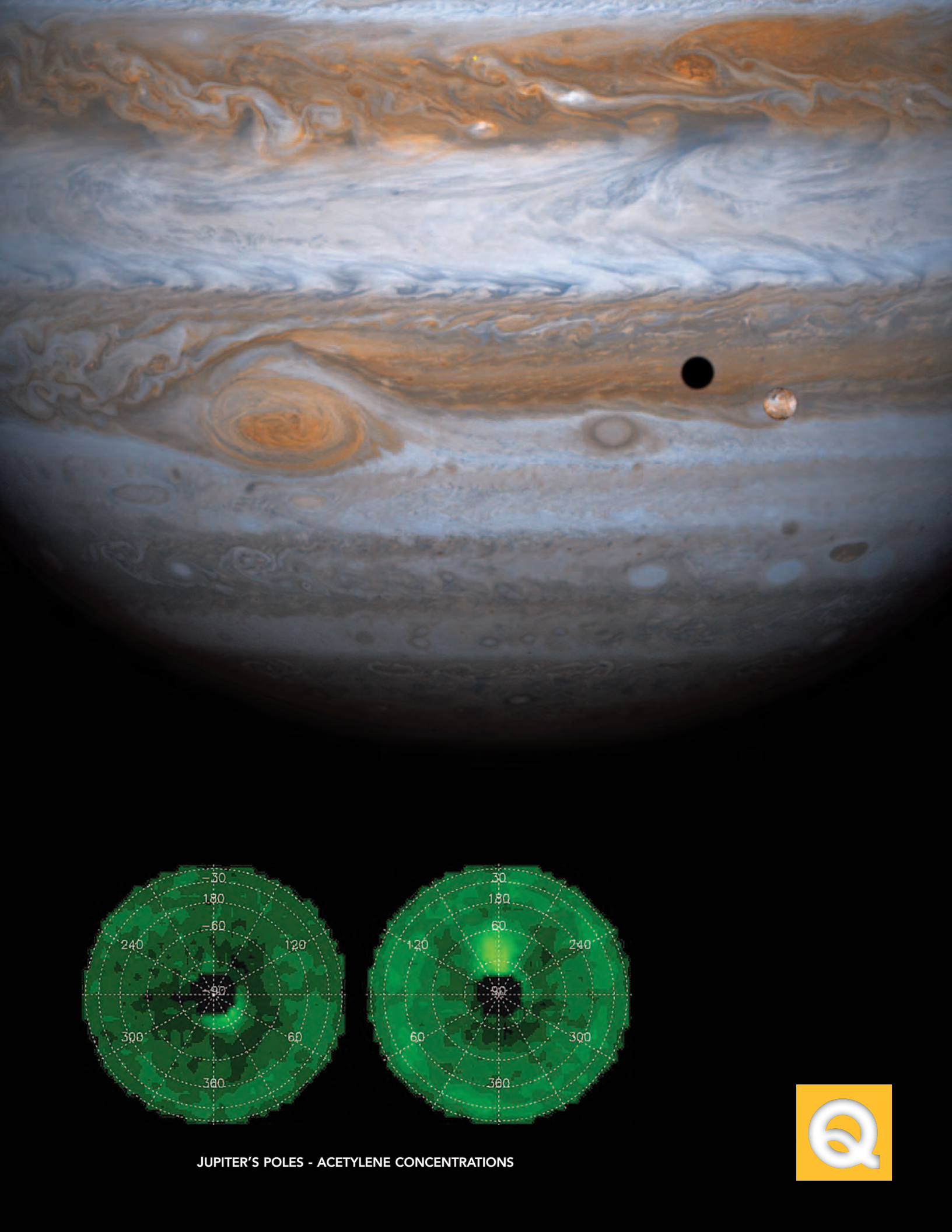




JUPITER'S POLES - ACETYLENE CONCENTRATIONS

CREATION RESEARCH SOCIETY



QUARTERLY

Volume 48 Summer 2011 Number 1

- THE LITTLE ICE AGE - PART II
- THE UNIVERSE IN REAL TIME
- "GEO THEORY": PAST AND PRESENT
- ORIGIN OF APPALACHIAN GEOMORPHOLOGY - PART I
- FLOOD / ICE AGE TRANSITION



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Haec Credimus

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

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The Universe in Near Real Time and the Light Time Effect

Ronald G. Samec and Bruce Oliver*

Abstract

At the 2009 CRS conference (Lancaster, SC), Steve Miller presented a paper entitled, “Universe in Near Real Time.” This paper suggests the possibility that the astronomical universe is actually being observed in near real time. Miller gives scriptural evidence for this proposal in Revelation 8:12. He envisions an envelope surrounding the solar system in which light travels at velocity c . But outside this envelope the speed is nearly infinite. Observationally, it is readily seen that the *light-time* effect refutes this idea. We cite observations from the literature as well as our recent observations of FY Bootis, a very short-period binary, which displays a sinusoidal orbital light-time effect (an O-C curve). The light-time effect in this system is due to a close binary orbited by a third body. If the scenario of the “Universe in Near Real Time” were true, the O-C curve should be a straight line fit instead of a sinusoid and we could not make the determination given here. This is an example of how real astronomical observations can aid the creation community in testing proposed models, and it stresses our need for our own professional creationary astronomical observatory.

Miller (2010), in his paper “Universe in Near Real Time,” proposed that astronomers are actually observing the astronomical universe in near real time. Thus, the recent image of two colliding galaxies taken by the HST shown in Figure 1 depicts a scenario that is currently taking place. The scriptural basis of this belief is Revelation 8:12. It is important to read the context of the verse, so we give it here.

And the second angel sounded, and as it were a great mountain burning with fire was cast into the sea: and the third part

of the sea became blood; and the third part of the creatures which were in the sea, and had life, died; and the third part of the ships were destroyed. And the third angel sounded, and there fell a great star from heaven, burning as it were a lamp, and it fell upon the third part of the rivers, and upon the fountains of waters; and the name of the star is called Wormwood: and the third part of the waters became wormwood; and many men died of the waters, because they were made bitter. And the fourth angel sounded, and the third part of the sun was

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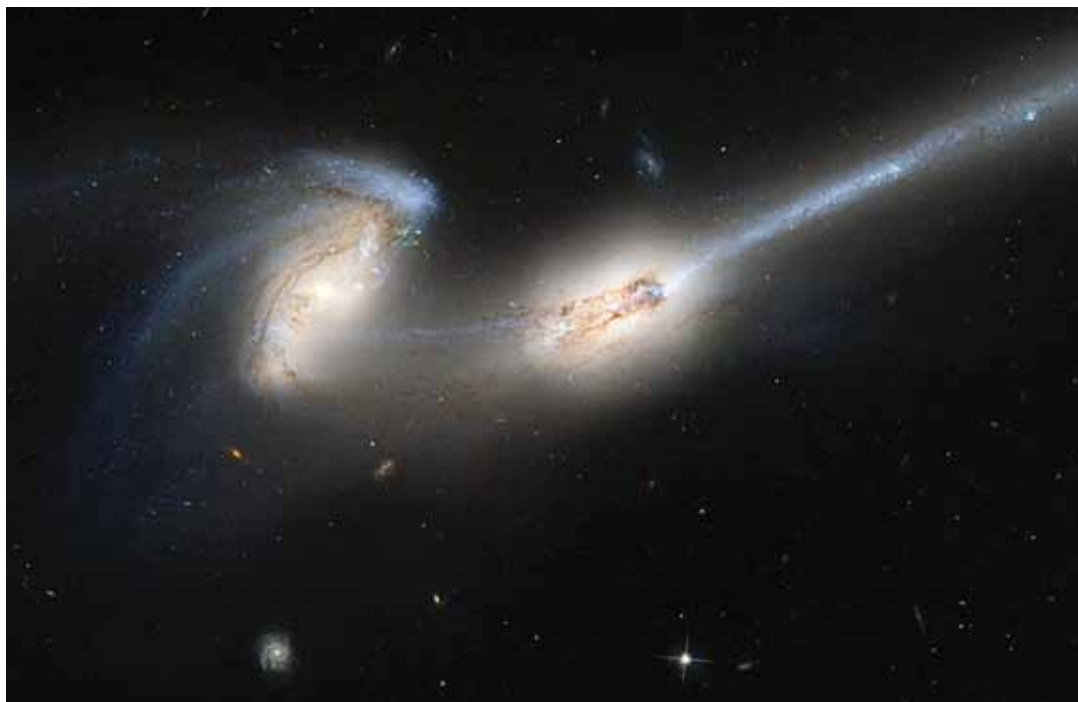


Figure 1 (*above*). HST image of colliding galaxies named the “Tadpole” (UGC10214).

Figure 2 (*below*). The sun, moon, and stars on top image and darkened and reddened by 1/3 or about 1.2 magnitudes on the bottom image.



smitten, and the third part of the moon, and the third part of the stars; so as the third part of them was darkened, and the day shone not for a third part of it, and the night likewise. (Revelation 8:9–12 KJV)

We understand the scenario here to be the end times, during the Great Tribulation. In the first section (the second angel sounding), apparently an asteroid strikes the oceans killing a third part of the sea creatures. Next, the third angel sounds, and apparently a comet with its frozen, noxious gasses strikes the fresh water supply of earth and poisons it. We picture a time of great destruction, asteroids, comets and subsequent volcanism, earthquakes etc. With all this upheaval, the sun, moon, and stars are darkened by 1/3, or about 1.2 magnitudes. They all are dimmed, *as seen by the earth-based observer*. In fact, they are all dimmed nearly simultaneously (see Figure 2). Does it follow that solar system bodies, stars tens of light years away, as well as bright galaxies up to several million light years away intrinsically become less luminous? Miller (2010) concludes that light travels at near infinite speeds outside the solar system, while measurements of the speed of light in the solar system yield the speed, $c = 3 \times 10^8$ m/s.

Another scriptural evidence mentioned to me in casual conversation with Steve Miller was Joel 3:15. Again, exploring the context, Joel 3:14–18,

Multitudes, multitudes in the valley of decision: for the day of the LORD is near in the valley of decision. *The sun and the moon shall be darkened, and the stars shall withdraw their shining.* The LORD also shall roar out of Zion, and utter his voice from Jerusalem; and the heavens and the earth shall shake: but the LORD will be the hope of his people, and the strength of the children of Israel. So shall ye know that I am the LORD your God dwelling in Zion, my holy mountain: then shall Jerusalem be holy, and there shall no strangers pass through her any more. And it shall come to pass in that day, *that the mountains shall drop down new wine, and the hills shall flow with milk, and all the rivers of Judah shall flow with waters, and a fountain shall come forth of the house of the LORD, and shall water the valley of Shittim.* (KJV, italics added)

Again, this is during the end times. The context is the Battle of Armageddon, and the sun, moon, and stars together are darkened *to the earth-based observer*.

In the Miller model, imagine an envelope separating the solar system from the rest of the cosmos. Since we gather from Scripture that God directly created everything in the solar system during Creation Week, and He placed the bodies in their particular orbits (Gen. 1:17), perhaps such an envelope might make some sense. To Mr. Miller, the speed of light inside this envelope is 3×10^8 m/s, and outside of it the speed is essentially infinite. Some supporters of the Miller model, who attended the 2010 CRS Conference, seem to think that the speed decreases, perhaps radially as it comes in from the distant universe

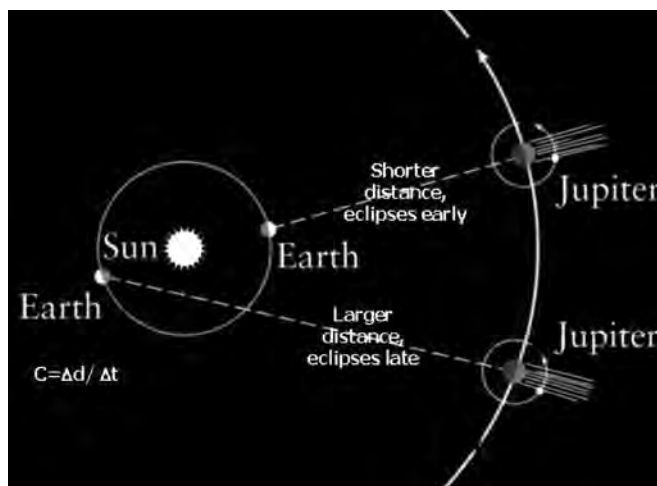


Figure 3. Roemer's determination of the speed of light using light time.

and impinges on the sun, for instance, rather than changing suddenly at the boundary of the envelope. We will address that complication later. Of course, all this has to fit within a context of about 6000 years of earth rotations (days) since this model is hypothesized in a young-earth creationist context.

Further evidence given by Miller for the “Universe in Near Real Time” is that deep space images reveal the existence of mature clusters of galaxies. The Hubble Deep field is an example of this. This may be interpreted to mean that the universe was created in a mature form and everywhere we look, the universe has a mature age, regardless of distance.

What Is the Light-Time Effect?

A good explanation of the light-time effect is seen in Roemer's determination of the speed of light. See Figure 3. This is simply the measure of time between two eclipses of Jupiter's moon Io and the difference of the distances of the two occurrences. When Jupiter is closer to the earth in their relative orbital motions, the eclipses will be seen from the earth earlier than on average. When Jupiter is relatively farther away, the eclipses will be seen later. This happens since it takes light longer to travel the additional distance. The difference in time is called “light time.” This particular light-time effect is allowed in the Miller model since it occurs inside the solar system “envelope.” The light-time effect for stellar binary systems, however, is another matter. These systems are from about 50 ly to 10 Mly distant, so they are well outside the solar system envelope [ly = light-years]. The solar system is about 50 AU in size, out to the Kuiper Belt, which is about 0.0008 ly or 7 light-hours.

An eclipsing binary is a pair of stars that regularly eclipse each other. The eclipses happen periodically, which means

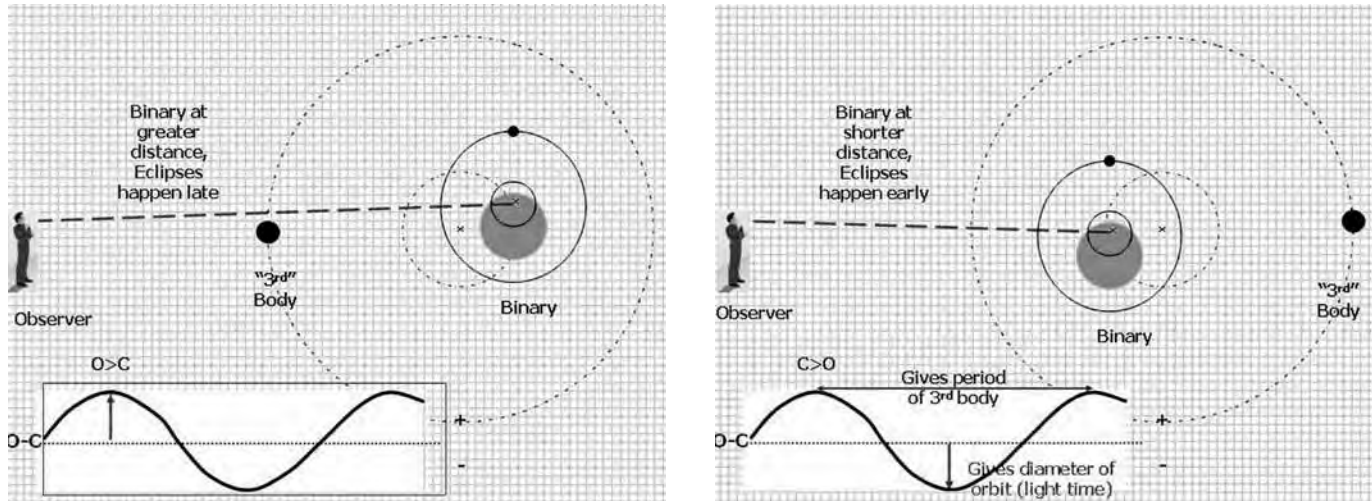


Figure 4. Light-time effect due to a close binary orbiting about a center of mass of a third body, left (a) and right (b).

that eclipse timings are equally spaced in time. The light-time effect we are referring to here, however, occurs when a close eclipsing binary systems has a “third body.” This means that the close binary is orbiting the center of mass of a third body, usually a companion star. See Figure 4a. The observer is on earth. By the way, to eliminate the light-time effect of the earth’s orbital motion, we calculate our time measurements from the sun’s center (so called Heliocentric Julian Date) or from the solar system’s center of mass, the Barycentric Julian Date. Here, we, as all other professional astronomers, will neglect this earth-caused light-time effect since it is already taken care of in our time calculations.

Compare Figure 4a to Figure 4b. The smaller dark star is undergoing eclipses with the large gray component as seen by the earth-based observer. This is the close binary system. In turn, the close binary is orbiting about a third star we refer to as a “third body.” If the binary is on the far side of the center of mass orbit as seen by the earth-based observer, as in Figure 4a, the eclipses will happen late due to the light-time effect (it is farther away and the light takes longer to get here). We mark this point on our O-C diagram (see arrow), which is the time of the *observed* eclipse minus the expected or *calculated* time of eclipse (eclipse timing). It is a positive value (see lower left-hand plot) since the observed happens later than the calculated time. In Figure 4b, the close binary is in the near side, closer to the observer. In this case, eclipses happen early and the O-C is negative. If many observations are taken, the plotted points will produce a sinusoidal curve as shown (sinusoidal, if the orbit is circular). The time between two adjacent maxima or minima is the period of orbit, and the amplitudes have to do with the size of the orbit of the close binary about the center of mass of the third body.

In the Miller model, the eclipses from the close binary, near or far, will arrive at the earth observer so that there will be no time delay or gain due to the distance of the close binary. So the time delay of the eclipses or the light-time effect is erased in the model. This is due to the infinite speed of light outside the envelope or barrier. The eclipses will always be on time, and never be early or late. See Figure 5 (the line represents the edge of the envelope). Sinusoidal light-time effects are not rare in binary light curves since multiple star systems are not unusual! So the Miller model is found to be incorrect on observational grounds. There is nothing complicated about this effect. It is nearly as simple as $\Delta d/c = \Delta t$ where the time delay, Δt , is the difference of the two times and it is due to the difference of the distances, Δd . If the c is infinite, $\Delta t = 0$, there is no time-light effect!

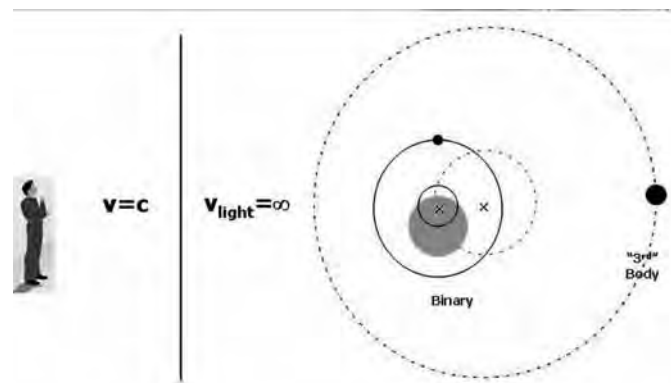


Figure 5. The timing of the eclipses in the binary are independent of distance. So the time delay of the eclipses or the light-time effect is erased in the Miller model.

Case One: VW Cep, ζ Phe, and HT Vir

There are many instances of the light-time effect in the astronomical literature. One example is from a paper in a series of articles by Zasche and Wolf (2007) on combining astrometry (positional analyses) with O-C diagrams. This combination confirms that O-C diagrams show that light-time effect is due to orbital motion of the third components. In this paper the astrometric orbits of three binaries, VW Cep, ζ Phe, and HT Vir, are shown, along with their O-C residual plots. The orbits are found to have periods of 30, 221, and 261 years, respectively. The orbital eccentricities also have been determined, $e=0.63$, 0.37 , and 0.64 , respectively, which is a strong indicator of orbital motion. Astrometric orbits and O-C diagrams are shown as Figures 6 and 7. Distances to these binaries are found to be 27.7 ± 0.7 , 85.8 ± 5.7 , and 65.0 ± 11.5 pc, or 90 ± 2 , 280

± 2 , and 210 ± 40 LY. Since VW Cep is a solar type contact binary, the O-C residuals are affected by long parabolic trends due to mass transfer and lesser amplitude effects due to star spot cycles and ongoing spot activity, so the noise is apparent. Close binaries all have various degrees of extraneous effects that somewhat cloud the orbital effects. Real astronomical data are always complicated by effects that make results somewhat unclear. But regardless, the evidence is strong.

Case Two: FY BOOTIS,

A Contact System with a Third, Dwarf Component

FY Boo was recently discovered by ROTSE I (Diethelm, 2001) and identified as an EW type (contact binary) variable with a period of $0.241168d$. This makes it one of the shortest period W UMa binaries known.

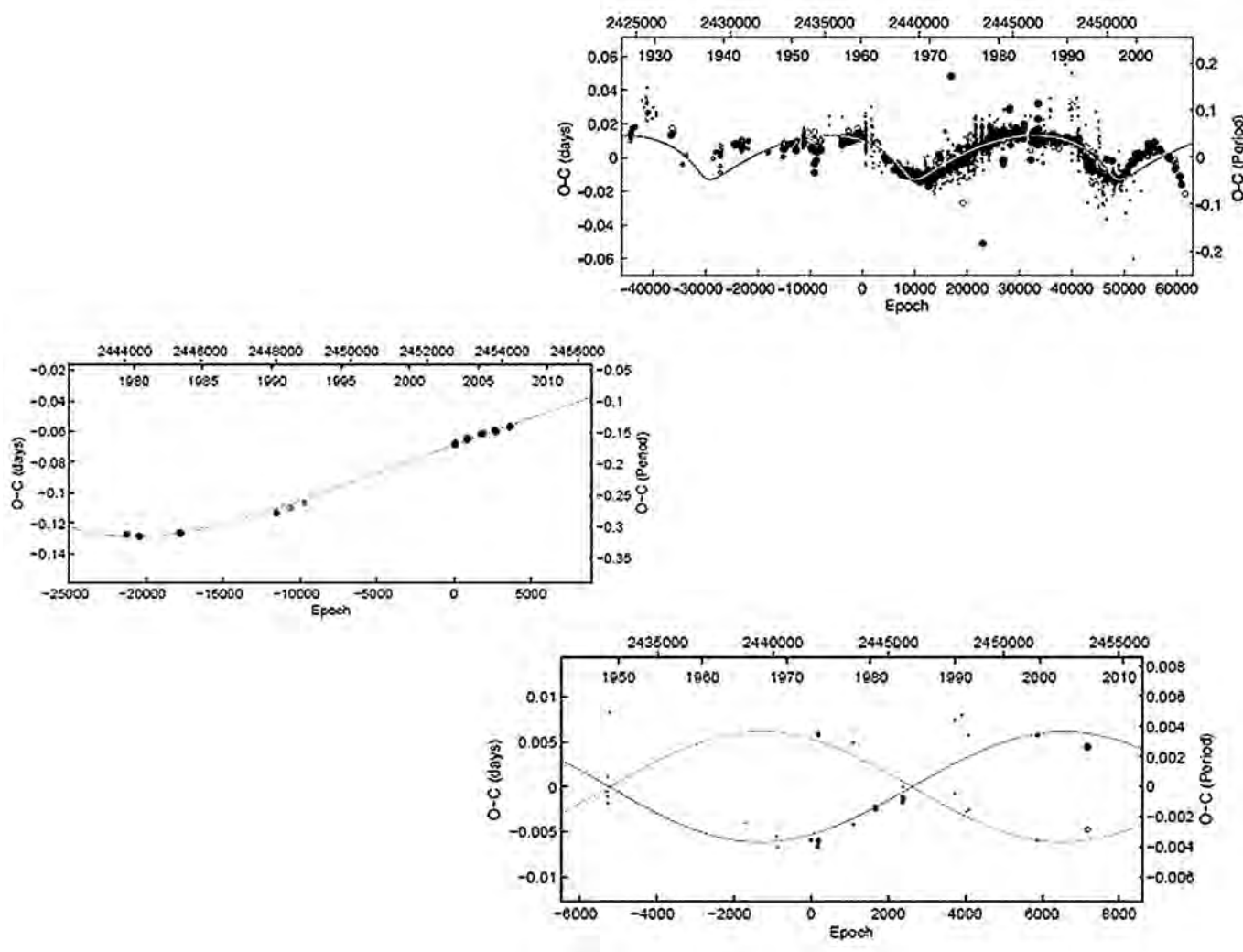


Figure 6. These are O-C (Observed minus calculated) diagrams of VW Cep (upper right), HT Her (left middle) and ζ Phe, right lower, the two curves are of the two components of the eccentric binary.

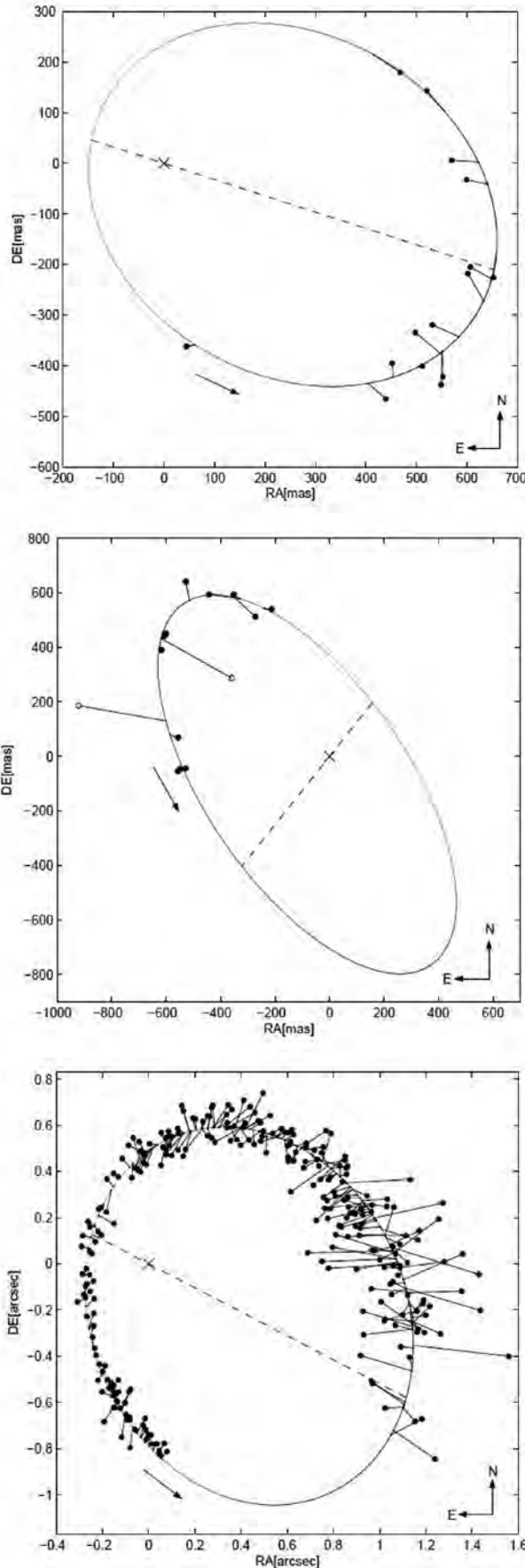


Figure 7. Astrometric orbit of (a, *left top*) VW Cep, (b, *left middle*) ζ Phe, and (c, *left bottom*) HT Her.

Our spring 2009 analysis of FY Boo was done as a project by Bruce Oliver (a physics and astronomy major at Bob Jones University). Interestingly, this binary also has a sinusoidal O-C curve. Because of that, we will provide a brief review.

We took B,V,R,I light curves of the binary with the Lowell 31-inch reflector in Flagstaff with a Cryotiger cooled (-100°C) NASACAM with a 2KX2K chip and standard BVR_cI_c filters. The dates of the observations were 11–15 March, 2009. We undertook the observing run under the auspices of the National Undergraduate Observatory (NURO) and were granted observing time by the Lowell TAC. We used the Lowell program LOIS to take our observations. Our modeled light curves included 107 B, 109 V, 95 R, and 98 I individual CCD observations. These observations were taken by Oliver, Samec and Faulkner. The photometric precision was ± 0.008 in B, ± 0.006 in V, and ± 0.005 in R and I.

We determined six times of minimum light from our present observations. The times of minimum light were calculated from parabola fits. With their standard errors in parentheses, they include: HJDMin I = 2454901.9711 (± 0.0022) d, 2454902.9350 (± 0.0024) d, 2454904.8587 (± 0.0002) d, 2454905.8304 (± 0.0002) d and HJDMin II = 2454904.9774 (± 0.0007) d, 2454905.9491 (± 0.0002) d. From our timings and 43 others from the literature, we calculated the following precision linear ephemeris.

$$\text{HJD Min I} = 2454904.8660 \pm 0.0003 + 0.24115955 \pm 0.00000005 \times E \quad [1]$$

Our fit revealed the presence of a low amplitude sinusoid. The sinusoidal ephemeris is:

$$\begin{aligned} \text{HJD Min I} = & 2454904.8691 (\pm 0.0003) \\ & + 0.24115955 (\pm 0.0000005) \times E \\ & + 0.0031 (\pm 0.0005) \times \sin[4.2 (\pm 0.3) \times 10^{-4} \\ & \times (E - 6.0 (\pm 1.4))] \quad [2] \end{aligned}$$

We believe this sinusoid is due to the light-time effect of a third, orbiting component. The ephemeris gives an orbital period of 9.9 ± 0.2 years for the third component. From the

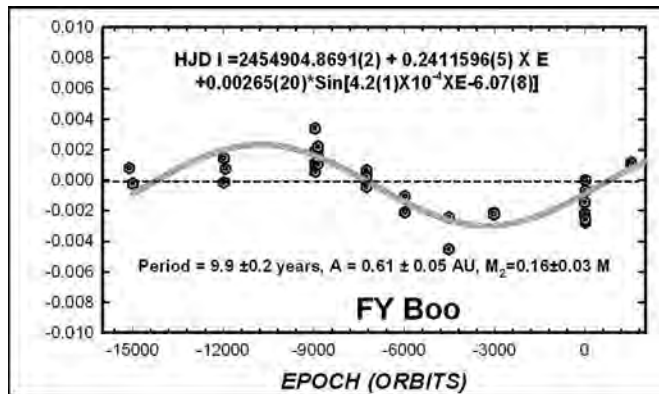


Figure 8. Sinusoidal O-C residuals from equation 2 revealing a third star orbiting the system.

amplitude, we calculate an orbital radius of 0.61 ± 0.05 AU in light travel time, assuming the orbital inclination of the third component is identical to the main binary. Using Newton's form of Kepler's harmonic law, the third body is found to have a mass of 0.16 ± 0.03 solar masses. This mass is that of an $\sim M6$ dwarf, which is small but comparable to the masses of the other two components. Assuming the system has an absolute magnitude near that of the sun ($M_V = 4.8$) and an apparent V magnitude of 13.1 (from the SIMBAD data base), the star's distance is ~ 450 Parsecs (~ 1500 light years), far outside of the radius of our solar system (50 AU = 0.00024 Parsecs). The sinusoidal O-C residuals, calculated from equation 2, are given in Figure 8.

Our B,V,R,I light curves were hand modeled with Binary Maker 3.0 (Bradstreet and Steelman, 2002). Averaged values of parameters were then entered into the 2004 version of the Wilson Code (Wilson and Devinney, 1971 [WD]; Wilson, 1990, 1994; Van Hamme and Wilson, 1998; Wilson and Van Hamme 2003). From these we ran a full BVRI simultaneous solution. Intermediate modeling iterations were done with PHOEBE (Prša and Zwitter 2005), which runs the same Wilson code in the background and makes it possible to view the light-curve fit as the iterations progress. Full synthetic light-curve solutions follow. The temperature of the main component (4750K, K3V spectral type), which we used to model our light curves, was taken from a period-color relation from Batten (1973) using the W UMa period. Recent 2MASS B-V, V-R, J-H and H-K average to $K1 \pm 4$ and affirms our choice. We computed both a hot spot and a dark spot model. The dark spot model has a slightly better sum of square residuals. The dark spot light-curve solution is seen overlaying the normalized flux curves shown in Figures 9a and 9b. Two phases of the Roche-lobe model of the binary for the dark spot solution are shown as Figures 10a and 10b. Phase zero shows the total eclipse.

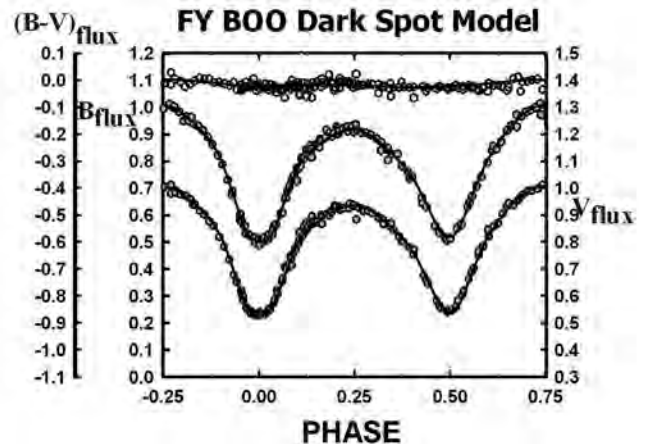


Figure 9a. B,V synthetic light curve solutions overlaying the normalized flux curves.

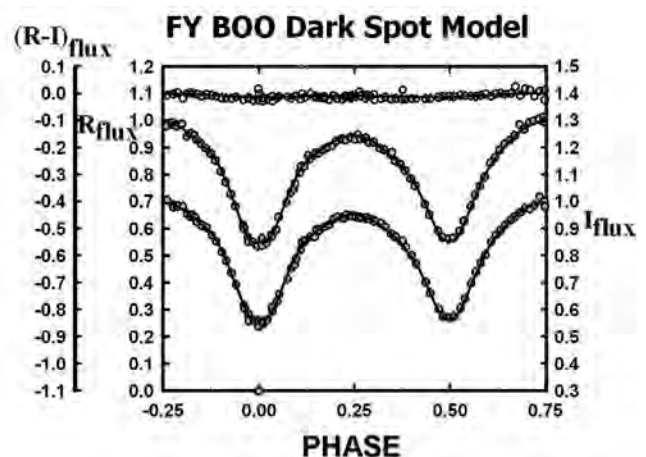


Figure 9b. R,I synthetic light curve solutions overlaying the normalized flux curves.

Our models show FY Boo is a W-type (the less massive component is the hotter) W UMa binary with a mass ratio of 2.5. The system parameters from our model include a contact fill-out of 11%, a slight temperature difference of 200 K, and an inclination of 82° . One large 68° radius magnetic region was modeled on the hotter companion with an average temperature of 0.96 times that of the photosphere. The T-factors and spot radii indicate that this is a *region* of spot activity rather than a giant single spot. The solution gives an eclipse duration of ~ 7 minutes. The shallow fill-out is quite normal for a W-type system. We believe that this results due to an early stage of contact. The fairly extreme mass ratio probably indicates that the components had nearly this value when they came

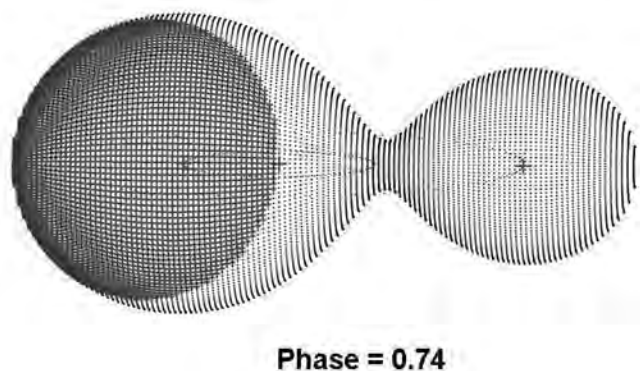


Figure 10a. Roche lobe surfaces from our BVRI solution, phase 0.74.

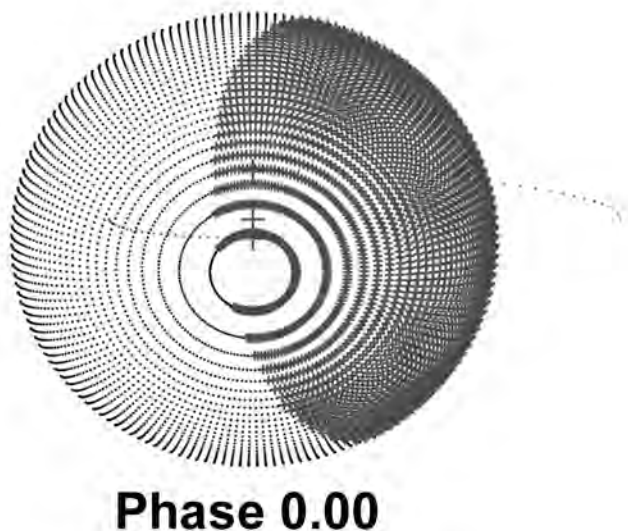


Figure 10b. Roche lobe surfaces from our BVRI solution, phase 0.0 (the primary eclipse).

in contact. We suspect that the mass ratio should progress to more extreme values in the future due to magnetic breaking. This is due to the torque supplied by outflowing winds along “stiff” magnetic field lines originating from this solar-type binary.

Should we be looking for eclipses of the third component? Our calculations show that the proposed dwarf orbiting at ~ 3.6 AU will never show any eclipses.

Decreasing Speed of Light?

In the situation where the speed of light is nearly infinite at the edge of the universe and equal to the value c in our local

solar system, what effects would this have on light itself? We summarize this circumstance briefly here. If we accept the usually stated size of the universe, the distant galaxies are about 14 GLy distant. In the neighborhood of the solar system, the speed is near c and equal to c inside our special envelope. When distances are on the order of a 10^3 ly (as with FY Boo) as compared to 10^{10} ly we would expect the velocity of light to be near c at the nearer distance. Consequently, we would have to probe phenomena on the order of billions of light years to find inconsistencies with a decreasing or spatially decaying speed of light. The effects of the alternate model is very reminiscent to the model proposed by Barry Setterfield (1987) and carries with it all the problems that accompanies that idea. The only coordinate change in plots of this “alternate Miller model” is that they carry axis labels of speed of light versus distance instead of speed of light versus time. The conversion between both would be the formula, $d = ct$, where c varies with distance instead of time (t). And as the light travels through space, time advances. So these ideas are essentially the same. The “cdk” model has been objected to elsewhere (Aardsma, 1988, 1989; Humphreys, 1988; Holt, 1988; Brown, 1988; Byl, 1988; Chaffin, 1992; Hartnett, 2002; Wanser, 2003). Another model that is similar to this is the Harris model (Harris, 1978), where light starts with an infinite speed, then changes to the current value after the Fall as a function of time and distance from the earth. Hartnett states, “One problem with this model may be the massive blue shifts resulting from the change of infinite to finite speed of light. Also, the fine structure of atomic spectra from a stage of no fine structure to the current state as the bubble (the same as my envelope) passes. This would be observable in starlight, but it is not observed (Hartnett, 2007).

As we have mentioned, we would expect observational problems to arise in deep space objects, those billions of light years away in the “alternate Miller model.” A light-time effect is used with deep space objects to determine their size using their light curves. This is particularly useful in determining the size of quasars. These objects have been found to be only light days in size and thus to fit a black hole model. The interval of the light curve variations tells us the size of the object. Figure 11 shows this light-time effect. For instance, if an accretion disk a light month across around a black hole emits a sudden flash, for example, when it evaporates a blob of swirling, in-falling matter, the event would be seen as a light pulse spread out over an entire month as viewed from the earth. This would reveal that the object is one light month across. However, in the case of the Miller model, this effect would be erased due to the near infinite speed of light. Actual observations tell us that quasar light curves vary on the order of light days. So they are light days across, hence they are probably due to black holes since these are on this order of that size. Other cosmological light-time effects explain the

appearance of characteristics of jets emitted from the cores of active galactic nuclei, including the apparent superluminal motion, relativistic aberration, and the appearance of shocks and other features, which produce counterintuitive phenomena such as a single shock causing apparently separated features (Mioduszewski, et al., 1998). In addition, there is another observational effect that is governed by the speed of light, that is, Doppler shifts. Doppler shift is governed by the equation,

$$v = \frac{\Delta\lambda}{\lambda} c$$

Doppler-shift radial velocity measurements are made on a regular basis for deep space objects, galactic jets, galaxy rotational velocities, etc. If $c \rightarrow \infty$ in deep space, then the velocity measurements would go to ∞ . The observations do not show this.

The Scriptural Basis

Lastly, we would like to examine the scriptural basis of the Miller model. In reading the aforementioned passages and the verses surrounding them, we came across this reading in Joel 2:30–31.

And I will shew wonders in the heavens and in the earth, blood, and fire, and pillars of smoke. The sun shall be turned into darkness, and the moon into blood, before the great and the terrible day of the LORD come. (KJV)

We immediately see the connection and a probable explanation of the darkening of the sun, moon, and stars. The darkening could be caused by dust, clouds, fumes from volcanic eruptions, and impacts by asteroids and comets arising from God's judgment. This would darken and redden all light (moon, sun, stars, and galaxies) in the sky. Matthew Henry (1991) suggests much the same—that these passages refer to the judgment of the wicked in the last days. He thinks that much of the description is figurative.

Finally, we admit to other possibilities. The aforementioned passages are all prophetic, during the season of end-time miracles. God is the God of miracles, and He is particularly active here. Miller's ideas would entail the continuous action of miracles rather than the rare occurrence of them, as during the end times. We also note that some elements of the passages are poetic such as the *mountains flowing with milk* etc. as Henry believes. We believe these elements are sufficient to explain the statements of Joel and Revelation.

The Anisotropic Synchrony Convention

As a postscript, we would like to note that the recent proposal that is called *the anisotropic synchrony convention* (Lisle, 2011) is also disallowed by light-time observations. The proposal suggests that the one-way travel time of light (in our direction from

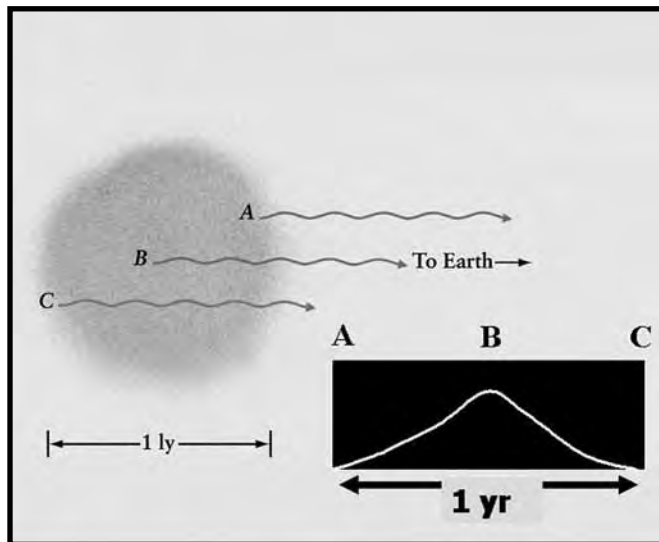


Figure 11. A black hole accretion disk flashes. However, due to its size (one light year across), the light curve pulse will take one year to be wholly seen. This is a cosmological example of a light-time effect.

distant sources like stars, galaxies etc.) is “instantaneous.” This would erase the freely observable light-time effects as noted in this paper. It gives the same results as Miller’s “universe in real time.” Furthermore, we have corresponded with Jason Lisle about this and he responds that this problem has been answered in the literature. However, we challenge that it has not yet been sufficiently answered in a public forum.

Summary

We find that the *universe in near real time* fails under observation, particularly due to the well-understood *light-time effect*, which is used regularly by the astronomical community and verified by independent observation. This paper serves as an example of how real astronomical observations can aid the creation community in testing proposed models, and it stresses our need for our own professional creationary astronomical observatory on a high-altitude, dry site. It also stresses the need to train astronomical professionals for the future who can help us establish a creation model in astronomy. We note that observations for the FY Bootis project were taken at a professional observatory with the instrumentation noted by the authors.

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Documenting the Sedimentary and Stratigraphic Transition between the Middle/Upper Flood Event Divisions and the Lower/Middle Ice Age Divisions in and Surrounding Providence Canyon State Park, Stewart County, Georgia (U.S.A.)

Carl R. Froede Jr.*

Abstract

Providence Canyon State Park, Stewart County, Georgia (U.S.A.), and the surrounding vicinity provide an excellent location in which to define sediments and fossils within a Bible-based framework of Earth history. The results of this investigation indicate that the strata reflect the transition from a middle-shelf subaqueous marine setting to subaerial conditions. Within the Flood framework, these sediments and strata record the transition from the Middle/Upper Flood Event Divisions to the Lower/Middle Ice Age Divisions. The stratigraphy within the study area indicates that Floodwater retreated from this part of Georgia as a function of sea-level decline and the concomitant uplift of the coastal plain across southwestern Georgia.

Introduction

The Genesis Flood was a singular event in Earth history. Any understanding of the geologic energy expended during this period can come only from the preserved rock record. While many theoretical models and regional studies have been offered describing the geological processes in operation during the Flood, validation of those ideas will require data collected from specific locations. Conducting this location-

specific work should eventually lead to an understanding of the geologic energy expended across a broader area and aid in defining those sediments, rocks, and fossils within the geologic Timeframes/Divisions of the Genesis Flood (Froede, 1995a, 2007; Figure 1).

Providence Canyon State Park, Stewart County, Georgia (U.S.A.), and the surrounding vicinity provide many excellent exposures of sediments, sedimentary features, and trace and body fos-

sils. Understanding the changes in geologic energy expected during the Flood should allow the diluvial geoscientist to define the materials and features within their former depositional settings. For example, we would expect the highest levels of geologic energy with the onset of the Flood followed by its reduction with passing time (Reed et al., 1996; Froede, 2007). This knowledge should allow correlation to a specific period within the diluvial geologic timescale (Froede, 1995a, 2007). The application of this process within the study area (Figure 2) indicates that the strata reflect the transition from a middle-shelf marine environment to terrestrial condi-

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TIME FRAME	DIVISION
Present Age	Upper
	Middle
	Lower
Ice Age	Upper
	Middle
	Lower
Flood Event	Upper
	Middle
	Lower
Antediluvian (Pre-Flood World)	
Creation Week	Day Seven
	Day Six
	Day Five
	Day Four
	Day Three
	Day Two
	Day One

Figure 1. This geologic timescale is consistent with the Biblical record of Earth history. The examination of sediments, rocks, and fossils at site-specific locations should allow their insertion into this timescale based on changes in geologic energy (see Reed et al., 1996; Froede, 2007). The sedimentary materials composing the United States Gulf and southern Atlantic Coastal Plains suggest that Floodwater withdrew at a slow rate (Froede, 1995b, 1997; Froede and Reed, 1999). The sediments and fossils exposed at Providence Canyon State Park and the surrounding area reinforce this interpretation.

tions. Applying this setting to the Flood framework would suggest that these

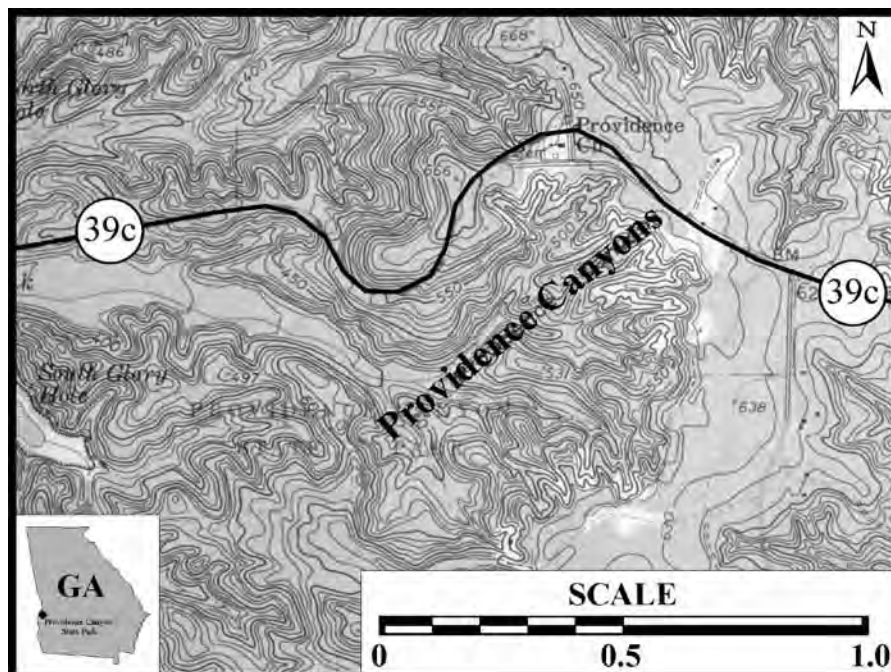


Figure 2. The study area includes Providence Canyon State Park, Stewart County, Georgia, and surrounding vicinity. Multiple outcrops both in and around the park allow a stratigraphic construction consistent with a Biblical timescale (Froede, 2007, 2008b). Scale in miles.

strata record the transition from the Middle/Upper Flood Event Divisions to the Lower/Middle Ice Age Divisions (Figure 3). The stratigraphy within the study area indicates that Floodwater retreated from this portion of Georgia as a function of both actual sea-level decline and concomitant uplift.

Providence Canyon Stratigraphy

In 1995, Williams offered a young-Earth creationist perspective on the stratigraphy and rapid formation of the many canyons found at Providence Canyon State Park. Subsequently, Froede and Williams (2004) explained the geology and hydrogeology of the park. Recently, Froede (2008a) postulated the shallow marine deposition of the updip portion

of the Clayton Formation, which was followed by: (1) subaerial exposure and subsurface ferricrete development (Froede, 2010), and (2) channel development and infill by reworked Clayton Formation clastics and ferricrete debris.

The lowest exposed sediments (Renfroes Marl of the Ripley Formation) were deposited as silts and clays and then bioturbated. They are overlain by cross-bedded quartz sands mixed with kaolin clays (Ripley Formation and Providence Formation). *Ophiomorpha* trace fossils (created by burrowing shrimp) have been identified in the Providence Formation (Figure 4). This type of trace would indicate that it was formed in marine conditions during the Flood. Above the Providence Formation are nearshore-to-littoral zone clastic sediments of the Clayton Formation.

Providence Canyon State Park and Surrounding Vicinity				
Diluvial Geologic Timescale	Stratigraphic Unit	Lithologic Description	Depositional Setting	Sea-Level Curve
Lower/Middle Ice Age Divisions	Unnamed Unit (Reworked Clayton Fm)	Pebbly to medium massive sandy clay with polished and unpolished ferricrete clasts of varying sizes	Terrestrial	
	Clayton Formation	Pebbly to medium sandy clay with occasional ferricrete layers and undulating base	Nearshore to Littoral Zone	
Upper Flood Event Division	Providence Formation	Pebbly to medium sand, cross-bedded, kaolin lenses, bioturbated in places	Barrier Complex	
Middle Flood Event Division	Ripley Formation	Coarse, medium, and fine sand, with clay clast lag along undulating base	Inner Continental Shelf	
	Renfroes Marl (Ripley Formation)	Black lignitic, pyritiferous, bioturbated clays	Mid-Continental Shelf	

Figure 3. The sediments and stratigraphy of the study area cover the transition from the middle Flood (Middle/Upper Flood Event Divisions) through the middle Ice Age (Lower/Middle Ice Age Divisions; see Froede, 2007, 2008b). The stratigraphic profile presents the formation/member names, their sedimentary composition, and inferred depositional setting relative to sea level. Modified from Veatch (1909), Eargle (1955), Donovan and Reinhardt (1986), and Froede and Williams (2004).



Figure 4. An *Ophiomorpha* trace in the Providence Formation was created by a burrowing shrimp. These traces are found today in the marine environment, and this trace fossil was formed when Floodwater still covered this portion of southwestern Georgia. Scale in inches and centimeters.

Exposures along Georgia State Highway 39C

Stratigraphic outcrops immediately outside of the park along Georgia State Highway 39C provide additional exposures of the Providence Formation, the Clayton Formation, and an unnamed stratigraphic unit that overlays and in places incises into the Clayton Formation. An iron-cemented layer (i.e., ferricrete) of one to three inches in thickness occasionally occurs at the base of the Clayton Formation (Figure 5). Horizontal layers of ferricrete also occur higher in the Clayton Formation sediments at some locations. Rare marine fossils have been found in some of these iron-rich layers, and their carbonate skeletons have been replaced by hematite (Figure 6). The unnamed stratigraphic layer above the Clayton Formation is a massive sandy-clay layer (these sediments were eroded from upgradient Clayton Formation exposures) containing ferricrete clasts of varying sizes (Figure 7).

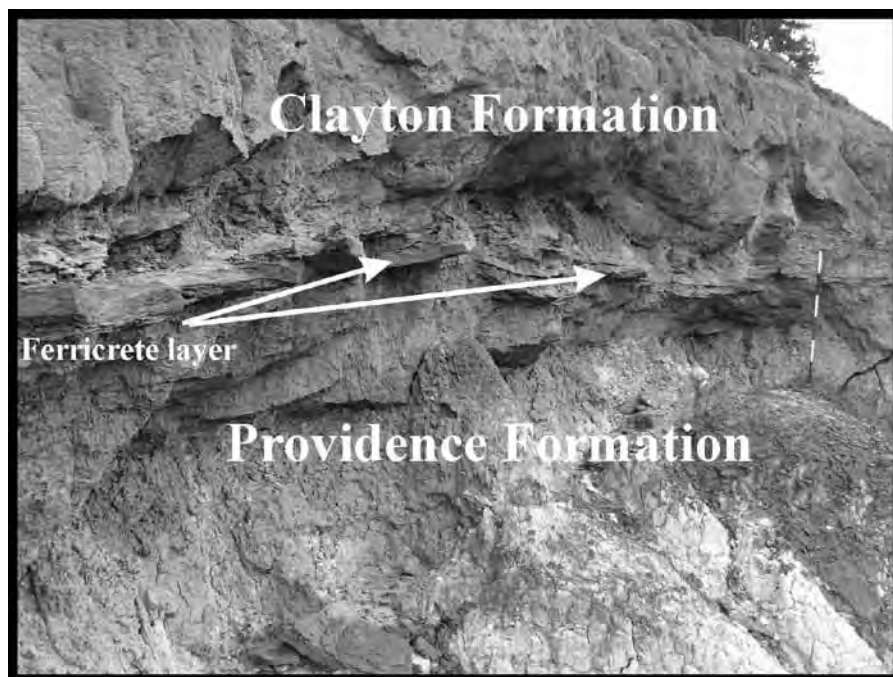


Figure 5. Ferricrete occurs at many locations between the Providence Formation and overlying Clayton Formation (see Froede, 2007, chapter 5). Oxidation of the dissolved iron-rich groundwater caused the iron minerals to precipitate out of solution forming the ferricrete layer. Scale in six-inch (15-cm) divisions.



Figure 6. Iron cement has replaced the carbonate skeleton of this former sea urchin. Fossils such as this one indicate that the Clayton Formation clastic sediments were deposited in a marine setting. The general lack of any pronounced sedimentary structures (e.g., cross-bedding) in the Clayton Formation suggests that it was deposited and reworked in a low-energy environment, indicating that Floodwater agitation had decreased.

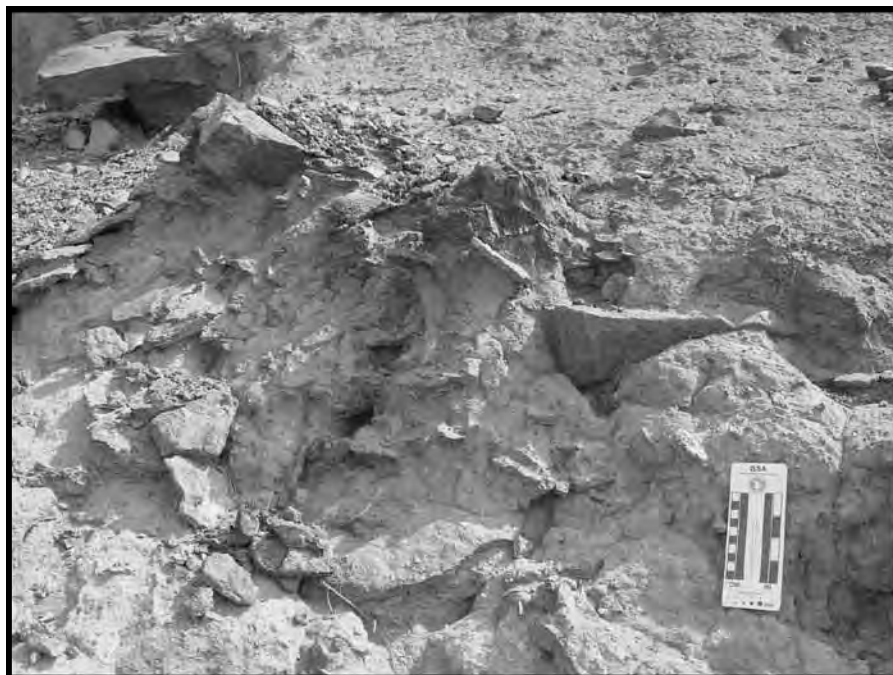


Figure 7. In many places, polished and unpolished ferricrete clasts of varying sizes line the sidewalls and bottom of the incised channels in the Clayton Formation. This mixture of clasts and sediment is not indicative of fluvial transport, but rather suggests mudflow deposition. Scale in inches and centimeters.

In some locations this unnamed unit incises the Clayton Formation (Figure 8). The age of this stratigraphic layer has not been resolved by geologists due to the lack of any datable body or plant fossils.

A Young-Earth Creationist Interpretation

The sediments and strata exposed within the study area exhibit an ascending profile reflective of sea-level regression. Changes in geologic energy, as displayed by the sedimentary features within each stratigraphic unit, will allow us to assign the strata to specific time intervals within the diluvial geologic timescale (Figure 1). Through this exercise we will be able to understand the Biblical geologic history of this area within the context of the Flood and ensuing Ice Age.

The Renfroes Marl is the lowest exposed stratigraphic unit in Providence Canyon State Park. A diluvial interpretation of this unit would place this marl in a submerged middle continental shelf setting. Sufficient organic content, oxygen, and time made it a prime target for rapid bioturbation by a variety of marine creatures (Froede, 2009). In the overlying Ripley and Providence formations, the high-angle cross-bedded sand indicates swift-moving currents. The depositional setting is envisioned as an inner-shelf to nearshore environment. High-energy conditions, coupled with a lack of organic content (as a food source), probably prevented these sediments from being extensively bioturbated.

The contact between the Providence Formation and the overlying Clayton Formation reveals an energetic mixing zone that decreases in energy moving upward into the Clayton section (Figure 9). The Clayton Formation sands were likely deposited and reworked in a nearshore-to-beach setting. Eventually, Floodwater completely withdrew from the area, marking the onset of the Ice Age Timeframe (Lower Ice Age Division) (see Froede, 1995a, 2007). Tectonic

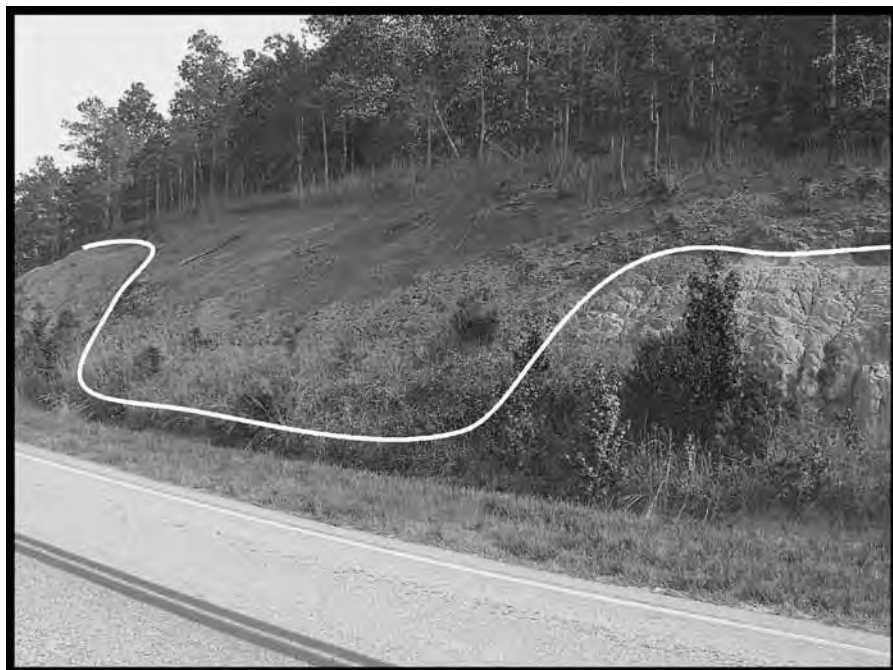


Figure 8. In places, a massive sandy-clay layer covers and incises into the Clayton Formation. This unnamed unit contains clasts of polished and unpolished ferricrete mixed within the stratigraphic unit. The exposed cliff face is approximately 25 feet high.

uplift of this portion of southwestern Georgia continued throughout the Lower/Middle Ice Age Divisions. With the onset of subaerial conditions, the marine connate water was displaced by ferrous groundwater as Floodwater continued to withdraw from the area. The dissolved iron within the groundwater was probably associated with the area of uplift to the northeast. The oxidation of the groundwater within the subsurface created ferricrete layers, which likely formed over the course of several decades (Ferguson et al., 1983; Phillips, 2000; Phillips et al., 1997; Yager et al., 2003).

With continued uplift across this portion of southwestern Georgia, precipitation eroded elevated areas, scoured channels, and filled them with reworked Clayton Formation clastics and ferricrete debris (Figure 8). The eventual cessation of uplift and the establishment of a vegetative cover reduced or

eliminated the sandy mudflows across the area. This portion of Georgia remained for millennia in geomorphic equilibrium until clear cutting of timber and poor farming practices began in the early/middle 1800s. Clearing of the land, coupled with uncontrolled runoff, created conditions of rill, gully, and eventual canyon development across this area (Williams, 1995; Froede and Williams, 2004).

Conclusion

A bottom-to-top study of the exposed strata in and surrounding Providence Canyon State Park reveals an interesting geologic history. Applying the diluvial concept of changing geologic energy to the exposed sediments suggests that the depositional setting changed from middle/inner continental shelf through nearshore/beach to terrestrial conditions.



Figure 9. Kaolin clay clasts from the top of the Providence Formation are mixed with sands, silts, and clays at the base of the Clayton Formation. This suggests that the Clayton Formation clastic sediments were derived from a different sedimentary source and were deposited on top of the Providence Formation as geologic energy was decreasing and sea level was regressing. Scale in six-inch (15-cm) divisions

This likely occurred over the course of several centuries as Floodwater gradually withdrew from the southwestern Georgia Coastal Plain. Inserting this dynamic depositional setting in a manner consistent with a diluvial geologic column would suggest that the strata found in the park and surrounding vicinity record the transition from the Middle/Upper Flood Event Divisions to Lower/Middle Ice Age Divisions. The strata suggest that Floodwater slowly retreated from this portion of the state due to a combination of sea-level decline and concomitant uplift across the southwestern Georgia coastal plain.

Acknowledgments: This article is dedicated to my friend Dr. Emmett L. Wil-

liams in gratitude for all of his excellent fieldwork at Providence Canyon State Park. I have greatly enjoyed working with him and have profited from his knowledge and experience gained in studying this area. I am grateful for the very capable constructive reviews and comments provided by A. Jerry Akridge, Emmett L. Williams, and the CRS geology editor. Gratitude is also expressed to the anonymous peer reviewers for their helpful comments. I thank my wife, Susan, for allowing me the time and opportunity to research and write this article. Any mistakes that may remain are my own. Glory to God in the highest! Proverbs 3:5–6.

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“Geothory”: Past and Present

John K. Reed, Peter Klevberg*

Abstract

The closing decades of the eighteenth century saw the beginnings of modern geohistory. Recent work by historians of science have broken through the persistent mythology of Hutton-Playfair-Lyell, and many lessons have been drawn from a better understanding of the early fusion of secularized science and secularized history. But one lesson that has received little attention is the inhibitive role played by “geothory,” a genre of scientific writing popular in the last half of the eighteenth century. Geothories were broad systematic attempts to scientifically explain Earth in its totality. They proved a barrier to the development of geology because of (1) their unrealistic scope, (2) unrealistic expectations, and (3) an unrealistic adherence to the hypothetico-deductive method of Newtonian physics, which in turn was related to serious misunderstandings of the limits of science and the nature of history. Numerous geothories were published, each attempting to build a comprehensive explanation of Earth. By 1800, geothory had fallen out of favor, replaced by inductive, limited, self-consciously historical investigations. Yet since geothory reflects an innate drive in the human psyche for comprehensive understanding, it never really died. Our view of science and its disciplines is much different now, but facets of geothory still exist—evolution being a secular example and grand “Flood models” a creationist manifestation.

Introduction

Mankind has a penchant for explaining his world—from the ancient creation myths to modern social theory. Greece was famed for its philosophy, the Chinese for their technology, and the

Mayans for their mathematics. At root, though, most explanations are religious, reflecting the indelible image of God and Augustine’s heart-shaped vacuum. Man was made to exercise dominion over the created order, and that required

understanding. Despite the distortion from the Fall, man the image-bearer still seeks to know his world.

Beginning in medieval Europe, knowledge came to reside in the burgeoning universities, so named for their quest of finding unity of truth in the diversity of phenomena. Christianity drove this process, leading to the development of modern Western science after the Reformation. It was an evolutionary, not a revolutionary devel-

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opment (Hooykaas, 1999). Newton was born during the English Revolution, a contemporary of John Bunyan, and saw the end of the Puritan Age and the beginnings of the post-Puritan deism. Unfortunately, because science required a methodological distinction from theology, many grew to believe that it could be completely severed from theology without consequence. Combined with a growing antipathy towards orthodox Christianity in the early eighteenth century, it laid the groundwork for the use of science as an enemy of theology rather than an ally.

Despite the American and British revivalism of Edwards, Whitefield, and the Wesleys, the church languished during the eighteenth century (less so in America than in Europe), and orthodoxy was becoming increasingly irrelevant to the growing class of intellectuals. Deism and unitarianism were symptomatic of this growing trend; the Reformation was over. This era was marked by the emergence of an international group of savants that Rudwick (2005) called the “Republic of Letters.” These intellectuals corresponded, traveled, and found common cause with like-minded men who were eager to unlock the mysteries of nature. Their heterodoxy may have appeared benignly eccentric at the time, but as the century progressed it became increasingly rigid and rabid, leading to a crescendo of atheistic fervor culminating in the French Revolution. In all the varieties of unbelief, there were several constants; the rejection of the Bible and a growing confidence that knowledge anchored in science was sure and certain, while that anchored in faith was weak and confused. Science became the new “revelation,” replacing Scripture as the basis for truth—a position that only belatedly has been shown to threaten both truth and science.

Geology was born during those turbulent times to provide an explanation for physical phenomena associated with Earth’s crustal features—strata,

fossils, minerals, volcanoes, and river valleys—that were a growing area of interest among the savants. It was only natural that this new discipline would assume the role of the guardian of the prehuman prehistory that leading intellectuals were promoting as an antidote to Moses, since the story of those vast eons resided in the rock record. Of course, our understanding of geology’s origins has advanced significantly in recent decades, largely thanks to serious historians of science who have finally rid us of the self-serving myth of the British invention of geology through Hutton, Playfair, and Lyell. Reading the primary sources has led these historians to recognize the wide variety of people and ideas that contributed to geology (e.g., Gould, 1987; Hooykaas, 1963, 1970; Laudan, 1987; Rudwick, 2005, 2008).

Although a better and more sophisticated understanding of the times has been gained, almost all of these historians fail to understand Christianity and therefore lose sight of its role—first as the mother of science (Glover, 1984; Hooykaas, 1999; Reed, 2001; Stark, 2003) and later as its foil. They record, but seem not to grasp, the depth of antagonism inherent in the secular worldview that was the product of the Enlightenment. Similarly, they do not grasp the importance of church history. Thus, a complete history of geology’s origin awaits the historian of science who can add those missing ingredients.

But the current accounts are infinitely superior to what Gould (1987) called the empiricist cardboard myth perpetuated by Lyell and far too many generations of his followers. These recent histories reach into the social fabric of the times and rely on primary sources. These have resulted in a fresh understanding of methods and ideas. One of the lesser examined but significant of these is what Rudwick (2005) called “geothory”—an enthusiastic search for a terrestrial synthesis to equal Newton’s achievement, which explained so much

via the law of universal gravitation. Geothories were typically based on a few initial assumptions and the deductive application of nature’s “laws,” leading inevitably to the grand truth. The genre attracted many of the best minds of the eighteenth century, and a “theory of the earth” was considered the crowning achievement of a career in the “Republic of Letters.”

Though Rudwick (2005) claims that geothory died in the early nineteenth century, it is all too clear that the demise was really a short slumber. When we examine the basics of geothory, we see current examples in both secular and Christian circles. Identification requires only that we grasp the essentials of the original genre. It was distinct from the more mundane descriptive and explanatory disciplines of the day, having more in common with the philosophical system building of the continental rationalists and Immanuel Kant.

Rudwick (2005) places the origin of geothory in Thomas Burnet’s (1635–1715) *Sacred Theory of the Earth* but notes that Burnet was heavily influenced by Descartes (1596–1650)—a cautionary example of how ideas in the sciences are often driven by trends in first-order philosophy. Geothory became more prevalent (and more anti-Christian) in the latter half of the eighteenth century, following the works of Georges-Louis Leclerc, Comte de Buffon (1749, 1778). But what started so well ended in frustration because the ideas could not ultimately be proven or falsified. Once that became clear, the genre faded, replaced in the early 1800s by more inductive methods (Laudan, 1987) that emphasized limited empirical studies of the rock record. The work of Smith, Cuvier, and the savants of the London Geological Society was a clear break from and reaction to geothory.

But the drive for grand explanations never really died. We need look no further than evolution to see a prime example. As a fundamental principle

of the earth, life, and the cosmos, evolution is a template for comprehensive explanation of the past, present, and future. Though Darwin discussed species, modern evolutionists attempt to explain everything in their grand materialistic synthesis. Additionally, elements of geothory can be found in other modern secular ideas like the big bang and plate tectonics. Nor are secular thinkers the only modern “geothorists.” This concept has even begun to crop up in modern creation science, with marked similarities between geothory and various grand “Flood models.” Thus, it is of concern to creationists, and we need to understand the Enlightenment origin of the genre to evaluate its coherence with the Christian worldview. This includes its historical context, its distinguishing criteria, and the distinctions between it and the subsequent geohistorical work in the earth sciences.

Historical Context

No comparison between Enlightenment and modern-day geothories can be made without understanding the differences between scientific disciplines relevant to the study of the earth in the eighteenth century. Although both eighteenth-century and modern secularists believe the scientific method the only doorway to truth, the appearance of that doorway has changed in many ways. Rudwick (2005) devotes an entire chapter to explaining them, and what we present here is largely a synopsis of his work. To begin with, he notes:

There was a major distinction between two complementary ways of studying the natural world. “*Natural history*” dealt with the description and classification of natural phenomena and natural objects of all kinds. “*Natural philosophy*”—or what Diderot called the “science of nature”—included the causal and mathematical relations between natural phenomena, as well as

mathematics itself.... The phrase “natural history” therefore denoted the description of the natural world, and the orderly classification of its diversity, without any temporal connotations whatever (Rudwick, 2005, pp. 52, 53, emphasis his).

Thus, the scientific disciplines of the earth in the 1700s resided under three major headings: natural history, natural philosophy, and geothory (Figure 1). Natural history was primarily a descriptive endeavor, including the acquisitive branch of mineralogy and the field studies of physical geography and geognosy. The former concentrated on landforms and surface phenomena, while the latter was concerned with the three-dimensional knowledge of the crust and especially its sedimentary layers. Natural philosophy attempted causal explanation of various observed phenomena, typically relying heavily on the new physics. Geothory was the synthesizing of the observations of natural history and explanations of natural philosophy to create an overarching synthesis of

Earth, including its past development and future prospects.

Geothory must also be understood in its intellectual context. As is true in most cases, the best perspective is gained from examining contemporary trends in theology and philosophy. In theology, the Reformation and the Puritan era were over. Skepticism had replaced the earlier zeal for Biblical theology and the worldview that had marked those historical movements. Yet their influences were still felt, albeit in a distorted fashion. For example, the Christian belief in the unity of truth within the diversity of knowledge was clearly inherent in geothory, although the corollary, that truth could be guaranteed only by God, had been lost in the glitter of the scientific age.

The church was in poor shape to correct these errors, and too weak, despite the revivals of the 1730s and 40s. A symptom of this weakness was the truncated cultural penetration of revivalism. In England, Wesleyanism had little impact on the continent, and with a few

(1) Natural History	“description and classification of the diversity of terrestrial things” (Rudwick, 2005, p. 59).
(a) mineralogy	The collection, identification, and classification of specimens of minerals, rocks, and fossils; knowledge distributed by exact pictures.
(b) physical geography	The study of major features of Earth’s surface, primarily through fieldwork, such as mountains, rivers, and volcanoes, with an emphasis on pictures and maps.
(c) geognosy	The study of the structure of Earth’s crust; emphasizing cross sections to depict the third dimension and closely associated with mining. It was developed most strongly in German mining schools.
(2) Natural Philosophy “earth physics”	The causal explanation via natural laws of terrestrial phenomena described by the sub-disciplines of natural history, and consciously distinct from the description and classification of those endeavors.
(3) Geothory “Theory of the Earth”	A high-level theory or system of Earth as a whole, derived from unifying the causal explanations of earth physics into a coherent whole. The goal was to discover the one overarching cause of Earth’s phenomena, just as Newton had done for the cosmos with gravity.

Figure 1. Sciences of the earth during the eighteenth century as described by Rudwick (2005). Note the absence of familiar boundaries between geology, biology, physics, and chemistry, which were not recognized at the time.

notable exceptions, such as Jonathan Edwards, revivals failed to win back the scholars—a hallmark of the Reformation and Puritanism. This led to an increasingly secularized intellectual class—the “Republic of Letters”—that was increasingly hostile to orthodox Christianity. Thus, a strong theological defense of the Christian worldview was lacking just at a time when it was most needed. The “salt” of the church, though still widespread in popular culture, had failed to prevent the rot in those savants that would drive the secularization of Western culture.

The pall of “Enlightenment” darkness is ironic in many respects. The incurable optimism that drove the rise of humanism with its fervent faith in science would not have been possible without the development of natural science spurred on by the Reformation (Reed, 2001; Schaeffer, 1982). Natural science opened doors for applied science, accelerating the pace of technological innovation that came to be known as the Industrial Revolution. Growing prosperity predictably spurred a turn from God. “Give me neither poverty nor riches; feed me with the food that is my portion; that I not be full and deny You and say, ‘Who is the Lord?’ Or that I not be in want and steal, and profane the name of my God” (Proverbs 30:8b-9 NASB). Europe’s elite benefited from a science rooted in Christianity while hypocritically turning it into a weapon against the church.

First-order philosophy played its part in the religious disinterest of savants. The continental philosophers, with their love of system, degenerated rapidly away from the Christian rationalism of Descartes toward the deism and pantheism of Leibniz and Spinoza. Europe’s elite deserted the faith, and the 1700s was an age of transition. In Britain, heresy took a different path. Locke’s fundamental error in confusing first and second intentions of the mind (Adler, 1985) led eventually to the radical skepticism of Hume, which in turn “awakened” Kant,

who built a tremendously influential anti-Christian system.

Yet even the most rabid Enlightenment atheist unconsciously absorbed parts of Europe’s pervasive Christianity, and Christian theology informed many of the unexamined presuppositions of these thinkers (Glover, 1984; Reed, 2001). This was reflected in their optimistic humanism and trust in truth in both science and history, despite the lack of a coherent epistemology for either. Thus, geothory was an interesting mix of ideas marking the transition from the vibrant Christianity of the seventeenth century to the looming atheism of later years. In retrospect, there was a dangerous combination of a blissful ignorance, naïveté of the complexity of creation, and an unwarranted optimism in the human potential to comprehend it.

Geothory

What Was Geothory?

This naïveté and unwarranted optimism were manifested in the short-lived enthusiasm for geothory. A “theory of the earth” was the pinnacle of an eighteenth-century intellectual career. Men spent years doing the more mundane work of gathering and publishing natural history and natural philosophy, while building a foundation for a grand synthesis that would attempt to explain Earth in terms of a few comprehensive natural laws. These laws, it was thought, would break the code to the workings of man’s terrestrial home in the way that Newton had deciphered man’s cosmic surroundings.

The ultimate goal of many savants concerned with the sciences of the earth was to construct what they called a “system” or high-level theory about the earth. This would be not merely a theory to explain specific features such as the elevation of mountains, the consolidation of rocks, or the emplacement

of fossils, important though such problems were. On the contrary, a system would try in principle to include all such limited explanations within a single, overarching causal theory.... The aim was to emulate on a terrestrial scale the achievement of Newton in the realm of celestial mechanics. It was to discover the one and only true explanation of how the earth works, just as Newton was believed ... to have discovered the one and only true theory to explain the movements of the sun and its planets, and all other stars and their putative planets throughout the universe, under the laws of universal gravitation. In other words, “Theory of the Earth” ... was not just a human conjecture or “hypothesis”, which might or might not be valid. It was Nature’s (or God’s) hidden construction, which another Newton might one day have the honor of discovering (Rudwick, 2005, pp. 133–134).

At first glance, this seems foreign to modern thought, but is perhaps less so than we think. Though theology and first-order philosophy have been jettisoned, materialistic science still possesses a schizophrenic drive for unifying explanation. The rationalism of the geothorists has evolved into modern positivism, and scientists from both periods still tend to overestimate their ability to reach truth. For example, “evolution” as a general principle is applied with equal zest to the origin of galaxies or various human behaviors—Enlightenment savants would certainly recognize its breadth of application in terms of geothory. But a closer examination of the Enlightenment genre is needed before we can make a careful comparison.

By the late 1700s, intellectuals had identified the normative features or rules for the genre. Rudwick (2005) identifies six key principles common to all (Figure 2). The ideal geothory would:

- Explain Earth’s major features, such as oceans, continents,

Systematic	Explain planet's major features in a unifying manner, since Earth was a unitary mechanism or entity. Necessarily complex.
Naturalistic	Direct divine action removed from consideration; science demands natural causes only.
Actualistic	Only observed causes are properly applied to workings and history of planet's features. Derived from Newton's "true causes."
Timeless (scientific)	Must be able to explain past, present, and future of planetary phenomena.
Hypothetico-deductive	Principles to deductive implications to supporting evidence.
Comprehensive	Principles must be able to explain everything from theology to human actions to physical phenomena. No demarcation between "scientific" and "nonscientific."

Figure 2. Characteristics of eighteenth-century geotheries, based on Rudwick (2005).

- mountains, strata, volcanoes, fossils, and rivers. Earth was viewed as a complex machine or entity, and explanation was required to be equally complex.
- Be restricted to natural explanation. God might be retained as the ultimate cause, but phenomena were expected to have a "secondary" or natural cause. This mechanistic method would lay the groundwork for a mechanistic metaphysic (Glover, 1984) by gradually stepping away from the traditional Reformation view of divine providence (Hooykaas, 1999).
- Be actualistic. The contingent actualism that worked so well for physical science was a different matter for history, because the latter was grounded in special revelation in a way in which the former was not. Unfortunately, Enlightenment atheists and deists realized this sooner than Christians, and subtly altered the concept of

actualism to eliminate God from the discussion.

- Describe past, present, and future developments on Earth. This illustrates the extent to which the scientific mind-set of Newtonian physics had been cemented into the minds of savants, in conflict with the linear, progressive time of Biblical history. In this context, it is easy to understand how the steady-state views of Hutton, for example, developed, and the tension between scientific and historical explanation continues to this day.
- Explain in a hypothetico-deductive fashion. Contrary to a later inductive emphasis, geotheorists would present foundational principles, deduce implications, and then present selective supporting evidence to "prove" their implications. Rudwick (2005, p. 137) notes that some savants even presented their theory before they gathered evidence

in order to demonstrate their confidence in their fundamental principles!

- Explain everything from theology to fossils. Since Earth was home to man, human nature and actions had to be addressed. Rudwick (2005, p. 138) notes the disjunction between this approach and modern thought, since for Enlightenment thinkers, "any modern distinction between "scientific" and "non-scientific" questions would have been regarded as inappropriate and indeed meaningless."

Examples of Enlightenment Geothery

Of the numerous geotheries of the eighteenth century, several stand out as examples of the genre, signposts to the future, and strong influences on the development of modern geology in the early 1800s. Rudwick (2005) discusses the ideas of Buffon, presented in two distinct geotheries, those of de Luc, and finally, Hutton's strange system as influential examples of geothery.

Georges-Louis Leclerc, Comte de Buffon (1707–1788) (Figure 3),



Figure 3. Georges-Louis Leclerc, Comte de Buffon, author of two influential and atheistic geotheries of the eighteenth century.

decades ahead of Lyell, published two grand systems—the first, an implicitly eternalistic steady-state universe in his 1749 *Histoire naturelle*, and the second, a chronological history in his 1778 *Époques de la nature* (for more detail, see Reed, 2010). Although little, if any, of his “scientific” content survived, his aggressively anti-Christian materialism and ability to thumb his nose at the church (thanks to royal protection) set the mood for the rest of the century. Completely ignoring any semblance of Biblical authority, he presented the development of a world without God, a sad parody of Burnet’s Christian theory. His strength was not his science, but his trailblazing arrogant materialist heresy.

Buffon’s models for the earth’s temporal development were highly conjectural and could easily be dismissed as no better than a form of science fiction. Yet although most of their details were later abandoned, both of Buffon’s geotheries were to remain powerful and fruitful exemplars for the future (Rudwick, 2005, p. 150).

Jean André de Luc (1727–1817) (Figure 4) was a Swiss naturalist and a tutor to Queen Charlotte of Britain. In contrast to Buffon, de Luc defended the reality of Biblical history, although



Figure 4. Jean André de Luc, court tutor to Queen Charlotte and defender of the Genesis Flood.

his understanding of it was vague and subject to change by natural knowledge. The theme of his geothory was that the continents and sea floor had exchanged places in a recent “revolution” just a few millennia ago, which he identified as the Biblical Flood. De Luc’s determined but shaky defense of Genesis provides a barometer of the times.

De Luc was well aware that to mention Genesis at all in a “philosophical” or scientific work was to invite a kneejerk reaction from many other savants. Far from expressing a view that was triumphantly dominant in his culture (as often portrayed by modern historical myth making), de Luc as a self-consciously Christian philosophe regarded himself as one of an embattled minority, indeed as part of a minority within a minority (Rudwick, 2005, p. 153).

Ironically, we owe the origin of the word “geology” to his work; he coined the term in his 1778 *Letters on Mountains* as a substitute for “cosmology.” Thus, the first meaning of “geology” was geothory.

Finally, Hutton’s profoundly misunderstood and misrepresented geothory was proposed relatively late compared to continental savants, and not completed until 1795. His deistic, teleological, steady state earth machine is far removed from the Hutton (Figure 5) of geologic lore (Reed, 2008a).

Above all, however, Hutton’s work has been misunderstood because it has not been treated, as it was by his contemporaries, as yet another “system” within the well-established genre of geothory (Rudwick, 2005, p. 158).

Though dismissed by many of his contemporaries, who were tiring of the profusion of geotheries and who saw Earth’s history in chronological rather than ahistorical terms, Hutton ironically became the “father of modern geology” thanks to Lyell’s rewrite of the discipline that deliberately downplayed or ignored



Figure 5. James Hutton, Scottish mineralogist and “father” of uniformitarian geology.

the prior work of French savants. Ironically, Rudwick (2005, p. 172) provides perhaps the best epitaph for Hutton, noting, “A sense of the history of the earth, whatever its source may have been, certainly did not come from Hutton.”

Finally, Rudwick (2005) describes what he calls the “standard model” geothory because it was common to many published theories of the earth. Its central idea was that of a receding ocean; today we call it “Neptunism” and mistakenly attribute it to Werner. Though Werner taught the concept, it preceded him and was based on the regression of a primordial ocean which precipitated Arduino’s “primary” and “secondary” rocks as it gradually fell. Werner never published a geothory.

In fact, geotheries based on a falling global sea level were so general that they will be grouped together here and termed the standard model of the earth’s temporal development (Rudwick, 2005, p. 173).

Thus, the controversy over the origin of basalt between Hutton the “Plutonist” and Werner the “Neptunist” would be distorted into an argument over the world ocean and the Flood. Some Lyellian propagandists would

even present Werner as a defender of the Biblical Flood to bolster Lyell's carefully crafted but false image of Hutton as the empiricist who discovered deep time in the rocks, as against the deductive theologians who clung to the Flood.

The Fate of Enlightenment Geothory

Like a comet, geothory blazed through the late Enlightenment before disintegrating under the weight of its own unrealistic expectations, *and this trend may be of great relevance to creationists*. Geothory was displaced by a competing paradigm of natural studies that emphasized limited field studies with inferences drawn inductively while in search of evidence in nature, rather than from deductive principles. This new approach was seen in the work of men like Nicolas Desmarest (1725–1815) and Jean-Louis Girard Soulavie (1752–1813), which culminated in that of Cuvier, with his emphasis on empirical paleontology, and William Smith and his stratigraphic mapping of England. It became the chosen approach of the rising class of gentlemen geologists in England, whose fieldwork would set the standard for geology for many years.

However, in Saussure's time [late 1700s] a few savants were beginning to treat the earth as the product of nature's own history.... They were trying to construct narratives of events or states that could not be predicted ... from any assumptions about initial conditions, but only pieced together from detailed analysis of specific relics from the deep past. There were two related sources for this new sense of "geohistory." ... Ironically, the first was the radically historical perspective of the Judeo-Christian tradition. Rather than being the enemy of progress in the sciences of the earth, as later mythmaking has portrayed it, this orientation fostered the extension of historicity to the previously uncharted vastness of prehuman

time. The second conceptual source was the secular analogue of biblical religion, namely the work of "erudite" historians and "antiquarians" in the practice of human history, which was expanding at just this time from its traditional focus on written texts to embrace a much wider range of evidence (Rudwick, 2005, p. 642, brackets added).

In the face of that "hard" scientific study, the rambling speculations of geothories began to appear weak and ineffective. Furthermore, geothorists became their own worst enemies. The popularity of the genre produced a number of competing works, none of which could be proven superior to the others because few of their assertions could be tested. This was largely due to their deductive approach.

Hutton's was openly hypothetico-deductive; he propounded it *before* undertaking fieldwork to find evidence to confirm it (Rudwick, 2005, p. 642, emphasis his).

Perhaps another contributing factor was the weakening of the ties between the "Republic of Letters" during the French Revolution and Napoleonic wars. Ill feelings toward France were inevitable, despite attempts by savants to continue transcending national boundaries even when their respective nations were at war, and the English, who had come out on top in that bitter struggle, were not inclined to generosity. Perhaps this partly explains Lyell's saga that placed the origin of geology with James Hutton, rather than Desmarest, Soulavie, or Dolomieu.

While the technical elite of "natural history" and "geognosy" were concentrated in Germany, the key players jousting over geothory were French and English. As time wore on, geothory-riddled English influence continued to grow, not only in the contemporary and previous parts of the British Empire but elsewhere in Europe as well (Børresen and Wale, 2008). In any case, it

is inarguable that British geologists and their theories increasingly ruled geology for most of the rest of the nineteenth century.

The Resurrection of Geothory

Aspects of geothory survive into the present. In fact, one might make the argument that it never died; it simply retreated into the background for a time. Each generation is quick to overestimate the ignorance of their predecessors and underestimate their own. Grand explanatory theories are typically the result of that twin prejudice. Modern geothory has revealed itself in two distinct trends—secular and religious. We will examine each in turn.

Secular Resurrections of Geothory

Perhaps geothory is an inevitable manifestation of a fundamental aspect of human nature, and for that reason it will never really disappear. Mankind has an insatiable desire for comprehensive explanation, and mankind apart from God must find it in himself, in nature, or in some hidden principle of history (Schlossberg, 1983), such as Marx's class struggle. However, the age of science pushes people toward natural explanations of physical phenomena, and perhaps that is why secular examples of "geothory" have rebounded and gained popularity.

However, one difference in modern thought has been the conscious identification of disciplines not recognized as such in the eighteenth and early nineteenth centuries. Today, we differentiate between biology, geology, and astronomy, even when they are addressing the mutual concept of natural history. Early naturalists would not have recognized these distinctions. Thus modern "geothories" tend to remain anchored to particular disciplines, although their implications are broader.

Evolution is the primary example of modern geothory. Starting as a bio-

Systematic	Evolution unifies explanation of all material phenomena. Everything from galaxies to human behavior can be explained in its evolutionary context.
Naturalistic	Causation is by definition naturalistic because evolution is the first principle of our modern materialistic cosmos. There is nothing beyond evolution that explains reality.
Actualistic	Problematic because evolution in the full sense cannot be observed. However, examples of “microevolution” are set forth in place of actual observation.
Timeless (scientific)	Evolution explains the past, present, and future of the cosmos, the planet, and life. As a principle, it transcends time, although it forces a particular view of history.
Hypothetico-deductive	Typically presented as inductive, but reality is otherwise. Evolution is a first principle; phenomena deduced as needed to support it.
Comprehensive	Evolutionists claim that everything can be explained by evolution, and that many phenomena already have been so explained. It does not always distinguish “explanation” and “interpretation.”

Figure 6. Evolution qualifies as a resurrected form of eighteenth-century geothery. The only difference is the inability of human observers to see evolution in action, requiring the substitution of inference for observation as is done with “microevolution” and biostratigraphy.

logical theory of speciation, it quickly assumed the role as the underlying principle of the entire universe to the point that its twentieth-century enthusiasts would say that “the whole of reality is evolution” (Huxley, 1955, p. 272). There is no question that it meets all of the criteria of eighteenth-century geothery (Figure 6). It is systematic, naturalistic, actualistic, timeless (at least in the sense that it is an eternal fundamental principle of matter), hypothetico-deductive (the reality is contrary to the claims of its proponents), and comprehensive.

Other examples are not as complete or as fundamental as evolution, but the big bang theory and plate tectonics meet many of these criteria. Although not as systematic as evolution, plate tectonics claims to explain most geological and geophysical phenomena. It might be seen as the evolution of geothery within later changes in the definitions of the disciplines. It is certainly naturalistic, but it suffers the same problem as evolution in regard to actualism—it exists on

a scale of both space and time to make definitive observation and testing impossible. Thus, both evolution and plate tectonics cannot be observed but are inferred from observation. However, the reality of nineteenth-century geothery was perhaps less actualistic than advertised; Hutton certainly went far beyond observation in his speculations. Plate tectonics is timeless; it is a fundamental process of Earth, inherent to its physical makeup, and spans the entire history of the crust. Like evolution, it pretends to be an inductive conclusion, but in reality, it is a deduction pressed on the data. This is demonstrated by the rigidity of plate tectonic theory; contrary data have not caused modification or rejection of the theory and in many cases they are simply ignored or addressed with ad hoc explanations (e.g., responses to Belousov, the Meyerhoffs, and other critics). Plate tectonics is not comprehensive in the eighteenth-century sense, but it is comprehensive within the modern domain of earth science. Very little

interpretation is done today without some reference to or implication of plate tectonics. With the death of Lyellian uniformitarianism, plate tectonics has joined deep time as one of the main integrating principles of geology.

Diluvial Resurrections of Geothery

Secular scientists are not alone in resurrecting geothery. Within a few decades of the rebirth of Biblical creation, creation scientists were engaged in attempting to construct speculative models of the Biblical Flood. Some are broader, attempting to unify the Bible’s teaching of Creation, the antediluvian world, the Deluge, and its aftermath into one comprehensive model (e.g., *Creation in Symphony*, 1996). Perhaps the first, and by far the most comprehensive, was the hydroplate theory of Brown (1980), which has grown in scope and complexity with succeeding editions of his book. At the same time, one of the better (and largely unrecognized as such) debates over a Flood model was winding down. After extended published disputation in the 1970s and 80s, the early “vapor canopy” model was laid aside, although work continues on lesser versions (Rush and Vardiman, 1992; Vardiman, 2003). Another limited model was that introduced in 1990 by Oard for a post-diluvial Ice Age. Its propositions were defensible, and it has been largely accepted. But the drive for grand explanatory theories took a step forward with the highly publicized and promoted catastrophic plate tectonics theory (CPT) (Austin et al., 1994). CPT and Brown’s hydroplate have found company in ideas of similar scope (e.g., *Creation in Symphony*, 1996; Budd, 1998; Fischer, 1992; 1994; 2006; Gentet, 2000; Tyler, 2006).

Why creationists seem determined to follow the trend toward modern geothery remains uncertain. Perhaps it is simply human nature. There is a desire for creationists to “catch up” to their secular colleagues, proving that “creation science” is the equal of secular science.

There is also a desire to leverage the work of secularists and apply it in Flood models. This is seen by the embrace of many creationists of the geological timescale and its chronostratigraphy. It is a crucial component of the recolonization model and CPT. Both explicitly use the relative stratigraphic scheme of the timescale to drive key tenets of their model, despite it being an encapsulation of secular natural history and as such embodying both uniformitarian and evolutionary thought.

At present, the two most popular models among creationists are CPT, which since 1994 has been primarily the work of Baumgardner, and the hydroplate theory. Their popularity stems largely from their promotion—CPT by creationist organizations and hydroplate by Brown's own organization and iterative editions of his book. We will examine their similarities and dissimilarities with geothory, although a similar analysis could be done for any of the Flood models (Figure 7).

Using the criteria shown in Figure 2, it is clear that both models share many tendencies of eighteenth-century geothory. Both speculate about historical events for which there is little possibility of scientific testing. CPT claims a systematic and comprehensive status:

In my view, as creationists we should be labouring with every resource we have at our disposal to bring to fruition a comprehensive Flood geology model/framework that accounts not only for large-scale tectonic phenomena but also from details of sediment deposition and erosion patterns and tectonics at a regional and local scale (Baumgardner, 2002, p. 81).

Brown's hydroplate model is actually more comprehensive than CPT. It purports to explain a great number of phenomena and presents a number of predictions by which it could potentially be tested. Both are theistic in the sense of affirming God's existence, creative works, and at least secondary causa-

	Hydroplate	Catastrophic Plate Tectonics
Systematic	Integrates explanation, over a wide range of phenomena from core to frozen mammoths, with an explicit claim to much greater power.	Makes explicit claim to explain the entirety of the Genesis Flood and all associated phenomena. Most published work is geophysical.
Naturalistic	Explanation does not require divine intervention except at Creation. Flood flows from pre-set planetary characteristics.	Explanation does not require divine intervention except at Creation. Flood flows from pre-set planetary characteristics.
Actualistic	Many earth processes are not actualistic, but can be derived from actualistic natural law.	Runaway subduction is not observed but is deduced and modeled from existing actualistic natural law.
Timeless (scientific)	Past and present explained by model, future predictions could be made based on extrapolation.	Past and present explained by model, future predictions could be made based on extrapolation.
Hypothetico-deductive	Explicitly stated that initial conditions and natural law require historical processes.	Principles asserted, but iterative use of modeling is inductive. But reality of events affirmed without doubt.
Comprehensive	Breadth of explanation is vast, but is self-limited to nature. Does not attempt to explain man or God.	Claimed to be comprehensive model of Flood, but in reality is less broad than Hydroplate model in published assertions.

Figure 7. A comparison of the two major Flood models to the criteria for eighteenth-century geothory shows many similarities. Neither is as comprehensive as evolution; both are self-limiting to natural phenomena apart from man and God. Catastrophic plate tectonics is more limited and inductive than hydroplate, but both share the hypothetico-deductive bent of the hard sciences and claim unequivocally to represent historical reality.

tion of the Deluge. However, both are naturalistic in assuming that the events and processes of the Noachic Flood can be completely explained scientifically. In other words, God initiated the process, and physical laws took over. Like modern secular geology, the actualistic method of both models is limited. Past catastrophic events cannot be examined by modern analogues, and many of the conditions and processes of both models are outside the scope of geological observation. For example, no modern observation can confirm or disprove the historical existence of a layer of subterranean supercritical water, just as none can confirm or disprove the special mantle conditions necessary to initiate

runaway subduction. Though neither addresses Earth's future, both models claim to present an accurate picture of the past and to explain present-day observations.

Methods of scientific reasoning in natural history are crucial yet seldom examined. Brown addresses his method briefly; Baumgardner does not. Laudan (1987) discussed five methods that have historically been used in geology (Figure 8). Her analysis is interesting, yet it is also illustrative of the futility of attempting to justify truth through science. A tangled web of epistemology underlies each of the different methods and typically presents a Gordian knot of confusion that could easily be cut by the orthodox

Methods of Scientific Reasoning Used in Geology					
	Hypothesis	Vera Causa	Analogy	Enumerative Induction	Eliminative Induction
Who		defined by Sir Isaac Newton		early official method of London Geological Society	linked to Francis Bacon's "crucial experiments"
What	any hypothesis compatible with observed data is, at a minimum, probable	hypothesis requires causes that are both real and sufficient to explain data	hypothesis infers unknown causes from observed relations of similar nexuses, like ratios in math	hypothesis emerges as simple generalization of data	observed data must refute all possible rival theories
Strength	inferences can be derived from small set of observed data	fruitful results emerged from Newtonian science	allows investigation of unobserved cause/effect relations	inferences closely tied to observations	inferences have the potential for certainty
Weakness	method cannot exclude incorrect inferences that fit the limited data set		must establish correct "similarities" between causes and effects that are sufficient to extrapolate to unobserved causes	unsuitable for geology due to spatial and temporal impossibility of observing a relevant cause/effect nexus in Nature	inferences can provide false confidence because it is difficult to know all of the alternative theories
	Least Reliable	Most Reliable	More Reliable	Limited Reliability	Less Reliable

Figure 8. Laudan's (1987) analysis of scientific methods applicable to geology and natural history.

Christian position that truth comes by revelation, and as a consequence empirical human observations rest on assumptions that can be justified only by Scripture. This was the epistemology that allowed the unique creation of science in the first place (Glover, 1984). The subsequent rejection of Scripture as a source of truth underlying philosophy, history, or science has led modern philosophers to postmodern relativism and despair. Only the widespread ignorance of scientists regarding these trends has allowed a naïve positivism to persist. Furthermore, the erroneous idea that science is the proper home of natural history has also distorted the methods of both secular and creationist scientists who search for the certainty of experimental science in the inherent uncertainty of the unrecorded past (Reed, 2000).

However, Laudan's (1987) analysis is worth examining, if for no other reason than its rarity in treatises about natural

history. She presents five methods that have been applied to geology: (1) hypothesis, (2) *Vera Causa*, (3) analogy, (4) enumerative induction, and (5) eliminative induction. She favors Newton's *Vera Causa* and the method of analogy as the most reliable for geological studies of the past. She favors analogy because it ties observations of modern processes to ancient products. She recognizes that the Lyellian univocal or near-univocal comparison of past and present can no longer be defended, but her belief in a more limited actualism assumes that indirect linkages are possible and helpful. *Vera Causa* has worked quite well in the hard sciences, but her assumption that science is the method of natural history boosts her confidence in its application to the past.

An argument could be made that eliminative induction is a more realistic method. This assumes natural history is a mixed question that inherently possesses the uncertainties of history but

can benefit from forensic applications of science. *Vera causa* requires a burst of insight to derive a hypothesis to which true causes can be applied. Analogy is useful only for processes similar to ongoing ones. That may well eliminate aspects of the Flood and certainly eliminates Creation. We must reject the secular univocal uniformity of events and recognize instead that the greatest discontinuities in earth history—Creation and the Biblical Deluge—are the cause of the rock record. As Laudan notes, enumerative induction does not work well for past events. Thus, *by elimination*, we are left with eliminative induction.

In this method, science is used to eliminate historical hypotheses based on their failure to live up to their necessary predictions. Not all may be disproved, and the correct hypothesis may never be discovered. But that uncertainty is only to be expected of natural history. This was recognized by Lyell's contemporary Granville Penn (Mortenson, 2004, p.

60) and, refreshingly, by some in the creationist and intelligent design movements today (Tyvand, 2009). It is thus all the more regrettable that so many prominent creationist researchers habitually follow the evolutionists' natural history recipe and then cover it with a consciously creationist "frosting," failing to see the deeper and essential disparity of worldviews in these mixed questions.

Both CPT and hydroplate have severe weaknesses in describing and justifying their methods. Nor are any other grand Flood models of which we are aware much better in this regard. This raises at least two topics that must be addressed in more detail by creationists: (1) what is the place of grand explanatory models in natural history, and (2) how far can tentative local interpretations be integrated toward that end. Of course, that assumes an inductive rather than deductive approach in the first place, which apparently is also a topic needing discussion.

Hydroplate appears to rely on the method of hypothesis, which Laudan identifies (correctly) as an unreliable method for natural history.

To explain scientifically an unobserved event that cannot be repeated, we must first assume the conditions existing before that event. From these assumed starting conditions, we then try to determine what should happen according to the laws of Physics (Brown, 2008, p. 116).

Thus, the hydroplate model appears to be an exercise in demonstrating as much coherence as possible between its unique starting conditions and its conclusions.

At first glance, CPT is more inductive, at least in the sense that iterative computer modeling has been applied to the problem. But it seems much the same in essence as hydroplate in the sense that special initial conditions are posited and then demonstration is attempted based on these assumptions. It may even be worse, since the computer

modeling is another step removed from nature's reality. On the other hand, it has at least shown an inductive reflex to criticism by changing the timing and number of runaway subduction events (cf. Austin et al., 1994, versus anything by Baumgardner after 2002).

There are certainly differences between these Flood models and eighteenth-century geothory. Both restrict themselves to scientific explanation, avoiding philosophical or theological discussions about the origin and nature of man. Both are constrained by our modern disciplinary boundaries, being primarily geophysical and geological, with support from chemistry and physics. However, these differences could be attributed to the different definition of the disciplines today. At any rate, they cannot mask the remarkable similarities that also exist.

Geothory was overthrown by the limited, inductive emphasis of the early English geologists. There is no doubt that geology became organized as an effective field science by that change in strategy, even though elements of geothory lingered. What relevance does that historical lesson hold for today, especially for creationists whose assets are limited? At the very least, it illustrates the need for a better historical understanding of the roots of the earth sciences and the ideas that drove them over the past two centuries. It also highlights the danger of a naïve positivism—the idea that with just a few "reasonable" assumptions, the "laws" of physics and chemistry can decipher a past that is not simply closed to direct observation but also lacks the uniformity of process necessary to successfully extrapolate knowledge of the present. That in turn should caution us against confusing natural history with empirical science and highlight the complex interaction between them. That is the reason that we have both followed Adler's (1965) classification of natural history as a mixed question and continue to advocate that approach. Fi-

nally, we see the most obvious lesson of the age of geothory as being a warning against overconfidence, recalling that if scientists were objective that there would be no need for science.

Conclusions

The proper appreciation for both the opportunities and the limits of science was severely distorted by the Enlightenment. Science was divorced from its Christian roots and accorded an unrealistic status as the key to truth. Merging that error with the Cartesian mania for system building, eighteenth-century scientists struggled to find scientific systems that would fill the vacuum left by the rejection of Christianity. The result was geothories, the most influential being those that dismissed biblical history—those of Buffon and Hutton.

But geothory could not long survive its own weight. Even as philosophical skepticism began to grow, eighteenth-century scientists, being more philosophically attuned than their modern brethren, quickly realized that the geothories were also unrealistic. Furthermore, they failed to deliver as promised—the end of the century saw a morass of competing systems, none of which could be demonstrated to be true or even as superior to its competitors. The growing trend of deriving geohistory from limited, field-based, inductive studies quickly replaced geothory as the foundation of terrestrial science, and Hutton gave way to Cuvier, Smith, and the gentlemen geologists of the London Geological Society. Then the aftermath of the Napoleonic wars brought about the elevation of English geology at the expense of their French predecessors. This is illustrated by Lyell's "victory" over Cuvier, as well as by our modern ignorance of the work of Desmarest, Soullavie, Dolomieu, and others, which preceded that of Buckland, Murchison, Sedgwick, and Lyell.

However, man's innate need of grand explanatory theories guaranteed that

geothery would not remain buried. It reemerged in the late nineteenth and early twentieth centuries in the form of evolution, and to a lesser extent in the later big bang and plate tectonics. Creation science is not immune to the virus of geothery. Although less comprehensive than the eighteenth-century theories of the earth, models attempting to comprehensively explain the Flood have begun to proliferate, each seeking to be the “silver bullet” that ties all observation and theory together into one neat explanation. The two most noticeable today—catastrophic plate tectonics and hydroplate—share many similarities with the old genre of geothery.

But this trend toward grand explanatory models ignores several realities. The first is that science is not an autonomous source of truth and that its only link to truth is through the justification of its assumptions and methods via Scripture. Related to that is the reality that natural history is a mixed question, more closely associated with history than with science. Thus, natural history does not and cannot hold out the same certainty found in the hard sciences, like chemistry or physics, that are constrained by what Adler (1965) called “special experience”—controlled observation and experimentation. A third reality is the enormous complexity of the planet, which is further exacerbated among creationists by the paucity of full-time researchers. Perhaps eighteenth-century savants knew so little that they could be excused in overestimating their understanding of Earth and its processes, but we know enough today to better estimate the extent of our ignorance. In short, the correspondence between any present Flood model and truth is likely limited and perhaps even fortuitous. Finally, the secular rebirth of geothery and the masking of modern geothery as “science” (e.g., evolution) should make any creationist cautious of the structure, methods, and assumptions built into

what is often presented as innocent summaries of data. A good example is the tendency to accept as much of the geological timescale as is possible (Snelling, 2009), despite its inherently anti-Christian nature on levels much deeper than the amount of time on its geochronologic scale (Reed, 2008b).

In rejecting geothery as a serious exercise in natural history, early nineteenth-century scientists understood that their efforts were better spent on developing limited answers to limited questions based mostly on field evidence. Lyell was able to use Hutton’s geothery to support his ideas only because he distorted Hutton’s actual work (beginning the legend of Hutton’s unreadable prose) and convinced his audience that Hutton had not been engaged in geothery. We cannot help but think that there is a lesson for creationists in this historical sequence: that the modern geotheries of our secular peers should not be emulated in terms of their method, any more than they should in terms of their anti-Christian conclusions.

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Origin of Appalachian Geomorphology

Part I: Erosion by Retreating Floodwater and the Formation of the Continental Margin

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Abstract

The general geology and geomorphology of the Appalachians is summarized. Geological features and the subdued relief of the topography indicate up to 6.5 km of erosion. Erosion can also be estimated by the amount of sedimentary rocks on the offshore continental margin sourced from the west. Assuming that this erosion came from the Appalachians east of the divide, the amount of sediment matches the estimate based on coal rank fairly well. Erosion of the Appalachians and deposition of the continental margin can readily be explained by sheet flow early in the retreating stage of the Genesis Flood, as the land rose up and the continental margin subsided. This is a pattern seen worldwide and is inexplicable by uniformitarianism. This places the Flood/post-Flood boundary in the very late Cenozoic in this region.

Introduction

The Appalachian Mountains of eastern North America form a zone 160 to 500 km wide starting from Newfoundland, southeast Canada, and running 2,400 km southwestward to central Alabama. The Appalachian Mountains include several provinces, including the Blue

Ridge Mountains and the Valley and Ridge Province. The highest mountains are in the Smoky Mountains of western North Carolina; Mount Mitchell reaches 2,037 m asl, the highest point east of the Mississippi River, and Grandfather Mountain in the Blue Ridge tops out at 1,810 m asl (Figure 1). “Appalachian”

refers not only to the mountains but also to several regions associated with the mountains (Fenneman, 1938; Thornbury, 1965), which are northwest and southeast of the Appalachian Mountains. These regions are divided into provinces of similar geomorphology —the field of geology that studies the features of Earth’s surface. This paper is restricted to the central and southern Appalachians. Although there are significant differences between the geomorphology of the central and southern Appalachians, they are similar enough to include in a

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Figure 1. Grandfather Mountain in the southern Blue Ridge Mountains at 1,810 m, as seen from the Blue Ridge Parkway at 1,265 m asl.

survey of the general geomorphology. Both areas are combined when describing the geomorphology of the Appalachians (Fenneman, 1938; Thornbury, 1965), as shown in Figure 3 below.

Before proceeding, I must clarify some terms. Many geologists no longer prefer to be called “uniformitarian,” having converted to neocatastrophism, rejecting gradualism while maintaining an “actualistic” method. They prefer to be called “actualists.” However, Hooykaas (1963) noted that “actualism” can be equally applied to many different historical systems. Reed (2010) noted the redundant use of the two terms and suggested the elimination of “uniformitarian” from the lexicon, since “actualism” has prior precedence. This revolu-

tion in geology leaves several problems unresolved; neocatastrophism implies that the physical evidence of the past is much more poorly distributed than was assumed by gradualists, leading to less certainty in interpretation. Also, there has been no wholesale reconstruction of geology as a discipline, that is, no weeding out of the many decades of uniformitarian assumptions that influenced the methods, assumptions, and conclusions of geology. To creationists, it appears that geologists have surrendered to the empirical evidence cited by catastrophists during the past several centuries, while clinging to their metaphysical belief system of naturalism. This, of course, is not science and cannot be justified scientifically. To avoid misunderstand-

ing, I will refer to “secular geologists” as actualists, whether they are either catastrophist or gradualist.

General Geology of the Appalachians

Secular scientists consider the Appalachians to have formed from repeated continental collisions between North America and Europe/Africa (Hatcher, 1989; Plummer and McGeary, 1996, pp. 462–464), citing evidence of “exotic” terranes, supposedly representing slices obducted onto North America, and exposed rare mantle rocks (Miller et al., 2006; Misra and Keller, 1978). Prior to the “last” continental collision, thick Paleozoic sedimentary rocks built up

over millions of years along the continental margins of North America and Europe. Then the continents collided to form "Pangea," and the sedimentary rocks were buckled, folded, and faulted. It is believed that multiple thrust faults pushed northwest tens to hundreds of kms up a low slope (Perry, 1978; Simmons, 1983). Some thrusts involved crystalline basement rocks, like those of the Blue Ridge Mountains. The thrusting was related to upward intrusions of mostly granitic rocks. During collisions, the Appalachians were supposedly raised as high as the modern Himalayas (Karle, 2009, p. 76). The mechanism and source of energy for this incredible overthrusting are not known, but it is assumed to be compression.

During the Mesozoic, the last supercontinent, Pangea, split apart. The high mountains in the eastern United States were subsequently eroded to the subdued, rounded mountains of today's Appalachian range. Detritus from that erosion was transported both east and west, possibly as far as the Colorado Plateau (Froede, 2004; Oard, 2009a). This is based on uranium-lead radiometric dates in zircon crystals. Sedimentary rocks dated as upper Precambrian and Paleozoic lie at the base of the Appalachian Basin, which is up to 12 km deep (Way, 1999), a northeast-southwest elongated basin just west of the Blue Ridge Mountains, extending from New York to Alabama.

Except for the very early Paleozoic rocks, which exhibit eastward paleocurrents (Whitaker, 1955), Paleozoic sedimentary rocks were transported toward the west to northwest (Nichelsen, 1958; Pelletier, 1958; Pettijohn, 1970; Schlee, 1963; Yeakel, 1962). This indicates a source from the location of the current Atlantic Ocean, but the sediment could have originated from the area of the Piedmont or coastal plain. Then after the Paleozoic, there was a flow reversal toward the southeast accompanied by significant volumes of erosion (see

below). The origin of this drainage reversal remains controversial (Kaktins and Delano, 1999).

General Geomorphology of the Appalachians

Geomorphology is a geological science that studies the general configuration of Earth's surface, especially the classification, description, nature, and origin of landforms and their relationship to the underlying geological structures (e.g., see Neuendorf et al., 2005, p. 267). Other terms for geomorphology are physiography and physical geography. Landforms are features that, taken together, make up the surface of the earth and include broad features such as mountain ranges, plateaus, or plains, and small-scale features such as hills, valleys, slopes, canyons, or alluvial fans.

The Appalachians or Appalachian Highlands can be subdivided into geomorphological provinces. The Blue Ridge Province is the backbone of the Appalachian Mountains and contains the highest elevations. The Valley and Ridge Province, just west of the Blue Ridge Province, is composed of folded sedimentary rocks of the Appalachian Basin. These two provinces show up from space as one large elongated landform (Figure 2). Farther west is the Appalachian Plateaus Province, which includes the Allegheny Plateau in the north and the Cumberland Plateau in the south. Farther west is the Interior Low Plateaus Province. To the east of the Blue Ridge Mountains is the Piedmont Province. These provinces are shown in Figure 3.

The Valley and Ridge and the eastern Appalachian Plateau Provinces are thought to represent thin overthrust slices pushed northwest for long distances along bedding planes. The Blue Ridge and Piedmont are comprised of igneous and metamorphic rocks believed to have been thrust a short distance northwest (Hatcher, 1972; 1978). Evidence of

thrusting, or at least of faulting, of the Blue Ridge Province against the Valley and Ridge Province is shown by fault breccia at the contact in Figure 4.

There are two other geomorphic features of special interest. The first is the Blue Ridge Escarpment of the southern Appalachians, a feature about 500 km long with a face that averages 300 to 600 m high (Figure 5). It is most abrupt in western North Carolina, where it rises vertically about 600 m (Figure 6a and b). Spotila et al. (2004, p. 42) stated:

In northern North Carolina and southern Virginia the Blue Ridge highlands exhibit low relief, such that the escarpment is a striking boundary between two subdued surfaces, which we refer to as the Upland and Piedmont surfaces.

The Blue Ridge Escarpment is not as high or well defined as the Great Escarpments along eastern Brazil, eastern Australia, western India, and around Southern Africa (Oard, 2008, pp. 53–54; Ollier, 1985), but it is still considered a Great Escarpment (Battiau-Queney, 1989; Pazzaglia and Gardner, 2000), similar in some respects to other Great Escarpments (Spotila et al., 2004). It is primarily an abrupt topographic rise across high-grade metamorphic and granite rocks from the Piedmont Province to the east to the Blue Ridge Mountains to the west (Figure 7). It is not a fault and is believed to have slowly eroded westward (Spotila et al., 2004). The fault at Caesar's Head eroded northwest in granite (Figure 8). The deduction of a northwest-eroding escarpment is reinforced by the existence of outliers of the Blue Ridge Province on the Piedmont. The amount of lateral erosion is uncertain (Battiau-Queney, 1989) but significant. Thornbury (1965, p. 105) stated: "These [Blue Ridge] outliers suggest that the front of the scarp may have been considerably farther east in Tertiary time." He places the erosional retreat of the Blue Ridge Escarpment in the Tertiary. The location of the escarp-

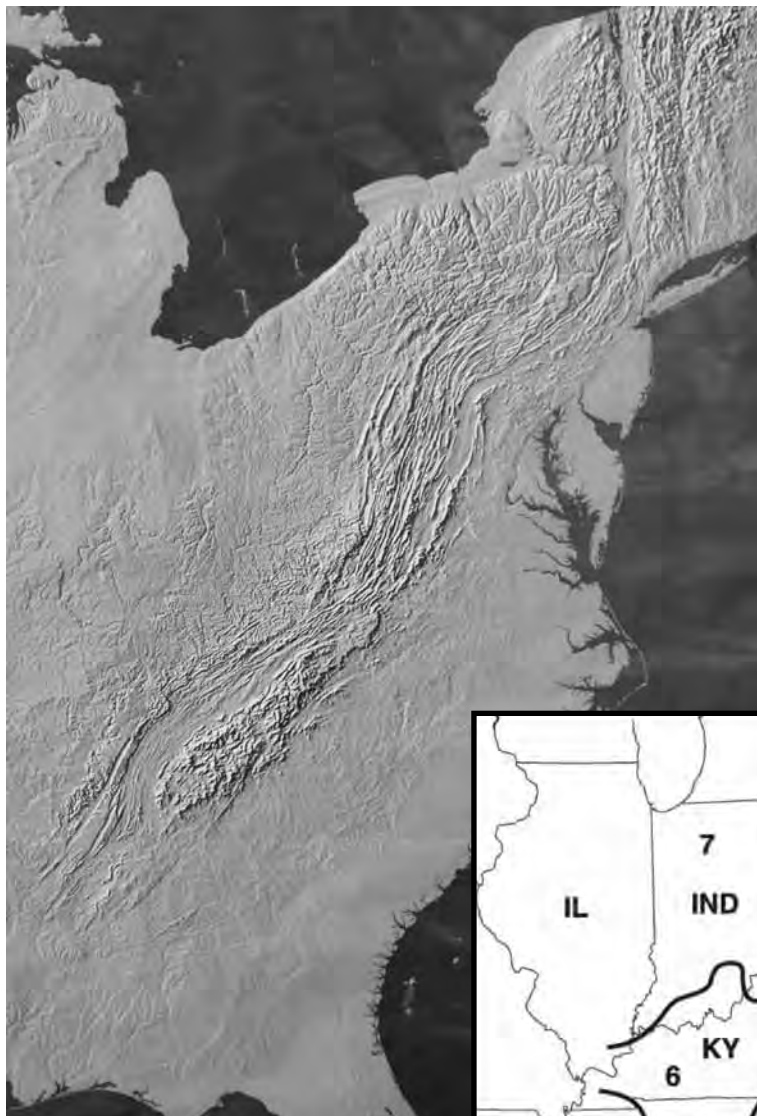


Figure 2 (*left*). The distinctive geomorphology of the Appalachian Mountains, the Blue Ridge and Valley and Ridge Provinces, as seen from space (from Thelin and Pike, 1991).

Figure 3 (*below*). Map of the Appalachian provinces and the two provinces to the west. Modified from Aadland et al. (1992).

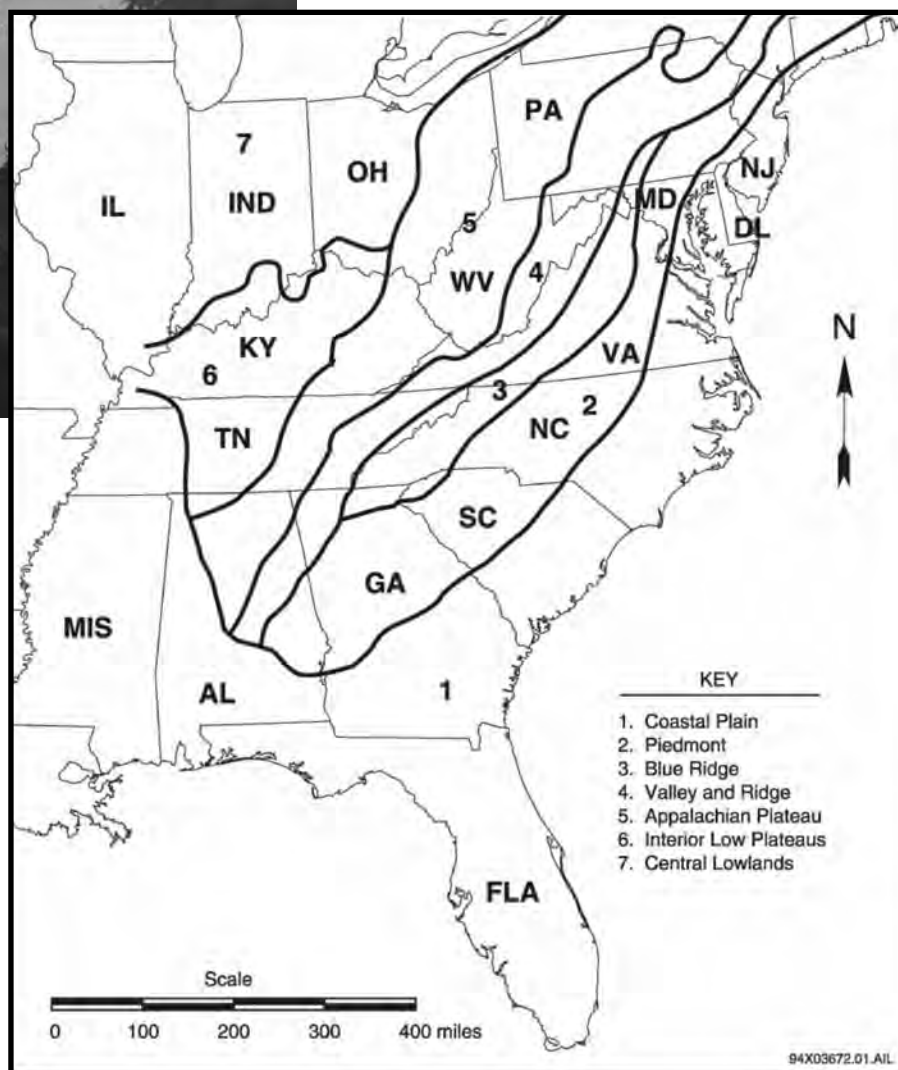




Figure 4. Fault breccia of Antietam quartzite in Blue Ridge Thrust Fault zone, Rt 340, Virginia. Note angularity and freshness of clasts. From Bentley (2010).

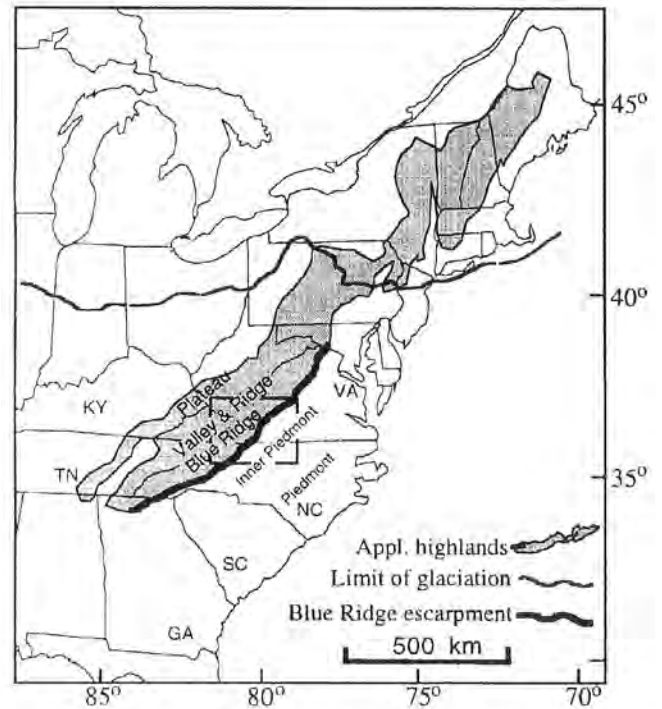


Figure 5. Location of the Blue Ridge Escarpment. From Spotilla et al. (2004, p. 42).



Figure 6a. Blue Ridge Escarpment, a 600-m cliff, at Caesar's Head State Park, South Carolina (view southeast).



Figure 6b. View northwest of the Blue Ridge Escarpment from the rolling Piedmont erosion surface, North Carolina.

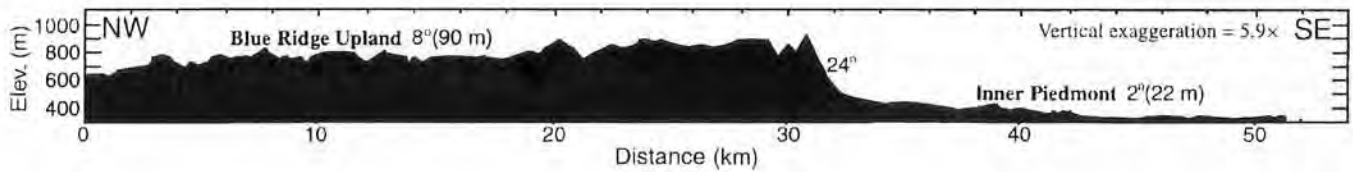


Figure 7. Cross-section with vertical exaggeration 5.9 across the Blue Ridge Escarpment with a 24° slope on a northwest—southeast line. From Spotilla et al. (2004, p. 43).

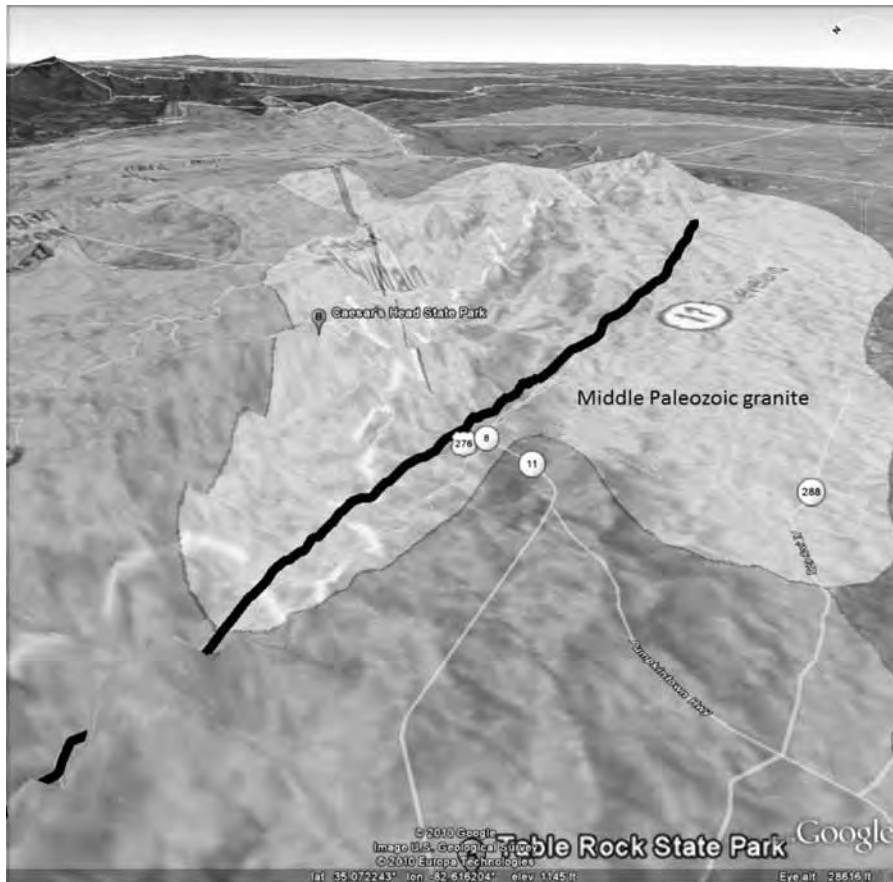


Figure 8. Google Earth/Google Map image of Caesars Head State Park area, showing base of Great Escarpment (black line) cutting across Middle Paleozoic granite as shown in Schruben et al. (2006). North is to top right of picture; 3x vertical exaggeration.

ment cannot be correlated to lithology (i.e., soft or hard rocks); the lack of preferential erosion (Spotilla et al., 2004) is a conundrum to most geologists. So, the Blue Ridge Escarpment is believed to have formed erosionally, like other Great

Escarpments, but the cause is unknown (Spotilla et al., 2004).

A second major geomorphic feature is the Great Valley (Figure 9), a prominent valley (see Figure 2) on the eastern edge of the Valley and Ridge

Province. It extends the full length of the Appalachians, from the St. Lawrence Lowland to Alabama, varying in width from 3.5–80 km. The Great Valley can be considered the first valley of the Valley and Ridge Province, but it is much wider than those to the west. It is 3.5 km wide just north of Roanoke, Virginia, but 80 km wide at its southern end. It goes by many local names, such as Coosa, Shenandoah, Cumberland, Lebanon, Hudson, and Champlain Valleys. The sedimentary rocks below the Great Valley are deformed and folded like the rest of the Valley and Ridge Province yet have been planed into a long, narrow erosion surface (Perry, 1978). Along its length, there are low passes creating segments. Many cities and towns have been built within the Great Valley, and Interstate 81 runs almost its entire length.

Appalachians Deeply Eroded

For many decades, geologists have believed that the Appalachian Mountains are “old” because they have been deeply eroded. They present a rounded appearance (Figures 10a and 10b) in many areas. Early estimates of Cenozoic erosion were 2 km from eastern North America (Mathews, 1975), with much less during the Mesozoic. Clearly, significant erosion has occurred, as witnessed by the erosional remnants, near-surface coal, and eroded anticlines. Surrounding provinces have also been eroded significantly into erosion and planation surfaces.

Some plutonic rock masses in the Appalachians (Figure 11) indicate a few



Figure 9. View northwest of the Great Valley from Rocky Top Overlook, Shenandoah National Park.



Figure 10a. The Blue Ridge Mountains, showing an eroded, rounded appearance (view southeast from exit 55 on Interstate 64 Virginia).



Figure 10b. The Great Smoky Mountains of the southern Blue Ridge Mountains, showing an eroded, rounded appearance (view southeast from Sevierville, Tennessee).

thousand feet of erosion as a minimum, namely of the rocks surrounding the pluton. Plutonic rocks were once under the ground and only have been exposed by erosion.

Coal is commonly found in the sedimentary rocks in the Valley and

Ridge Province west of the Blue Ridge Mountains (Figure 12). It includes high-rank anthracite and medium-rank bituminous coal; the rank is typically higher toward the southeast (Hower and Rimmer, 1991). If rank was a result of heat and pressure just from burial, several

km of overlying sedimentary rock was eroded at one time. The exact volume of rock varies with assumptions, which are speculative. Friedman and Sanders (1982) believed that the anthracite coal in the Catskill Mountains of New York required an overburden of rock about



Figure 11. Exposed granite seen from Log Hallow Overlook on the Blue Ridge Parkway.

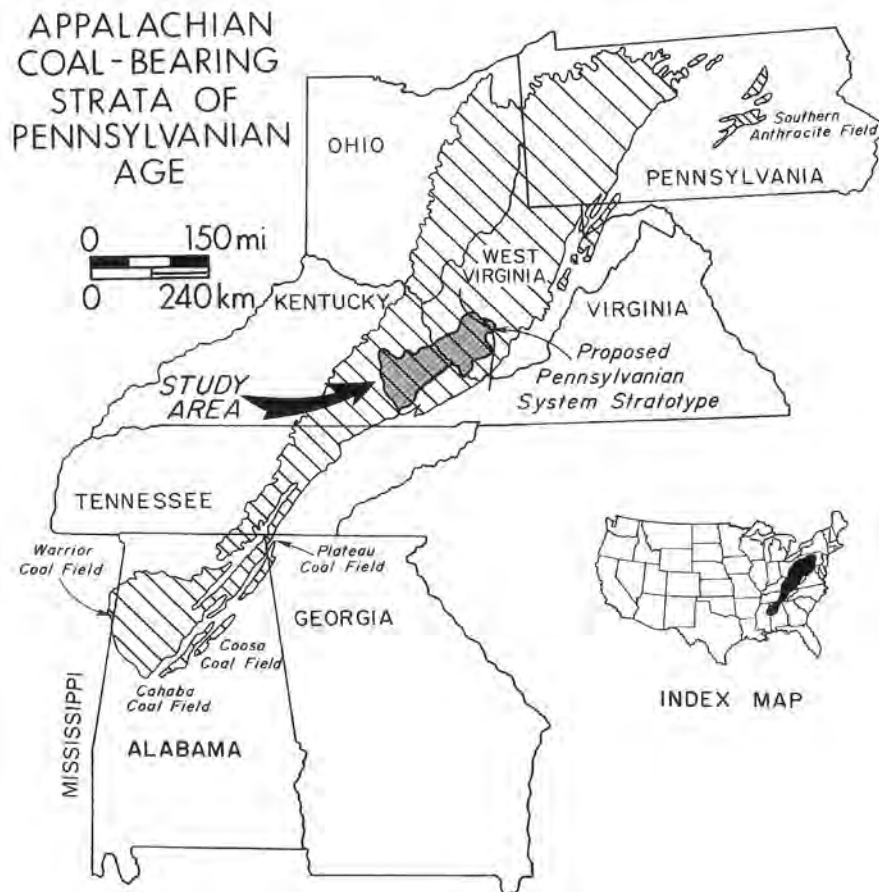


Figure 12. Area of the Appalachian coal of Pennsylvanian age within the uniformitarian geological column. From Eble and Grady (1993, p. 122).

6.4 km thick, implying this much erosion occurred since the coal is near the surface. This depth was estimated based on a normal geothermal gradient and no local heat sources. However, a higher gradient in the past or some other thermal source would have required less sedimentary overburden (Hower and Rimmer, 1991). Although Friedman and Sanders (1982) studied anthracite coal in the Catskill Mountains, their deductions based on the existence of anthracite coal would also apply to the coal of Valley and Ridge Province, since their depth estimate is simply based on estimated overburden and the geothermal gradient. The lower-rank bituminous coal would require less heat and pressure. So if there were no other heat sources and the geothermal gradient were normal, the removal of between 4 and 6.5 km of sedimentary rock from the Valley and Ridge Province is a reasonable estimate based on coal rank.

In regard to the Blue Ridge and Piedmont Provinces, erosion could have been tens of km, but this assumes the grade of metamorphic rocks, now on the surface, formed at depths of tens of kms and pushed up to the surface with the rock above eroded off. There could be other ways to form metamorphic rocks besides depth, so the deduction of tens of kms of erosion is uncertain. Regardless, a huge volume of rock was eroded off these provinces during uplift.

Amount of Erosion Based on Offshore Sediments

Another, more accurate, method of estimating the amount of erosion is to determine the volume of sediment, presumably derived from the Appalachians, deposited in the offshore continental margin system and its associated basins. The continental margin includes the continental shelf, slope, and rise. These sediments form a wedge, thickening seaward, and beginning near zero at the "fall line," a small topographical



Figure 13. Exposed rapids at the fall line after a dam was built, Savannah River, Augusta, Georgia.

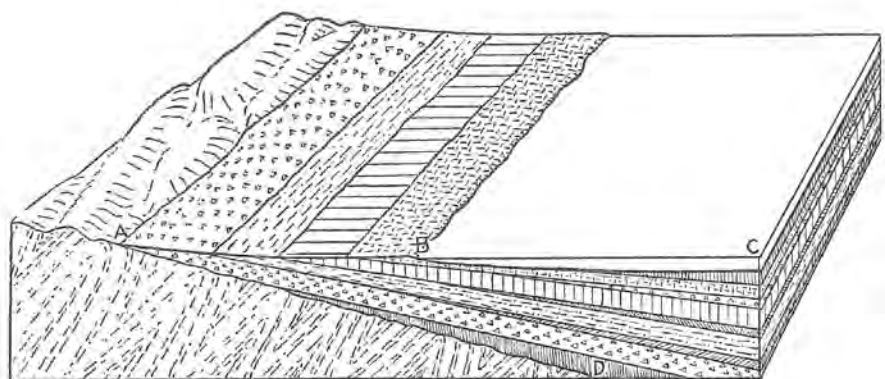


Figure 14. Seaward prograding wedge of sedimentary rocks after Fenneman (1938, p. 7). A to D represents the original surface, A to B is the coastal plain, and B to C is the ocean on top of the continental shelf.

drop between the Piedmont and Coastal Plain provinces. As the limit of upstream navigation, many large cities in the southeast are built on the fall line. Its topography varies. Major rivers crossing the fall line form either waterfalls or a series of rapids (Figure 13). The coastal plain sedimentary wedge thickens out across the continental shelf, slope, and

rise (Figure 14) (Klitgord et al., 1988; Poag and Valentine, 1988).

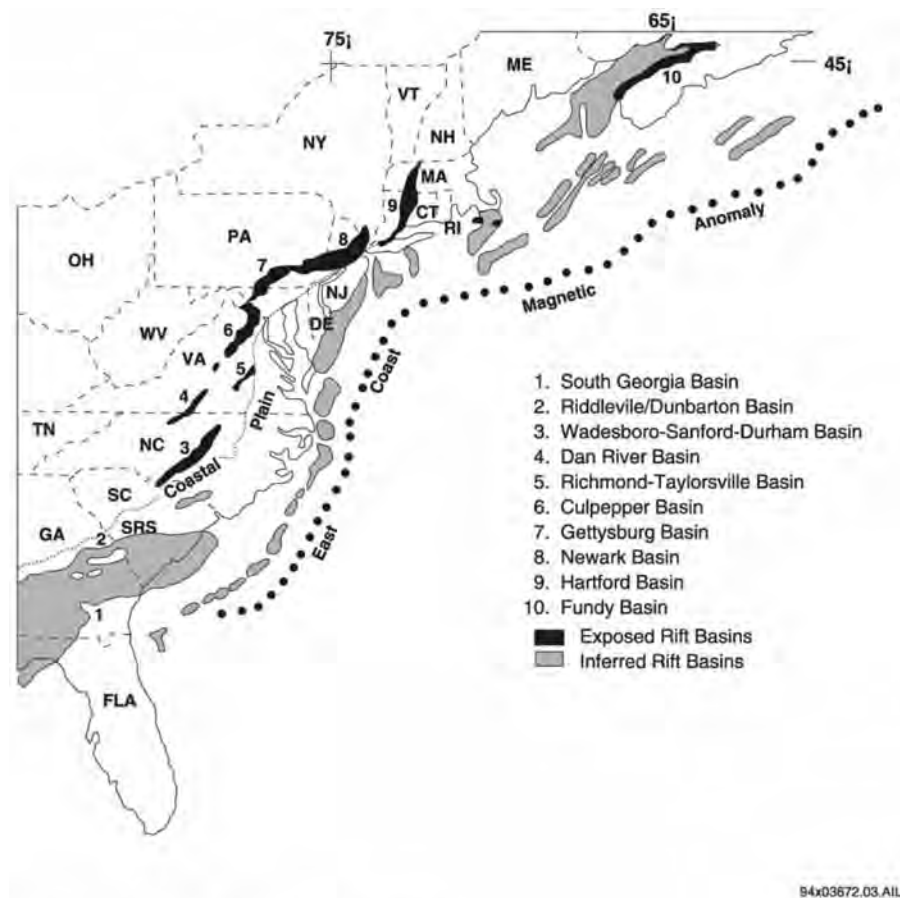
Though typically only about 1000 m, the thickness of continental margin sedimentary rocks is quite impressive in basins. Extensive deep-sea boreholes and seismic reflection profiles have shown great thicknesses of sedimentary rocks offshore, and there are many bur-

ied rifts or basins caused by extension and subsidence east of the Blue Ridge Mountains (Hack, 1989; Schlische, 1993; Pazzaglia and Gardner, 1994, p. 12,153). These basins parallel the coast and the Blue Ridge Mountains (Figure 15), indicating that they are related to differential uplift between the land and the sea (see below).

One of the deepest of these basins is the Baltimore Canyon Trough. It extends some 400 km from Cape Hatteras to Long Island (Pickering et al., 1989, pp. 263–269) with a maximum fill thickness of 18 km (Pazzaglia and Gardner, 2000, p. 287) and a total area of 200,000 km². A similar deep basin off Newfoundland—the Jeanne d’Arc Basin—contains up to 20 km of sedimentary rock (Deptuck et al., 2003).

This vast amount of sediment was likely sourced from the Appalachians. The cause of erosion and sedimentation was the concomitant uplift of eastern North America and sinking of the Atlantic basin. Poag and Sevon (1989, p. 119) stated that “the primary forcing mechanisms considered have been tectonic and isostatic uplift and subsidence.” Tectonic uplift of the eastern United States is believed to have caused the erosion, while the total amount of subsidence along the continental margin is believed to be 14 km (Poag, 1992; Poag and Sevon, 1989). In other words, the continent rose up and the adjacent ocean sank down.

Given the extensive data available along the margin of eastern North America, Poag and Sevon (1989) calculated the total volume of sedimentary rock for each period from the Jurassic to the Quaternary. The amount of sedimentary rocks per period depends upon assumptions of dating (primarily by index fossils), so I will simply examine the total volume of sediments and sedimentary rocks. The total volume of non-carbonate and non-“evaporite” sedimentary rocks is 1.377 million km³ over an area of about 500,000 km² between



SOURCE: F. R. Heck, "Mesozoic Extension in the Southern Appalachians", pp 711-714 in *Geology*, volume 17, August 1989.

Figure 15. Exposed and inferred rift basins, east of the Blue Ridge Mountains and offshore along the continental margin. After Heck (1989).

latitudes 36° and 42° N and longitudes 39° 30' and 78° W. The average depth of this sediment over that area is 2.7 km, and if carbonates and evaporites are included, it may exceed 3 km.

The central Appalachians, including the Valley and Ridge, Blue Ridge, and Piedmont Provinces, cover an area of around 315,000 km² (Poag, 1992). Based on the total volume and assuming that the sediment originated from these provinces, the average thickness of rock removed by erosion would have been 4.37 km, ignoring issues of compaction, etc. However, it is probable that these

sediments were mostly eroded from east of the Appalachian divide, reducing the area by nearly 30%, and increasing the thickness of overburden removed to approximately 6 km. That is close to Pazzaglia and Gardner's (2000) estimate of about 7 km and to that derived from coal studies on the Valley and Ridge Province (4 to 6.5 km) but less than that assumed to have eroded from the Blue Ridge and Piedmont Provinces.

It is not possible to calculate the volume of erosion over the Appalachian Plateaus and interior Low Plateaus Provinces west of the continental divide.

Because of the potential energy generated by the uplifting Appalachians and the adjacent sinking ocean basins, it is likely that erosion was much stronger east of the divide than west of the divide. The eroded debris west of the divide should have been much less than east of the divide and transported into the Gulf of Mexico.

From the standpoint of geomorphology, it is clear that the Appalachians have been heavily eroded, probably by as much as 6 km or more. What caused the erosion, transport, and redeposition of these rocks? Many clues point to the deduction that erosion had to be catastrophic and not by slow erosion over millions of years as provided by the details of the geomorphology of the Appalachians, described more fully in Parts II and III. Since planation and erosion surfaces, erosional remnants (monadnocks), long transported rocks, and water and wind gaps are inimical to the model of slow erosion over millions of years, a catastrophic mechanism is favored (Oard, 2008). Evidence of rapid erosion exists in the hundreds of erosional remnants, especially the monadnocks on the Piedmont (see Part II). If the erosion were slow and gradual over millions of years, these monadnocks also would have eroded and would be very small today.

Another clue to the erosional history comes from the late timing of the erosion—after a huge amount of sediments had been laid down. Most geologists date the erosion during the late Mesozoic and Cenozoic. Such powerful catastrophic erosion and deposition of the Coastal Plain and offshore sediments late in geological history strongly points that the erosion occurred during the latter stage of the Genesis Flood.

Erosion by the Flood

Clearly, the erosion and deposition was caused by the combined uplift of the Appalachians and subsidence of the

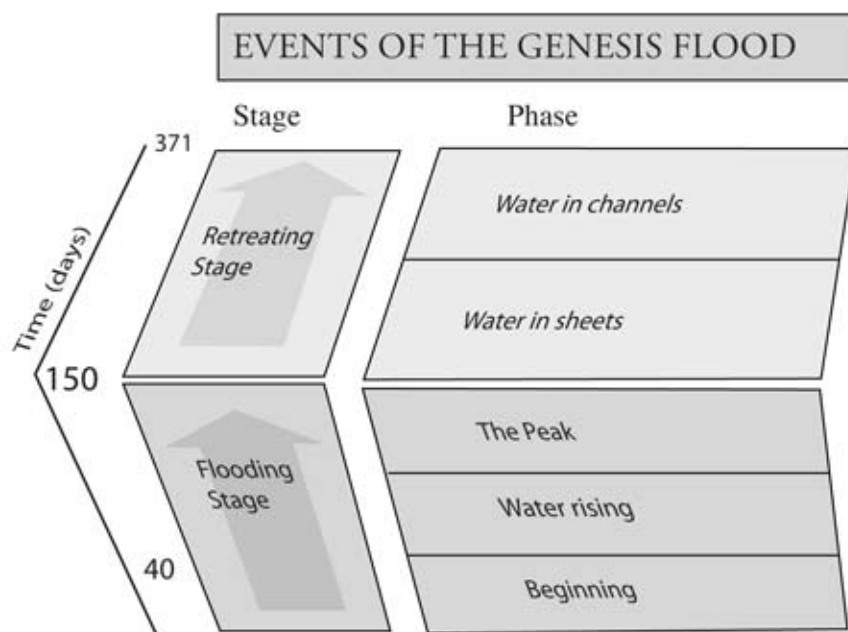


Figure 16. Walker's classification of the Flood into the 150-day flooding stage and 221-day retreating stage with five phases.

continental margin. This fits both Biblical and scientific data from other parts of the world. Uplift and deposition in the rifts along the coastal plain and offshore began before Day 150 based on dinosaur tracks in these sediments (Froede, 2010), since tracks imply a live vertebrate that had to be dead by Day 150. The majority of the thick offshore sediment probably occurred during the retreating stage of the Flood (Oard, 2008; Walker, 1994) as the Appalachians continued to uplift. Psalm 104:6–9 describes the latter part of the Flood, speaking of the simultaneous rising of the mountains and sinking of valleys. Figure 16 shows the two stages and five phases of the Flood.

Because the Blue Ridge Escarpment likely represents a northwestward retreating erosional escarpment, like a 500-km long retreating waterfall, erosion of the Appalachians likely was caused by currents flowing generally from the northwest, perpendicular to the mountain chain. Moreover, if erosion were

by currents parallel to the Appalachians, many pediments would have been formed (Oard, 2004; 2008). Based on work done in the western U.S. (Oard, 2008; Ranney, 2005), it appears that there was an initial episode of sheet-flow erosion along the entire length of the Appalachians. That current would have transported the detritus to the coastal plain and offshore regions, depositing the sediment as a sheet where the water depth increased and as the current velocity decreased.

Ongoing uplift and falling water levels during this sheet flow episode would eventually divert the flow around the Blue Ridge Mountains. Figure 17 shows a series of schematics showing the uplift and erosion of the Appalachians during the sheet-flow phase of the retreating stage of the Flood. Very thick sediments were laid down early in the huge northeast-southwest Appalachian Basin early in the Flood from currents mostly coming from the east (Figure 17a). Then

the Appalachians uplifted late in the flooding stage and early in the retreating stage with the future Blue Ridge and Piedmont Provinces overthrust toward the northwest and buckling the Appalachian Basin sedimentary rocks (Figure 17b). Such uplift with the adjacent sinking ocean basin to the east causes the sheet flow to reverse east of the major uplift. Sheet flow continues in Figure 17c, eroding the whole area.

The strongest currents would be expected east of the divide because of the rising Appalachians and greatly sinking continental margin to the southeast rapidly increasing the potential energy for gravitational acceleration. The greater the differential change in elevation, the faster the water runoff. Water diverted toward the west, on the other side of the Appalachians, would have been accelerated to moderate speeds by the sinking of the Gulf of Mexico, which is far away.

The Formation of the Continental Margin

The eroded debris would have been deposited as soon as the current energy dropped, which would have been at the transition to deeper water at the subsiding continental margin and its associated basins. Thus, the coastal plain and continental margin sediments were deposited in the same event that eroded the Appalachians. The scale of the event is supported by the nature of the sedimentary strata. Pitman (1978, p. 1,393) stated:

The general structure of Atlantic-type margins is that of a seaward-thickening mass of systematically stratified sediment overlying a deeply subsided, faulted basement platform ... The sedimentary strata consist of seaward-thickening wedges separated, at least in the shallower sections, by remarkably undisturbed planar horizons. The deepest strata are often disturbed by basement horsts and grabens, reefal structures, and diapirs.

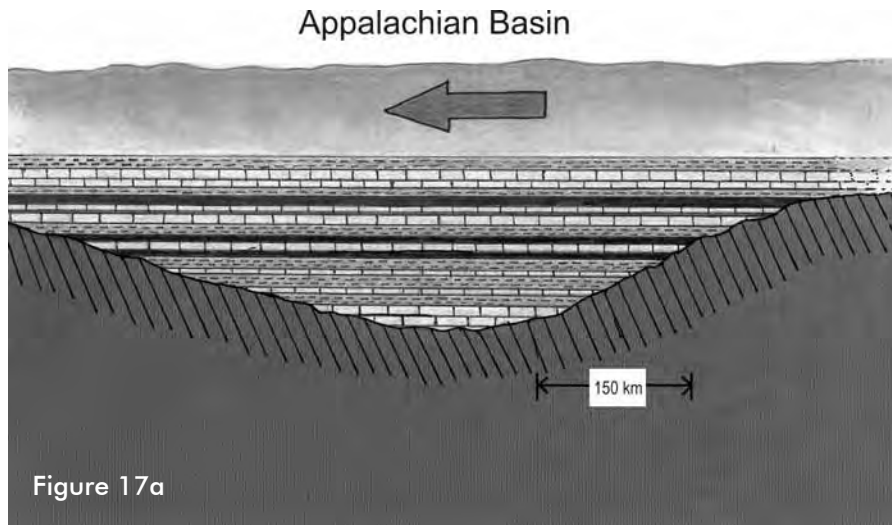
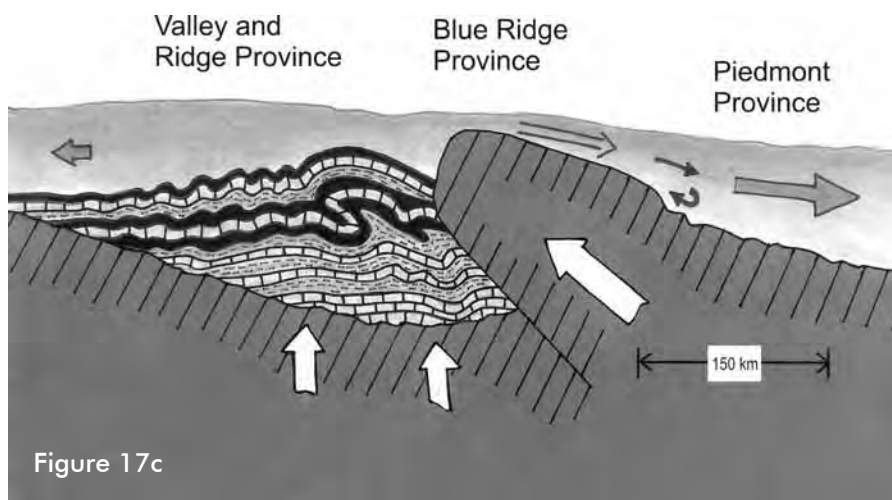
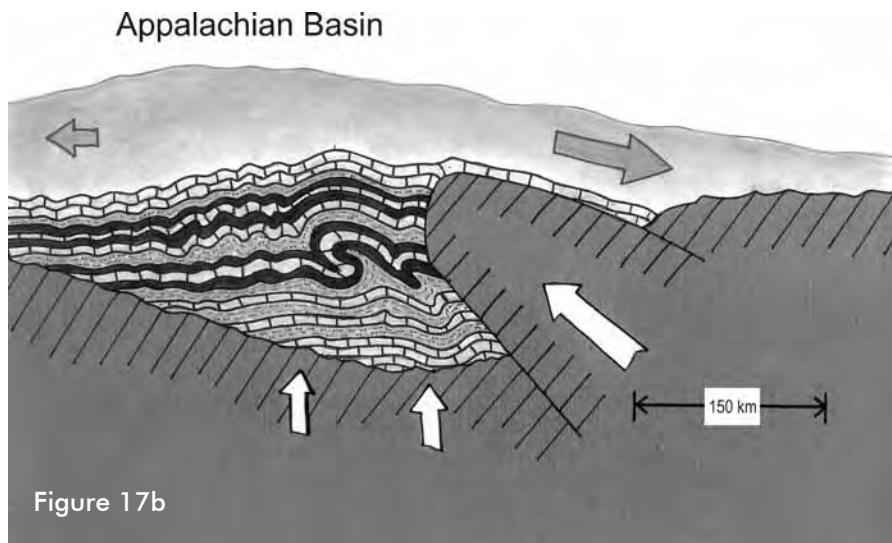


Figure 17. Schematic of suggested tectonic and erosional features for the Appalachians. Illustration by Melanie Richard.

A. Very thick sediments collect in the Appalachian basin early in the Flood from currents coming mostly from the east.

B. Appalachians uplift early in the retreating stage with the future Blue Ridge and Piedmont Provinces overthrust toward the northwest and buckling the Appalachian Basin sedimentary rocks.

C. Sheet flow continues and erodes the whole area.



A horst is an uplifted block, and a graben is a downfaulted block. Reefal structures are rare. Diapirs are intrusions of salt, mud, or sand that are squeezed upward from beds below by density differences. Such diapirs are an indication of rapid deposition in that the soft material did not have a chance to dewater before the next layer was deposited. Like the Gulf of Mexico basin, the Atlantic margin diapirs are believed to be mostly salt from the deepest layers of the continental margin.

During subsidence, many rift basins opened due to extension and block faulting (see above). Figure 15 shows these basins elongated parallel to the coast and the trend of the Appalachians.

These basins have been cited as evidence of the breakup of Pangea in the plate tectonics paradigm, but simple extension as the Appalachians uplifted while the continental margin greatly subsided can account for them. These basins were quickly filled with sediments.

The broad sheets of sediment that form the continental margin are typically flat with a slight seaward dip, decreasing from the basement upward through the sediment wedge. But sometimes, the dip increases seaward, forming unconformities and delta-like features that indicate that the current flow was perpendicular to the shoreline and not parallel as expected by wind generated currents. Hedberg (1970, p. 11) stated that the “reflection profiling has shown that many slopes in their present form are the result of prograding sedimentation.” This prograding wedge of sedimentation is perpendicular to the coast.

The dip of the sedimentary rocks of the coastal margin is steeper where they are buried deeper (Steckler et al., 1999), reinforcing the role of differential vertical tectonics. King (1982, p. 45) commented in regard to the continental margin sedimentary rocks off southeast Africa:

We note that all the formations drilled dip offshore. The oldest and deepest formations dip at several degrees, the youngest and upper most dip at less than one degree.

Such a profile of the subsurface sedimentary rocks of the continental margin indicates a broad scale uplift of the adjacent continental area and sinking of the continental margin, probably along with the ocean basins farther seaward (Uchupi and Emory, 1967; Pazzaglia and Gardner, 1994). This is consistent with the subsidence of guyots far from land that were probably planed off close to sea level but whose tops are now at an average of 1,500 m below sea level (King, 1983). The hinge line for this uplift and subsidence is near the coast. King (1983, p. 200, emphasis added) summarized:

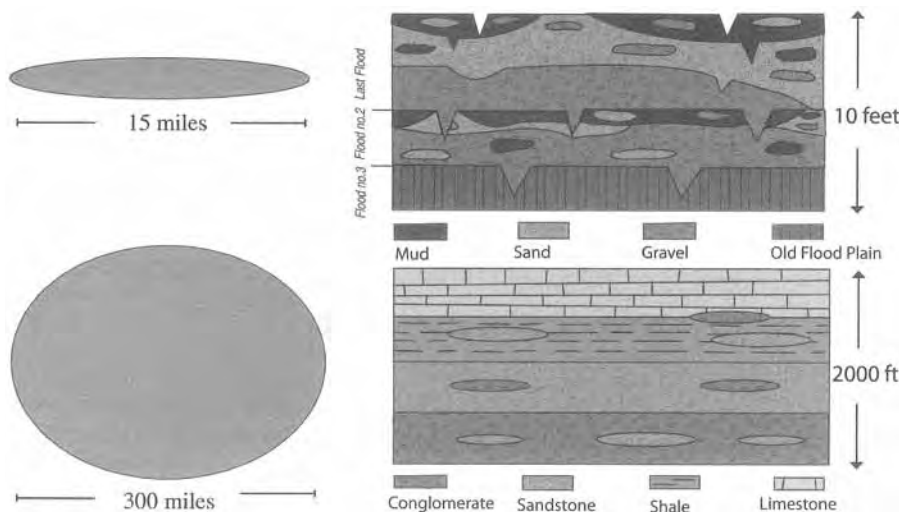


Figure 18. Schematic comparing the scale and character of uniformitarian sedimentation in local floods (top) contrasted with the Genesis Flood (bottom). The left side is an aerial view, while the right side is a vertical cross-section. Note the much larger aerial and vertical scale of flood deposition with little or no erosion at the contacts between types of sedimentary rock. From Oard (2008, p. 26).

The formations and unconformities have been tilted seaward (monoclinally) at intervals during the later Cenozoic. There have been repeated tectonic episodes: *always in the same sense—the lands go up and the sea floor down.*

King indirectly quoted Psalm 104:8! He believed that stepwise tectonic movements caused the unconformities, but others believe such unconformities could be caused by other processes, such as the change in the amount of sedimentation (Steckler et al., 1999). King also believed that the vertical tectonics occurred quite late in geological time, which would correspond to the late Flood differential vertical tectonics.

This pattern, seen in the Appalachians, is also observed worldwide. Differential vertical tectonics explains features at a variety of scales, from interior mountain basins (Oard, 2008) to the megaregional continental margins. This also answers the common canard about the relationship between the Flood and marine strata

found on high mountains; the difference in elevation was once much less during the Flood (Oard, 2009b). The same features are seen in ocean basins, as shown by fracture zones and the ubiquitous abyssal hills (Oard, 2008).

The timing of the erosional and depositional event that formed the current Appalachian geomorphology and the sedimentary wedge of the continental margin clearly was relatively late. Geologists date these events mostly in the Cenozoic. Thus, in this region, the end of the Flood coincides with the late Cenozoic, similar to many other features found around the planet (Oard, 2007).

Implications for Actualism

The large-scale, uniform sedimentation finds no place within classical gradualism and is hard-pressed to be explained by neocatastrophist concepts. Uniformitarian erosion and sedimentation is generally linear and small scale (Figure 18). But the continental shelf and slope sediments are mostly planar.

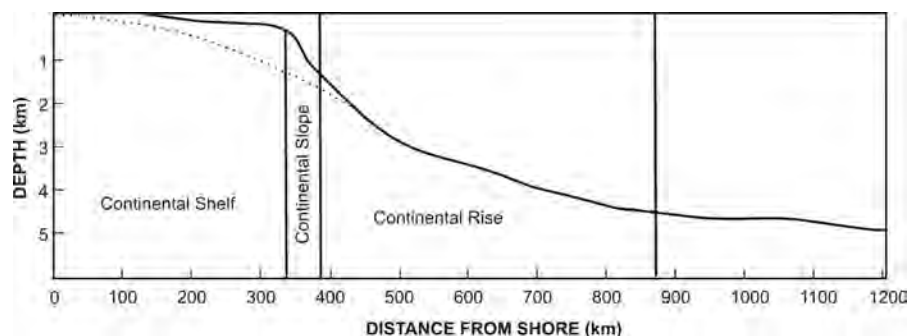


Figure 19. Principle features of a wide Atlantic-type margin with a continental rise (vertical exaggeration 50x). The dashed line represents the expected profile of the continental margin if formed over millions of years according to King (1983). Modified from Kennett (1982, p. 27)

The surface profile of the continental margin is also contrary to expectations of gradualists. Natural processes operating at lower energy levels over longer periods would generate a steady slope from continent to abyssal plains; there should be no continental shelf or slope. Figure 19 shows the current profile of the continental margin with the dashed line showing the slope predicted by gradual processes. King (1983, p. 199, emphasis added) described this puzzle:

There arises, however, the question as to what marine agency was responsible for the leveling of the shelf in early Cenozoic time, a leveling that was preserved, with minor modification, until the offshore canyon cutting of Quaternary time? Briefly *the shelf is too wide, and towards the outer edge too deep*, to have been controlled by normal wind-generated waves of the ocean surface.

At the time King wrote these words, many scientists believed that submarine canyons were young features formed by the lower sea level of the “Quaternary” Ice Age. However, researchers now realize that submarine canyons must have taken much more time to erode in their paradigm (Oard, 2008).

Ocean currents are commonly parallel to the coast, and such is the case here,

with the Gulf Stream (Kennett, 1982). Sediments today are mainly supplied to the continental margin by rivers. These rivers create deltas, with shore-parallel currents spreading the sediment along the continental margin. Slumping and other mass movements cause the sediment to slide down to the deep ocean basins. If these processes operating over millions of years had formed the continental margin, we would expect quite different features from those actually observed.

Summary

The Appalachian Mountains include (from east to west) the Piedmont, Blue Ridge Mountains, Valley and Ridge, and Appalachian Plateaus provinces. Geological features, such as near-surface high-rank coal, geomorphologic features, and the volume of derivative sediment generally agree in suggesting comprehensive erosion averaging 4–6.5 km in depth from the entire region. The best explanation of the geomorphology of the mountains and adjacent continental margin is erosion along the entire length of the mountains by sheet flow perpendicular to the Appalachian axis. Eroded detritus was transported, sorted, and deposited along the ad-

jacent subsiding continental margin, creating a unique continental shelf and slope system that cannot be explained by the long-term work of present-day processes, even granting higher rates of energy. Instead, these features support the work of the early retreating stage of the Genesis Flood. The Flood/post-Flood boundary in this region is clearly in the very late Cenozoic since the uplift, huge erosion, and the thick sedimentation of the continental margin predominantly occurred during the Cenozoic of the uniformitarian timescale.

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 JoC: *Journal of Creation, Technical Journal, or Creation Ex Nihilo Technical Journal*
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The Little Ice Age in the North Atlantic Region

Part II:

Magnitude, Extent, and Importance of the Little Ice Age

Peter Klevberg, Michael J. Oard*

Abstract

Controversy has surrounded the term “Little Ice Age” since its inception in 1939. While some degree of cooling is acknowledged in the Northern Hemisphere in recent centuries, the magnitude, extent, and timing of the Little Ice Age remain controversial. A tendency to downplay both the Little Ice Age and the preceding Medieval Warm Period has accompanied the recent emphasis on climate change in general and global warming in particular. Secular scientists and diluvialists hold different assumptions about natural history, and employ different methodologies in paleoclimatology, resulting in different opinions about future climate change. While inferred past ice ages are entirely speculative, the Little Ice Age is constrained by historical data, providing a unique opportunity to evaluate natural history speculation. Although instrumental records are too brief to allow anything more than calibration of transfer functions for climatic proxy data, these proxy data are particularly good for the North Atlantic region, which also can provide useful geographic conditions for testing predictions of the rapid, postdiluvial ice age model. The first paper in this series provided background for the methods used to study climates of the past. This paper summarizes evidence for past climate change and provides a description of the study area.

Was the Little Ice Age Regional?

Could the Little Ice Age have been just a European phenomenon? The question

is an important one, especially in regard to the applicability of the data obtained from the Little Ice Age to testing natural history scenarios on a broader scale.

Global Evidences

The best historical data for the Little Ice Age are from the North Atlantic region; although historical accounts are available from China and Japan, proxy data must be relied upon for most of the rest of the world (Grove, 1988). These data do provide a strong case for a period of widespread glacial advance across the earth—a little ice age. In particular, one

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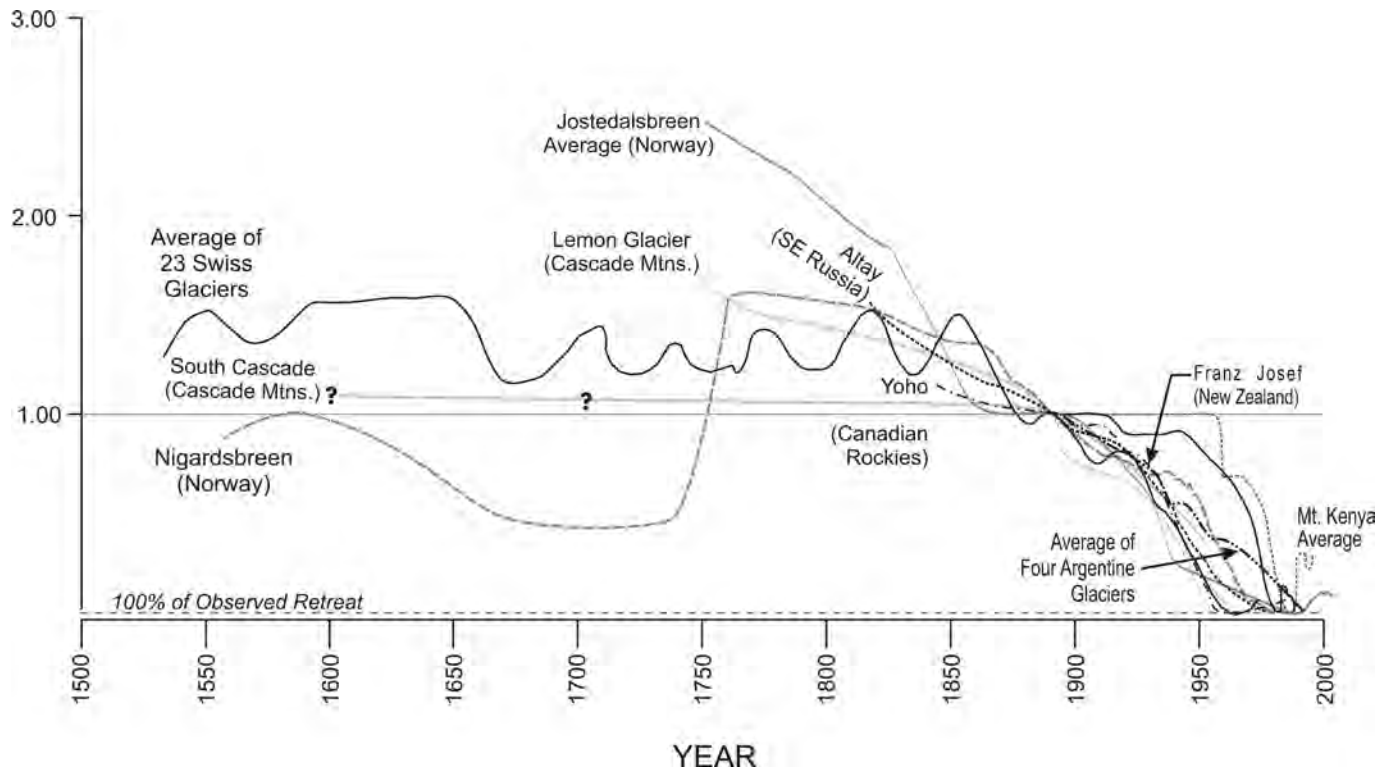


Figure 1. World glacial fluctuations. Frontal positions of representative glaciers from various temperate regions of the world. The reference datum (horizontal line at 1.0) chosen to standardize these data is the frontal position of each in 1890. Data from Grove (1988) and Kjølmoen (2007).

form of proxy data—measurements of the glaciers themselves—is particularly useful (Oerlemans, 2005). Some important records are presented in the form of Figure 1.

“Glaciers on every continent have expanded in the last few centuries; the Little Ice Age was a global phenomenon” (Grove, 1988, p. 354). Jean Grove’s salient work on the Little Ice Age presents data from far beyond the North Atlantic region: Switzerland, Russia, the Himalayas, East Africa, Indonesia, New Zealand, South America, and North America. These show a roughly contemporary fluctuation of glaciers in these distant places (Oerlemans, 2005)—perhaps even more strictly contemporary if we account for some of the uniformitarian biases that may affect proxies. Even areas without glaciers have produced records

of climate change that support the conclusion that climate fluctuations driving the Little Ice Age reached far beyond the North Atlantic region (Grove, 2001; Hendy et al., 2002; Pienitz et al., 2000).

Regional Influences

The most prominent regional influence invoked to attempt to explain the Little Ice Age is the North Atlantic Oscillation (Fagan, 2000; Mann, 2002). A “positive index” for the North Atlantic Oscillation (N.A.O.) resembles the situation shown in Figure 2, while a “negative” N.A.O. index has high pressure over Iceland and low pressure near the Azores. A “positive index” is associated with strong westerly flow from the North Atlantic Ocean to Europe, with milder conditions, while a “negative index” produces reduced flow and greater winter-summer con-

trast, with more of the storms heading south to the Mediterranean. Changes in the N.A.O. produce a “seesaw” effect between Greenland and Europe; for example, a mild winter in Greenland is likely to coincide with a hard winter in Europe. Clearly the N.A.O. cannot explain the Little Ice Age itself, since temperatures fell and glaciers advanced on both sides of the North Atlantic, so variations in the N.A.O. explain only the decadal-scale variations within the Little Ice Age (Barlow, 2001). The global cooling signal was therefore stronger than the regional (Grove, 1988).

When Was the Little Ice Age?

The term “Little Ice Age” was originally coined by F. Matthes for what is generally called today the “neoglacial”

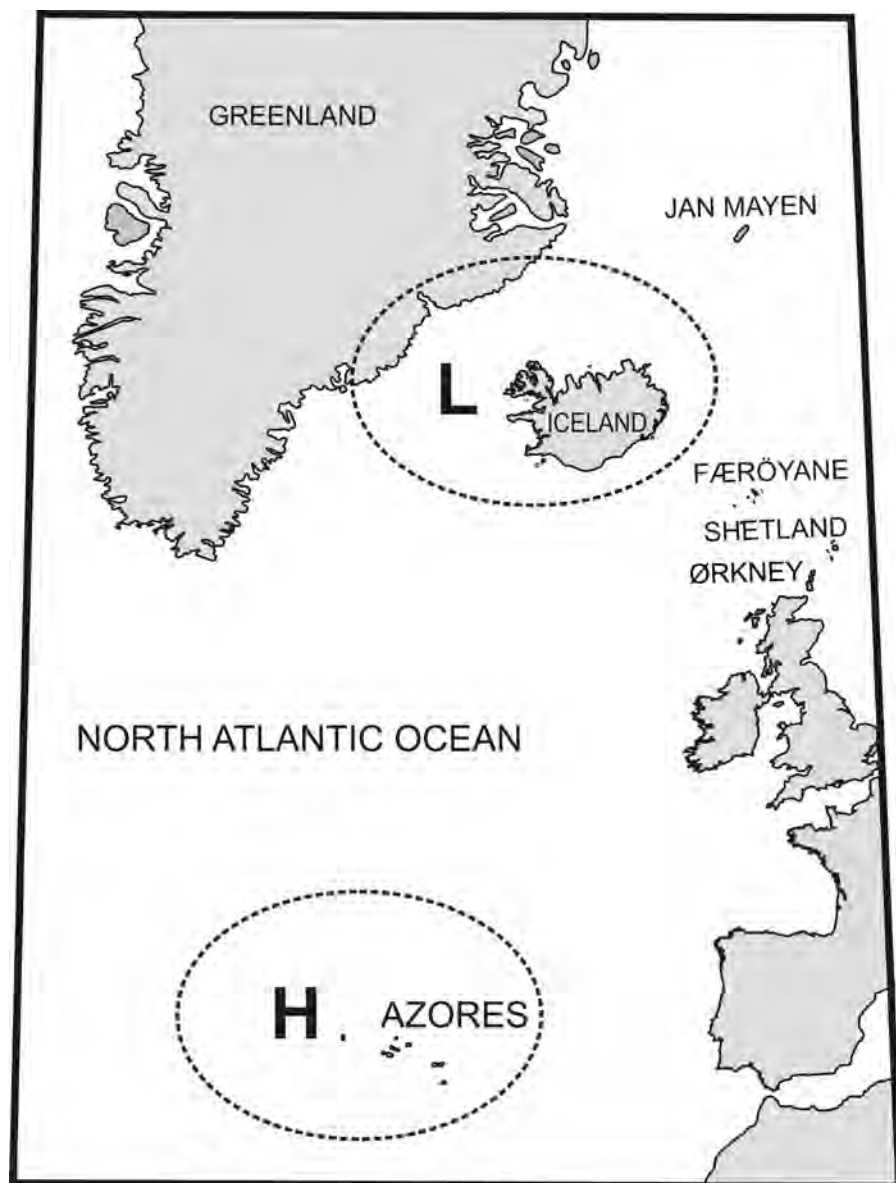


Figure 2. The North Atlantic Oscillation. The N.A.O. is shown in “positive” or normal mode; a “negative” N.A.O. index would have high barometric pressure over Iceland and low over the Azores.

period (Mann, 2002; Ogilvie and Jónsson, 2001). It has now come to be used for an equivocal period in late medieval to early modern times, depending on the definition. The definition may be climate-based, or it may be based on observed glacial response, which is a less used but more objective definition. Regardless of the approach taken, and

contrary to naysayers (Mann, 2002), the Little Ice Age was still a phenomenon that is reasonably definable on a global basis.

The beginning of the Little Ice Age in Iceland may be placed at about 1360 or as late as 1500, depending on the climatic changes or glacier positions one chooses to define it (Ives, 2007).

Fell (1999) describes a “worsening” of the climate after 1200 but “much worse” in the seventeenth and eighteenth centuries. Onset of the Little Ice Age occurred at a similar time in Norway and Greenland (Grove, 1988). The Little Ice Age peaked in Iceland, Norway, and Greenland about 1750 to 1850 (Grove, 1988; McKinze et al., 2005). In Norway, the Little Ice Age ended about 1880 according to Nordli (2001), which coincides with the maximum extent of major outlet glaciers in Iceland (Ives, 2007). For Western Europe, the reconstruction of Guiot et al. (2005) provides a marked cold period from AD 1560 to 1930. Oerlemans (2005), in an investigation of glaciers worldwide, placed the peak of the Little Ice Age at about 1800.

“The timing attributed to [the Little Ice Age] has varied considerably from author to author, perhaps reflecting real regional differences. However, this lack of agreement could be due in part to the uneven distribution and character of the evidence available, to the dating techniques used, and their resolution, and possibly to differing degrees of effort devoted to unravelling glacial history” (Grove, 2001, p. 54). Apparent differences in timing sometimes result from uniformitarian bias in dating methods, as described in part I of this series, and sometimes from natural factors. Lichenometry is probably the chief method for Little Ice Age moraine dating (methods and difficulties of lichenometry are described in Appendix B). But differences in timing may also be real. Differences in timing from region to region can be a natural response to climatic forcings (Juckes et al., 2007). In general, the Little Ice Age is considered to start about 1350 and end around 1880.

Did the “Medieval Warm Period” Exist?

The Medieval Warm Period is even more controversial than the Little Ice

Age. This is partly to be expected, since the Medieval Warm Period is even more distant in time from us than the Little Ice Age. The end of the Little Ice Age, in fact, occurred during the instrumental period, the time of photography, and a time with significant expansion of population and technology. Whether the Medieval Warm Period existed is a question entirely dependent on historiography and proxy data.

Arguments against the Existence of the Medieval Warm Period

Many dispute the existence of the Medieval Warm Period, especially strong advocates of the man-caused global warming theory, some of whom also reject the existence of the Little Ice Age itself (Mann, 2002; Ogilvie and Jónsson, 2001). Most of the data marshalled against the existence of a significant period of time warmer than the present are proxy data, not historical data, and are typically tied to varves, radiocarbon dating, or ice cores. In general, they are simply inconclusive data or very dependent on subjective or local factors, not data that refute the Medieval Warm Period (e.g., Clement and Horn, 2001; Cook et al., 2007; Retelle and Johnson, 2007; Stevens et al., 2001). These proxy data have been smoothed and “massaged” and may be variously interpreted (Esper et al., 2005), including to denying the Medieval Warm Period entirely or at least as anything comparable to current conditions (Mann and Jones, 2003; Juckes et al., 2007).

Arguments for the Reality of the Medieval Warm Period

While models such as that promoted by the Intergovernmental Panel on Climate Change (IPCC) tend to downplay (if not deny) the Medieval Warm Period, others support it (Esper et al., 2005; Guiot et al., 2005), and historiography (i.e., the body of contemporary historical accounts) supports them. A considerable number of proxy data are

more readily interpreted by a significant Medieval Warm Period (Anderson et al., 2007; Brown et al., 2005; Eiríksson et al., 2000; Fréchette et al., 2006; Heyerdahl and Lillieström, 1999; Keigwin, 1996; Ogilvie and Jónsson, 2001), including in locations outside the North Atlantic region (Brown et al., 2005; Keigwin, 1996). Diluvialists, recognizing the catastrophic and providential nature of history, should be aware of the limitations of climate modeling, particularly when the models are based on uniformitarian assumptions and methods. In the realm of history, natural history or otherwise, the methods and records of history take precedence.

Whether the Medieval Warm Period existed as a global phenomenon is another and more difficult question, though proxy evidence seems to confirm it (Broecker, 2001; Grove, 1988). Further evaluation of the regional or global nature of the Medieval Warm Period is a promising area for future research but is beyond the scope of this paper.

English and German Agriculture

Both England and Germany had well-established wine industries during early medieval times, and both were forced to cease due to climate change (Fagan, 2000). Agricultural changes extended well beyond the wine industry and were not primarily driven by social conditions, disease, or other nonclimatic factors, as both weather records and general historical accounts indicate. Weather records from England are particularly complete.

Swiss Agriculture and Settlement

Switzerland is particularly important in studies of the Little Ice Age. Records are very good, and impacts from growing glaciers were both severe and widespread. Valleys, farms and towns, and mountain passes were overrun by ice. The extent of agricultural development and trade routes indicate conditions in early medieval times as warm as or warmer than today (Grove, 1988).

Icelandic Glaciers

Icelandic glaciers were much subdued relative to today at the time of the country's settlement (*Landnám*). Rivers had deeper, more established courses than today (*Landnåmsboken*, 1997), and the outwash plains (*sandur*) that are today barren and often ravaged by catastrophic outburst floods were then generally fertile and well vegetated. The much-reduced nature of Icelandic glaciers prior to the thirteenth century will be more fully documented in part III of this series.

Icelandic Crops

As will be described in part III, cereal grains were grown in various parts of Iceland during the Medieval Warm Period. As the climate cooled in the 1200s, the range of grain growing was steadily reduced, and finally ceased altogether (Grove, 1988). It is now possible to grow barley again on the southern coast of the Icelandic mainland (Figure 3) but not on the north or east coasts.

Norwegian Forests

The Medieval Warm Period was not the *clima optimum* in Norway; this occurred much earlier, as indicated by remains of pine forest on Hardangarvidda, far above the present treeline (Lillehammer, 1994). The greater warmth of the Medieval Warm Period is, however, indicated by the extent of pine-oak forest where spruce-birch now predominates and agricultural development at elevations above what can be sustained today (Helle, 1994).

Agriculture in Greenland

As will be described in part V, Norse Greenland was an agricultural society. The population of Greenland was well in excess of what could be supported by the traditional Inuit (Eskimo) lifestyle. As advancing ice covered farms, increasing cold stunted vegetation, and falling water temperatures chased cod from the Davis Strait, Greenland's agriculture collapsed (Fagan, 2000).



Figure 3. Photograph of barley stubble on south coast of Iceland, April, 2002.

Elsewhere

Records from other parts of the world (Western Hemisphere, Southern Hemisphere) tend to be few and relatively recent. They document retreating ice with the end of the Little Ice Age but do not generally extend far enough back to document whether the Medieval Warm Period was global. The few proxies that cover longer periods and low latitudes tend to be more prone to speculation and interpretation, with the predictable controversy resulting (Grove, 1988; Lindeholm et al., 2009).

Little Ice Age Was Not Uniformly Cold

Various fluctuations in climate, both regional and more general, occurred throughout the Little Ice Age (Fagan, 2000; Guiot et al., 2005). Phrases such as “the terrible winter of 1678,” “the terrible winter of 1684,” and “the terrible winter of 1888” (Poirier, 1960) imply that these were in fact unusual years. Uniformly cold conditions would cease to be mentioned after approximately one

generation, since observers would then be accustomed to the conditions. “Climatic research from more recent times has pointed to the 1400s as the period in Europe’s history when the climate was the worst, and especially the 1430s and 1450s” (Bjørnvik, 1994, p. 35). The Little Ice Age appears to have peaked earlier and ended earlier in Switzerland and southeastern Europe than in the North Atlantic region, which is the subject of this paper (Grove, 1988). Thus, the Little Ice Age was a period of significant variability, but it was also a time during which cold, especially hard winters, clearly predominated (Eiríksson et al., 2000; Fagan, 2000).

The Little Ice Age—What Difference Does it Make?

The Little Ice Age holds a special potential for the application of science to the study of natural history—it is historically constrained. Natural history scenarios are often rendered believable by their remoteness from observation, which the Little Ice Age was not. Research into the

Little Ice Age may be a good means of discrediting some of these speculative models and, beyond that, illuminating the worldview struggle that underlies disagreements in beliefs about Earth history.

Good Science versus Political Manipulation

Whenever you hear, “The science is in,” you know that science is out. Science deals in probabilities, not certainties. Certainties require divine revelation, and true science is always subject to revision as new data are acquired and old ideas are disproved. No doubt the domination of empiricism and evolutionism in Western culture over the past couple of centuries has conditioned the masses to accept such oxymorons as “scientific certainty” and “scientific consensus.” A dose of good science may inject an element of healthy debate into this arena, perhaps even helping to free science from the clutches of a disingenuous and manipulative political elite.

Good History versus Political Manipulation?

Those enlightened by divine revelation understand the personal nature of evil in the world and the purposive corruption of what God has created (2 Cor. 2:11). The Bible is a book of history, and it is no coincidence that so-called “postmodernism” (or “nonreason” per Schaeffer, 1982) rejects the value of history with a skepticism *ad absurdum* and often rationalizes falsehoods based on desired social or political outcomes (Grenz, 1996; Veith, 1994). The threat this poses to science has been pointed out (Anderson, 2007, 2008; Klevberg, 1999, 2008). That this is behind at least some of the junk science (e.g., Gore, 2006) at the surface of the global climate change question is clear. Regardless of postmodern denials, one’s view of history determines one’s view of the present and future, and it is for this reason that the forces of evil have so virulently attacked not just the verac-



Figure 4. Map of North Atlantic region. Gray arrows indicate comparatively warm ocean currents; black arrows indicate cold currents.

ity of the Bible in general, but also the account of natural history it provides us. The good historiography of the Little Ice Age, especially from Europe, is helpful in this struggle over the nature of history.

Good Research versus Evolutionism

Many evolutionists have contributed good research for our understanding of the Little Ice Age, and we will cite them throughout this series. We contend that their research is conducted despite their worldview, not because of it, and actually rests on principles of honesty, the objective nature of reality, the uniformity of natural processes, and allied concepts derived from the Biblical worldview (Morris, 1984; Schaeffer, 1982; Reed, 2001; Reed et al., 2004).

Evaluating the Great Ice Age

We have no historical proof of a great ice age. Most creationists accept the idea of

a single, significant ice age in the early postdiluvian period. This position has been well developed and its plausibility well established (Oard, 1990, 2004). Evolutionists, loath to accept the idea of unique geologic events, speak of “ice ages” during the “Pleistocene” and other times in Earth history, clear back over 2 billion years ago (Oard, 1997). Since climate models are simply sophisticated and mathematically refined guesswork, there is no means of constraining speculation regarding a great ice age. However, this is not true for the Little Ice Age.

Quantifying “Quaternary” Geology

“Pleistocene” or “quaternary” geology in much of the Northern Hemisphere deals largely with deposits believed to result from continental glaciation. Like paleoclimatology, historical geology is a branch of history that can roam unfettered to the realms of absurdia without

scientific constraint. The Little Ice Age provides significant constraint and opens avenues for quantitative evaluation of likely glacial deposits. This provides a new level of insight into geologic processes and deposits.

The North Atlantic Study Area

As shown above, the Medieval Warm Period and Little Ice Age impacted far more than just the North Atlantic region (Figure 4). However, we have chosen to focus on the North Atlantic due to its good historical data, variety of climates (temperate to polar), degree of glaciation both before and during the Little Ice Age, and to scale back our task in the face of the enormity of the subject. We employ the definition of Jean Grove (Ogilvie and Jónsson, 2001): the Little Ice Age was a period of widespread glacial advance on a global scale during the past millennium. Much of Europe that shows evidence of past glaciation (e.g., Great Britain, Germany) was not affected by glaciation during the Little Ice Age and is therefore excluded from our study. We also excluded the Alps, since Switzerland is in a continental setting less suitable to our desired application to a postulated postdiluvian ice age.

One might also argue the choice of the study area may be partly due to the ethnic heritage of the lead author. For various reasons, an abundance of pertinent literature has not gained the attention of the English-speaking audience. Unless otherwise noted, translations from Norwegian and Danish in this series and efforts at deciphering Icelandic and Old Norse are those of the lead author.

Summary

The complexities of paleoclimatology belie efforts at simplistic affirmation or denial of the Little Ice Age, but evidence is significant that terrestrial climate was cooler for a period of several centuries

worldwide compared with today's average temperatures and the averages of the early second millennium (the Medieval Warm Period). With the definition of the Little Ice Age as a period of roughly contemporary advance of glaciers worldwide, we affirm the existence of the Little Ice Age and find the term useful in describing the period of roughly 1350 to 1880. Because good historiography and even some instrumental records exist for this period in key locations of the North Atlantic region, the Little Ice Age provides a key to understanding climate change in the postdiluvian period, tempering political rhetoric and naturalistic speculations and offering hope for insights into the much more substantial Great Ice Age and glacial geologic processes in general.

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Glossary

Diluvialist – one who maintains that the Deluge of Noah's day was the principal global geologic event in earth history since the Creation.

Historiography – the body of historical records on a particular topic; also, the manner in which historical research is conducted, particularly in reference to a particular topic.

Postdiluvian – the period of earth history after the Deluge (Genesis Flood), probably consisting of a time of residual catastrophism and a great ice

age followed by a more stable period of relative climatic equilibrium.

Paleolimnology – the study of earth history using samples of lake sediments.

Proxy – a phenomenon that is mathematically or causally related to the phenomenon of interest; e.g., length of growing season can be a proxy for average annual temperature.

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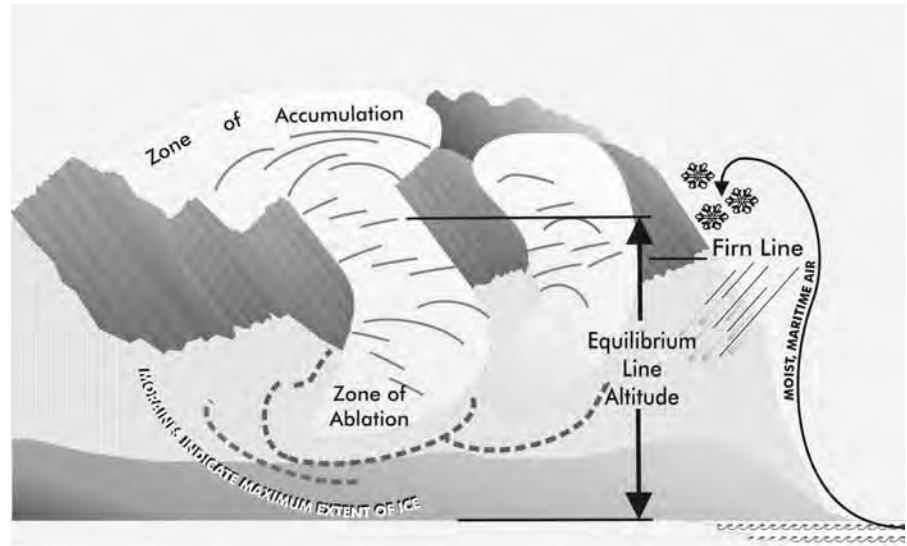


Figure 5. Glacier schematic.

the glacier is steep, with a large zone of accumulation, much ice can move far below the equilibrium line altitude (ELA), even to sea level. Such a glacier may respond quickly to changes in precipitation. If the glacier follows a low

gradient, a slight change in ELA may produce a very large response by greatly increasing or decreasing the ratio of accumulation area to ablation area, but the movement of ice over the low gradient is likely to be slow. Glaciers that respond

Appendix A: Glaciology Primer

Glaciers have the following components.

- A zone of accumulation, where snowfall exceeds snowmelt and ice is produced.
- A zone of ablation, where annual melting of ice exceeds the formation of ice from snow.
- A firn line, an elevation above which precipitation falls as snow.
- An equilibrium line altitude, the elevation that separates the zone of accumulation from the zone of ablation (usually very close to the firn line).

These components are illustrated in Figure 5.

Geography significantly impacts the response of glaciers to climate. If



Figure 6. Photograph of lichens on basalt rock. For lichenometry, *Rhizocarpon geographicum* is preferred. Photograph by Mark Armitage.

slowly to changes have large lag times. For example, if a particularly warm and dry decade were to interrupt otherwise normal years, a glacier with a long lag time could be stable or actually advance throughout that dry and warm decade, and begin receding during subsequent years that are wetter and colder again. In Iceland, differences in lag times between some of the steeper, smaller glaciers and large outlet glaciers may have exceeded a century (Kirkbride and Dugmore, 2001). With differences in lag times, inferring climate from glacial response can be tricky.

Appendix B: Lichenometry

Lichenometry is a commonly used means of dating moraines. When the ice withdraws, rocks are colonized by lichens (Figure 6). The method is simple: find the largest lichen, measure it, and figure out how old the moraine is by the rate of growth of the lichen. In practice, it is not very exact, with lots of potential problems (Grove, 1988; Kirkbride and Dugmore, 2001; Thompson and Jones, 1986). A better statistical basis is needed for the “largest” lichen (Caseldine, 1991;

McKinze et al., 2005), a measurement method must be defined (Kirkbride and Dugmore, 2001), local curves linked to known dates (e.g., gravestones, buildings) are needed (Grove, 1988; Kirkbride and Dugmore, 2001; Kugelman, 1991), and growth rates may be nonlinear. In some cases, lichenometric dates have been disproven by tephrochronology or other methods (Kirkbride and Dugmore, 2001; McKinze et al., 2005). Nonetheless, it can provide an educated guess for features from the Little Ice Age (Thompson and Jones, 1986).

Notes from the Panorama of Science

Reevaluation of Earth Age Using Hung's Dating Model

Introduction

The dispute on the age of Earth between scientists and Biblical theologians has continued for centuries. Currently, most scientists claim an age of 4.5 billion years (US Geological Survey, 1997; Dalrymple, 2001), whereas James Ussher, priest of the Anglican Church, calculated it to be 6014 years from the present (Ussher, 1650–1654). Intensive study made by the group Radioisotopes and the Age of the Earth (RATE) concluded that the age of Earth should be thousands of years but not billions of years (DeYoung, 2005).

The author's recent publication pointed out that the traditional model, which geologists use in dating the age of minerals and rocks, contains serious theoretical deficiencies (Hung, 2004, 2008). As a result, the traditional model overestimates the age of minerals. These deficiencies were inevitable because of lack of computational technology and equipment when the traditional dating model was developed. The same article also presented Hung's dating model, which was developed with sound theoretical bases, for dating the age of rocks and minerals.

This paper applies Hung's dating model to convert the age of Earth claimed by scientists to a more realistic age and presents the processes and results of the conversion. The converted age of Earth is expected to be free from the huge error inherited by the traditional model.

Description of Hung's Dating Model and Traditional Model

Because uranium minerals are constantly inundated in a groundwater stream, a geochronological dating model should involve solving the flow equations and solute transport system equations (e.g., Hung, 1986, 2000, 2004, 2008; Hydrogeologic Inc., 1995; Leak and Lilly, 1997; Yeh et al., 2002). The flow equations and solute transport system equations used in Hung's dating model are summarized in a Cartesian coordinate system (Hung, 2004, 2008) as:

$$v_i = -K_i k_{rw} \frac{\partial h}{\partial x_i} \quad (1)$$

(for $i = 1$ to 3)

$$\sum_{i=1}^3 \frac{\partial}{\partial x_i} \left(K_i k_{rw} \frac{\partial h}{\partial x_i} \right) = 0 \quad (2)$$

$$\begin{aligned} \frac{\partial}{\partial x_i} \left(D_{ij} \frac{\partial c_k}{\partial x_j} \right) - v_i \frac{\partial c_k}{\partial x_i} &= \phi S_w R_k \frac{\partial c_k}{\partial t} \\ &+ \phi S_w R_k \left(\lambda_k c_k - \frac{A_k R_{k-1}}{A_{k-1} R_k} \lambda_{k-1} c_{k-1} \right) \end{aligned} \quad (3)$$

(for $i = 1$ to 3 , $j = 1$ to 3 , and $k = 1$ to ℓ when $k-1 > 0$)

In the above equations, v_i are the components of Darcy velocity, K_i are the components of saturated hydraulic conductivity, k_{rw} is the relative conductivity, h is the hydraulic head, x_i are the spatial coordinates, D_{ij} is the component of apparent hydrodynamic dispersion tensor, c_k is the concentration of the k th daughter-nuclide in the ℓ member decay chain desorbed in the water; Φ is the effective porosity, S_w is the degree of water saturation, R is the retardation factor, λ is the radionuclide decay constant, A is the atomic weight, and subscripts k , i and j represent the order of daughter nuclide in the decay series and x , y , z the spatial coordinates, respectively.

Because of the generic site nature of the model, the same properties for the ambient host rock and mineral collected in the original Hung's model are also used in this analysis (Hung, 2004, 2008). They are listed in Tables 1 and 2, respectively for the porosity, density, hydraulic conductivity, and dispersivity.

The processes of solving the above dynamic equations are extremely complex, and involve tedious numerical analyses. To avoid these complex processes, the traditional model simplified them by imposing two crude assumptions: (1) a closed system and (2) ultimate equilibrium. The first assumption eliminates the necessity of flow equations, and the second assumption avoids its tedious transient decay calculations (Hung,

Table 1. Collected porosity and density for ambient host rock and mineral.

Transport media	Porosity, unit-less	Density, g/cm ³
Ambient host rock	0.03	2.67
Mineral	0.01	2.65

2008). As a result, the solution of the above system equations was simplified and expressed as (Durrance, 1986; Getty and DePaolo, 1995):

$$t = \frac{1}{\lambda_{238}} \log_e \left[\frac{{}^{206}\text{Pb}(t)}{{}^{238}\text{U}(t)} - \frac{{}^{206}\text{Pb}(0)}{{}^{238}\text{U}(t)} + 1 \right] \quad (4)$$

where, λ_{238} represents the decay constant for ${}^{238}\text{U}$, t represents the time, and ${}^{206}\text{Pb}(t)$ and ${}^{238}\text{U}(t)$ represent the number of atoms for ${}^{206}\text{Pb}$ and ${}^{238}\text{U}$, respectively. Thus, the age of a mineral can be calculated from Equation 4 once the ${}^{206}\text{Pb}/{}^{238}\text{U}$ ratio of the mineral is measured and its ${}^{206}\text{Pb}(0)/{}^{238}\text{U}(t)$ ratio is properly estimated. Equation 4 is the basic equation of the traditional model. Unfortunately, the traditional model constantly overestimates the age of minerals and rocks and is, therefore, impractical for dating application (Hung, 2008).

An exact model, which is known as Hung's dating model (Hung, 2004, 2008), solves the exact partial differential equation system listed in Equations (1–3). The model was implemented in a personal computer. The model is applied to convert the age of the earth obtained from the traditional model to a more realistic age and thereby eliminates the errors inherited by the traditional model.

Reevaluation of the Age of Earth

Scientists claim the age of Earth is 4.5 billion years old (Dalrymple, 2001) based on the dating results obtained from

geologic formation. As stated previously, the ages of the earth claimed by scientists were calculated based on the traditional model, which contained large errors in its calculations. These errors may be corrected by converting an age obtained from the traditional model to a more realistic age with Hung's dating model. The conversion starts with the application of Hung's model to a conceptual model. The conceptual model assumes the uranium mineral is contained in an igneous rock formed in the earth's crust and immersed in a groundwater environment. The ambient groundwater flow is slow to near standing still, because of the impervious host rock.

Based on this conceptual model, Hung's model receives the initial condition of radionuclides, which contains only one unit weight (one unit of mass per unit of sample mass) of ${}^{238}\text{U}$, and simulates the variation of ${}^{206}\text{Pb}/{}^{238}\text{U}$ ratio with time. The simulations are conducted for both Hung's dating model and the traditional model. The results of simulations are plotted and presented in Figure 1. The same figure is also used for the conversion of the earth's age. The conversion takes two steps. The first step applies the conventional age of Earth of 4.5 billion years old to the simulated ${}^{206}\text{Pb}/{}^{238}\text{U}$ versus time line from the traditional model (Figure 1). The plot shows that at the time of 4.5 billion years the ${}^{206}\text{Pb}/{}^{238}\text{U}$ ratio is 0.62. The second step applies the same ${}^{206}\text{Pb}/{}^{238}\text{U}$ ratio of 0.62 to the curve obtained from Hung's dating model to obtain the age of earth to be 220,000 years old. The results of conversion are also plotted and presented in Figure 1. The result of conversion indicated that the age of Earth should be 220,000 years old, rather than 4.5 billion years old. The result of evaluated Earth age is much closer to the age claimed by the RATE group.

Conclusions

This study utilizes Hung's dating model to convert the age of the earth claimed by the geologists to a more realistic age. The model adapts a conceptual model that assumes the uranium mineral was formed in the earth's crust when the earth was created and inundated in groundwater environment. The ambient groundwater flow is slow to near standing still because of the impervious host rock.

Table 2. Collected hydraulic conductivities and dispersivities for ambient host rock and mineral.

Transport media	Hydraulic conductivity, cm/sec		Dispersivity, m		
	Horizontal	Vertical	Longitudinal	Lateral	Vertical
Ambient host rock	4.0E-9	2.0E-9	0.1	0.05	0.05
Mineral	4.0E-10	2.0E-9	0.1	0.05	0.05

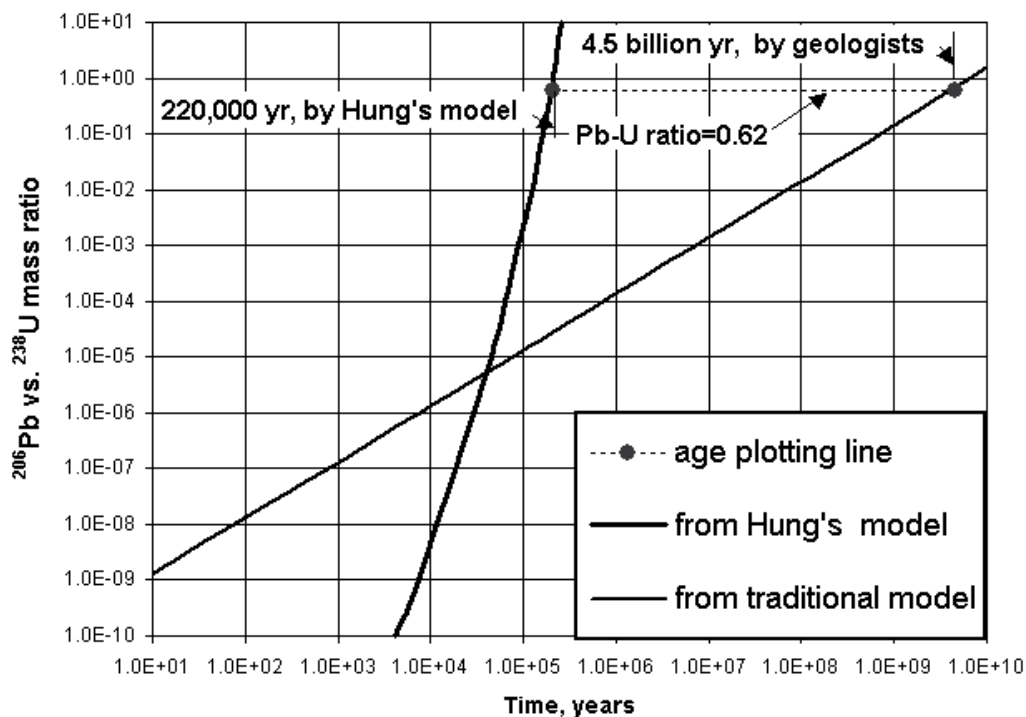


Figure 1. The simulated results of the time variation of $^{206}\text{Pb}/^{238}\text{U}$ ratio from the traditional model and Hung's dating model. The initial condition of the mineral contains one unit of ^{238}U only; the mineral was formed in the earth crust and inundated in a groundwater stream. These results of simulation are used to convert the age of the earth from that claimed by scientists to an age simulated by Hung's dating model. The results of conversion are also presented together in this figure.

The result of conversion indicated that the age of Earth should be 220,000 years old, rather than 4.5 billion years old. The result of evaluated Earth age is much closer to the age the RATE group claimed.

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Letters to the Editor

The policy of the editorial staff of CRSQ is to allow letters to the editor to express a variety of views. As such, the content of all letters is solely the opinion of the author, and does not necessarily reflect the opinion of the CRSQ editorial staff or the Creation Research Society.

Mammals and Mammal-like Reptiles: Within Their Kinds

Our story starts with the discovery of the earliest known modern mammalian jaw hinge at 200 million years old, and then, at 195 million years old, a mammal called *Hadrocodium wui*. This creature had middle ear bones attached to the jaw, as in modern mammals.

Yet it is dated 45 million years before evolutionists expected such a development (Gore, 2003). According to CT scans, these shrewlike creatures had a modern brain (Anonymous, 2011).

These discoveries are enough to wipe out any thought of evolution of any manner in the Jurassic, leaving all that we see, or could be, from then on being within the kind. Mammal-like reptiles, for the most part, were too specialized to be the ancestors of mammals. To my mind, their skull profile is not the same. They were far larger than those shrewlike creatures and, for the most part, their reign ended in the Triassic.

At 164 million years is a mammal with fur and modern skin structures and a beaverlike tail, named *Castorocauda lutrasimilis* (Hect, 2006). This creature had overlapping ribs, a feature found in Cynodonts but not in those mammal-like reptiles viewed to have evolved into mammals. Hence, this feature was not handed down nor did it re-evolve, because re-evolution simply does not occur. Rather, they were either created,

or formed by the life-form's genetic potential, thus creating a significant gap between mammals and mammal-like reptiles (Hect, 2006).

This principle operates in other areas also. The brain cells of early mammals are found in early Cynodonts but are not found in the advanced forms, once again not a handover or re-evolution but created or formed by the life-form's genetic potential within creation (Kermack et al., 1981).

Like the platypus, there were some unique mammals in the past, some with a different sound-conducting system, using some reptilelike bones in the jaw. It must be noted they were within their kind.

Marsupials are born with a reptilelike jaw joint. Did they once have reptilelike bones in the jaw that have now moved into the ear? Most of the marsupial ear is akin to the placental ear. Only the stapes bears a slight resemblance to those of mammal-like reptiles. However, it must be pointed out that [according to evolutionary theory] mammal-like reptiles died out long before marsupials entered this world. So, any shared features would either be due to their being directly created or brought about because of the life-form's genetic potential (Brown, 2010a, 2010b).

The point is this: do not always hold today's life-forms as being the yardstick of the way things have always been. Also, allow the greatest gift the Creator has bestowed on His creation—the wonderful ability to adapt, which, thanks to symmetric variation, will always be within the kind, no matter what features life-forms have or could produce (Brown, 1999, 2009).

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Harmonizing Humphreys, Hartnett, and Gentry

Humphreys (1994) pioneered the white hole theory in 1994 by solving Einstein's field equations in a novel way. A white hole continuously created matter in the past, because no white hole has been observed so far. Therefore, the white hole must have existed in the past. Hartnett (2007) modified the white hole theory using Cameli's solution to Einstein's field equations by using an additional coordinate, namely, the velocity of expansion. By so doing, Hartnett was able to solve all problems of dark matter. Gentry (2005–2005) showed that space cannot be expanded, because space expansion violates the law of conservation of matter/energy. Gentry proposed

that the 1915 paper of Einstein actually points to a static universe. Therefore, space expansion happened only in the early cosmos. Dark energy was proposed to account for the rapid expansion of space. Dark energy takes the energy budget of 74% in the standard model. Since space is not expanding, therefore, no dark energy is required. If space has been expanding, the present radius of the universe should be about 46 billion light years. Yet, the presently observable radius of the universe is only 13.75 billion light years. This means that the universe is not expanding.

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Nephilim vs. Modern Man? A Critique

It is a difficult thing to critique a fellow Christian's work. This is made more difficult when you know this person, when you know he is a fellow young-earth creationist, when you have many friends in common, and when you know you sometimes make similar mistakes. However, the purpose of having peer-reviewed journals is to submit one's ideas to a community for their comments. Thus, it is critical for creationists to both submit ideas and receive criticism of those ideas.

I was propelled to write this particular review by a recent article in this journal by Dr. Joel D. Klenck. In this paper (Klenck, 2010a), he makes some interesting points about human history and the relationship between modern and non-modern humans in the fossil record. His thesis nests nicely with ear-

lier work he has published on dinosaurs (Klenck, 2010b) and the location of the Garden of Eden (Klenck, 2010c), but all of these works rely on a set of starting assumptions to which many creationists take exception. A lot of this discussion necessarily goes back to the arguments between the "American" and "European" schools of creationism about where to place the pre-Flood/Flood/post-Flood boundaries in the rock record, and much of that depends on how much of the uniformitarian model one is willing to accept. Klenck seems to take the evolutionary dates in order, but compresses their timescale, without explanation. He is not the first to attempt this.

Klenck's main idea is that the non-modern human remains found in various places in the world (including *H. neandethalensis*, *H. erectus*, *H. habilis*,

etc.) represent pre-Flood, part-human, "Nephilim" populations. In order to incorporate the available fossil material for both modern and non-modern man into his model, Klenck must place the Flood late, but he then adds a multitude of continental, hemispherical, or worldwide disasters prior to the Flood (alá Cuvier?) in order to bury the fossils in the order he requires. Being that much of the material he cites in this article was found in shallow rock layers or in caves, and that he claims this material is pre-Flood, it must not have been disturbed during the entire Flood year. This would include the inundatory and recessive stages (Walker, 1994), which most Flood geologists believe would have caused significant geological deposition and erosion, respectively. Since some of the supposed pre-Flood

caves have no significant disturbance layers above the non-modern remains, one wonders what geological work was left for the Flood to do.

This harkens back to the famous error of William Buckland who, after studying the fossil bones in Kirkdale Cave (*cf.* Mortenson, 2004), concluded they represented a group of animals killed in Noah's Flood. But this meant that everything prior to that in the fossil record, and that includes nearly all of it, was antediluvian. As many other geologists of the day believed, Buckland thought the Flood did little to no geological work, being restricted to creating surface deposits called "diluvium." He would later recant this opinion, saying that attributing *anything* to Noah's Flood was a mistake. When Louis Agassiz's ideas on the Ice Ages (first published in 1837) were finally accepted, the diluvium was explained and the last vestiges of the evidence for Noah's Flood were removed from secular geology. Even though Klenck affirms young-earth creationism, unlike Buckland and others, he is in danger of following in their footsteps. For example, what criteria does he use for determining whether or not a geological feature was created before, during, or after the Flood? If Neanderthals are pre-Flood, the Flood essentially did no geological work, and the Flood is thus irrelevant for any discussion of geology.

In fact, the Flood is the one place in Scripture where we can turn for an explanation of the origin of the rock and fossil records. Klenck's assertion that the dinosaurs were wiped out and, by association, that the non-modern "Nephilim" humans were buried in a series of huge disasters is not an "argument from silence" but a "conspicuous absence" in Scripture; it is amazing that the author (or authors, if it includes eyewitness accounts [see below]) of Genesis did not mention any of these purported calamities in the one and a half millennia prior to the Flood.

In much of this article, he assumes his conclusions before demonstrating their validity. For example, he frequently references "populations" of Nephilim, but where does it say that in the Bible? It only says some Nephilim existed. Their numbers are not given. He also assumes Nephilim "reproduction," but the Bible only says some Nephilim existed, not that they could, in turn, reproduce with each other or with humankind. One of these might be true, but he has made no argument for it beyond the initial assumption, which he then incorporates into his model and throughout his text. Also, where does the Scripture indicate the Nephilim had a separate "culture" from the rest of mankind? This one point seems particularly strange, but it is necessary for his model. Finally, to have a reproducing population with a specific culture, you need females. In Genesis, the Nephilim are specifically referred to as "men" (Gen. 6:4b). Does this mean no female Nephilim existed? No, but out of two possibilities the Bible only mentions one. All these points are consistent with, but also assumed by, his idea that the Nephilim are represented by non-modern man. Thus, he assumes his model is true from the outset but fails to fill several gaping holes in his logic.

Several additional points can be made against his thesis. First, much of the material he cites has been heavily filtered and thoroughly vetted by the evolutionary community. For example, "we should expect to find our suite of morphological traits [of modern man] in the earliest paleoanthropological contexts," and, "these remains should be associated with the earliest radioisotope dates, fauna, flora, or other indices that show these remains are older than assemblages from non-modern human populations." In both these examples, he is appealing to data collected and interpreted in light of assumptions derived from the philosophical construct of naturalism. In some places, he adds "supposedly" or "allegedly" prior to a

radiometric date, but if he is going to question the relative magnitude of the dates, he is going to have to question their order, indeed, the entire validity of radiometric dating, and then he is going to have to question both the absolute and relative dating of each the geological eras in earth history. But, he does not even begin this process. This is a glaring inconsistency.

I also take exception to some of his textual analysis. For instance, he posits at least two different times for the thriving of Nephilim, based on Genesis 6:4. The context of this verse is a singularity, written in the past tense, by the author, as if the author were saying, "They were there on Thursday, and also afterwards." Genesis 6:4 does not indicate a waning and waxing of Nephilim "culture." I agree with him that the time of the Nephilim was only prior to the Flood, and I believe he did an excellent job exegeting this point. Interestingly, his treatment of this subject exactly parallels that of *Alien Intrusion* (Bates, 2010).

Likewise, I take issue with the way he treats the genetic ancestry of Noah. He says, "Noah was a direct patrilineal descendant of Adam," which is true, but he also says, "The name [Nephilim] separates these people from direct descendants of Adam," which is not true, for all people were descendants of Adam, even the Nephilim! Perhaps he meant to include "patrilineal" in his second quote, but he did not.

There are several schools of thought on whether or not there were Nephilim genes in the pre-Flood human population, and this depends on one's view of who the "sons of God" were. In my experience, the second-most common theory is that the "sons of God" are the descendants of Seth and the "daughters of men" are the descendants of Cain. If this is true, one is left wondering why a mingling of such closely related peoples would produce offspring that were so radically different in behavior from the non-hybrids. It is also not strongly sup-

ported by other usages of “sons of God” in Scripture (Bates, 2010).

The most common theory seems to be that the “sons of God” are fallen angels and the “daughters of men” are regular human females. This begs several questions: Do angels have human chromosomes? If not, are they genetic engineers? If they did create human-angel hybrids, could these, in turn, reproduce with people to create $\frac{3}{4}$ -human, $\frac{1}{4}$ -angel hybrids? Etc. I find neither of these theories perfectly satisfactory, yet the “fallen angels” concept is a better fit, despite the unanswered questions, especially when considering the relevant New Testament passages (see below).

What does Noah being “perfect in his generations” (Gen. 6:9b) mean? Klenck asserts that this means Noah had no Nephilim ancestry. Even though I agree (for different reasons), there are several factors to consider before we can draw such a conclusion. Here, the Hebrew word for perfect is *tamiyim*, meaning “without spot or blemish” (Brown et al., 2000). This could be referring to his ancestry, or to his faith, or both. How can we tell? Interestingly, there is quite a bit of variation among the major English translations regarding this verse. Some (e.g., KJV) take two different Hebrew words in this verse and translate them both “generation.” The word for “generation” in the first half of 6:9 is *toledoth*, which equates to “account” or “ancestry” (Brown et al. 2000). In the second half, the word is *dowr*, roughly meaning “time” or “place” or even “contemporaneous generation.” The English word “generation” is ambiguous in this case, as different senses can be attributed to two separate Hebrew words. In contrast, The New International Version translates *toledoth* as “account” and *dowr* as “among the people of his time,” which brings out more of the semantic meaning of these two words. There are many other variations found among the various translations, and this causes confusion. The main point is that there are two

different ideas in this verse. One is that Noah had an ancestry. The other is that Noah was righteous. The link between these two ideas is open for debate.

If Taylor (1994) is correct, and this is debatable, there is a break in authorship in the middle of 6:9. In this case, the *toledoth* in 6:9 would be referring backwards, to Noah’s eyewitness account, and everything after that is part of the eyewitness account of Noah’s sons, which concludes in 10:1a. This would do great harm to the idea that Noah’s genealogy is germane to his perfection, but even this is a minor point.

Importantly, prior to the Flood, the only person to whom righteousness is ascribed is Noah. The Bible does not say that about any other person living at the time, including the patriarchs who were alive when God gave Noah the command to build the ark. If the command came 120 years prior to the Flood (Gen. 6:3), Noah’s father (Lamech) and grandfather (Methuselah) were still alive. If Noah’s righteousness were based on his heritage, Lamech and Methuselah, and at least all of Noah’s full siblings (if there were any) and possibly many of his cousins (if there were any) should have been included. Instead, as the Bible says, he was considered righteous because of his faith. This is the specific reason given.

The idea that no Nephilim genes were on the ark might be correct, especially since the Messiah should not or could not have had any ancestors, especially male ancestors, that were evil angels, but there are multiple possible ways for this to be true. First, perhaps there *was* a problem with Nephilim genes spreading throughout in the human population, and perhaps God *did* single out Noah because he was perfect in his genealogy (all members of his family also had to be “perfect,” including the wives of unknown genealogy). This is not the only possible way to solve the riddle, however, for there was more than one way for the sons of God to contaminate every single human lineage.

If their progeny, the Nephilim, could reproduce with people, eventually every human line could have become tainted. Alternatively, even without Nephilim reproduction, they could have taken every living female simultaneously. They could have killed off all the pure people (not that God would have allowed them to). Or, they could have killed off some or most of the people and claimed the remaining women for themselves. If God removed Noah at any time prior to the completion of any these diabolical scenarios, we would get the same result: no Nephilim genes in the post-Flood human population. This is important, but “no Nephilim genes on the ark because Noah was perfect in his generations” is an assumption that must be backed up with more data, and the Bible gives us nothing else.

Recent genetic evidence, however, puts Klenck in an awkward place. Now that the field of ancient DNA studies has advanced far enough, we are able to get useable DNA out of some of the best-preserved ancient bones, including classic Neanderthal skeletons and others. DNA from Neanderthal (Green et al., 2010) and the enigmatic “Denisovan” (Reich et al., 2010) populations indicate both these populations interbred, independently, with the ancestors of modern man. The small percentage of shared genetic features can be interpreted as evidence for limited interbreeding between two populations (as the evolutionary studies claim) or the complete mixing of two populations of different sizes (if the Neanderthals were a single family that merged with other people groups as they all spread out from Babel, for example). Klenck has a choice to make: either Nephilim genes were on the ark, or Neanderthals and Denisovans are post-Flood. His thesis is contradicted by the most recent discoveries in genetics.

In his article, he lists three characteristics that made the Nephilim different. The second (physical prowess) and third (valor) are non-definitive, for

people today fall into those categories. The first (appearance) is false, for it is the combination of ancestry, physical prowess, and valor of the Nephilim that allowed them to be distinguished. There is no mention of them looking different from the non-Nephilim. Klenck does not make the assertion that they appeared different in physical form (he certainly is making that case throughout the article, however), yet the biblical text says nothing about their appearance, only their behavior (note: I agree with Klenck that the Nephilim were not “giants”).

In his detailed citations of the evolutionary studies that claim modern remains in very “old” strata, the material is mostly fragmentary (making discrimination among the various species of *Homo* difficult), the sources are older, and the conclusions of the sources are as much driven by the contemporaneous trends in paleoanthropology as anything else. Later, he encourages YECs to “begin osteological comparisons on all remains attributed to *H. habilis*, *H. rudolphensis*, and *H. ergaster*” to see if any of these belong to *H. sapiens sapiens*. But why stop there? Why not throw out all of the evolutionary data and start from scratch, analyzing each fossil independently? This would be a huge and impossible undertaking, but it illustrates an important point. We cannot trust the source data. Yet, Klenck takes much (but not all) of that source data and simply rolls it into his theory.

I am not going to argue whether or not the traits found among non-moderns are within the range of modern man (they are not, for the most part, but there are exceptions, and intermediate skeletons have been found). As he points out, various authors have suggested diet, exercise, longevity, and disease to explain the classic Neanderthal features. I am not ready to jettison this early work as quickly as Klenck, however, as I believe these authors have made several significant contributions. This is a very complicated subject, we have a lot of

work to do before we can make any firm conclusions, and new data may challenge us with new ideas. For instance, inbreeding is something that few have considered as a possible explanation of the existence of the classic Neanderthal type. Perhaps the Neanderthals looked similar to one another because they were very closely related. In fact, the most recent genetic data, surprisingly, says exactly that (Reich et al., 2010). From the data we have today, it seems Neanderthals were closer to each other than individuals within any modern population are to one another. This is despite the fact that the Neanderthal individuals sampled in this study covered a huge geographic area (Spain to Russia and south from there). He can be forgiven this lapse, however, for it was published after his submission to the CRSQ was accepted. It seems that a single, closely related tribe or family unit, who had the ability, and took the opportunity, to have children with modern-looking people, spread out across a significant geographic area. We call them Neanderthals. When could this have happened if not immediately after the Flood?

Finally, his warning about tinkering with genetic cloning of Neanderthal DNA seems a bit stretched. Even if we had the ability to take highly degraded DNA and clone an individual from it (we don't), there is no evidence that the genes of Neanderthals or any other non-modern people (e.g., *Homo erectus*) carry “Nephilim” spirits or would cause overly aggressive tendencies (enhanced robustness and strength are possibilities). If this were true, and since we apparently share genes with Neanderthals, it might be possible for a Nephilim to spontaneously arise from the normal process of sexual recombination! Also, would God allow man to resurrect that which was destroyed in the Flood? Peter and Jude may have been referring to the angelic fathers of the Nephilim, saying their souls are held in chains until judgment (1 Pet. 3:19–20; 2 Pet. 2:4–5; Jude 6–7).

This is controversial, but if so, it does not sound like we have much to fear from them, as this would mean God specifically took action to prevent any more Nephilim being produced.

In conclusion, although Klenck is arguing a model that is somewhat internally consistent and incorporates wide-ranging ideas, from explanations of Neanderthal man to the demise of the dinosaurs, I believe he has created more theological and scientific problems than he has solved. He is not the first to discover many of these problems. In particular, I would encourage him to jettison the evolutionary dating scheme, even in a compressed format. Naturalism was invented as a way to explain the world without God, and we creationists should start our analyses from first principles. This means we cannot use naturalistic conclusions as a backbone for our work but must do the hard work of starting from a blank slate and build up our ideas from scratch. If he did this, I believe he would be able to stop struggling in his attempt to wed such dissimilar ideas as young-earth creationism and the order of events derived from naturalistic assumptions. There is tremendous uncertainty and ambiguity within the biblical passages discussed above. It would behoove us to avoid making unwarranted, unsupported, and sweeping claims with downstream theological and scientific ramifications.

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Genesis Model and the Necessity for Post-Morris Paradigms

It is necessary that creationists establish multiple explanatory models that accommodate the full range of Biblical references and examined phenomena. I believe two factors have hampered creation science's development: (1) an overzealous devotion to the theories of Henry Morris and (2) the elevation of the latter's views to the position of Biblical inerrancy and theological dogma. As the founder of modern creationism, Morris deserves our respect and appreciation; however, he was not an apostle, and many of his views were mistaken, reflected his educational bias in North American hydrology, and do not correspond to the breadth of Scripture or observed phenomena. Creationists need to develop post-Morris paradigms

that encompass the entirety of relevant Biblical references and a greater range of observations.

Genesis model represents one of several alternate models incorporating a wider range of Biblical references and observed facts (Klenck, 2010a, 2010b). Here, Biblical sources suggest an explanatory model for the origin, variation, and continuation of human populations (see Table 1). Conversely, Carter advocates that all humans (e.g., Neanderthals and modern humans) are post-Flood populations formed around the time of the tower of Babel; that we should ignore observed data; and Morris's position that most geological strata were formed during the Flood. I disagree.

Genetic Considerations

Although I personally appreciate many of Carter's studies, in this matter we disagree. Despite that Carter's educational background is genetics, his theories conflict with observed data. Carter has enthusiastically promoted the notions that Neanderthals and modern humans are alike, that they lived in Europe after the Flood, and that they were descendants of Noah and his family. Given these assumptions, the DNA of Neanderthals and modern humans should be identical or at least possess no greater differences than modern human races today (e.g., between Asians and Caucasians). Also, there should be so much overlap in archaeological deposits that Neanderthals should be

Table 1: Genesis Model for the origin, variation, and continuation of human populations (from Genesis 1–10).

Biblical Periods & Events	Populations in Genesis	Linnaean Classifications	Other Nomenclature
Modern times.	Non-Nephilim Descendants of Adam.	<i>Homo sapiens sapiens</i>	Anatomically modern humans.
After the Flood (Genesis 8:15 and afterwards).			
Flood of Noah (Genesis 7:10-8:14).	Non-Nephilim Descendants of Adam; Nephilim; and offspring of both.	<i>Homo sapiens sapiens</i> , <i>H. habilis</i> , <i>H. rudolfensis</i> , <i>H. ergaster</i> , <i>H. erectus</i> , <i>H. antecessor</i> , <i>H. heidelbergensis</i> , <i>H. neanderthalensis</i> , <i>H. floresiensis</i> , and potentially other populations.	Anatomically modern humans and non-modern humans.
“...and also afterward” (Genesis 6:4).			
“...in those days” (Genesis 6:4).			
“...when men began to multiply on the face of the earth” (Genesis 6:1).			
Soon after expulsion from Eden (Genesis 3-4).	Descendants of Adam.	<i>Homo sapiens sapiens</i>	Anatomically modern humans.
Sixth Day of Creation Week (Genesis 1-2).	Adam and Eve.		

found in present-day burials and exist in contemporary human populations. Recently, Carter has claimed, albeit in a lay-oriented article, that Neanderthals and modern humans were so close that Neanderthals could represent relatives attending “your next family reunion” (Carter, 2010). No data support Carter’s assertions (Krings et al., 1997; Serre et al., 2004; Currat and Excoffier, 2004; Ovchinnikov et al., 2000; Orlando et al., 2006; Gibbons, 2010).

As Hooper (2011) notes with excessive zeal, Carter’s arguments are flawed, as Neanderthals do not exist today, all non-modern humans died before the Holocene (today’s environment, which allegedly began around 11,500 kya), and Neanderthals are very different from modern humans morphologically and genetically. Furthermore, the preferred

lifestyle and culture of Neanderthals differed greatly from modern human assemblages (see references in Klenck, 2010a, 2010b).

Paleoanthropological data also supports the Genesis model with its hypothesis that all non-modern humans (e.g., Neanderthals), which are correlated with the Nephilim in Genesis 6:1–4, went extinct before or during the Pleistocene / Holocene transition. In addition, data suggests that only modern humans (or *H. sapiens sapiens*) survived into the Holocene epoch and that the genetic heritage of non-modern groups, which I associate with Nephilim populations, is negligible (Hedges et al., 1992; Long, 1993; Maddison et al., 1992; Templeton, 1992; Kahn and Gibbons, 1997; Krings et al., 1997; Lindahl, 1997; Ward and Stringer, 1997; Ovchinnikov et al.,

2000; Orlando et al., 2006; Briggs et al., 2009; Gibbons, 2010). Indeed, the lack of genetic evidence for Neanderthal ancestry in modern human populations has prompted hypotheses that Neanderthal and modern human sperm and eggs could not align or that chemical signals from the egg did not permit penetration of cell walls, reducing the possibility of interbreeding between these two populations (Olson, 2002, pp.73–83; Currat and Excoffier, 2004).

Since sending the Genesis model to CRSQ, two studies have suggested that 1–4% of the genomes of select modern human populations—persons from France, Han China, and Papua New Guinea—might be derived from Neanderthals, and non-modern humans from Denisova Cave, Siberia, possibly contributed 4–6% of their genetic mate-

rial to only the genomes of present-day Melanesians living in New Guinea (Green et al., 2010; Reich et al., 2010).

Research teams are cautious about these findings for three reasons. First, DNA contamination might affect the results. Green et al. (2010, p. 712) notes that estimated DNA contamination from modern human males in the data to “be about 0.60% with an upper 95% bound of 1.53%.” Although this effect is minor, the alleged impact of Neanderthal DNA in modern humans is also small (1–4%), prompting added caution. Second, the acquisition of Neanderthal traits in modern human genomes is based on an evolutionary premise of closer ancestral affinity between Neanderthals and chimpanzees (verses modern humans). With this premise, the study filtered out genomic regions that “might be duplicated in either humans or chimpanzees based on an inferred genome sequence of a common ancestor” that could also affect their findings (Green et al., 2010, p. 712). In addition, the research teams caution those reading too much into the percentages of alleged Neanderthal ancestry in select non-African populations. They note that very few incidents of interbreeding between non-modern and modern humans before the Holocene could cause Neanderthal genetic information to disperse or “surf” through modern human groups causing “heightened” frequencies of Neanderthal alleles in contemporary human populations. To reiterate, even though only select human groups outside of Africa might show a very small proportion of Neanderthal DNA (1–4%), these percentages could be overemphasized by the effects of the dispersion of these alleles through modern human populations (Green et al., 2010).

As opposed to Carter’s statement of Neanderthals appearing at a family reunion, both studies suggest that the role played by genetic ancestry from non-modern humans is very “minor” and that the “vast majority” of genetic variants

in today’s populations originated from pre-Holocene modern human populations (Green et al., 2010, pp. 721–722; Reich et al., 2010). This data supports the Genesis model with its notion that Nephilim, or non-modern genetic material, in modern human populations would be negligible.

Despite Carter’s prior statements, I was still surprised that in his letter he insinuated that Noah possessed Nephilim ancestry. To review, the Bible mentions variation in pre-Flood human groups as denoted by Nephilim and non-Nephilim populations (Gen. 6:1–4). This inclusion is followed by a verse stating that Noah was perfect in his generations and preceded by a genealogy from Adam to Noah with no hint of Nephilim ancestry (Gen. 5:1–32; 6:9). Furthermore, Genesis is specific that only Noah, his three sons, and their wives survived the Flood (Gen. 6:18; 7:1, 13; 8:18; 9:18–19). That Carter attempts to “explain” the Hebraic verbiage to support his notion that Noah had Nephilim ancestry is philologically, contextually, and theologically untenable.

With regard to the new studies, questions remain as to how *any* Nephilim or non-modern human genetic material (even a negligible amount) survived into the Holocene and how this relates to Biblical references in Genesis. Although Genesis strongly suggests that Noah was unaffected by Nephilim ancestry, there is no mention of the names or heritage of the wives of Noah and his sons. As such, it is possible that one of these wives possessed a negligible trace of non-modern human genetic material. I am intrigued by the new data. The studies from Green et al. (2010) and Reich et al. (2010) suggest that sub-Saharan and West African populations do not have traces of either Neanderthal or Denisovan ancestry. Conversely, these studies show that non-African persons from France, China, and New Guinea were influenced by a minute proportion of Neanderthal heritage,

while only Melanesians were affected by a small proportion of Denisovan genetic ancestry. Curiously, the Bible suggests African populations were descendants from Noah’s son, Ham, while European and possibly Asian cultures derived from another son, Japheth (Gen. 10:1–20).

If the aforementioned data is correct and replicated by future studies, I tentatively suggest that Japheth’s wife possessed a trace of Nephilim ancestry. This negligible trace could have “surf” to other populations if they intermarried with Japheth’s descendants later in history. This heritage was so slight that it did not cause the ire of the Almighty, prevent her marriage to Japheth, prohibit her entry into the ark, or enable the concentration of non-modern human genes or traits in post-Flood human populations. Furthermore, the dispersive effects at Babel would have further prevented the concentration of this heritage in modern human groups (Gen. 11:1–9). Still, the negligible amount of non-modern human ancestry from Japheth’s wife would continue in the genomes of her descendants and might correlate with data from recent studies by Green et al. (2010) and Reich et al. (2010). Again, future studies will serve to replicate or discount these initial findings and conclusions.

Angelic Heritage?

When I submitted my Genesis model paper to CRSQ in December 2009, there were no studies that confirmed the existence of DNA material that could derive from angelic sources from the Nephilim abomination. This position was based on Biblical claims from Genesis 6:1–4, morphological traits, and cultural differences between modern and non-modern human populations. The inference of the Genesis model is that angelic genetic material would be found in Nephilim or populations with Nephilim ancestry such as Neanderthals and other non-modern human groups but not in apes. In modern human popu-

lations during the Holocene, Nephilim genetic material would be negligible. Extant studies merely confirmed that there were differences between modern human and Neanderthal genomes and that it was unlikely that Neanderthal genes affected modern human populations (Hedges et al., 1992; Long, 1993; Maddison et al., 1992; Templeton, 1992; Kahn and Gibbons, 1997; Krings et al., 1997; Lindahl, 1997; Ward and Stringer, 1997; Ovchinnikov et al., 2000; Orlando et al., 2006; Briggs et al., 2009).

The recent studies show many genetic traits specific to Neanderthals not found in modern human genomes (or apes):

- A large number (111) of Neanderthal-specific segmental duplications do not overlap with human segmental duplications (Green et al., 2010, p. 715).
- Neanderthal-specific duplications were found with “no evidence of duplication among humans or any other primate” and “none contained known genes” (Green et al., 2010, pp. 715–716).
- Estimated copy number for Neanderthal genes were compared with those from modern humans showing 43 genes of more than 5 copies—67% being increased in Neanderthals and not in modern humans. Most of these genes are “of an unknown function” (Green et al., 2010, p. 716).
- Gene PRR20 (NM_198441) shows an estimated 68 copies in Neanderthals versus only 16 in modern humans. These genes encode a proline-rich protein “of unknown function” (Green et al., 2010, p. 717).
- After comparing a stretch of 293 consecutive single-nucleotide polymorphism (SNP) positions between modern humans and Neanderthals, the results showed noteworthy differences in certain genes from the two groups:

- Gene THADA, associates with diabetes and energy metabolism.
- Gene DYRK1A, associates with Down syndrome.
- Gene NRG3, associates with schizophrenia.
- Gene CADPS2, associates with social interactions, communication, and cognition.
- Gene AUTS2, associates with autism.
- Gene RUNX2, associates with cleidocranial dysplasia (causing delayed closure in cranial sutures), morphology of the frontal bone, hypoplastic or aplastic clavicles, bell-shaped rib cages, and dental abnormalities (Green et al., 2010, p. 717).

In addition, changes in RUNX2 impact other morphological differences in the upper body and cranium, causing more distinctions between modern humans and Neanderthals (Green et al., 2010). Differences in the closing of cranial sutures, degree of frontal bossing or protrusion, clavicle morphology, and the shape of the rib cages are all traits that differentiate Neanderthals (and other non-modern humans such as *H. erectus*) from modern humans.

In addition, more than 500 and 400 genes control jaw and tooth development and the formation of the ear and temporal/mandibular region, respectively (Cheverud et al., 2008; Wagner, 2008). Moeller (personal communications on January 22, February 6, and February 7, 2011) prudently suggests that morphological differences between modern and non-modern human populations, which are pronounced and wide-ranging, are more likely a reflection of preexisting genetic instructions rather than a result of selection and mutation. Also, genes ascribed to the neuro-cranial-dental complex act as an extreme stabilizing factor limiting modifications caused by mutations (Pavlicev et al., 2010; Marroig and Cheverud, 2010). This data supports

the notion that morphological characteristics in non-modern humans (e.g., Neanderthals) primarily originated from a preexisting source outside processes of selection and mutation.

In this milieu of observations, I continue to suggest that genetic materials found in Neanderthals and other non-modern human specimens (and not found in modern humans or apes) and the genomic differences between non-modern and modern humans are partially derived from angelic sources from the Nephilim abomination (Gen. 6:1–4). The latter would reflect preexisting genetic instructions that would have caused Nephilim morphological characteristics exhibited in non-modern humans, which differentiate from non-Nephilim groups that are typified by modern human populations and their morphological traits. The effects of preexisting genetic instructions from angelic sources, provided the primary cause for the morphological differences in Nephilim (non-modern humans) compared to non-Nephilim (modern humans) groups. Subsequently, these Nephilim morphological traits were affected by biogeographical factors, activity levels, disease, aging, diet, and other variables that caused further minor morphological variations within Nephilim / non-modern human populations.

Currently, a well-funded cross section of pharmaceutical interests, evolutionary research groups, and geneticists are combining their efforts to obtain Neanderthal DNA to form a “group” of living neo-Neanderthals (Zorich, 2010). They are keenly aware of the genetic differences between modern humans and Neanderthals, and their efforts toward the rebirth of neo-Neanderthals are publicized and celebrated.

Against Radicalism

Some creationists attempt to dismiss all radiometric dates, archaeological reports, paleontological analyses, and other observations that conflict with

their views. For me, Carter's appeal that we should ignore observed data because he labels it "naturalist" seems excessive. Others are much more vociferous and insist that we should delete paleontological and archaeological reference points such as the "Mesozoic" or "Paleolithic" since these terms, which refer to assemblages of plants, animals, and human cultures, are associated with old-earth views and evolutionary research.

This extreme position seems ill advised. The Bible is a wonderful source of explanatory models for the early earth and observations in paleontology, geology, and from other academic disciplines. Removing words from the research lexicon or data from our tableau of observations hinders communication, degrades the pace of research, and inhibits our ability to elucidate aspects of God's creation. In addition, many original geological studies were made by those who firmly believed in the inerrancy of the Bible. Also, many geological, paleontological, and archaeological reports are mostly recordings of what researchers have observed (e.g., Winchester, 2002).

Carter declaration that we should be "starting from a blank slate and build up our ideas from scratch" also seems ill advised. His appeal to ignore all data prompts the question: What data are we to follow—just materials from Carter's theories? Carter's appeal to ignore all data of the past and start from a "blank slate" is highly questionable. The pronouncement seems also inconsistent, as Carter references studies from evolutionary geneticists. Perhaps he is suggesting that we adopt the "blank slate" approach for only conventional observations in geology, paleontology, or archaeology.

Conversely, I believe that we should diligently study Biblical passages and observed data. We should be wary of evolutionary biases and assumptions. In addition, we should treat with caution those creationists who desire to dismiss observed data or widely used terms per-

haps in an effort to control creationist research and advocate their own ideas.

Necessity for Post-Morris Paradigms—Biblical Reasons

The Hebrew verbiage in Genesis provides clear support that only the terrestrial animals and humans on the ark survived the Flood (Gen. 7:23; 8:1); all terrestrial animals and humans outside the ark died (Gen. 6:7, 17; 7:4, 21–23); the Flood was worldwide and covered the earth (Gen. 6:17; 7:4); all the fountains of the great deep burst forth (Gen. 7:11); the floodgates of the sky were opened (Gen. 7:11); it rained 40 days and 40 nights (Gen. 7:4, 11); the Deluge lasted 371 days (Gen. 7:14; 8:14); and the Floodwaters increased and covered the earth (Gen. 7:17–20, 24). The Bible also confirms the fountains of the great deep and floodgates of the sky were closed (Gen. 8:2); the rain from the sky was restrained (Gen. 8:2); and God caused a wind to pass over the earth and the waters subsided (Gen. 8:1, 11–14).

The Bible does not affirm flood geology claims that the Deluge caused most geological layers. This claim is an inference or a product of eisegesis, where diluvialists have read into the Biblical texts to support their interpretation of geological phenomena (Price, 1923; Whitcomb and Morris, 1961; Morris, 1976).

The direct curse of a serpent is not an "argument from silence" but firmly attested to in Scripture (Gen. 3:14). That this curse would have applied to all serpents is strongly suggested in that God's post-Fall judgments applied to all men, including Adam, and all women, including Eve (Gen. 3:16, 17–19). One animal group [*chayat ha'sadeh*] is mentioned relating to dragon-like kinds in the early parts of Genesis and then is not mentioned by God or Noah embarking on or debarking off the ark (Gen. 1:24–25; 2:19–20; 6:13–8:22). This is a powerful testament that something happened to these serpents/beasts of the field, which were not crawling on their belly or eating

the dust of the earth, before the advent of the Flood (Klenck, 2010c).

Flood geologists argue that the Flood, or *ha-mab-bul*, is a unique work denoting "*cataclysm*," suggesting its primacy in forming most geological layers on earth. I disagree. The Hebrew term *ha-mab-bul* [לִיבְמָה] is noted in twelve verses from Genesis 6:17 to 11:10. All these references denote the Flood of Noah, and the word *mab-bul* does not denote a general cataclysm, but specifically, the Noachian Deluge. Only Psalm 29:10 mentions *mab-bul* outside Genesis, but this verse is also tied to the same event, as God sits as a king over the *mab-bul*. Also, the mere Biblical mention of *ha-mab-bul* in no way affirms that this event formed most geological strata.

Second, the breaking up of "all the fountains of the great deep" or *kol ma'ye-not te-hom ra-bah* [מְעִיֵּי־תְהוֹם רַבָּה כָּל] does not affirm the Flood's formation of most geological strata. The locales of volcanoes, springs, tectonic plates or any features that represent "*the fountains of the deep*" were separated by considerable distances and in no way support the *global crustal fracturing* of the entirety of earth's surface. Furthermore, many geologists ascribe pronounced tectonic activity and volcanism to the Cenozoic Era, which most diluvial geologists assert is *after* the Flood. Even during the Cenozoic, evidence for volcanism, tectonic activity, and the formation of springs does not cover the earth as these features are separated by notable distances.

That the "waters prevailed," or *gav-ru ha-ma-yim* [גָּבְרוּ הַמַּיִם], "and covered," or *vay-cus-su* [וַיִּכְסֹּוּ], the earth is interpreted by flood geologists as the formation of most geological layers (Walker, 1994, pp. 591–592). However, Genesis specifically mentions that water, or *ma-yim* [מַיִם], covered the earth (Gen. 6:17; 7:6–7, 10, 17–20, 24; 8:1, 3, 5, 7–9, 11, 13; 9:11, 15). There is no scriptural mention of geological layers forming or covering the earth during the Deluge.

Also, the Hebrew term "and cov-

ered,” or *va-chus-su* [ויכסו], alludes to the wearing of a garment, not the destruction of pre-Flood geological stratigraphy or formation of most geological layers as asserted by flood geologists (Whitcomb and Morris, 1961; Walker, 1994, pp. 591–592). The same verb for *covered* used in the Flood, in Genesis 7:19–20, is the same verb used when Japheth and Shem *covered* Noah’s nakedness (Gen. 9:23) or when Rebecca *covered* her face when she first saw Isaac (Gen. 24:65). This covering of the earth by water was then removed by God using “a wind” (e.g., Gen. 8:1; Ps. 104:6–9), which again conflicts with Morris’s notion that the Flood formed most geological stratigraphy.

Another argument flood geologists employ: they equate God’s “I will destroy” or *em-cheh* [אמחה] and “am destroying them” [משחיתם] as support for the formation of most geological strata during this event (Gen. 6:7, 13, 17; 7:4, 23; Price, 1923; Whitcomb and Morris, 1961; Morris, 1976). However, these verses do not assert the destruction (or formation) of most geological layers but firmly state that all terrestrial life was destroyed: “all flesh wherein is the breath of life” (Gen. 6:17) or “every living thing that moved on the earth perished” (Gen. 7:21). To reiterate, the destruction and blotting out indicates the destruction of all terrestrial life—not the destruction of pre-Flood geological strata or the formation of most geological strata.

These associations between the Flood and the destruction of human and animal life continue in the New Testament. Jesus mentions the Flood destroying pre-Flood populations eating and drinking (Matt. 24:39; Luke 17:27). Peter connects the Flood to the destruction of human life (1 Pet. 3:20; 2 Pet. 2:5). Flood geologists attempt to employ 2 Peter 3:6 to justify the Flood’s formation of geological strata (Price, 1923; Whitcomb and Morris, 1961; Morris, 1976). However, the direct translation of this verse associates a destruction re-

sulting in death (*apōleto* or ἀπόλετο) of the pre-Flood world (*kosmos* or κόσμος) with water (*udati* or ὕδατι) that had been flooded (*kataklystheis* or κατακλυσθεῖς). Far from supporting that all geological layers were formed by the Flood, this passage states a Flood caused death in the pre-Flood world. This correlation between the Flood and human and animal deaths is readily attested in other aforementioned Scriptures but in no way affirms the formation of most geological strata during the Deluge.

Also, there is no scriptural justification to support the claims that the Flood destroyed the entire surface of the pre-Flood earth and that there is absolutely no geographical continuity before and after the Deluge (Price, 1923; Whitcomb and Morris, 1961; Morris, 1976). It seems odd that Moses, the probable author of Genesis, would attach the name “*Perat*” to two waterways, before and after the Flood, in Genesis 2:14 and 15:18, which had no geographical association. On theological grounds it seems suspect that this author of the inerrant Word of God would apply the name “*Perat*” or “*Hiddekel*” to rivers, existing before and after the Flood, which had nothing to do with each other. Especially noteworthy is that Genesis associates three rivers from the pre-Flood Garden to three post-Flood locales: the land of Havilah, the land of Cush, and the city of Asshur. These correlations provide overt and direct Biblical support for geographical continuity before and after the Deluge (Gen. 2:10–14; Klenck, 2010d).

Necessity for Post-Morris Paradigms— Observational Reasons

I disagree with Carter’s comments and premise regarding the primacy of Morris’s flood geology theory. For me and a growing number of other creationists, Morris’s theories have approached the semblance of a sect, where Biblical verses and observations that run contrary to the claims of the initiates are ignored,

derided, associated with works by Cuvier (an old-earth creationist) and Buckland (an agnostic), or dismissively regarded as a “mistake” or a “danger” (using Carter’s remarks).

Most Biblically based creationists would readily agree that all animal and human life was created less than ten thousand years ago and that all humans and terrestrial animals (living at the time of the event) died in a global Flood, with the exception of those on the ark (Gen. 1–10). However, there are deep divisions in the creationist community concerning the main premise of Morris’s Flood geology—that the one-year Deluge caused all geological stratigraphy and completely destroyed any continuity between the pre-Flood and post-Flood earth. Sadly, while creationists publicly lament the “slaughter” of their dissenting views by evolutionists, followers of Henry Morris are engaging in similar conduct within creation science. His advocates attempt to silence those who disagree with the tenets of flood geology (or their own studies), castigate competing ideas at conferences, and some refuse to publish analyses that proffer different creationist paradigms based on the range of Biblical passages and observed phenomena.

I believe the views of Price (1923) and Morris (1976) are passé, while alternate views by Watts (1984) and Gentet (2000) are increasingly relevant. Below are observations that conform to the academic consensus in geology, paleontology, and other disciplines. First, there are no associations between dinosaur and human remains in paleontological or archaeological contexts. There are no faunal remains that evidence large populations of dinosaurs survived the Flood or associated with humans. Most iconography suggesting the presence of dinosaurs in post-Flood contexts comprises at best mistakes and at worst hoaxes. Lower layers exhibit certain animals and plants that are regularly found associated with each other, clus-

tered together in geographical locales throughout the globe, and encompassed by ancient geographical barriers such as early oceans, mountains, swamps, and deserts.

Multiple living surfaces exhibiting dinosaur or dinosaur-like fossils are evident in lower strata superimposed by layers exhibiting many mammal species. These dinosaur and dinosaur-like animals, which are prevalent in lower strata, are absent in upper strata and are not evident today. Strata with dinosaur and dinosaur-like fossils are arguably all related to local or (at most) regional events causing their deposition. Lower layers exhibit superimposed stratigraphy of living surfaces with different types of plants and animals and numerous layers with cracked, dried earth. As plants would not grow and dried earth would not exist during the Noachian Deluge, the main premise of flood geology that all strata were formed during the one-year Flood conflicts with observed data.

Upper layers (with mammal kinds), before strata associated with our current environment (the Holocene), are associated with horrific and global tectonic, volcanic, and perhaps bolide activity. These upper layers attest to the formation of modern mountain ranges, dramatic increases in sea levels, and the establishment of large lakes and seas. Also, the last layers before our modern environment exhibit biased destruction of most animals in the Americas and Australasia (as opposed to the greater survival of animals from Eurasia and Africa), the extinction of all non-modern humans, and the dramatic decrease of modern human populations or *H. sapiens sapiens*. These last levels, before our current environment, fully exhibit a cacophony of death: oceanic kinds and terrestrial animals are mixed together in a gruesome porridge such as in "Florida hash."

The earliest archaeological sites around Mount Ararat represent villages evidencing craft specialization and

prominent architecture, which appear suddenly, fully formed, from cultural antecedents that are hundreds of miles away. These cultures were able to farm the fertile soil from newly formed and globally deposited layers of silt-sand loess and aeolian (wind-borne) deposits that covered the earth at the onset of the Holocene, our present environment. These populations near Ararat divided into archaeological cultures in Anatolia that increasingly displayed advances in agriculture and animal domestication. These populations then abandoned many sites in Anatolia and the Levant while dramatic increases occurred in areas further south between the Tigris and Euphrates rivers.

All of these observed phenomena associate with the breadth of references in the Bible. Yet, Morris's followers insist that correlations between these observed phenomenon and Biblical passages are unacceptable since these data oppose Morris's premise that only the Flood formed most geological stratigraphy.

The views of Morris and his subsequent followers are heavily influenced by their academic and geographical biases. Morris was a hydrologist. Is it any wonder that he believed that water impacted all strata? Most flood geologists are from North America and Australia—regions that comprised the largest populations of dinosaur or dinosaur-like animals and the greatest evidence for a rich diet of regional destructions including bolide impacts, volcanism, and the draining of large lakes. Not surprisingly, their tendency is to interpret all geological strata in light of Australian and North American contexts, especially the Grand Canyon, instead of looking farther afield where there are different stratigraphical profiles and formation processes. Lastly, there is the admission that flood geology is a partial product of an early marketing campaign entailing the K.I.S.S. principle (keep it simple, stupid), enabling individuals without backgrounds in science to more efficiently declare a di-

luvial cause for all geological features in short debates, while practicing geologists would be encumbered having to explain features that delineated multiple layers with different plants and animals.

Morris's followers also insist that there can be no evidence for tremendous geological deposits before the Flood. This position is untenable. Austin (1986) and Berthault (1994) have shown that modern events, from the eruption of Mount Saint Helens to the River Seine overflowing its banks, can quickly establish multimeter deposits with microstratigraphy. Why then do flood geologists insist that there were no local disasters that deposited significant strata after the Fall and before the Flood? To reiterate, in today's environment we witness tsunamis, volcanoes, earthquakes, rivers overflowing their banks, and the draining of inland lakes and seas. All these events have occurred after God removed "the curse of the earth for Adam's sake" immediately after the Flood (Gen. 8:21). However, in lower geological strata it should surprise no one that we witness evidence for similar phenomena. Studies from geologists, paleontologists, and archaeologists provide evidence for volcanoes, earthquakes, rivers overflowing their banks, draining of inland seas, tsunamis, and other events in early layers—similar to today's events.

Sadly, claims that pre-Flood processes formed geological layers, which are supported by all conventional geological studies, are castigated by Morris's followers. The latter insist that all geological observations from lower layers were caused only by the Flood. This demand is made in spite of Biblical references stating that the pre-Flood earth was in the midst of God's curse (Gen. 3:17; 8:21) and the similarities between the ancient pre-Flood world and the present environ (Eccles. 1:9–11; Matt. 24:37). With these Biblical references, it again seems odd that flood geologists deny that contemporary events, which

form today's geological features and microstratigraphy, did not occur in the pre-Flood earth in the milieu of God's curse for Adam's sake (Gen. 3:17; 8:21).

I believe creation science is approaching a floruit as we incorporate former works using the research database at www.creationeducation.org and engage in robust discussions concerning Biblical exegesis and observed data through the Creation Research Society and other venues. It is time that creationists establish post-Morris paradigms incorporating the breadth of Biblical references and observed phenomena.

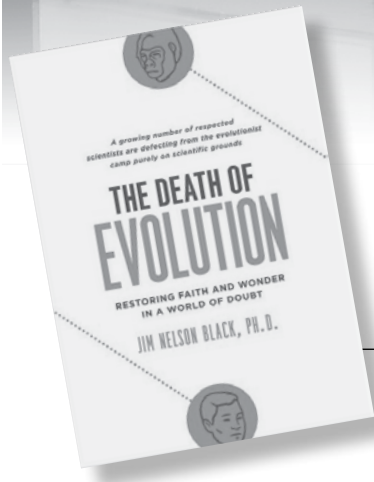
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Media Reviews



The Death of Evolution

by Jim Nelson Black

Zondervan, Grand Rapids, 2010, 171 pages, \$17.00.

Author

Jim Black holds a humanities doctorate and has written several conservative-oriented books about troubling educational trends across the U.S. In this compact volume, he summarizes the creation-evolution issue in a popular, devotional style. The subtitle is “Restoring Faith and Wonder in a World of Doubt.”

All of the included material is “secondhand,” and references are sketchy. For example, the book begins with a full description of the designed defense mechanism of the bombardier beetle. This story is a creationist classic from writer and speaker Dr. Duane Gish. However, Duane Gish is not named in the book. In fact, there is no mention of creationist groups such as the Creation Research Society, or the Flood, which changed the earth’s topography, or the

important earth-age controversy. The book also repeats much of the material presented in the 2008 documentary *Expelled*.

Author Black writes some memorable statements such as “[Evolution is] the only gospel allowed on public property” (p. 12). Several pages attack evolution, although in an uncomfortable, “bashing” style. At the same time, theistic evolutionists including Francis Collins, Michael Behe, and Owen Gingerich are lauded. I do not demean these leading scientists, but it is inconsistent to praise them while criticizing the (God-directed) evolution they promote. In the text there are a few points of confusion including the earth’s rotation, revolution, and magnetism (pp. 31, 41).

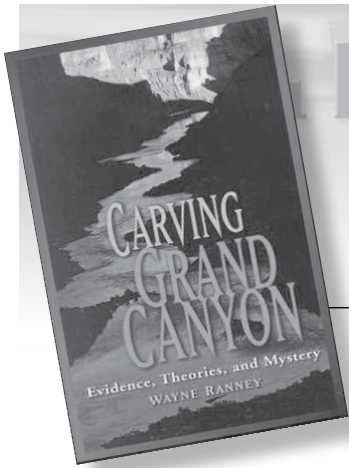
A conversation is related between Isaac Newton and a religious skeptic (pp. 15–16). In the story, Newton displays an intricate model of the solar system

called an orrery to the friend, who then asks the name of the builder. Newton, with tongue in cheek, replies that the machine has no builder but somehow built itself from spare parts, thus showing the futility of spontaneous origins and evolution. Unfortunately, this story is an urban legend that author Black presents without reference or qualification (No author, 2003).

This book may reach an audience beyond our usual creationist efforts. It is encouraging to see Zondervan publish a book that questions evolution. An index is provided.

No author. 2003. http://goliath.ecnext.com/coms2/gi_0199-614347/Who-made-it-The-Isaac.html (as of January 17, 2011).

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Reviews

Carving Grand Canyon: Evidence, Theories, and Mystery

by Wayne Ranney

Grand Canyon Association,
Grand Canyon National Park,
AZ, 2005, 160 pages, \$15.00.

This very interesting book is written by an evolutionist and geologist about the formation of the most famous of all geological icons, the Grand Canyon. The purpose of the book is to provide lay readers with an overview of the evolution of the debate over the origin of the canyon, mainly as it has played out among geologists during the past 150 years. As of yet there is no consensus from the geological community about how Grand Canyon formed or how old it is. Ranney summarizes his own work well when he states, "The Grand Canyon is an enigma, a puzzle, a mystery. It is located in an unlikely location and follows a path that is confusing at best. Try as we might, we may never find a definitive answer to its origin and we may never know everything about it" (p. 25).

In spite of this apparent lack of answers, the book demonstrates that scientists have come to agreement on several points, including a previously northwest-flowing river system (exactly opposite the current flow of the Colorado River) and an extremely tectonically active region that has experienced uplifts, faults, and mountains both rising and falling. These and many other complicated factors have kept geologists guessing about the exact time and way the canyon formed. One of the most popular theories at present is that two rivers, one on either side of the Colorado Plateau, joined each

other by back-cutting into the Plateau until they joined. Another idea is that ancient lakes overflowed their beds and catastrophically cut the Grand Canyon in a relatively short period of time. Both of these ideas have their proponents and opponents, and no idea is without difficulty. All parties agree that the river was somehow involved in canyon cutting, but to what extent or at what time is not known.

There is a very helpful summary at the end of the book that gives what Ranney refers to as the basic "truths" on which most geologists agree. One is struck in particular by the lack of evidence of any kind during the period (on the conventional timescale) from 30 to 16 million years ago. This is amazing because it is precisely during this period that geologists believe the actual process started that led to Grand Canyon. In other words, at the very point where evidence is most needed it is lacking.

The author writes in an engaging and relatively easy-to-understand manner that most people can grasp, although there is some technical terminology, particularly in the chapter on landscape evolution of the Grand Canyon region. However, most readers would be able to understand and enjoy the better part of the book's contents, and the historical information on past geologists and their thoughts on Grand Canyon are well worth studying.

Ranney provides a section on pages 84–85 that discusses "Legends and Non-

scientific Ideas" about the formation of Grand Canyon. In this section he mentions an unidentified book published in 2003 "documenting a religious interpretation for how the canyon was formed." Apparently he cannot bring himself to name the 2003 book *Grand Canyon, a Different View* by Tom Vail. Ranney briefly discusses the ideas presented within the book and then criticizes it for ignoring evidence regarding "rates of change in landscape development" and for assuming that the Bible must be true before coming to the evidence. To his loss, Ranney overlooks his own presuppositions and discounts the creation alternative completely. Nevertheless, his work is a valuable summary of Grand Canyon studies, particularly for those not familiar with the technical jargon of geology, and the book can be profitably used by creationists. I recommend it to anyone desiring to study the history, science, and people surrounding this amazing landmark, Grand Canyon.

The book contains an excellent summary of the evolutionary interpretation of the canyon, a helpful glossary, scientific and popular-level bibliographies concerning the origin of the Canyon, and an index. It features many colorful pictures, as well as helpful diagrams and drawings that illustrate various points of canyon formation and the geology of the Grand Canyon region.

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Reviews

In the Beginning... God or Dirt

by Sal Giardina

New Creation Ministries, Mesa,
AZ, 2010, 196 pages, \$13.00.

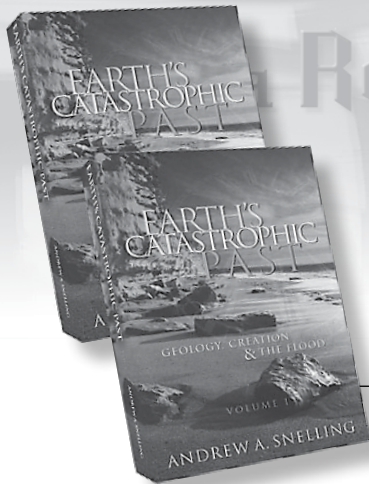
Author Salvatore Giardina is a mechanical engineer with an advanced degree in geology. He is a longtime member of the Creation Research Society and the Phoenix-based Arizona Origin Science Association. The president of this group, Joseph Kezele, M.D., wrote the

foreword. The book is an overview of origins and is aimed toward seekers who are unfamiliar with the important issues involved.

As an engineer, Sal provides helpful and thorough discussion of the first and second laws of thermodynamics. Both involve energy, and both raise important challenges to evolution theory. Other topics briefly discussed include living fossils, radioisotope decay, the RATE project, the gap theory, irreducible complexity, and probability arguments.

The book includes illustrations, charts, tables, and small photos. Four illustrations are shown for the decreasing longevity of Old Testament patriarchs (pp. 152–154). The gospel is clearly spelled out in the final chapters. The book certainly will be helpful to those making an initial exploration of the creation worldview. The book offers no subject index.

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Reviews

Earth's Catastrophic Past

by Andrew A. Snelling

Institute for Creation Research,
Dallas, TX, 2009, 1102 pages in
two volumes, \$60.00.

This book is an update of the classic *The Genesis Flood* (1961) by John C. Whitcomb and Henry M. Morris. Many observers attribute *The Genesis Flood* as greatly contributing to the launching of the modern creation-science movement. Andrew Snelling largely follows the format of the older book in this two-volume treatise. He begins with the scriptural implications of Creation and the Noachian Deluge similar to the first section of the 1961 book. He delves into the various aspects of the Flood (duration, depth, extent) and the ark (need, size, capacity) and answers various objections raised by skeptics. He brings together cogent arguments from others and refers to works that cover the subject at hand in greater depth such as John Woodmorappe's *Noah's Ark: A Feasibility Study* (1996).

Snelling then develops a framework for Biblical Geology that covers the events of the Creation Week, the Fall, the Antediluvian period, the Flood, and post-Flood eras (pp. 185–292). He returns to this topic in greater detail in the second volume (pp. 613–793). Snelling then contrasts the Biblical framework with the modern geological synthesis (pp. 295–417). Modern geology is dominated by uniformitarian principles, but Snelling is careful to point out that episodes of catastrophism are now accepted by many in the conventional geological

community (pp. 477–486). Perhaps the main value of this section is to give the reader an extended treatment on what the modern geological community believes and teaches.

Next is a very important section in which the author documents many evidences of catastrophism within the geologic record (pp. 493–610). These evidences include rapid, widespread water-deposited strata in the Grand Canyon and elsewhere, fossil graveyards, and mass extinctions. He discusses types of fossilization and how fossils are formed, showing that fossils by their very nature require rapid burial. This section certainly presents some of the strongest geological evidence for a worldwide and greatly destructive Flood.

Snelling's creation model for Earth history follows the familiar Creation, pre-Flood, Flood, and post-Flood eras. The Creation era includes the seven days of God's creation in Genesis 1–2. Snelling establishes among other things the basement rock layers. He believes the stromatolites (produced by cyanobacteria) were the first fossils. He does not see evidence for any significant (i.e., fossil-producing) catastrophes during the antediluvian time. "Nevertheless, we cannot be dogmatic about geologic activity in the pre-Flood world on a local scale, except to infer from the geologic record that any such activity had to be mild in its effects, otherwise there would have been some destruction of larger multi-cellular organisms, which would thus be found in the geologic

record pertaining to this era" (p. 679). The Flood was responsible for the late Precambrian (Ediacara fauna) through to the Cretaceous/Tertiary boundary (pp. 751–761). This includes trilobites, fish, amphibians, reptiles, dinosaurs, some mammals, and birds. The rest of the fossil record (most mammals, megafauna, etc.) Snelling places in post-Flood regional catastrophes.

Two important things stand out in Snelling's evaluation. First, he mounts a vigorous defense of the stratigraphic rock/fossil record (pp. 299–364) but is careful to jettison the uniformitarian deep-time baggage. "It is crucial to recognize that the order of occurrence of fossils in the rock record is based on real and verifiable observational field data and does not depend in any way on the evolutionary interpretation which the conventional geological community imposes on the fossil record. Although the rock sequences and the order of occurrence of the fossils in them clearly imply a relative time sequence, this recognition in no way requires one to accept the uniformitarian geological timescale of billions of years" (p. 347). This makes Snelling controversial with some of his colleagues within the creation science community. Second, he is a prime advocate of the catastrophic plate tectonics (CPT) model (pp. 365–415, 683–706). Indeed, he is one of the originators of the CPT model in 1994. This book is published by ICR rather than by a third party publisher, and the strong CPT presentation would seem to be a shift

in ICR's position. As late as 1996 ICR president emeritus, the late Henry M. Morris, and current president John D. Morris, took a much more cautious approach to plate tectonics.

The author relies on the work of fellow creation science researchers such as John Baumgarder, Larry Vardiman, Michael Oard, Kurt Wise, Steve Austin, and T. C. Wood in establishing a post-Flood model when discussing the Ice Age, regional catastrophism, biological diversity, and dispersal (pp. 751–793). Snelling devotes a book section to an extensive critique of radioactive dating methods (pp. 797–864). He documents from the conventional scientific community the pitfalls of each dating system. He also uses creation science research and the findings of the RATE project (2000, 2005) of which he was one of the primary researchers to bolster his case for a young Earth. This is surely a difference between *The Genesis Flood* and the present volume. Snelling has access to not only newer findings from the secular scientific camp but also over forty-five years of good creation research to draw upon.

While Snelling uses the research and findings of others in the creation science movement, it would be unfair

to say he is just compiling information from others. He is a brilliant scientist in his own right and brings to bear his own considerable knowledge and expertise in geological areas. For the most part, Snelling's prose is very readable and he is an excellent science writer. He makes strenuous efforts to cover all the bases, answering questions and objections in a civil and comprehensible manner. This reviewer occasionally found himself getting bogged down in highly specialized geological terminology and concepts suited more to serious students of earth science. For the most part, Snelling does not engage in direct creation science community debate. One exception is his critique of the pre-Flood vapor canopy theory (pp. 662–667) proposed by Whitcomb and Morris and later expanded on by Jody Dillow.

Snelling ends his book with two invitations. He is realistic regarding the massiveness of the task to reorient current science to Biblically consistent ends. "The ranks of full-time and part-time creation scientists and Flood geologists are meager and thin, and therefore brittle. Furthermore, the modern scientific enterprise has mushroomed, with veritably millions of professional scientists around the globe working in state-

of-the-art laboratories with multi-billion dollar budgets to elucidate the workings of the earth and life on it, grounded in the belief that there was no Creator who instantly brought the earth and life on it into existence, but instead all that was needed was time plus chance!" (p. 1035). He then extends an invitation to upcoming and future generations. "I would therefore unashamedly issue a challenge, particularly to young readers who are in the formative stage of their careers, to heed God's call, and use the intellectual gifts and abilities He has given you, to train in whatever fields of science or intellectual endeavor He may lead you into, so as to join the growing ranks of professional creation scientists and Flood geologists" (pp. 1035–1036). Snelling then goes on to give an evangelistic appeal for those non-Christian readers to receive Christ as their Lord and Savior.

This book is a valuable resource for much of current creation thinking regarding earth history and can be profitable for any serious reader and especially those considering a career in the sciences.

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Media Reviews

God Created the Earth: Genesis of Creation Chemistry

by Edward Boudreaux
and Eric Baxter

Central Ohio Creation
Research Association, Canal
Winchester, OH, 94 pages,
\$20.00.

This book explores the notion (called aquo-nucleosynthesis) that all elements originated from water; accelerated radioactive decay theory also is treated. Part one of the book covers in detail the chemical mechanisms that could produce all known chemical elements from the hydrogen (H) and oxygen (O) atoms in water. It is significant that water is the first material substance cited in the Biblical account of Creation.

The authors document that collisions between H and O nuclei within a ten-billion-degree plasma state promote fusion of the O nuclei, producing the nuclei of other atoms. The authors then determine that under these conditions the newly produced nuclei will fuse with more O nuclei to produce additional atomic nuclei until all elements, including the radioactive species, are produced within a period of less than three days.

This mechanism is supported by the experimental work completed at the *Proton-21 Electrodynamics Research*

Laboratory in the Ukraine (pp. 37–38). This mechanism contradicts the standard evolution model that requires billions of years to produce nucleosynthesis from hydrogen.

I felt part 2 was the more valuable contribution of the book. This section postulates that the same plasma conditions that produce the chemical elements greatly influence the decay rates of the radioactive elements. The primary effects caused by accelerating radioactive decay arise from the plasma's intense magnetic field and temperature. Under normal conditions neither heat nor magnetic fields have a significant effect on decay rates, but under extreme plasma conditions this is not a valid conclusion. Six radioisotopes were selected to evaluate as example cases to document the authors' theory. These elements were: U-238, U-235, Th-232, Sm-147, Rb-87, and K-40. The first four are alpha emitters and the last two beta emitters. It is shown in detail that the

standard billion-year half-lives of these radiometric isotopes, as currently observed, are reduced to half-lives of only minutes under the intense conditions of the plasma.

As the plasma cools, the temperature is reduced from ten billion to ten million degrees within some 200 minutes and the half-lives then return to the billion-year values seen today. Complete details as to how the thermal and magnetic effects of plasma cause the greatly accelerated radioactive decay rates are provided in the text. A mechanism for rapid cooling via thermal conduction is provided as well.

All of the results strongly support the Biblical time frame for earth's creation. I support consideration of this book because I believe that this model, while controversial, needs careful evaluation.

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Media Reviews

God Created the Earth: Genesis of Creation Chemistry

by Edward Boudreaux
and Eric Baxter

Central Ohio Creation
Research Association, Canal
Winchester, OH, 94 pages,
\$20.00.

Author Edward Boudreaux holds a Ph.D. chemistry degree from Tulane University, New Orleans. He retired after 29 years on the faculty at the University of New Orleans and continues creation research. Coauthor Eric Baxter holds a Masters degree in theoretical physics from the University of Texas, Austin.

The book discusses an unusual scenario regarding origins in a young-age context. First, all universe matter begins as water molecules; that is, hydrogen and oxygen atoms. The authors claim to derive this view from Genesis 1:1–3 (pp. 5, 7). Second, an initial plasma temperature of 34 billion degrees is proposed to have caused fusion collisions between

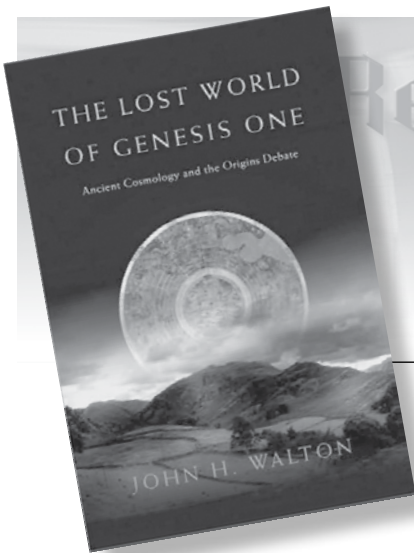
the H and O atoms with a resulting rapid nucleosynthesis buildup of all the other elements in the periodic table. One might consider that the solar core is estimated to be 15 million degrees, thousands of times “cooler” than the author’s assumed initial temperature of matter. Several pages are given to numeric parameters for isotope formation based on the authors’ model. Third, the extreme temperatures are said also to allow for rapid nuclear decay and buildup of decay products on a timescale of just days.

This work does not fully address the total picture of element development throughout the universe, the observed ratios of atomic isotopes, or the dissipa-

tion of the assumed extreme initial heat energy. The authors continue to work on such details of their origin model. References are included but no book index.

Although the book effort is appreciated, one must wonder about the motivation, the need for “a valid scientific model accounting for the origin of the chemical elements” for a young earth and universe (p. 5). Why is there a current trend in creation science to attempt scientific explanations for the details of the *supernatural* Creation Week? Is this not a fundamental and logical conflict?

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The Lost World of Genesis One: Ancient Cosmology and the Origins Debate

by John Walton

InterVarsity Press, Downers Grove, 2009, 192 pages, \$16.00.

Author Walton spent 20 years on the faculty of Moody Bible Institute before joining Wheaton College in 2001 as professor of Old Testament. In this book he develops the theory that Genesis 1 has nothing to do with the origin of the earth or cosmos. Instead, Creation Week details describe specific functions assigned to preexisting components of creation. Walton interprets Genesis 1 as a temple dedication ceremony, the temple being the entire earth.

In Walton's view, when God says, "Let there be light" (Gen. 1:3), light is not created since it is already present. Instead, God is defining a period of time, the day-night cycle (p. 56). Likewise, the mention of animals on Days 5 and 6 does not describe their origin but instead is a reference to their function as a food supply (p. 61). The "very good" statement of Genesis 1: 31 means that everything on earth was working as planned (p. 149).

Other Genesis 1 explanations continue, completely separate from *ex nihilo* Creation. Walton's rationale is that the book of Genesis is not primarily written to us but to Israel (pp. 9, 21). Proper meaning of the Scripture, therefore, must come by entering the ancient culture. Walton makes the case that ancient Near Eastern cultures had no interest in or conception of ultimate origins of

material or life. Usefulness or functionality of existing materials was everything.

Walton suggests a new interpretive translation of Genesis 1:1: "In the initial period, God created by assigning functions throughout the heavens and the earth, and this is how he did it" (p. 46). And when was the initial creation? Walton has no idea and can find no scriptural statement or position regarding creation details or the age of the earth (pp. 95, 169). Nevertheless, the book supports long ages of prehistory and is receptive to the big bang and theistic evolution (pp. 98, 131, 137). Thus, it is no surprise that Walton's "temple text" theory for Genesis is endorsed by leading theistic evolutionists Bruce Waltke, Davis Young, Francis Collins, and Tremper Longman III (Back cover).

Author Walton's novel interpretation of Genesis 1 raises many serious questions, including the following.

- Does ancient Near Eastern literature indeed neglect ultimate origins as stated? Does not the Babylonian myth *Enuma Elish* describe the creation of gods, the earth, and mankind?
- Since the author's approach to Genesis is an unconventional theory of interpretation (p. 112), is it not a leap in logic for him to claim that the burden of contrary proof lies with the traditional Creation interpretation of Genesis 1?
- Does the Bible contain sections of erroneous, outdated, Old

World science as Walton assumes (p. 61)?

- Why does Walton take both the days of Genesis 1 and also our first parents, Adam and Eve, as literal, when the entire Genesis Creation account is reinterpreted figuratively as a temple text (p. 91)? Is this an accommodation to students (and parents) who favor a literal six-day Creation?
- Dr. Walton suggests that dinosaurs lived in a "prefunctional cosmos" and there were also prehuman hominids (p. 169). This is a rather bizarre assumption of early experiments by God in making and eliminating creatures complete with imperfections, predation, disease, and death, long before the Curse of Genesis 3. The book does not mention the global Genesis Flood, which provides a consistent explanation of the fossil record.

The *Lost World of Genesis One* is a classroom guide for hundreds of college students, past and present. The obscure interpretation of the first chapter of Genesis brings to mind Isaiah 45:19: "I have not spoken in secret." This passage describes the creation of the heavens and the earth.

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Already Gone: Why Your Kids Will Quit Church and What You Can Do to Stop It

by Ken Ham, Britt Beamer, and Todd Hillard

MasterBooks, Green Forest, AZ,
2009, 190 pages, \$13.00.

One of the issues that relate to working in creation science is that science itself is merely one topic of creation research. In fact, creation studies are integrally related to the scholarly study of the Bible, worldview and apologetics development, current environmental issues, Biblical theology, archeology, and anthropology, just to name a few related disciplines. This broad field of impact is a result of the fact that what we believe about origins really does make a difference in other areas of study and life. Ken Ham and Britt Beamer argue in their coauthored book that creation studies should also have an impact on how we do church.

The focus of this book is on a study done by Britt Beamer, the founder of America's Research Group, on 1,000 young people between 20 and 30 years of age who have left the church. It has been shown before that of young people currently attending evangelical churches, fully two thirds will leave at some point after they leave home. Though many of these will return at some later point, the study was specifically designed to find out why these young people had left. There were a number of surprising results obtained by the study, including the following.

Overall, those young people who had attended Sunday school were *more likely* to leave church than those who had not.

Of those surveyed, the majority left church during *high school*, not college.

There was *no significant difference* between those who had attended public school, Christian school, or were homeschooled.

About half of those surveyed said they do attend church at holidays (Christmas and Easter), while nearly 40% planned on returning after they had children.

Further results from the study showed that many of the people who left church still value the Bible and believe in its inspiration, but they do not see church as important for their lives right now. Many did admit to having doubts about the historicity of some of the Biblical accounts such as Creation and the Flood, but more were concerned about alleged contradictions in the text and how the Bible could be trusted if it was written by humans. Ham and Beamer suggest that many of these trends indicate that churches are not doing enough work in the areas of apologetics and basic Biblical instruction for children and young adults currently in the church.

One of the problems in dealing with any kind of statistical study is that results must be interpreted. It is obvious from the book that the church does have problems connecting with the young people within it; however, it is not as clear exactly what the problem is or how it has happened. Lack of solid teaching and apologetics has certainly played a role, but whether or not this is to blame for the widespread movement of young adults away from the church

is uncertain. It is also important to note that many of those who leave eventually come back, as noted in the book.

Based on the results of the survey as presented in the book, I would submit that perhaps another reason for the trend is that many parents, youth leaders, and pastors have not done a good job showing how church is relevant and in fact vital for the everyday life of believers. In other words, what we learn on Sunday should affect how we live Monday to Friday. The relationships we have on Sunday should be maintained and strengthened throughout the week. During the time of the early church, believers would often gather or meet one another during the week, and spiritual growth and fellowship would take place at many places and times. This does not seem to be reflected, by and large, among churches in modern America.

This point is hinted at in the book, though not fully developed: "Certainly, the decrease in the belief in the Bible and the embarrassing un-biblical atmosphere in many churches did not happen overnight. The spiraling descent can be described in one word: *IRRELEVANCE*" (p. 68). The authors argue that defending and teaching the Bible from the very first verse is necessary to overcome the irrelevance that has characterized much of the church, and what we believe must be reflected daily in how we live. Certainly, if young people do not see how the spiritual life of the church is to be lived out in their everyday lives, they may not see the need for church attendance at all.

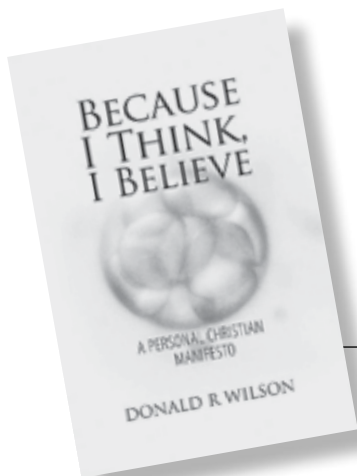
One further point that the authors make deserves special attention. They reference a study done by the Willow Creek Church showing that personal time in God's Word is the biggest and most important indicator of spiritual growth. In other words, participating in church activities, though beneficial in many ways, does not automatically lead to a closer walk with God. Instead, time spent meditating on the Bible and in prayer combined with church fellowship is the best way to grow spiritually. The

Word of God, while providing truth for understanding Creation and origins, is still the catalyst for change in our personal lives as well as the world at large. This is the most important point to be taken from this book.

The book is well written and concise and contains an appendix with an abbreviated form of the survey given, as well as several appendices of resources. It does not contain an index, which would have been a helpful addition. A possibility for future research and study is how many

of the "20-somethings" that leave the church actually end up returning and living productive lives for God and what caused them to return. I recommend this book to anyone interested in current trends among Christian youth as well as those in church leadership.

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Because I Think, I Believe

by Donald R. Wilson

American Book Publishing,
Salt Lake City, 2010, 212 pages,
\$20.00.

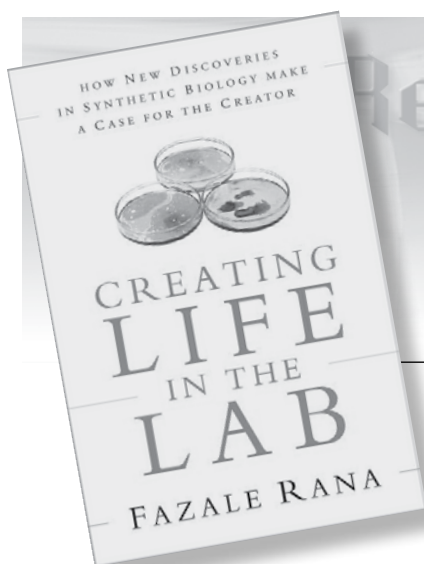
Author Donald Wilson piloted luxury corporate jets worldwide for decades. He has published popular-level articles on flight and also on family values. His contacts include many worldviews, and Don eventually adopted a strong creationist

position. The purpose of this book "is to declare the *logic* of a belief in God and the Christian faith and to point out some of the logical difficulties of trying to avoid such a belief" (p. 8). The book presents a crystal-clear picture of Christian faith while confronting naturalism graciously yet confidently.

Don's interest in history and logic is evident in his discussion of geocentri-

cism, historic slave trade, witch-hunting, crusades, Spanish Inquisition, and logical fallacies such as "irrelevant thesis" (pp. 190-192). This book should be a help and encouragement to many readers. No book index is provided.

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Reviews

Creating Life in the Lab

by Fazale Rana

Baker Publishing Group,
Grand Rapids, 2011, 238 pages,
\$11.72.

As a biochemist, I find Fazale Rana's book an adequate and moderately technical description of the efforts in synthetic biology and certain evolutionary speculations about how life got going on primitive earth. A better title for the book might have been *Disassembling and Reassembling Bacteria in the Lab*, since the scientific achievements discussed by Rana are really about transplanting genetic information (DNA) from one bacterium to another. The related topic is the conjecture on how life, according to evolution, might have arisen by random chemical events. Rana (p. 195) states that scientists are attempting to "re-create" life in the lab. The two major approaches to investigating life are the synthetic biology of Craig Venter and the highly speculative primitive earth chemical evolution of Jack Szostak.

Craig Venter and his team of biochemists, chemists, microbiologists, and geneticists accomplished the complete sequencing of *Haemophilus influenzae* and then competed with the Human Genome Project administrated by Francis Collins to sequence the human genome. The public-funded effort of the Collins team is credited for first sequencing the human genome. What Venter later did (briefly) was to successfully transplant a biochemically engineered *Mycoplasma mycoides* (from

yeast) into *Mycoplasma capricolum*. In some instances (p. 44), the transplanted genome took over, transforming *M. capricolum* into *M. mycoides*. From these successes, Venter hopes to produce what he will call *Mycoplasma laboratorium*, a completely new synthetic organism. This has not to date been accomplished, but even if it were, there would exist vast differences between creation of life by divine command and the human reassembling of genetic material into cells made by life and with the essential assistance of enzymes (ribozymes and other enzymes). In other words, Venter could not and did not do his experiments without enzymes, cell walls, intelligent design, and intensive copying of *in vivo* processes. By no means has he or will he or others produce a living organism from scratch or from the chemicals hypothesized to be present on primitive earth. I would consider successful heart transplant and artificial heart transplant operations of greater human achievement than transplanting DNA from one organism to another.

Rana's main thesis in the book is that whatever the accomplishments of Venter, Szostak, Shapiro, Ferris, and others, they do it by intelligent design. In this manner, Rana makes a relatively understated case for God alone creating life. Rana presents himself as a Christian who does not accept the atheistic pronouncements of many of the above named scientists. He apparently socializes with the elites in the origin-of-life group, presenting papers at and attending origin-of-life conferences like the

International Society for the Study of Origin of Life.

The second group of efforts includes simulations of chemical evolution by Jack Szostak and others. Szostak states (2009, p. 54), "I is virtually impossible to imagine how a cell's machines, which are mostly protein-based catalysts called enzymes, could have formed spontaneously as life first arose." However, he ignored his intellectual instincts and somehow has what he considers a plausible scenario, which is "in principle" physically possible.

To make formation of nucleotides possible, the primitive atmosphere includes hydrogen cyanide, acetylene, cyanoacetylene, and formaldehyde, which together can chemically form 2-amino-oxazole, then arabino-oxazoline, finally combining with a source of soluble phosphates to make nucleotides. Without this bizarre early earth atmosphere and the fortuitous soluble phosphate from a meteorite (Szostak, p. 57), there would be (according to them) no us. All efforts in this field use only *in vivo* enzymes, other chemicals made by living things (biochemicals), and laboratory systems to carry out their research. Rana suggests (p. 82) that Szostak emulated God's handiwork rather than making God irrelevant.

Synthetic biology and genetic engineering of microbes have been of great benefit to humankind. One such example is the deliberate optimization of yeast cells to make artemisinin, a naturally occurring alkaloid that kills malaria parasites. Plant production and chemi-

cal synthesis are much less efficient in producing this anti-malarial agent. Microbes can be engineered to produce C5 to C8 alcohols to supplement gasoline, obviating the need of corn to produce ethanol. The fact that some publically funded scientists attach an unwarranted religiosity to this work does not mean it is of no value. Public support specifically to fund atheistic hypotheses on the origin of life should be withdrawn on the basis of the constitutional prohibition for the establishment of religion.

Criticism of the evolution-of-life theories is seen in the internal critiques of research efforts in this narrow field. Leslie Orgel (p. 161) said, "I hope no creationists are in the audience, but it would be a miracle if a strand of RNA ever appeared on the primitive Earth." Some of these investigators favor DNA first, some RNA first, and some metabolism first (Robert Shapiro). Some favor

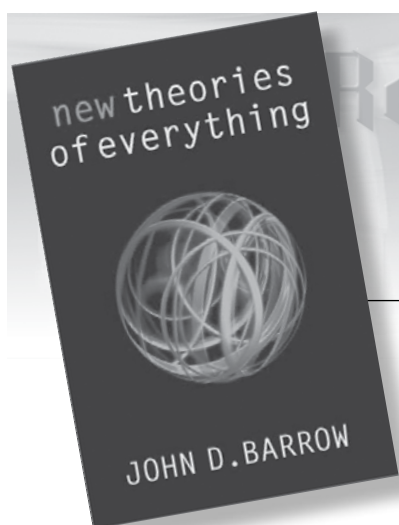
a special type of clay as the catalytic surface; others point out that this is impossible. At bottom, none of these highly intelligent scientists want to admit that their scenarios for producing life on the earth could not have happened. I wonder if the Venters and Szostaks of this world really believe their explanations of life's origin, or do they have so much at stake in reputations, pride in accomplishment, and grant money that retracting anything is out of the question. They have resisted the truth to the extent that they are now "futile in their thinking" (Romans 1:21).

Fazale Rana has high praises for the scientific accomplishments of the origin-of-life group and believes that life will be created in the laboratory. However, he considers these accomplishments as clear evidence for intelligent design in creation. Rana has written at least one book with "progressive creationist" Hugh

Ross and is the vice president of research and apologetics at Reasons to Believe (founded by Hugh Ross). Rana stated in speaking of macroevolution (p. 30), "My view is that while organisms can adapt to changing environments and other selective pressures, they cannot evolve in dramatic ways." It is unclear how he would relate to persons at the Discovery Institute, Bio-Logos founded by Francis Collins, or members of the Creation Research Society. Be that as it may, if you want a detailed and coherent explanation of what Venter, Szostak, Shapiro, Ferris, and others are doing now, this book will help in that regard.

Szostak, A. Richardo, 2009. Life on earth. *Scientific American* 301(3):54-61.

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New Theories of Everything

by John D. Barrow

Oxford University Press, New York, 2008, 260 pages, \$11.60.

John D. Barrow received his Ph.D. in astrophysics from the Magdalen College in the University of Oxford, UK in 1977. He is an active member of the Big Bang cosmology establishment with a long list of research publications and books related to the topic. Barrow is presently Gresham Professor of Geometry and Director of the Millennium Mathematics Project at Gresham College, London. This book updates his first book on the subject, *Theories of Everything*, published in 1991. In the past 19 years his optimism for such a theory of everything (TOE) has been tempered by the slow progress that has been made and the dead ends that have been encountered. Barrow summarizes his present position in the last paragraph of this book: "There is no formula that can deliver all truth, all harmony, all simplicity. No Theory of Everything can ever provide total insight. For, to see through everything, would leave us seeing nothing at all" (p. 246).

The book is well organized, with a preface, table of contents, nine chapters, select bibliography for further reading, and an index. In chapter 1, "Ultimate Explanation," Barrow covers the subject of finding an explanation for everything. Much of this topic he ascribes first to theologians and philosophers, but he introduces the subject of this book when, in recent times, scientists have begun

to play a large role. He addresses both secular and creation origins stories but dismisses them as myths. According to him, their most important quality was that they presented the idea of "a place for everything and everything is in its place." (pp. 4–5). In other words, these myths left nothing to chance. The TOE is based on the same principle that he calls compressibility: Everything can be compressed into one overarching equation. Chapter 2, "Laws," provides a historical overview of the search for that equation.

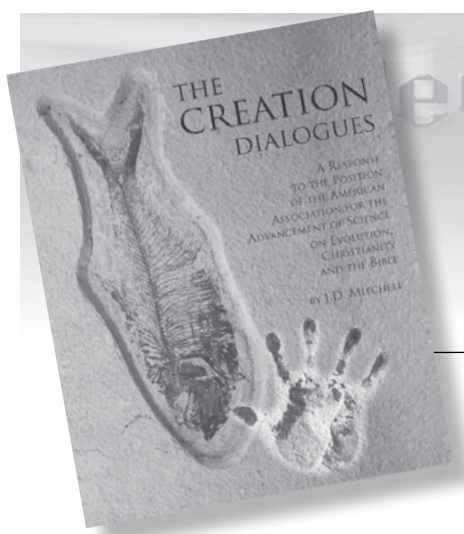
The main section of the book is devoted to explaining why the TOE has not been found. One major problem scientists have encountered is that the initial conditions of the universe are unknown. (I would recommend that they read and understand Genesis 1:2 for the answer.) Another problem they face is quantum mechanics, where the small particles and forces do not lend themselves to be compressed. Positions and velocities of quantum-sized particles can only be expressed in terms of probabilities. The scientists also discovered that they have to question whether the constants found in nature apply equally to objects of stellar and atomic proportions. Recent TOEs have proposed more than three dimensions of space, but all the constants of nature are defined in only three dimensions. Another problem is broken symmetry. The underlying problem is that the same cause can have more than one result. Scientists find it difficult to express this with a single equation.

After addressing these problems Barrow describes in the final chapter how the most recent and popular theories,

M-theory and the big bang theory with all its patches, fail to overcome these problems. A major problem for the mathematics used is to show a local-global connection. The scientists must show that the initial conditions they assume, which are in the quantum world of probability, can be extended to the real world of discrete objects in which we live. So far they have not found any unique path because all the mathematics they have available do not cover discontinuous functions such as broken symmetry successfully. M-theory is actually five theories with different mathematics applied in each one. Barrow also describes how the lack of knowledge of initial conditions makes it difficult to discover the connection. He states that the connection "is by no means inevitable and may require the Universe to have emerged from a rather special primeval state" (pp. 227). It sounds as if they need a specially created universe as designed by the Intelligent Designer to start their models.

As this book demonstrates, the quest for a TOE remains a popular research topic and it will continue to be as long as there are funding sources for it. Its successful completion, however, depends heavily on solving all the mysteries that the Creator has introduced into the universe. In my opinion, that level of knowledge may be beyond human capability.

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The Creation Dialogues

by J. D. Mitchell

WinePress Publishing,
Enumclaw, WA, 2010,
136 pages, \$16.00.

Author Mitchell is a longtime researcher and defender of creation science. He holds a B.S. in mechanical engineering and an M.S. in biblical studies. J. D. Mitchell directs the Institute for Creation Science in Oregon and also maintains a traveling dinosaur and fossil museum. Anyone is to be commended who transports such an inventory across the country to encourage and enlighten people with the creation worldview. Pictures of the museum displays are on the website creationengineeringconcepts.org.

This book is a reaction to the similarly named *The Evolution Dialogues* and study guide (Baker, 2006). The 2006 volume tells the story of a graduate

student with a conservative Christian worldview who struggles with and finally accommodates evolutionary teaching. It is firsthand experience since author Mitchell himself accepted evolution until age 40 (p. 19). Mitchell clearly refutes the theological compromise promoted in the AAAS book.

Included is discussion of logical fallacies (p. 114), natural history museums (pp. 75–91), and Grand Canyon flood evidences (p. 96). It is bothersome that evolution is referred to as a fairy tale (pp. 9, 10, 18, 74), a fantasy (pp. 20, 25), and garbage (p. 30). Insulting the opposition does not help the creationist effort, even though they do the same to creationists daily. Author Mitchell rightly describes the creationist heritage of science but mentions only men. Many science pioneers of the female gender also qualify (DeYoung, 2006). The book has helpful indexes and endnotes.

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Instructions to Authors

Submission

Electronic submissions of all manuscripts and graphics are preferred and should be sent to the editor of the *Creation Research Society Quarterly* in Word, WordPerfect, or Star-Office/Open Office (see the inside front cover for address). Printed copies also are accepted. If submitting a printed copy, an original plus two copies of each manuscript should be sent to the editor. The manuscript and copies will not be returned to authors unless a stamped, self-addressed envelope accompanies submission. If submitting a manuscript electronically, a printed copy is not necessary unless specifically requested by the *Quarterly* editor. Manuscripts containing more than 35 pages (double-spaced and including references, tables, and figure legends) are discouraged. An author who determines that the topic cannot be adequately covered within this number of pages is encouraged to submit separate papers that can be serialized.

All submitted manuscripts will be reviewed by two or more technical referees. However, each section editor of the *Quarterly* has final authority regarding the acceptance of a manuscript for publication. While some manuscripts may be accepted with little or no modification, typically editors will seek specific revisions of the manuscript before acceptance. Authors will then be asked to submit revisions based upon comments made by the referees. In these instances, authors are encouraged to submit a detailed letter explaining changes made in the revision, and, if necessary, give reasons for not incorporating specific changes suggested by the editor or reviewer. If an author believes the rejection of a manuscript was not justified, an appeal may be made to the *Quarterly* editor (details of appeal process at the Society's web site, www.creationresearch.org).

Authors who are unsure of proper English usage should have their manuscripts checked by someone proficient in the English language. Also, authors should endeavor to make certain the manuscript (particularly the references) conforms to the style and format of the *Quarterly*. Manuscripts may be rejected on the basis of poor English or lack of conformity to the proper format.

The *Quarterly* is a journal of original writings, and only under unusual circumstances will previously published material be reprinted. Questions regarding this should be submitted to the Editor (CRSQeditor@creationresearch.org) prior to submitting any previously published material. In addition, manuscripts submitted to the *Quarterly* should not be concurrently submitted to another journal. Violation of this will result in immediate rejection of the submitted manuscript. Also, if an author uses copyrighted photographs or other material, a release from the copyright holder should be submitted.

Appearance

Manuscripts shall be computer-printed or neatly typed. Lines should be double-spaced, including figure legends, table footnotes, and references. All pages should be sequentially numbered. Upon acceptance of the manuscript for publication, an electronic version is requested (Word, WordPerfect, or Star-Office/Open Office), with the graphics in separate electronic files. However, if submission of an electronic final version is not possible for the author, then a cleanly printed or typed copy is acceptable.

Submitted manuscripts should have the following organizational format:

1. Title page. This page should contain the title of the manuscript, the author's name, and all relevant contact information (including mailing address, telephone number, fax number, and e-mail address). If the manuscript is submitted by multiple authors, one author should serve as the corresponding author, and this should be noted on the title page.

2. Abstract page. This is page 1 of the manuscript, and should contain the article title at the top, followed by the abstract for the article. Abstracts should be between 100 and 250 words in length and present an overview of the material discussed in the article, including all major conclusions. Use of abbreviations and references in the abstract should be avoided. This page should also contain at least five key words appropriate for identifying this article via a computer search.

3. Introduction. The introduction should provide sufficient background information to allow the reader to understand the relevance and significance of the article for creation science.

4. Body of the text. Two types of headings are typically used by the *CRSQ*. A major heading consists of a large font bold print that is centered in column, and is used for each major change of focus or topic. A minor heading consists of a regular font bold print that is flush to the left margin, and is used following a major heading and helps to organize points within each major topic. Do not split words with hyphens, or use all capital letters for any words. Also, do not use bold type, except for headings (italics can be occasionally used to draw distinction to specific words). Italics should not be used for foreign words in common usage, e.g., "et al.", "ibid.", "ca." and "ad infinitum." Previously published literature should be cited using the author's last name(s) and the year of publication (ex. Smith, 2003; Smith and Jones, 2003). If the citation has more than two authors, only the first author's name should appear (ex. Smith et al., 2003). Contributing authors should examine this issue of the *CRSQ* or consult the Society's web site for specific examples as well as a more detailed explanation of manuscript preparation. Frequently-used terms can be abbrevi-

ated by placing abbreviations in parentheses following the first usage of the term in the text, for example, polyacrylamide gel electrophoresis (PAGE) or catastrophic plate tectonics (CPT). Only the abbreviation need be used afterward. If numerous abbreviations are used, authors should consider providing a list of abbreviations. Also, because of the variable usage of the terms “microevolution” and “macroevolution,” authors should clearly define how they are specifically using these terms. Use of the term “creationism” should be avoided. All figures and tables should be cited in the body of the text, and be numbered in the sequential order that they appear in the text (figures and tables are numbered separately with Arabic and Roman numerals, respectively).

5. Summary. A summary paragraph(s) is often useful for readers. The summary should provide the reader an overview of the material just presented, and often helps the reader to summarize the salient points and conclusions the author has made throughout the text.

6. References. Authors should take extra measures to be certain that all references cited within the text are documented in the reference section. These references should be formatted in the current CRSQ style. (When the *Quarterly* appears in the references multiple times, then an abbreviation to CRSQ is acceptable.) The examples below cover the most common types of references:

- Robinson, D.A., and D.P. Cavanaugh. 1998. A quantitative approach to baraminology with examples from the catarrhine primates. *CRSQ* 34:196–208.
- Lipman, E.A., B. Schuler, O. Bakajin, and W.A. Eaton. 2003. Single-molecule measurement of protein folding kinetics. *Science* 301:1233–1235.
- Margulis, L. 1971a. The origin of plant and animal cells. *American Scientific* 59:230–235.
- Margulis, L. 1971b. *Origin of Eukaryotic Cells*. Yale University Press, New Haven, CT.
- Hitchcock, A.S. 1971. *Manual of Grasses of the United States*. Dover Publications, New York, NY.
- Walker, T.B. 1994. A Biblical geologic model. In Walsh, R.E. (editor), *Proceedings of the Third International Conference on Creationism* (technical symposium sessions), pp. 581–592. Creation Science Fellowship, Pittsburgh, PA.

7. Tables. All tables cited in the text should be individually placed in numerical order following the reference section, and not embedded in the text. Each table should have a header statement that serves as a title for that table (see a current issue of the *Quarterly* for specific examples). Use tabs, rather than multiple spaces, in aligning columns within a table. Tables should be composed with 14-point type to insure proper appearance in the columns of the CRSQ.

8. Figures. All figures cited in the text should be individually placed in numerical order, and placed after the tables. Do not embed figures in the text. Each figure should contain

a legend that provides sufficient description to enable the reader to understand the basic concepts of the figure without needing to refer to the text. Legends should be on a separate page from the figure. All figures and drawings should be of high quality (hand-drawn illustrations and lettering should be professionally done). Images are to be a minimum resolution of 300 dpi at 100% size. Patterns, not shading, should be used to distinguish areas within graphs or other figures. Unacceptable illustrations will result in rejection of the manuscript. Authors are also strongly encouraged to submit an electronic version (.cdr, .cpt, .gif, .jpg, and .tif formats) of all figures in individual files that are separate from the electronic file containing the text and tables.

Special Sections

Letters to the Editor:

Submission of letters regarding topics relevant to the Society or creation science is encouraged. Submission of letters commenting upon articles published in the *Quarterly* will be published two issues after the article’s original publication date. Authors will be given an opportunity for a concurrent response. No further letters referring to a specific *Quarterly* article will be published. Following this period, individuals who desire to write additional responses/comments (particularly critical comments) regarding a specific *Quarterly* article are encouraged to submit their own articles to the *Quarterly* for review and publication.

Editor’s Forum:

Occasionally, the editor will invite individuals to submit differing opinions on specific topics relevant to the *Quarterly*. Each author will have opportunity to present a position paper (2000 words), and one response (1000 words) to the differing position paper. In all matters, the editor will have final and complete editorial control. Topics for these forums will be solely at the editor’s discretion, but suggestions of topics are welcome.

Book Reviews:

All book reviews should be submitted to the book review editor, who will determine the acceptability of each submitted review. Book reviews should be limited to 1000 words. Following the style of reviews printed in this issue, all book reviews should contain the following information: book title, author, publisher, publication date, number of pages, and retail cost. Reviews should endeavor to present the salient points of the book that are relevant to the issues of creation/evolution. Typically, such points are accompanied by the reviewer’s analysis of the book’s content, clarity, and relevance to the creation issue.

Creation Research Society

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The membership/subscription categories are defined below:

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Please complete the lower portion of this form and mail it with payment to CRS Membership Secretary, P.O. Box 8263, St. Joseph, MO 64508-8263, or fax for credit card payment to (816) 279-2312. Applications may also be completed online at creationresearch.org.



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Creation Research Society

History—The Creation Research Society was organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a need for an association devoted to research and publication in the field of scientific creation, with a current membership of over 600 voting members (graduate degrees in science) and about 1000 non-voting members. The *Creation Research Society Quarterly* is a peer-reviewed technical journal. It has been gradually enlarged and modified, and is currently recognized as one of the outstanding publications in the field. In 1996 the CRSQ was joined by the newsletter *Creation Matters* as a source of information of interest to creationists.

Activities—The Society is a research and publication society, and also engages in various meetings and promotional activities. There is no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund and research center are maintained to assist in such projects. Contributions to the research

fund for these purposes are tax deductible. As part of its vigorous research and field study programs, the Society operates The Van Andel Creation Research Center in Chino Valley, Arizona.

Membership—Voting membership is limited to scientists who have at least an earned graduate degree in a natural or applied science and subscribe to the Statement of Belief. Sustaining membership is available for those who do not meet the academic criterion for voting membership, but do subscribe to the Statement of Belief.

Statement of Belief—Members of the Creation Research Society, which include research scientists representing various fields of scientific inquiry, are committed to full belief in the Biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution) both of the universe and the earth with its complexity of living forms. We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. *All members of the Society subscribe to the following statement of belief:*

1. The Bible is the written Word of God, and because it

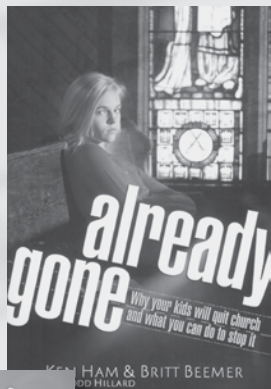
is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.

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

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

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

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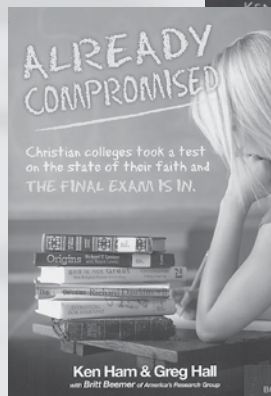


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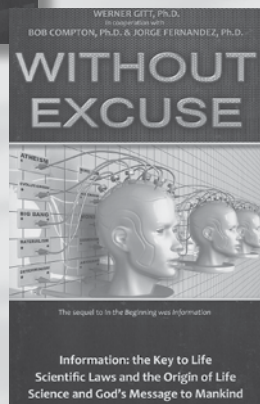


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