 4) relatively fresh and growing mountain ranges on opposite shores of continents away from the apparently fitting former "Gondwanaland" coastlines; 5) synchronization/harmonization of scientific conclusion with these passages of Scripture, rather than depending wholly upon the Flood itself for genera-

tion of plate tectonics; 6) virtually universal genesis and flood stories of one type or other across cultures and languages.

If God is the all powerful Creator which the Bible and we keep saying that He is, then what is the big deal that He should separate the languages, then the people, and then separate the continents to keep the people apart?

Has there been any substantive discourse or investigation regarding this subject from this particular angle?

Craig M. Szwed
cmarsz@snet.net

Editor's Remark

Yes, there have been numerous comments on this subject. Here are a few:

- Strickling, J. E. 1978. Peleg's Division. *CRSQ* 15:159. Strickling discussed the Red Sea and the Rift Valley of east Africa. He wrote: "... the occurrence of a rift in ancient times in the location and of the magnitude of that described beneath the Red Sea would quite conceivably be described as a division of the earth. Might this not be what happened in Peleg's time? "... the name of one (son of Eber) was Peleg, for in his days [plural] was the earth divided" Genesis 10:25.
- Tippetts, Mark W. 1979. Pangaea shattered. *CRSQ* 16:7-15,83. Tippetts (p. 15) wrote: "The breakup of Pangaea probably occurred much as supposed in traditional geology, but in a short time. This breakup came after Babel, and mostly ended before the Christian era, so there has been approximately 2000 years for the continents to arrive at there present positions." Tippetts (p. 7) also wrote: "Noah's Ark, it is suggested, came to

rest on the mountains of Ararat near the western end of the Tethys Sea. During the century following the Deluge, Noah and his progeny would have migrated to the area of Babel. At this time the tongues were confounded; and perhaps 100 years later (during Peleg's lifetime) Pangaea started to break up. Between these two events the peoples could have moved to the farthest reaches of Pangaea. At an easy pace of 16 km per day (10 miles per day) it would have taken at most two years."

- Burdick, Clifford L. 1980. A critical look at continental drift. *CRSQ* 17: 111-114. Burdick wrote: "If India, for instance, had travelled all the way from Antarctica to its present location in Peleg's days, the result would have been a catastrophe far greater than the Flood in Noah's days."
- Hansen, Patrick S. 1983. The necessity of continental re-location in the creationist model. *CRSQ* 19:206-207, 225. Hansen wrote: "... even though there has been some controversy about the geological significance of

the intriguingly mysterious reference in Genesis 10:25 to Peleg a study of the etymological background of the name, "Peleg," shows that the derivation of the word involves meanings that include a physical dividing asunder, as earthquake, and "watercourse," perhaps a reference to a recent formation of a body of water, i.e., the Atlantic Ocean. Whatever the reason Peleg received his name, it is clear that a very significant geological event took place in his lifetime, which appears to have been nearly contemporaneous with the incident at the Tower of Nimrod's Babel, at which time the Lord "did scatter them abroad upon the face of all the earth."

- Waisgerber, William. 1987. The mechanisms for mountain building from a creationist perspective are not yet understood. *CRSQ* 24:129- 132. Waisgerber wrote: "Thus Peleg's division seemingly offers Hansen the opportunity to separate the continents during the lifetime of Peleg. Yet throughout history, Peleg's division was believed by devout Jews and Christians to be the time when Japhetites, Shemites, and Hamites were

A Possible Solution to the Heat Issue Within Catastrophic Plate Tectonics

In a recent letter, Carl R. Froede Jr. (1998, p. 46) discussed the problem of the heat generated during the short Flood period by the process known as catastrophic plate tectonics, CPT. He asks the question "What happened to the heat generated during this period?" (1998, p. 46). The author states that the rapid removal of such energy is an unexplained aspect of the CPT model. However, ongoing theoretical research may give a possible solution to this and other problems such as the rates of radioactive decay.

In an Internet published paper (Herrmann, 1998), the "metric" method used in the General Theory of Relativity is applied as a possible mechanism for many of the Flood related physical scenarios. The major reasons this paper is placed on the Internet are to make the results immediately available for review and possible adoption by other researchers, and to allow for immediate revision as the research is refined. For an area where research results are developing rapidly, being able to revise the original research paper as dictated by further research findings appears to be an exceptionally useful procedure relative to the rapid communication of new knowledge. This is ongoing research and this letter is intended, in the usual manner, to be an announcement of the present research findings.

Within gravitational theory, different metrics are employed for different physical scenarios and within each scenario the gravitational parameters are allowed to vary. Within this Internet paper, the same general approach

found in Herrmann (1996) that yields the Special Theory linear effect metric is applied radially to the earth. This metric is not obtained through ad hoc assumptions but, rather, it is derived from first principles. For the Flood, there is only one special metric and one parameter d . This parameter is allowed to vary depending upon the physical scenario to which it is applied. Using this Flood metric and through formal derivations, it can be shown that numerous many rates of change will increase when compared to the rates of change as measured within our present environment. This is all brought about by a type of "time-compression." However, not all rates of change will be increased by application of this Flood metric.

Of significance to questions of heat dispersal is the prediction that all of the ordinary modes of internal heat transfer, and external radiation and cooling, as they are modeled by differential equations and energy or temperature rates of change, will increase greatly during the Flood period. This very rapid cooling and great increases in the rates of energy transfer coupled with other increases in rates of change could effectively solve this problem. One other important aspect of this Flood metric for CPT is an increase in radial velocities for certain physical entities during the Flood period.

This "metric" method should not be construed as the final word on this subject. It yields a fully describable mechanism that can solve this problem. But, most certainly, there will be many other mechanisms investigated and presented as possible solutions. It is hoped that these

results might help to encourage further research towards finding a scripturally based Flood model that is accurate and solves all significant problems such as the problem of heat within CPT.

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Robert A. Herrmann, Ph. D.
Mathematics Department
U.S. Naval Academy
572 Holloway Rd.
Annapolis, MD 21402

More Evidence against Plate Tectonics

In the recent June issue of the *CRSQ* [35(1): 46-47], Carl Froede warned against premature acceptance of the CPT (Catastrophic Plate Tectonics) Model by the Scientific Creationist community. The basis of his objection was the fact that large amounts of heat would be generated by the creation of an Atlantic Ocean on a young earth. Furthermore, the proponents of CPT have done next to nothing to solve this apparently-intractable and probably-fatal difficulty in their model.

Of course, there are many other serious problems with plate tectonics. And, contrary to some opinions, these problems did not disappear with the 1960's. To the contrary, they have only grown as more evidence has been accumulated since the "plate tectonics revolution" of some 30 years ago.

Consider, for instance, the conventionally-accepted age of the Atlantic Ocean. The ruling paradigm dictates that, according to the conventional time scale, the Atlantic Ocean is no older than Mesozoic. The areas of the ocean near the Mid-Atlantic Ridge should uniformly be of near-zero age. After all, that is the site of the most recently-formed oceanic crust, according to plate-tectonics concepts.

For a long time, however, rocks dredged from the Atlantic bottom have been found that soundly contradict this prediction. They are significantly older (paleontologically and/or isotopically) than the accepted age of the local oceanic crust, and many are much older than the presumed age of the entire Atlantic Ocean. During the time that the now-late Meyerhoff father-son team were challenging plate tectonics (Meyerhoff and Meyerhoff, 1972), these discrepantly-old rocks were explained away as ice-rafted erratics. Now there are so many of them that they cannot any longer be thus rationalized away (Meyerhoff et. al., 1992, p. 169-171; Smoot and Meyerhoff, 1995). Some of the more notable studies cited and discussed by the Meyerhoff team include the

following: Saito, Ewing, and Burckle (1966), Aumento (1969), Aumento and Loncarevic (1969), and Honnorez (1975).

It should also be pointed out that many of these anomalously-old rocks occur in geographic regions of the ocean where no ice is inferred to have ever been. Moreover, many of these unwelcome rocks are undoubtedly in-situ constituents of the oceanic crust. For these reasons, the new rationalization has them being bits of foundered continental crust that had "chipped off" the continents as they were drifting apart and thus "built in" within the new oceanic crust.

In recent years, more contrary evidence has accumulated, and a maze of so-called transform faults has been invoked for such discrepancies. As Snelling (1997) has pointed out, a whole area of paleontologically Cretaceous crustal rock has been found near the mid-Atlantic Ridge. (As noted earlier, the "correct" age should be near zero at the mid-Atlantic Ridge). This block of ostensibly 120-million year-old material was explained away as an ad hoc "large chip" of continental material trapped by a series of transform-fault jumps following the opening-up of the Atlantic Ocean in the Mesozoic.

Recently, yet another line of evidence has emerged which contradicts the usual sequence believed for the opening of the Atlantic Ocean. In a recent article (Pilot, Werner, Haubrich, and Baumann, 1998) zircons from Mid-Atlantic Ridge rocks have been U-Pb dated as Paleozoic to Proterozoic! These anomalies were explained away as mineral inclusions within foundering crust or transform-fault jump.

Of course, if the uniformitarian time scale is rejected, these "dates" need not have any meaning, and the plate-tectonics origin of the Atlantic Ocean can occur without conventional temporal constraints. However, these contrary bodies of evidences do have relevance to the falsification of CPT for at least two reasons. To begin with,

although the multimillion-year results themselves are rejected, the alleged younging TREND of the Atlantic crust going away from the Mid-Atlantic Ridge is accepted by CPT-proponents as evidence for the validity of continental drift. Moreover, in view of the fact that proponents of CPT tend to uncritically “import” uniformitarian ideas into a Creationist context (including a time-compressed version of the conventional uniformitarian time scale), the discrepant conventional “ages” of Atlantic-seafloor assume even greater relevance to the evaluation of CPT.

Finally, there is no escaping the fact that proponents of plate tectonics (of whatever type) are ignoring evidence contrary to their model. The words of the late Creationist geologist Clifford Burdick echo in our ears: “Is geology the only science where evidence does not matter?” It behooves us Creationists to be very cautious in rushing to accept popular ideas such as plate tectonics.

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John Woodmorappe

Book Review

Finding God at Harvard, edited by Kelly Monroe
Zondervan Publishing House., Grand Rapids. 1996. 368 pages. \$17.99.
Reviewed by John Kaplan

The jacket of this book asks, “Does finding God mean abandoning your intellect?” Forty-two testimonies from Harvard faculty, former students, and prestigious speakers answer in the negative and “refute the claim that Christian faith cannot survive a rigorous intellectual atmosphere.”

Harvard was not founded to be strictly a divinity school, but a place to explore God’s works as well as his word. “Yielding joy and not cynicism, a relationship with Christ could be celebrated in every area of life and study. The Christians rejected any dichotomy, later made in the Enlightenment, between reason and revelation” (p.15). A quote from the College laws of 1642 reads, “Let every stu-

dent... consider well the main end of his life and studies is to know God and Jesus Christ which is eternal life, John 17:3, and therefore to lay Christ in the bottom, as the only foundation of sound knowledge and learning. Seeing the Lord giveth wisdom, everyone shall seriously by prayer, in secret, seek wisdom of him” (p.14).

Many of the contributors have impressive credentials yet write very readable and inspiring stories. Michael Yang with an M.D. and Ph.D. from a joint program in the health sciences and technology at Harvard Medical School and M.I.T. writes:

As a physician, I face the challenge of providing sound medical practice with ministering the super-

natural healing that I believe is available in Christ Jesus. At times, it seems easier to ask God to heal the sick using only my medical knowledge. To be honest, it would spare me from having to depend as much on him. While I thank God for the gift of medical science, I know its limitations. Through research and study, I hope to contribute to the advancement of medicine, but I don't know many people who have become believers in God as a result of contemplating the marvels of health care. I do know many who have become confident in the abilities of man apart from God. What the world needs to see again is the supernatural ministry of Jesus Christ. Like the apostle Paul, I want to see God's kingdom come, not in words only but in demonstration of the Spirit and of power (I Corinthians 2:4) (pp. 126,127).

Gregory Hammett, holding an A.B. in physics from Harvard and a Ph.D. in astrophysical sciences from Princeton, notes in connection with limitations of science and technology:

Like money, technology sometimes merely aggravates preexisting human problems. The true culprit is the fallen human heart, which has the capability of turning virtually everything it invents into two-edged sword—a blessing or a curse... The capacity for evil is in the heart, not in advanced technology (p.278).

The discussion by astrophysicist, Owen Gingerich, is a disappointing endorsement of theistic evolution. He believes that:

There is much about myself which can be profitably understood as a mechanical product at the end of a four-billion-year chain of evolution... As Theodosius Dobzhansky, perhaps the greatest geneticist of our century, remarked, no other species was impelled by natural selection to evolve in similar ways [as humans] (p.272).

However, most of the other testimonies are very uplifting. Consider this well balanced observation by Elton Trueblood who earned an S.T.B. from Harvard, a Ph.D. from Johns Hopkins, and 14 honorary doctorates:

What we need is not intellectual theorizing or even preaching but a demonstration. There is only one way of turning loyally to Christ, and that is by loving others with the great love of God. Abstract and unembodied Christianity is a fiction. We cannot revive the faith by argument, but we might catch the imagination of puzzled men and women by an exhibition of a Christian fellowship so intensely alive that every thoughtful person would be forced to respect it. (p.335).

Other enjoyable writings include two by Krister Sairsingh and Poh Lian Lim. Sairsingh, a Yale graduate who also earned a Ph.D. from Harvard, tells of his conversion to Christianity from an influential Hindu background. Poh Lian Lim who studied biochemistry at Harvard and obtained an M.D. from Columbia has written on biblical sexuality.

John Rankin, Th.M. from Harvard Divinity School, begins at Genesis to address male chauvinism:

Whether one is evangelical or liberal it is clear that Genesis 1-3 is the interpretive foundation of all scripture. In these chapters, the cardinal doctrines of creation, sin, and redemption are introduced and defined. Whether or not one takes these chapters as historically accurate and divinely revealed, as I do, or as mythological.... Scripture nonetheless on its own terms distinguishes between the order of creation on the one hand and its reversal in the introduction of human sin on the other. Thus, male chauvinism and a whole host of other sins are described in the Old Testament, but as the result of sin (p.203).

A commencement address given at Harvard by the Russian novelist, Aleksandr Solzhenitsyn, is presented in an abridged form on, among other topics, the consequence of humanism.

Harvard graduate Richard Keyes states that "investigation, stewardship, and nurture of the world was not permitted but commanded by God in the first chapters of Genesis" (p.79). He explains:

For Newton and many of his generation, the discovery that many natural occurrences in the world were caused not by the direct hand of God but by other natural occurrences posed no threat to faith but rather deepened it. Many of the founders of the Royal Academy of Science were Puritans who saw their scientific curiosity as an expression of their biblical faith, not as a threat to it. Science was simply investigating the wonders of what God had created, ordered, and sustained. Harvard College itself was founded as an expression of this world view. Harvard's motto Veritas [truth] was implicitly, and later explicitly, related to the early seals in *Christi Gloriam* and *Christo et Ecclesiae*.... A relationship to God through Christ would inform every aspect of life and knowledge and also yield wisdom, humility, and intellectual honesty (p.80).

In summary, the writings are encouraging, balanced, and thought provoking. They demonstrate that God encourages the use of our intellects as we explore His creation. "The works of the Lord are great, sought out of all them that have pleasure therein" (Psalm 111:2).

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Lazella M. Lawson*

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*Lazella M. Lawson, M.S., 21515 Placerita Canyon Road #16, Newhall, CA 91321.

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Book Review

The Science of God by Gerald Schroeder
Simon and Schuster, New York. 1997. 226 pages. \$25.00
Reviewed by Don B. DeYoung

The author is a Ph.D. nuclear physicist and researcher at the Weizmano Institute in Israel. This volume and Schroeder's earlier *Genesis and the Big Bang* (1990) emphasize Hebrew word interpretations from Genesis. This new book is largely a repeat of the former with little new material. Extensive use is made of early Jewish scholars such as Nahmanides and Moses Maimonides, both from 1200 A.D.

Schroeder appeals to relativity to reconcile the controversy over earth age. He explains that locations with extremely high gravity (large mass) or high speed experience a longer duration between ticks of the clock. This was therefore, somehow the condition on earth while the creation week occurred. Earth clocks ticked off just six days while cosmic clocks turned through 15 billion years, a trillion times longer. He calls the six literal creation days linear time, while the vast ages are cosmic time. Schroeder doesn't mention the obvious conflict that the Biblical creation events occur largely upon the earth itself. He also does not suggest a detailed mechanism as Russell Humphreys does in *Starlight and Time* (1990). Schroeder simply writes "There are any number of ages for our universe, each being correct for the location at which the measurement was made" (p. 50). This innocuous statement has been sufficient to put Schroeder recently on several national talk shows. The author needs to be reminded that the greatest relativistic time dilation yet verified is measured in microseconds only (Serway, 1995). This is 1028 times less than the author's assumption.

Author Schroeder knows the Hebrew Old Testament

well. This makes many of his statements all the more surprising. "Nowhere does the [Biblical] text claim that Earth is central to anything" (p. 8). Adam is said to have had sexual relations with subhumans other than Eve (p. 141). The Genesis Flood is explained as only a local storm in Mesopotamia (p. 206). The discredited Day-Age theory is promoted throughout the book. It also is claimed that God has placed undirected, randomness into nature, beyond his own control (p. 106).

Some of Schroeder's insights are helpful. He accepts the long ages of Old Testament patriarchs, suggesting a life-sustaining metabolic skill. He suggests the plural word for reptile, *taneen*, found in Genesis 1:21 and Exodus 7:10 may refer to dinosaurs (p. 193). Schroeder believes the word Hebrew *tinshemet* in Leviticus 11:18 and 11:30 may refer to the fossil *Archaeopteryx*. Some of Schroeder's material is useful to the Intelligent Design movement. An index is included with 200 Old Testament references, and none from the New Testament.

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Eugene F. Chaffin*

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- *Eugene F. Chaffin, Ph.D.
715 Tazewell Avenue
Bluefield, VA 24605

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