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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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Was the Year Once 360 Days Long?

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Abstract

Many recent creationists believe that the year originally was 360 days long. I examine the biblical and ancient nonbiblical arguments for this and find them wanting. Suggestions that the year was originally 360 days lack physical rigor of a mechanism to alter the year to its current length, and so it is difficult to criticize them physically in the general case. However, I propose here a very simple model of how part of this might have happened, and I show that the energy involved is unrealistically high. It is doubtful that a successful physical model that could have changed the year from 360 days to 365 days can be produced.

Introduction

There is a belief among many recent creationists that the year once had 360 days and that the month was 30 days long. This is quite different from the year as it now exists (365.24 days) and the current length of the month (29.531 days). The reasons for this belief, the time at which the bases for calendars allegedly changed, and the manner in which they changed have many variations. We will examine some of these and evaluate whether any are likely to be true.

Definitions

First, we ought to define what we mean by the year, the month, and the day. The year is the revolution period of the earth around the sun. However, we must specify with respect to what we are measuring the orbital period of the earth. The *sidereal* year is the orbital period of the earth with respect to the stars. That is, if the earth, the sun, and a distant star align with one another, we say that one sidereal year has elapsed when the three align once again. The word "sidereal" means "star." The sidereal year is the true orbital period of the earth, for the stars are so distant as to represent a good nonmoving standard of measurement. The *tropical* year is the revolution period of the earth with respect to the vernal equinox. The equinoxes are the intersections of the ecliptic (the earth's orbital plane) and the celestial equator (an imaginary circle in the sky lying directly above the earth's equator). The ecliptic and celestial equator intersect, making an angle of 23.5 degrees, the angle of the earth's axial tilt. Because both the ecliptic and celestial equator are great circle arcs, they intersect in two places, and hence there are two equinoxes. The equinox where the sun crosses the celestial equator traveling northward is the vernal equinox; the equinox where the sun crosses moving southward is the autumnal equinox.

Why are the sidereal and tropical years not the same length? The spinning earth has a slight equatorial bulge. The gravity of the sun and other objects in the solar system produce a torque on this bulge. This torque results in a gradual shift in the orientation of the earth's rotation axis, an effect that we call *precession*. Precession is easy to demonstrate with a spinning top or gyroscope. The ecliptic is reasonably fixed, but the celestial equator is perpendicular to the rotation axis of the earth and hence must precess as the rotation axis precesses. Thus, the intersections of the celestial equator and the ecliptic, the equinoxes, gradually shift along the ecliptic. In fact, astronomers call this the precession of the equinoxes. It takes 25,900 years to complete

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one precession cycle. Since the vernal equinox slides very gradually along the ecliptic or against the background stars, the tropical year and the sidereal year cannot have the same length.

Which year is the basis of our calendar? The sidereal year is the true orbital period of the earth, but the seasons repeat with the tropical year. Until recently, virtually all societies were agrarian and hence were directly dependent upon agriculture. Even today, we must eat, so we are still dependent upon agriculture, albeit less directly. Knowing when to plant crops is essential knowledge in farming, and so the tropical year is the basis of our calendar. This keeps the seasons synchronized to our calendar, which even most modern people find agreeable.

We can mention at least one other year, the *anomalistic* year. The anomalistic year is the revolution period of the earth with respect to perihelion. Perihelion is the point on a planet's orbit that is closest to the sun. The gravitational perturbations of the other planets cause the earth's perihelion to gradually shift along the ecliptic as well, an effect we call *perihelion precession*. For most purposes, the anomalistic year is not nearly as important as the other two years.

The month is the orbital period of the moon, but as with the year, we must define the month with respect to some reference. The *sidereal* month is the orbital period of the moon with respect to the stars. Since the stars represent a distant, reasonably fixed reference, the sidereal month is the true orbital period of the moon. However, the *synodic* month is the more obvious orbital period of the moon. The synodic month is the orbital period of the moon with respect to the sun. Since the geometrical relationship between the moon, the sun, and the earth determines lunar phases, the synodic month is the period with which lunar phases go through a complete cycle. There are other ways of defining the month, such as the *nodal* month. The nodal month is the orbital period of the moon with respect to its nodes, the nodes being the intersection of the moon's orbit and the ecliptic. The nodal month is important in predicting eclipses, but it is the synodic month that is normally the month of choice for calendar purposes.

Most ancient calendars were observationally based. For example, in the Hebrew calendar, which is still observed today, a month begins when one can spot the first thin crescent moon in the western sky following a new moon. Since this is done shortly after sunset and the Hebrews reckoned the beginning of the day from sunset, this observation quickly determined whether a particular day that just started was the first of a new month or the final day of the previous month. The moon generally is not visible for two to three days near new moon.

Since the synodic month is approximately 29½ days in length, if the beginning of each month (and likewise the end of the preceding month) is observationally determined in this way, the months generally will alternate between 29 and 30 days. With a few years of records, one quickly learns when to anticipate when the first thin crescent is likely to be visible, and thus one can calculate with some certainty in advance (or in the past) when a month is likely to begin. A strictly lunar calendar such as this will result in 12 months and be about 10 days shorter than the tropical year. The Islamic calendar is of this type, so the months of that calendar slip 10 days earlier each year. This is why the Islamic holy month of Ramadan occurs progressively earlier each year, and so that month of religious observance is not fixed with respect to the seasons.

After 12 synodic months, there will be a discrepancy of about 10 days from the tropical year. After another 12 months the discrepancy will be 20 days, and after a third 12-month period the discrepancy will be approximately 30 days. Since this accumulated error is about one month every three years, most ancient lunar calendars corrected for this problem by inserting an intercalary month approximately every third year. The intercalary month is placed at the end of the year. For many ancient calendars, the end/beginning of the year was near the time of the equinoxes. Thus, a year with an intercalary month was approximately 385 days long, and years without an intercalary month were approximately 355 days long. Instead of methodically inserting an intercalary month every third year, many ancient calendars followed the pattern of the Metonic cycle, discovered by Meton of Athens, a fifth-century BC mathematician and astronomer. The Metonic cycle inserts an intercalary month in years 3, 6, 8, 11, 14, 17, and 19 of a 19-year cycle. The ancient Babylonian and Jewish calendars follow this method. We do not know when the Jews adopted this approach, but many think that it may have happened during the Babylonian captivity. There are no direct biblical references to how this was done in Old Testament times, and the earliest specific mentions from secular Jewish literature are medieval.

The Romans took a different approach. The length and frequency of the intercalary month was much more confusing and subject to bureaucratic tampering. The Roman calendar was a strictly lunar-based one until 45 BC, when the Julian calendar reform took effect. The most significant change of the Julian calendar reform was that ten extra days were distributed throughout the twelve months that then existed in the calendar, thus removing the need for an intercalary month and increasing the length of the year to 365 days. This meant that the phases of the moon now drifted progressively earlier in each succeeding month, thus abandoning the strictly lunar basis of the month.

The second most important change of the Julian calendar reform was the institution of observing leap days. Since

the tropical year is approximately 365¼ days, an extra day inserted at the traditional place of the intercalary month brought the calendar year in near alignment with the tropical year. The intercalary month had been placed between February and March, so this is where a leap day was inserted every fourth year, and eventually people came to associate this extra day as part of February. Most readers will recognize the elements of this calendar in our own calendar. Some readers probably are aware that the tropical year is actually less than 365.25 days, which results in an error of ¾ day per century. Some of the Christian religious calendar was adopted at the Council of Nicaea in AD 325. The error in the Julian calendar accumulated to ten days between then and the sixteenth century, which necessitated the Gregorian calendar reform in 1582. The Gregorian calendar essentially is the calendar that we observe today.

To bring the calendar back to the standards of AD 325, the Gregorian calendar reform deleted ten days from the calendar—October 4, 1582, was immediately followed by October 15. The more lasting legacy of the Gregorian calendar reform was the altering of the rule for adding leap days. Under the Julian calendar, any year divisible by four is a leap year, but even century years (divisible by 100) are not leap years (common years), unless they are also divisible by 400. This omits three days per four centuries, which amounts to the ¾ day discrepancy for the Julian calendar. Thus, while the years 1700, 1800, and 1900 were leap years, 1600 and 2000 were not.

We should emphasize that there are many other ways that one could reconcile what appears to be a mismatch between the lengths of the days, months, and years, and different ancient societies used different methods. It is important to realize that there is not a single, uniquely satisfying way to do this, or else there would not be such diversity. As with any other measurement system, we get very comfortable with what we are used to, and think other measurements are odd or downright weird. For instance, many moderns find the Hebrew calendar odd with the dates of Passover, Yom Kippur, and other festival and holy days moving about our calendar. However, on the Jewish calendar, those observances are on the same dates each year. For instance, Passover is on the fifteenth day of the first month of the religious calendar. The fifteenth day of any strictly lunar month will be the full moon, and the first month is the month that follows the vernal equinox. The Jewish New Year (on the civil calendar) is the first day of the seventh month of the religious calendar, which occurs about the time of the autumnal equinox. Jewish tradition holds that the creation was at this time, so this is a logical choice for the beginning of the year. The religious calendar was introduced at Sinai as a memorial to the first Passover. The Jewish civil calendar almost certainly predates the religious calendar. Anyone who is used to a lunar calendar would find it odd that our celebrations do not occur on the same phase of the moon during the respective month each year. In other words, our fixed dates bounce about on a lunar calendar.

The day is defined as the rotation period of the earth, but as with the year and month, we must specify the reference frame. The most obvious references are the sun and the stars. The *solar day* is the rotation period of the earth with respect to the sun, and that is the day that we normally use. The *sidereal day*, the rotation period of the earth with respect to the stars, is the true rotation period of the earth. The sidereal day is about four minutes shorter than the solar day. The extra four minutes is made up by the motion of the earth around the sun over the course of a day. The result is that stars rise about four minutes earlier each (solar) day.

Reasons for Belief in a 360-day Year

We are finally prepared to discuss why so many recent creationists think that the tropical year once consisted of twelve 30-day months, or 360 days. Some are motivated by what appears to them to be a cumbersome mismatch between the lengths of the day, month, and year. To them, this appears to violate the description of the original creation as "very good" in Genesis 1:31. However, are these people reading into that passage what their opinion of "very good" is? While the current arrangement may offend some of our mathematical sensibilities, is it not a bit presumptuous to dogmatically assert that the current relationship between our timekeepers is somehow not "very good?" The pronouncement of the creation being "very good" stands in stark contrast to the ravages of sin that soon entered the world. That being the case, to be consistent, one ought to postulate that the mismatch in timekeepers must have happened at the Fall, not at some later catastrophe. Yet, proponents of the 30-day-month and 360-day-year theory generally do not make this case.

Another motivation is that many see the prophetic year of 360 days in the book of Daniel as problematic. If this year does not properly match the actual year, then how could this scheme work? We can answer this in a number of ways. First, most recent creationists who take Daniel as evidence that the year once was exactly 360 days long think that the change happened centuries before Daniel, most notably at the time of the Flood or shortly after. Daniel prophesied in the sixth century BC. Taking the very conservative Ussher chronology, the Flood was in the twenty-third century BC. Thus, if Daniel's use of a 360-day calendar was the result of the year actually being that long, one must question why Daniel used a calendar that was more than a millennium and a half out of date in his time. No one in Daniel's

time was observing such a calendar, and no one would have found such a calendar particularly useful. Indeed, there is a much easier answer. We have already discussed how many ancient cultures approximated the length of the year in different ways. The point is, 360 is a very nice, round number, so it works very well in estimating time. Even today some interest calculations are figured on a 360-day basis, but no one in the business sector thinks that the year actually is 360 days long. For instance, users of Microsoft Office should examine the Excel function DAYS360.

Measurement in 360 increments has certain advantages over base ten measurements, such as the number of divisors. Ten is divisible by 2 and 5, but 360 not only is divisible by 2 and 5 but is also divisible by 3 and 4. As a strictly lunar calendar seems peculiar to us with our non-lunar calendar, so measurements in any other base than ten seems odd to us. There is nothing natural or obvious as to why we use base-ten mathematics. Most historians of math believe that we do so because we have ten digits on our hands (and toes!). Long division and multiplication are very cumbersome, but they are required with base-ten arithmetic. For the most part, this chore has been eliminated today with such widespread use of electronic calculators. But until very recently, many computations were done with fractions, and this is where divisors are very helpful. Especially in science we are caught up with the supposed superiority of base ten with the metric system, but for certain conversions, particularly small conversions, fractions work better. Consider the common English standards of volume measurement. There are two cups in a pint, two pints in a quart, four quarts to a gallon, two gallons to a peck, and four pecks to a bushel. One can quickly see that there are 128 cups in a bushel (incidentally, this is base 2). Going the other direction, there is some base three (or alternately, base six) involved. A quarter cup contains four tablespoons, and there are three teaspoons in a tablespoon. Thus, one can quickly see that there are 48 teaspoons in a cup. Many younger people have difficulty with this, for they have never been forced to use fractions in this way. But older people, particularly ones with much experience in cooking and baking, find that they can increase or decrease these measurements very easily to alter the size of a recipe. In similar fashion, people in pre-calculator times found it easier to work in bases other than ten. For instance, the UK monetary system was not decimal until 1971. Prior to that, it took 12 pence to make a shilling, and 20 shillings to make a pound sterling. There were three and six pence pieces (making up ¼ and ½ shilling). Many people today, particularly in the US, find this confusing in making change, but the British got by quite well for centuries with this system.

The ancient Babylonians had a base-60 number system (technically, it was a mingled base six and base 10). The Babylonians apparently introduced the division of the circle into 360 degrees. This is important for several reasons. First, since their number system was already base 60, it required only multiplication by six to get to this figure. Second, the ancient Babylonians attached religious significance to the number six, though it is not entirely clear that this came first or after the adoption of the use of the number six so much. As an aside, the number of the beast, 666, appears to have a direct relation to the city of Babylon in the book of Revelation. Third, the number 360 is very close to the number of days in a year, so at least over the short run, 360 days is a good approximation for the number of days in a year. Keep in mind that Daniel prophesized in Babylon, at the height of Babylonian power and influence. Within this culture, his readers would have understood this simplification without insisting that the year either was or had been exactly 360 days long.

Another biblical passage cited by proponents of the 360-day year is the Flood account. Genesis 7:11 records that the Flood began on the seventeenth day of the second month of the six hundredth year of Noah's life. Of course, nearly everyone is familiar with rain for 40 days and nights (Gen. 7:12). Most recent creationists also are familiar with the statements in Genesis 7:24 and 8:3 that the water prevailed upon the earth for 150 days. That latter statement is followed by Genesis 8:4, which tells us that the ark rested on the mountains of Ararat on the seventeenth day of the seventh month. Assuming that this follows the chronology begun by Genesis 7:11 and that the statements of Genesis 8:3 and 8:4 refer to the same thing, many argue that 150 days here must exactly equal five months, implying a 30-day month. But is this the only possible meaning? No, there are at least three other possibilities.

First, there are a few assumptions listed in the previous paragraph. Those assumptions appear to be sound, but they are assumptions and thus ought to be clearly acknowledged. For instance, the text does not require that verses 3 and 4 of chapter 8 refer to the same events. That is, we cannot necessarily conclude that the end of the prevailing of the waters coincided exactly with the same day that the ark rested upon the mountains of Ararat. Second, there are several possible ways to understand this Genesis 8:4 date and the 150 days of Genesis 8:3. One is the aforementioned exact equivalence, with 150 days exactly equal to five months. However, there are other ways to understand this. We do not know what calendar was employed by Noah; all ancient calendars that we truly understand are far later. At the time, Noah may have used an entirely different calendar, one with even a 30-day month, even though that month did not align with the synodic month and had some unknown mechanism to bring the calendar in line with the moon and the year. A third possibility is that

the 150 days of Genesis 8:3 may be an approximation for the amount of time elapsed. Even today we approximate the length of the month by 30 days, as evidenced by so many financial and legal obligations stated in terms of 30, 45, 60, 90, and 180 days. Why are these numbers so often selected as opposed to, say, 10, 20, 50, or 100 days? Obviously, these are approximations to 1, 1½, 2, 3, and 6 months. In our overly litigious society today, the exact day count likely is to take precedence over an integral month count in tort matters, but the number of months undoubtedly is the intention. We do not know how many, if any, attorneys existed at the time of the Flood, but throughout history, an approximation of 30 days has been applied to the month, particularly when the number of months is low. In short, Genesis 8:4 contains a much more precise statement of time measurement than Genesis 8:3 does. That is, the length of time involved is five months (to the day), an interval of approximately 150 days. This conclusion is consistent with the precision of the statements, does no harm to a straightforward reading of Scripture, and does not require that the original month was exactly 30 days long.

Many recent creationists who support the 360 day year claim refer to Emmanuel Velikovsky's *Worlds in Collision* (1950), where Velikovsky claimed that many ancient cultures once had a 360-day year but were forced to add an extra five days at some point because of some abrupt change in the length of the tropical year. For instance, Velikovsky (1950, p. 336) states:

> The Egyptian year was composed of 360 days before it became 365 by the addition of five days. The calendar of the Ebers Papyrus, a document of the New Kingdom, has a year of twelve months of thirty days each. In the ninth year of King Ptolemy Euergetes, or -238, a reform party among the Egyptian priests met at Canopus and drew up a decree; in 1866 it was discovered at Tanis in the Delta, inscribed on a tablet. The purpose of the decree was to harmonize the calendar with the seasons "according to the present arrangement of the world," as the text states. One day was ordered to be added every four years to the "three hundred and sixty days, and to the five days which were afterwards ordered to be added." The authors of the decree did not specify the particular date which the five days were added to the 360 days, but they say clearly that such a reform was instituted on some date after the period when the year was only 360 days long.

Velikovsky apparently chose to interpret this addition of five days as the result of some actual change in the length of the calendar at that time, but that was not the case. Sharpe (1870) translated the tablet that Velikovsky mentioned. Sharpe (1870) provides a translation of this passage in context.

> So that the seasons also may do what is fit in every way according to the present arrangement of the world, and that it may not happen that some of the national festivals, which are held in the winter, should be sometimes held in the summer, in consequence of the star moving one day in four years, and that others of those now held in the summer, should be held in the winter in the future seasons, as had formerly happened to come to pass, from the arrangement of the natural year remaining of three hundred and sixty days and of the five days which were afterwards ordered to be added; from the first day the festival of the gods Euergetae being now carried forward, because of the four years, on to the five days added on before the new civil year; so that all men may know how the former defect in the arrangement of the seasons, and of the natural year, and of the decrees about the whole disposition of the pole, happened to be amended and made perfect by the gods Euergetae (Sharpe, 1870, pp. 15–16).

Notice that the purpose of the decree is to implement the practice of leap year, not to add five days to the 360-day year, for that was already being done. Velikosvky claimed that this marked the institution of adding five days upon the 360-day year, but he could do this only by quoting out of context and emphasizing what was not the purpose of the decree. Consider editorial comments of Sharpe, who translated this stele.

> This Decree is valuable to us for other reasons besides its help to the study of hieroglyphics. It tells us of a proposal then made by the priests to reform the Egyptian calendar, at least, so far as it was used in fixing the days when the religious feasts were to be celebrated. Ever since the year BC 1322, in the reign of Menophra, probably the king better known as Thothmosis II, the Egyptian civil year had consisted of 365 days; and hence, for want of a leap-year, the new-year's day, and the feasts then celebrated, were always moving one day earlier every four years. This change, which must in every generation have been noticed, had now, by the help of the Alexandrian astronomers, been determined with greater exactness. The new-year's day, the 1st of Thoth, which ought to fall on the 18th of July, when the Dog Star is seen to rise heliacally, had now, in the ninth year of Ptolemy Euergetes, moved nearly nine months earlier and fell on the 22nd of October. This is well known from several observations recorded by the Alexandrian astronomers; and quite agrees—at least, as well as observations which depend upon eyesight and the weather can be expected to agree—with the information contained in this Decree, namely, that the Dog Star then rose heliacally on the 1st of Payni. Calculating back

> from what we are told by Censorinus, our great authority on the Calendar, we should have supposed that was not the case till the next year, the 10th of Euergetes. The very small disagreement shows with what accuracy the heliacal rising of the star could be observed. However, the priests proposed to be no longer guided by this movable civil year in the arrangement of their feast days. How far their proposal was acted on we do not know. The change was not made by civil authority till the reign of Augustus, who first introduced the Julian mode of reckoning into Alexandria, in the year BC 25 (Sharpe, 1870, pp. vii–viii).

Thus, Velikovsky takes a very different meaning from the text than that taken by the translator of the text. Using this approach, one could just as well claim that Julius Caesar's addition of leap year was required by some change in the actual length of the year during his lifetime or that the 1582 Gregorian calendar reform was necessitated by change that then occurred. Instead, both of these calendar reforms, along with the one that Velikovsky references, were required by earlier calendars that had failed to properly account for the true length of the tropical year.

Velikovsky continues:

> In the fifth century Herodotus wrote: "The Egyptians, reckoning thirty days to each of the twelve months, add five days in every year over and above the number, and so the completed circle of seasons is made to agree with the calendar" (Velikovsky, 1950, pp. 336–337).

Here Velikovsky quotes from the 1920 translation of Herodotus by A. D. Godley. The complete Herodotus passage earlier translated by Rawlinson (1858) read as follows, with the passage quoted by Velikovsky in italics.

> The Egyptians, they said, were the first to discover the solar year, and to portion out its course into twelve parts. They obtained this knowledge from the stars. (To my mind they contrive their year much more cleverly than the Greeks, for these last every other year intercalate a whole month, but *the Egyptians, dividing the year into twelve months of thirty days each, add every year a space of five days besides, whereby the circuit of the seasons is made to return with uniformity.*)

Note that the quote in context places a different spin on the passage. What Herodotus is commenting on is the manner in which the Egyptians handled the fact that the year is not an integral multiple of the month, and Herodotus found the Egyptian solution to the problem preferable to that of the Greeks. Herodotus in no way stated that the Egyptians had to update their previously accurate calendar of twelve 30-day months because of some disjointed shift in the length of the year, as Velikovsky suggests.

In *The Natural History of Pliny* xxxiv 12 (Bostock and Rily, 1957, p. 159) we read:

> I find also, that statues were erected in honour of Pythagoras and of Alcibiades, in the corners of the Comitium; in obedience to the command of the Pythian Apollo, who, in the Samnite War, had directed that statues of the bravest and the wisest of the Greeks should be erected in some conspicuous spot: and here they remained until Sylla, the Dictator, built the senate-house on the site. It is wonderful that the senate should then have preferred Pythagoras to Socrates, who, in consequence of his wisdom, had been preferred to all other men by the god himself; as, also, that they should have preferred Alcibiades for valour to so many other heroes; or, indeed, any one to Themistocles, who so greatly excelled in both qualities. The reason of the statues being raised on columns, was, that the persons represented might be elevated above other mortals; the same thing being signified by the use of arches, a new invention which had its origin among the Greeks. I am of opinion that there is no one to whom more statues were erected than to Demetrius Phalereus at Athens: for there were three hundred and sixty erected in his honour, there being reckoned at that period no more days in the year: these, however, were soon broken to pieces. The different tribes erected statues, in all the quarters of Rome, in honour of Marius Gratidianus, as already stated; but they were all thrown down by Sylla, when he entered Rome (Bostock and Riley, 1857, p. 159).

Note that Pliny does not state that the year was 360 days long, but that there being was "reckoned at that period no more days in the year."

As for the Persians, Velikovsky (1950, p. 333) wrote,

> The ancient Persian year was composed of 360 days or twelve months of thirty days each. In the seventh century five Gatha days were added to the calendar. In the Bundahis, a sacred book of the Persians, the 180 successive appearances of the sun from the winter solstice to the summer solstice and from the summer solstice to the next winter solstice are described in these words: "There are a hundred and eighty apertures [rogin] in the east, and a hundred and eighty in the west ... and the sun, every day, comes in through an aperture, and goes out through an aperture. ... It comes back to Varak, in three hundred and sixty days and five Gatha days." Gatha days are "five supplementary days added to the last of the twelve months of thirty days each, to complete the year; for these days no additional apertures are provided ...." This arrangement seems to indicate that the idea of the apertures is

older than the rectification of the calendar.

For his first sentence, Velikovsky (1950) had this as footnote and reference:

> "Twelve months … of thirty days each … and the five Gatha-days at the end of the year." The Book of Denkart, in H. S. Hyberg, Texte zum mazdayasnischen Kalender (Uppsala, 1934), p. 9."

Presumably, Velikovsky provided his own translation. Notice that the quote doesn't actually state when or why the practice of adding five extra days each year began. Velikovsky assumes that it was because of a catastrophic change in the lengths of the month and the year, but the text does not say this. The alleged catastrophic change is Velikovsky's hypothesis, but offering this as support is begging the question. Interestingly, elsewhere the Book of Denkard states,

> Be it known that the solar year is of two kinds. Of these (two solar years) one is made up by the addition of days, the other by the addition of hours. The one that is made up by the addition of days consists of twelve months, each month of which is of thirty days. (When to these three hundred and sixty days) the five additional days, required for the course of the sun through the constellations during twelve months, are added the year becomes one of three hundred and sixty-five days. The five days which are over and above (the thirty days) of each month are placed at the end of the last month of the year. These five days are made up by the increase (in time of the solar year over the year of 360 days) and they are fixed after many calculations. According to such calculations these days are named (in the daily prayers recited on the last five days of the year).
>
> Besides the sum-total of three hundred and sixty-five days there are six additional hours (to be taken into consideration). These hours have to be added every year. These additional (six) hours (for every year) make up one day for four years, ten days for forty years, one month for a hundred and twenty years, five months for six hundred years and one year for one thousand, four hundred and forty years. The time of six hours should be kept apart from (i.e. not to be added to) the last days of the year for many years, till (the hours) amount to (a definite period of time).
>
> This additional period (i.e. the intercalary month at the end of every hundred and twenty years) is fixed by calculations. And it (i.e. the intercalary month) is necessary for (the right performance of) Noruz, Mihragan, and other time-honored Jashans. Again the commencement of the year has been fixed by great kings from the first day of the year from the beginning of creation (Sanjana, 1900).

Notice that the entire text in context clearly shows that the Persians knew that the year was 365 days long and that they added the extra five days to bring their twelve 30-day months into conformity with the actual year, as did the Greeks and Egyptians. More important, the last sentence indicates that this calendar had operated since the beginning of creation, thus contradicting Velikovsky's claim that Persian records indicate an initial 360-day year.

As for Velikovsky's use of the Bundahis, his first quote above is from chapter 5 of the Bundahis. The second quote is from a footnote of E. W. West, the translator of the Bundahis into English. Velikovsky has misinterpreted the meaning. Neither the text nor the footnote says that the five extra days were added to fix some drastic change from an earlier 360-day tropical year. In fact, elsewhere in the Bundahis the idea of the original year being 365 days is alluded to. In chapter 25, in dealing with the religious calendar of ancient Persia, we find this:

> On matters of religion it says in revelation thus: "The creatures of the world were created by me complete in three hundred and sixty-five days," that is, the six periods of the Gahambars which are completed in a year (West, 1897).

And:

> Again, the year dependent on the revolving moon is not equal to the computed year on this account, for the moon returns one time in twenty-nine, and one time in thirty days, and there are four hours (zaman) more than such a one of its years; as it says, that every one deceives where they speak about the moon (or month), except when they say that it comes twice in sixty days. Whoever keeps the year by the revolution of the moon mingles summer with winter and winter with summer (West, 1897).

Note that the creation of the animals was said to have been accomplished in 365 days. This makes no sense if the originally created year actually was 360 days. Furthermore, this second quote explicitly states that the moon's orbit is 29.5 days, and the last sentence firmly states that if one keeps a strictly lunar calendar, the seasons will soon be out of cycle. When these statements are taken in total, it is very clear that Velikovsky's claim that the ancient Persians once had a 360-day calendar is not supported by the Bundahis.

This is the manner in which Velikovsky handled all of his support for his contention that the year was once 360 days long and then abruptly changed to 365 days. It is not clear whether Velikovsky merely misunderstood what he was reading or if he intentionally misrepresented the references to support his thesis. At any rate, careful analysis of the supporting references footnoted by Velikovsky reveal that the original sources in no way support the idea that

the tropical year was once measured to be 360 days long. Unfortunately, many creationists have uncritically accepted Velikovsky's claims in this matter, and with no actual statements from antiquity concerning the tropical year actually being 360 days in length, the case for this is severely weakened.

Supposed Changes in the Year

When did the length of the year allegedly change? The most common claim is that the year lengthened by five days at the time of the Flood, though some suggest some post-Flood catastrophe such as Babel or a supposed physical dividing of the earth at the time of Peleg. How might such a change in the length of the year have been accomplished? Again, there is much diversity of opinion. The most straightforward change would be in the orbital period of the earth. That is, an impact or some other catastrophe moved the earth farther from the sun and thus increased the orbital period. This is fraught with problems.

First, for an impact to do this, it must be precisely directed. The easiest way requiring the least energy would be an impact in the direction that the earth is orbiting the sun, which would propel the earth forward. Orbital dynamics can be tricky. If an orbiting body is propelled forward in its orbit, the orbit generally is raised (with a corresponding increase in orbital period). If this kick is delivered at perihelion, aphelion is raised, but perihelion remains unchanged. Conversely, if the kick is delivered at aphelion, perihelion is raised while aphelion is unaffected. If the orbital energy is inserted at any other time, then the computation gets more difficult. And if the increase in motion is not in the direction of the earth's motion, then far more energy is required.

As an example, suppose that the original orbit of the earth was circular with the orbital radius equal to the earth's current perihelion distance and that the earth's orbit was changed by raising aphelion and increasing the eccentricity of the orbit. The earth's current perihelion distance is 1.47095×10^{11} m. Taking this as the original circular orbit distance from the sun, the general form of Kepler's third law of planetary motion shows that the original orbital period was about 356 days, roughly four days shorter than desired. As a second approximation, one might suppose that the original orbit was not perfectly circular but less elliptical than today's orbit. An eccentricity about half of today's eccentricity but with the same perihelion distance would produce something close to a 360-day orbital period. A kick delivered at perihelion and directed forward in the earth's motion could produce today's orbit.

As a specific example, let us consider a very simple model for changing the earth's orbit by a directed impact at perihelion so that the length of the year increased from 360 days to the current 365.25 days but the perihelion distance did not change. For the orbital period to be 360 days, the average distance of the earth from the sun would have been 1.481593×10^{11} m. If we match the current perihelion distance of 1.47098×10^{11}m, the eccentricity would have been 0.007183, about 43% the current eccentricity, consistent with our estimate above of about half the current eccentricity. We can determine the orbital speed at perihelion of both the original orbit and the current orbit by using the *vis viva* equation,

$$v^2 = G(m+M)[\frac{2}{r} - \frac{1}{a}],$$

where v is the velocity, m is the mass of the earth, M is the mass of the sun, r is radius vector, and a is the semimajor axis of the orbit. Using the values already stated, the original orbital velocity at the perihelion was 3.01396×10^4 m/s, while the orbital velocity at the perihelion after the collision was 3.02821×10^4 m/s. This is a change in speed of 142 m/s. How large would the impacting body likely need to have been? A high velocity for a meteoroid is 5×10^4 m/s. Assuming this initial speed for the impacting body and 142 m/s velocity change, conservation of momentum requires that the impacting body have been 0.28% the mass of the earth, a little more massive than Pluto.

A second difficulty is that the amount of energy involved is quite staggering. The amount of orbital energy difference of this impacting body is $\sim 3 \times 10^{31}$, which amounts to approximately 4 million J for each kg of the earth's mass. This would be an inelastic collision, so only a portion of that energy would go into altering the orbit; the rest would be absorbed by the earth. Even if only a tiny fraction of the energy were absorbed by the earth, a large problem would result. The effects of such an impact are staggering, and this is for a minimum energy impact. For a less ideally oriented and timed impact, the energy released would be far more – an actual impact likely would have been more energetic. Therefore, it does not seem likely that the earth's year could have been increased by changing the earth's orbit.

An alternate way to lengthen the year would be to shorten the day. This could be accomplished either by applying a torque that speeds the earth's rotation or by decreasing the earth's momentum of inertia, perhaps by shrinking the earth in size.

This leaves the difficulty of changing the length of the month. This must happen by decreasing the moon's angular momentum, most likely by injecting energy at the right position, direction, and time to lower the moon's orbit. This is the reverse of the scenario just mentioned about raising the earth's orbit.

Ultimately, one must change both the length of the month and alter the number of days in a year. It is possible to do this several ways, so it is difficult to criticize the exact mechanism that might be employed (until someone actually suggests such a mechanism). If and when such a model is proposed, then it may be possible to assess whether

this is a physical possibility that does not require too much energy. However, the brief discussion here shows what a typical energy requirement might be.

Conclusion

I have explored the biblical, extrabiblical, and physical arguments for the thesis that the year once was 360 days long. No Bible passages tell us that the year originally was 360 days long. Rather, people have inferred this from some passages. However, those passages do not demand that the original year was 360 days long, and they easily can be understood in terms of no significant change in the length of the year. Much of the argument for the original year being 360 days comes from nonbiblical ancient sources, but examination of those sources reveal that those passages were misinterpreted by Velikovsky. Lacking in most discussions of an alleged original 360-day year is a specific mechanism for how a large change in the year may have happened. A simple calculation of a possible mechanism shows that the energy required to make such a large change would have been unacceptably large. Proponents of an original 360-day year ought to produce their models of how the change might have happened so that we can assess the energy input. Until such models are produced and examined, recent creationists are cautioned against advocating an original 360-day year.

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The Uinta Mountains and the Flood

Part I. Geology

Michael J. Oard*

Abstract

The geology of the Uinta Mountains can be explained in four phases. The first phase was the development of a deep basin that was infilled by sediments. The second phase was the deposition of a thick sequence of horizontal, undeformed sedimentary layers on top of the basin fill. The third phase was one of massive uplift, erosion, and the formation of unique geomorphological features. The final phase was the development of valley glaciers. Features representing all four phases are explained by biblical earth history, and it appears that almost the entire rock record of the Uinta Mountains is the result of the Flood.

Introduction

The Uinta Mountains in northeast Utah are only one of three major east-west ranges in the Western Hemisphere. The Uinta range is one of about 100 mountain ranges that combine to form the Rocky Mountains of the United States. The Uintas are similar to other mountain ranges in the Rockies, exhibiting significant uplift adjacent to deep basins.

The Uinta Mountains are located about 100 miles (160 km) east of Salt Lake City and range in elevation from 11,000 to 13,500 feet (3,400 to 4,100 m). Kings Peak is the highest at 13,528 feet (4,123 m) and is also the highest point in Utah. The mountains extend about 125 miles (200 km) east-west and 40 miles (60 km) north-south in northeastern Utah and extreme northwestern Colorado. The northern boundary is on the southern border of Wyoming (Figure 1). The Uinta Mountains are broadly arc-shaped, concave to the south (Hansen, 1986, 2005). They are composed of a western, higher dome and an eastern lower dome (Figure 2). At some point, the eastern dome collapsed and formed Browns Park. The resulting basin is infilled with about 2,000 feet (600 m) of sandstone with interbedded volcanic tuff and conglomerate (Hansen, 1986). High peaks surround most of Browns Park, but it is open to the southeast. The southeastern Uinta Mountains extend out from the main axis and are composed of several anticlines, synclines, and thrust and reverse faults (Figure 2). On the extreme southeast edge of the Uinta Mountains a steeply dipping bed (to the south) on the Split Mountain anticline forms Dinosaur National Monument, a dinosaur graveyard in sandstone (Untermann and Untermann, 1969).

Geology of the Uinta Mountains

An examination of the geology of the area suggests that the history of the Uinta Mountains can be explained by four phases: (1) the formation and filling of a deep basin; (2) rapid deposition of thick, undeformed strata on top of the deep basin fill; (3) massive uplift of the area accompanied by folding, faulting, massive erosion, and the formation of unique landforms; and (4) the development of alpine glaciers. These geological phases provide insight into the Flood and evidence against uniformitarianism.

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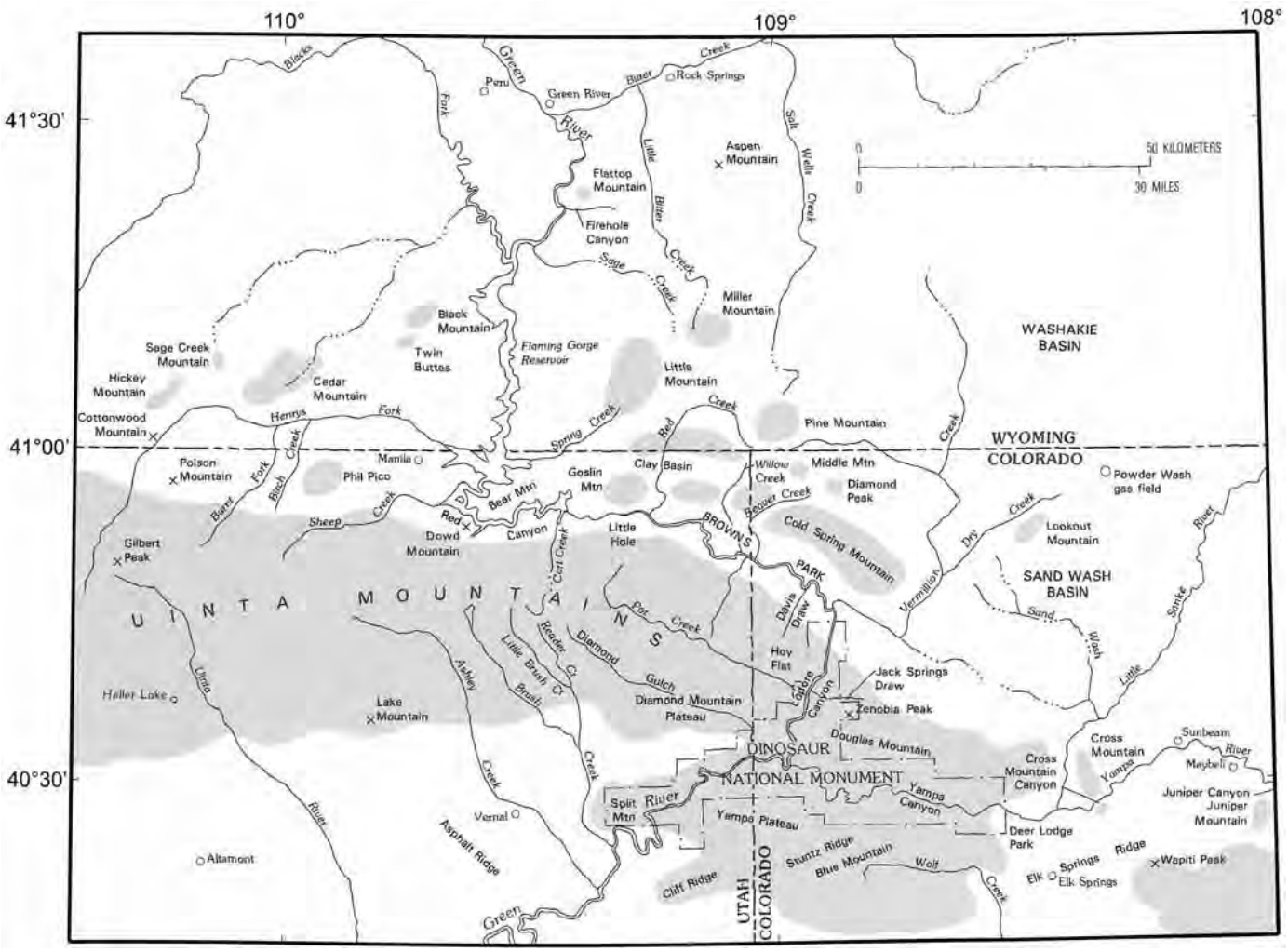

Figure 1. Regional setting of the Uinta Mountains with principal features. Grey represents mountainous areas (from Hansen, 1986, p. 4).

Phase 1. Formation and Filling of a Deep Basin

Early in its geologic history, the Uinta Mountains region was the site of a large extensional basin. This is shown by the thick sequence of Proterozoic sedimentary and metamorphic rocks at the core of today's Uinta Mountains. The origin of the basin is not clear, but it is thought to have been an extensional rift basin, mainly because there are no associated volcanic rocks (Dehler et al., 2010). In fact, there are no igneous rocks of any type associated with the Uinta Mountains, which is a unique feature of this range as compared with most other ranges in the Rocky Mountains (Marsell, 1969).

Sediments were deposited in this extensional basin or trough. Uniformitarian geologists believe the basin, like so many others, slowly subsided so that it maintained a shallow marine setting. The principal researcher on the Uinta Mountains, Wallace Hansen, stated:

> Throughout most of recorded geologic time, long before mountains themselves appeared, the Uinta Mountains region was occupied by a slowly subsiding basin—a broad elongate trough flooded much of the time by shallow-marine waters (Hansen, 2005, p. 77).

He further elaborated: "The trough subsided slowly, and its rate of subsidence was counterbalanced almost exactly by the accumulation of sediment" (Hansen, 2005, p. 79). The idea of a shallow sea or lake is based on ripple marks, mudcracks, and raindrop imprints in the strata (Hansen, 2005), but it is hard to envision a setting where such a delicate

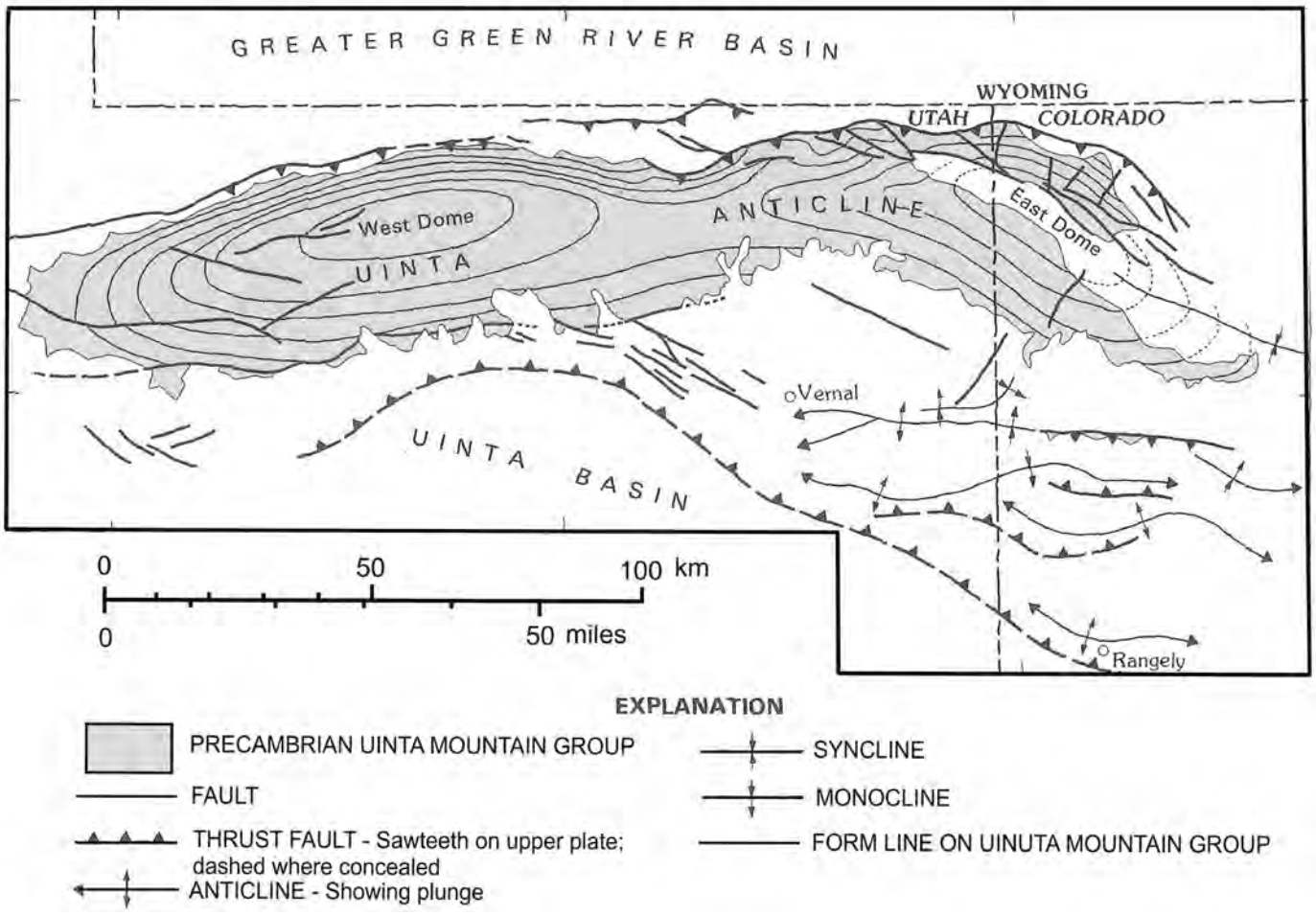

Figure 2. Generalized structural map of the large-scale anticline of the Uinta Mountains showing two domes. The east dome collapsed to form Browns Park (from Hansen, 1986, p. 6).

balance could be maintained for millions of years.

Paleocurrent indicators suggest that sediment in the deep basins migrated from the east and northeast (Dehler et al., 2010). Uniformitarians believe that zircon crystal dates in the sedimentary particles suggest that some of the sand originated in the Appalachian Mountains and flowed approximately 1,200 miles (2,000 km) in a single broad river or a fluvial system to the Uinta area, as well as other areas of the southwest United States (Froede, 2004; Mueller et al., 2007; Oard, 2009a). These rivers are thought to have transported Appalachian sand as far as Antarctica, Australia, and South America, which were then supposedly abutting western North America (Dehler et al., 2010).

The basin fill is largely sand with some conglomerate and mud. These clean quartz sands were cemented into sandstones and then later metamorphosed to quartzite, called the Uinta Mountain Group, which is at least 23,000 feet (7 km) in thickness, with no exposed lower contact (Dehler et al., 2010). The quartzite is brick red to purplish-red. In the eastern Uintas, it is an orthoquartzite (Figure 3). However, its metamorphic grade increases in the western Uintas and is typically white or gray (Figure 4). The Uinta Mountain Group contains a wealth of microfossils (Dehler, et al., 2005). It has abundant colonial bacteria and supposedly records the first appearance of vase-shaped microfossils (Dehler et al., 2010). The Uinta Mountain Group is dated at about 750 Ma old (late Precambrian), according to the geologic timescale. There is supposed to be an older quartzite, called the Red Creek Quartzite, dated about 2 billion years old, confined to a few square miles in the northeastern part of the range (Hansen, 2005, p. 76).

Figure 3. Red quartzite of the Uinta Mountain Group from the eastern Uinta Mounains. Notice that the quartzite has small pebbles and is low grade, more like a coarse, hard-cemented sandstone or orthoquartzite.

Figure 4. White and grey quartzite boulder from the western Uinta Mountains.

Phase 2. Rapid Deposition on Top of the Basin Fill

After the basin was infilled by the sand that became the Uinta Mountain Group, the area was covered by a blanket of horizontal sediment, approximately 25,000 feet (7.6 km) thick (Hansen, 2005). These sediments are dated as Paleozoic, Mesozoic, and early Tertiary, with the Tertiary particularly represented by the conglomerate of the Wasatch Formation (Figure 5), which could represent a syntectonic debris apron shed at the beginning of uplift. There are few if any tectonic or deformation structures of any significance within the sedimentary rocks of this second phase. Similar sequences are found across the Rocky Mountain and High Plains regions, and beyond: "Many of the rock formations that crop out in the Uinta Mountains are recognized throughout much of the western interior of the United States" (Hansen, 2005, p. 75). The Paleozoic strata are especially extensive.

It is interesting to note that this thick sedimentary rock sequence is missing any rocks dated from the Ordovician, Silurian, and most, if not all, of the Devonian, approximately 150 million years (Hansen, 2005). These strata are also largely absent in sequences as far apart as Grand Canyon and Montana (Alt and Hyndman, 1986; Beus, 1990). The Cambrian is also missing from the north flank of the Uintas (Hansen, 2005); there, the Mississippian directly overlies the Precambrian.

The thick horizontal sediments of Phase 2 contain two interesting marker beds. One is the late Paleozoic Park City Formation, which contains a high proportion of phosphate that is mined for fertilizer on the south side of the Uinta Mountains. This phosphate-rich bed is regionally extensive, found in southwest Montana, western Wyoming, eastern Idaho, and northeast Utah (McKelvey et al., 1956; Piper, 2001). It is also called the Phosphoria or the Shedhorn Formation in other states. It has six times the concentration of P_2O_5 as is found in seawater and a high organic content (Stephens and Carroll, 1999).

The second marker bed is the distinctive Mowry Shale. It is thought to have formed largely from settling volcanic ash and is noted for its abundant fish scales easily found in most outcrops (Hansen, 2005). Despite the Mowry's broad extent over areas of the Rocky Mountains and High Plains, including Montana and Wyoming (Coffin et al., 2005), there

Figure 5. An erosional remnant of the Wasatch Formation conglomerate tilted at a high angle down toward the north on the north side of the Uinta Mountains. The early Tertiary Wasatch Formation probably represents coarse gravel first deposited at the beginning of uplift of the Uinta Mountain anticline that resulted in northward dipping strata on the north side.

are few other fish remains found. The bed was evidently deposited quite rapidly (volcanic settling and preserved fish scales), but it is difficult to explain how the fish scales were separated from other skeletal or organic remains and then preserved in the Mowry Shale.

Phase 3. Formation of Unique Landforms

After the deposition of this thick, relatively undisturbed, widespread, horizontal sedimentary sequence, a period of intense regional deformation marks the beginning of Phase 3. Most geologists think that the area was fairly flat prior to this Cenozoic episode. The typical uniformitarian interpretation of nearby areas in Wyoming is shown in Figure 6.

With the onset of tectonism, the Uinta Mountains buckled into an im-

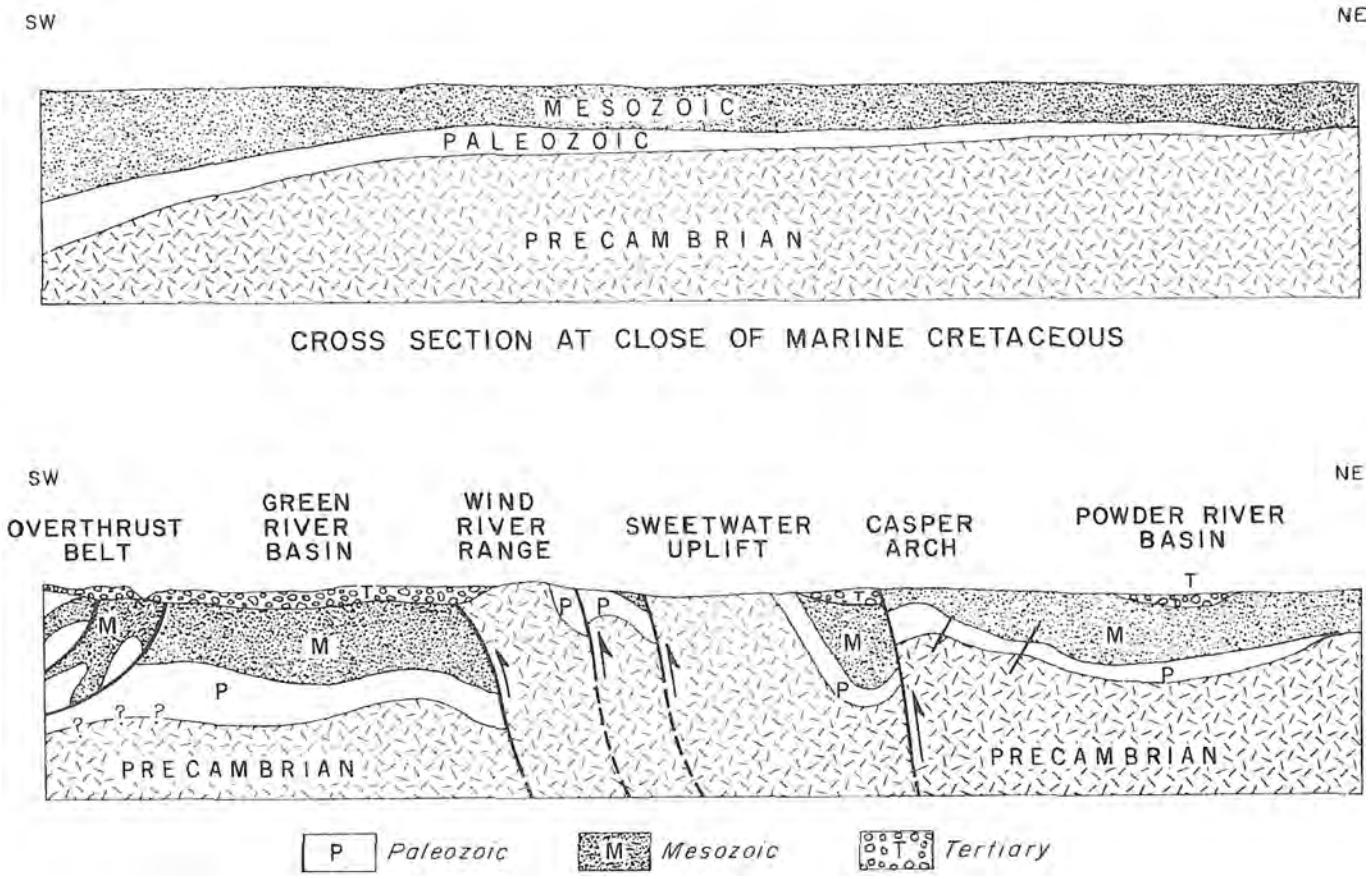

Figure 6. The uniformitarian view of the sedimentary rocks on top of generally horizontal Precambrian granite in Wyoming right after the Mesozoic, followed by huge differential vertical tectonics during the Tertiary (from Glass and Blackstone, 1994, p. 3).

mense anticline (Hansen, 2005) that was also thrust northward by a large reverse fault (Figure 7). At the same time, basins adjacent to the uplifting Uintas formed and subsided; the total differential movement exceeded 40,000 feet (12 km).

> The upbuckling that produced the mountains was accompanied by comparable downbuckling under the basins. *As the mountains rose, the basins subsided*, so that deposits once near sea level throughout the region are now 12,000–13,000 feet high in the mountains but are as much as 30,000 feet below sea level beneath the Green River and Uinta Basins (Hansen, 2005, p. 104; emphasis added).

Notice how Hansen essentially quotes Psalm 104:8, which describes differential vertical tectonics while the Floodwater drained. The differential tectonics of the Uinta Mountains and these late-forming basins is similar to that described in Wyoming, where a total of 45,000 feet of differential motion between the uplifting mountains and sinking basins is deduced (Love, 1960).

Another result of this deformation was the creation of extensive faulting within the Uinta Mountains (Hansen, 2005). The uplift was also responsible for the collapse of the crest of the east dome, which was then partially infilled by sand, volcanic tuff, and gravel of the Browns Park Formation (Hansen, 2005).

With uplift came erosion. The thick strata deposited during Phase 2 were eroded off the top of the anticline, initially forming an extensive planation surface on the quartzite called the Wild Mountain upland surface (Hansen, 1986; Munroe, 2006). It is possible that this planation surface is

Figure 7. High angle reverse fault in the northeastern Uinta Mountains. Uinta Group quartzite on the left and Paleozoic sedimentary rocks on the right.

Figure 8. Eroded, steeply dipping strata on the southeast edge of the Uinta Mountains at Split Mountain.

Figure 9. Much-eroded strike ridges and valleys with dip of the strata down to the north (view east across Flaming Gorge Reservoir).

Figure 10. Strike valleys and ridges on the north side of the Uinta Mountains (view northeast). In the background is Little Mountain representing a large erosional remnant of the Gilbert Peak erosion surface capped by Bishop Conglomerate.

Figure 11. The Gilbert Peak erosion surface southeastern Uinta Mountains

Figure 12. Bishop Conglomerate on top of the Gilbert Peak erosion surface on the Diamond Mountain Plateau just south of the main axis of the eastern Uinta Mountains.

an exhumed surface, formed before the sedimentary rocks were laid on top and only exposed due to subsequent erosion. This planation surface will be discussed in another article on the geomorphology of the Uinta Mountains (Oard, in press). Strata that were once flat and horizontal are now tilted up on the north and south sides of the Uinta Mountains and have been greatly eroded (Figure 8). Differential erosion in places created strike valleys and ridges (Figures 9 and 10). Debris eroded from the mountains filled the surrounding basins with a thick sedimentary sequence.

The axis of the Uinta Mountains lies in generally horizontal Precambrian quartzite (Bradley, 1936), and this quartzite was eroded, leaving behind deep valleys and high mountains on the axis of the mountains. The eroded rounded-to-subrounded quartzite lies mostly on an erosional surface called the Gilbert Peak erosion surface (Figure 11) and is called the Bishop Conglomerate (Figure 12).

Phase 4. Glaciation

Following the tectonism, with its differential uplift and basin formation, and the deformation of the Phanerozoic strata, the Uinta Mountains were extensively glaciated. Glaciers occurred predominantly in the valleys, not on the generally flat mountaintops (Munroe, 2007).

Flood Explanation

The phases of Uinta Mountain geology can be readily explained by the stages and phases of the Genesis Flood (Walker, 1994, Figure 13). We can use his criteria to interpret the phases of the Uinta Mountains using the outline of biblical earth history.

Phase 1

In Walker's model, there are two periods of intense tectonism (cf., Reed et al., 1996), the very early Flood and the

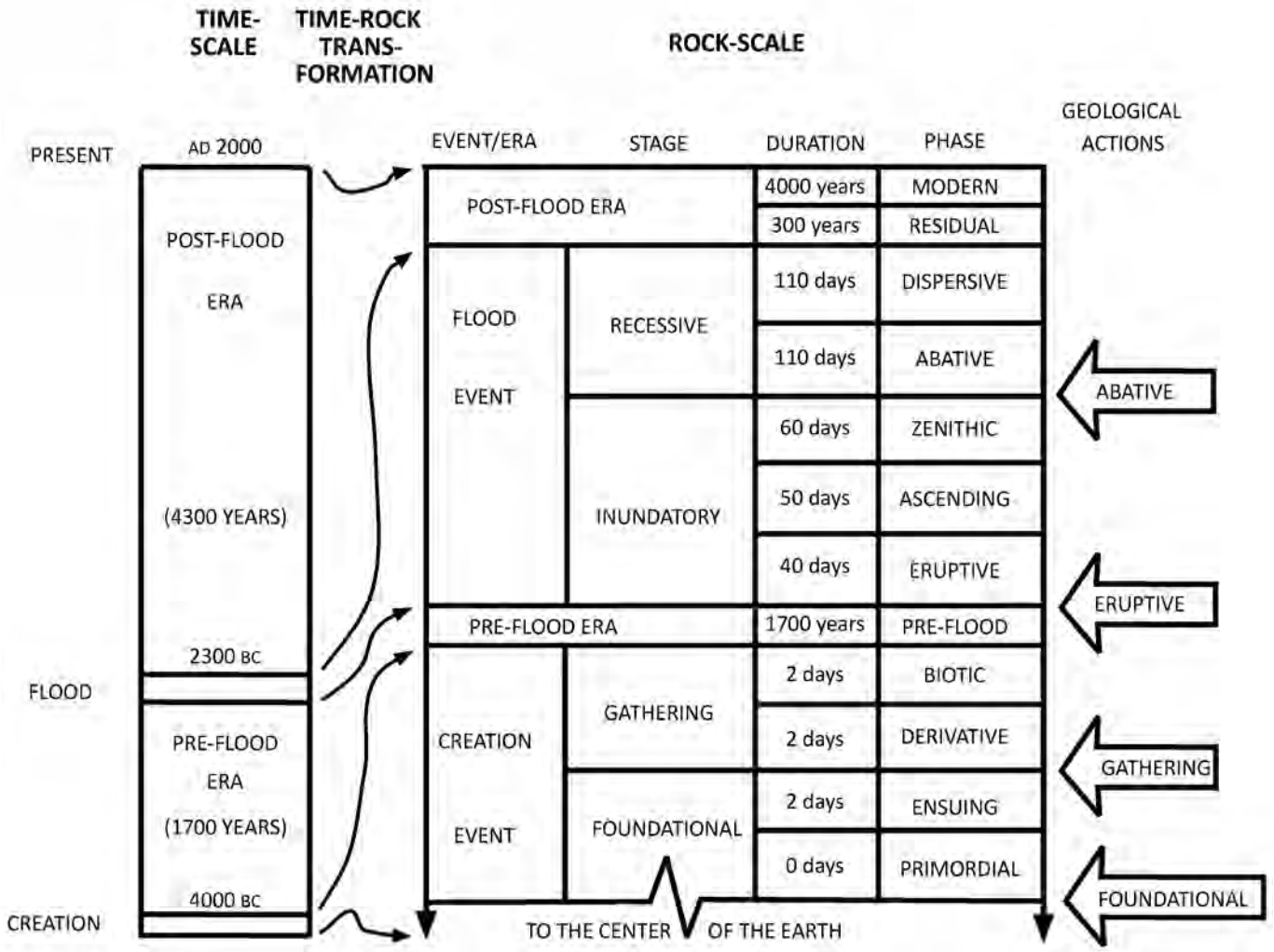

Figure 13. Walker's biblical geological model showing the Flood with its two stages and five phases.

beginning of the Flood retreat after Day 150: "The Eruptive [very early Flood] and Abative [early Recessive Stage] actions probably involved tectonic activity and may have been spread over weeks or months" (Walker, 1994, p. 587). Phases 1 and 3, described above, fit with this defining criterion very well.

The deep basin or trough formed during Phase 1 would correspond to the eruptive phase of the inundatory stage. Extensive rift and extensional troughs and basins are found throughout the basement of North America (Reed, 2000). Accumulation of mostly sand-sized particles in the trough indicates relatively high energy that was constant over a large area or originated from a sediment source restricted to quartz sand. Both the energy requirements and the lack of mud or carbonate facies in the basin suggest rapid deposition occurring simultaneously with the trough's subsidence and the absence of carbonate mud in the source area.

If so, this would place the pre-Flood/Flood boundary below the Precambrian Uinta Mountain Group. This is supported by the presence of subariel mudcracks and raindrop imprints in the sediments of the Uinta Mountain Group, assuming these features have been correctly identified. However, caution is warranted because mudcracks also can form in subaqueous conditions (Whitmore, 2009). But even if the Uinta Group features are subariel mudcracks, they can form within days (Whitmore, 2009), which would imply that the rain of the first 40 days was not everywhere heavy and continuous. The raindrop imprints indicate that the quartzite is younger than Creation Week, since Genesis 2:5–6 states that there was no rain until after man was created. Walker

uses raindrop imprints as a criterion in placing strata at the beginning and middle of the inundatory stage.

> Raindrops [imprints] have been reported in rock formations. Raindrops are significant for the Biblical model because the surface must be exposed to rain. This would rule out the Foundational Rocks of the Creation Event. Also there would be some period of time during the Flood toward the end of the Inundatory Stage and the beginning of the Recessive stage when raindrops could not form because the surface was covered by water (Walker, 1994, p. 589).

The raindrop imprints and mudcracks can readily be explained the same way as dinosaur tracks, eggs, and scavenged bonebeds early in the Flood (Oard, 2011). The BEDS hypothesis proposes that in areas of rapid accumulation, the top of the sediments would approach the surface of the Floodwater and become briefly exposed during a local lowering of sea level. Mudcracks and raindrop imprints can quickly form. A subsequent rise in sea level would bury and preserve the delicate features.

Moreover, there are abundant microfossils in the quartzite, which would also indicate their formation during the Flood. There is still the possibility of placing the Uinta Mountain Group between the Creation and the Flood, but this is unlikely because of the huge volume of rapidly deposited sediments and the catastrophic tectonics, erosion, and deposition that occurred, requiring an energy budget far in excess of any antediluvian processes.

Phase 2

Phase 2 was a widespread, rapid depositional event notable for its lack of extensive sediment deformation. Sedimentation must have occurred either in very deep water or during a period of rapid subsidence, since over 25,000 feet (7.6 km) of sediments was deposited. Another indication of rapid, ongoing deposition is the absence of significant erosion within and between strata. These physical indications of continuous deposition contradict the biostratigraphic conclusion that the 150 million years of the Ordovician, Silurian, and Devonian periods are not present. It is likely that the fossils that define those periods simply were not deposited in this region.

Mesozoic rocks in the Rocky Mountains contain millions of dinosaur tracks and thousands of dinosaur eggs (Oard, 2011), and these suggest deposition between Day 40 and about Day 120 of the Flood. Dinosaur tracks are a very good criterion for the inundatory stage of the Flood (Walker, 1994). The tracks early in the Flood can be explained by the same way the mudcracks and raindrop imprints can be explained—with pulses of rapid deposition covering sediments that were briefly exposed to subariel conditions. Therefore, dinosaur tracks and eggs were incorporated into the rock record on an Earth not yet totally flooded. The absolute latest day for these features was Day 150, but they probably formed days or weeks earlier. Since there are few instances of raindrop imprints with eggs and tracks, then the rain between Days 40 and 150 may have been greatly reduced and may have been more local than global.

Phase 3

Geologic conditions then changed significantly, marking the beginning of a third phase. Rather than rapid deposition with little deformation, this period of time was marked by large-scale differential tectonics and erosion (see Hansen quote above). Deep basins subsided next to the rising mountains, and heavy erosion filled them with sediments, as well as formed different types of surficial landforms. These processes fit well with the recessive stage of the Flood, mainly the abative phase. According to uniformitarians, practically all the uplift occurred during the Cenozoic with adjacent basins sinking and collecting sediments; even early Tertiary beds are tilted at high angle along the north flank of the mountains (Bradley, 1936). This vertical tectonic movement was typical of this stage of the Flood all over the earth (Oard, 2008) and verifies Psalm 104:6–9 (as noted above, Hansen nearly quoted Psalm 104:8). Figure 14 is a schematic of this phase during the recessive stage of the Flood.

The final phase of the Flood in Walker's (1994) scheme is the dispersive phase, in which Flood currents became channelized as relative sea level continued to drop. The large-scale tectonic movements of the early abative stage decreased, though vertical movement continued on a broad scale (Oard, 2008). It was during this phase that the Gilbert Peak erosional surface was greatly eroded and divided into erosional remnants (Figure 15) as the channelized flow created the numerous water gaps in the area (Oard, in press). Therefore, it is likely that the Flood/post-Flood boundary in this region corresponds with the late Cenozoic.

Physical characteristics of the strata deposited in Phase 3 indicate rapid sedimentation under energetic conditions. For example, large rounded-to-subrounded quartzite boulders are found on the Gilbert Peak erosion surface. The sandstone underlying the erosional surface was thus consolidated and even metamorphosed before the abative phase of the Flood. Rapid lithification is also suggested by shale chips containing fish scales of the Mowry Shale (Hanson, 2005). In one case, an 11-foot-long (3.4 m) limestone boulder was transported at least 8 miles (13 km) (Hansen, 1965), implying that the limestone was lithified before the recessional stage of the Flood.

Figure 16 is a summary of the secular explanation of these three phases. Many physical processes would be similar to a Flood explanation, although the scale and rate would differ, since interpretation is driven by the same physical data. Note that many secular geologists

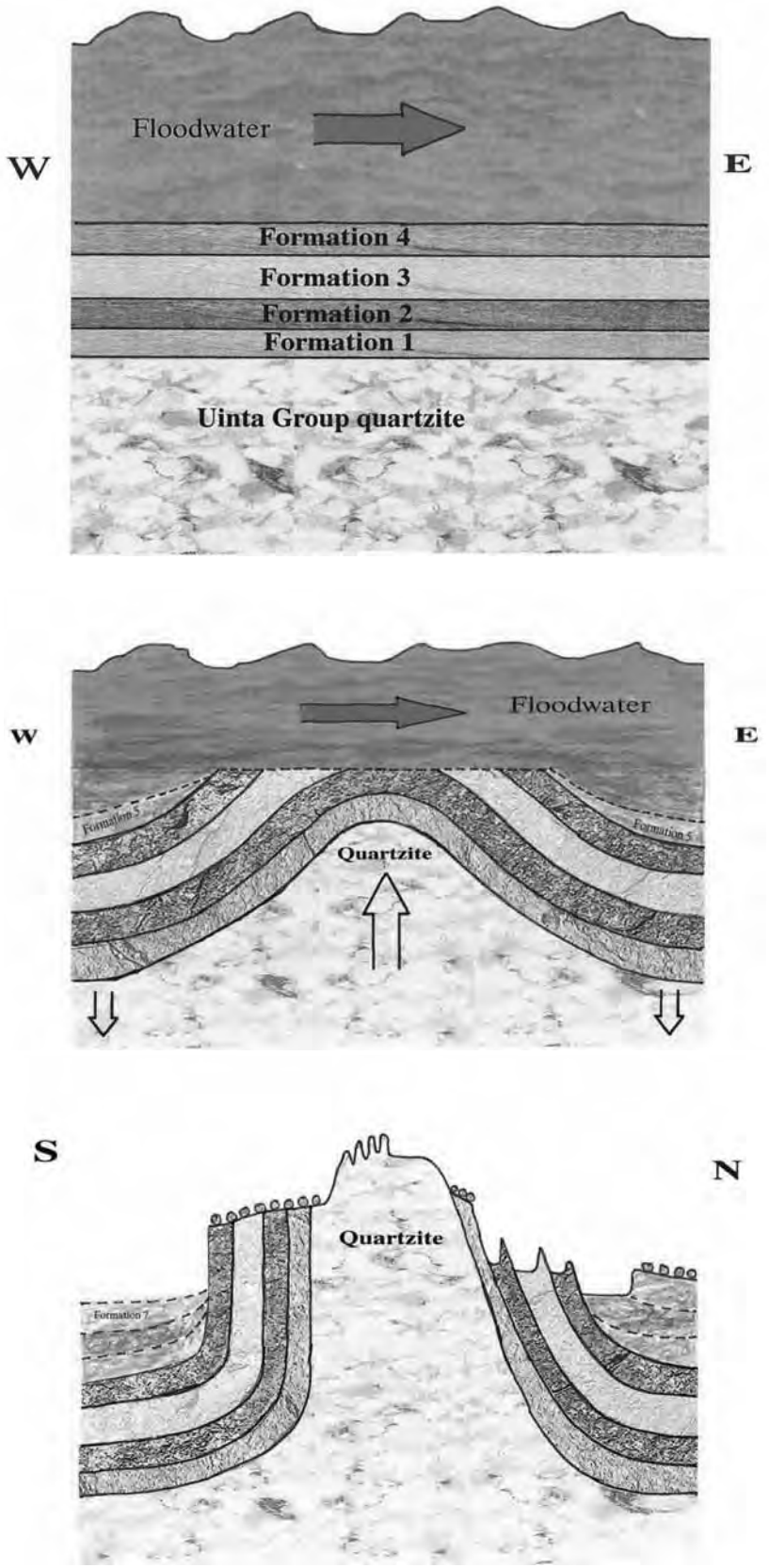

Figure 14. Schematic of phase 3 during the Recessive Stage of the Flood (drawn by Mrs. Melanie Richard).

believe the original basin was a rift, but Dehler et al. (2010) disagree because of the absence of volcanics. The massive nature of the quartzite, along with the scarcity of shale or argillite interbedding, renders the fluvial/deltaic scenario untenable because there are no discernible facies changes as expected in such a model. The sand dunes in the fourth schematic from the top left are based on the belief that the Navajo Sandstone is a wind-blown deposit, despite contrary evidence (Oard et al., 2010).

Phase 4

The final phase was marked by glaciation that probably occurred during the post-Flood ice age (Oard 2004). However, it is interesting that the valleys were preferentially glaciated and the uplands were not. A possible explanation for glaciated valleys but unglaciated uplands might be persistent high winds in the heights, scouring the high elevations and depositing the blowing snow into the surrounding valleys.

Summary

This interpretation of the geology of the Uinta Mountains is a straightforward application of Walker's (1994) biblical geological model (Figure 13). Phase 1 suggests intense activity, consistent with the eruptive phase. This includes the Precambrian extensional basin and thick sand. Phase 2, the deposition of massive amounts of eroded debris, would be expected with the decrease of the early Flood violence. Dinosaur tracks and eggs in Mesozoic sediments bracket this deposition between the eruptive phase and Day 150. Deposition was nonlinear; most occurred early in the Flood. The recessive stage was predominantly erosional in this location, with concomitant deposition in basins between rising mountains and along the continental margins. The Flood/post-Flood boundary would thus be late Cenozoic, and, with the exception of minor glacial

Figure 15. A remnant of the Gilbert Peak erosion surface on Pine Mountain northeast of the Uinta Mountains (view southeast from Miller Mountain, a much larger erosional remnant of the erosion surface).

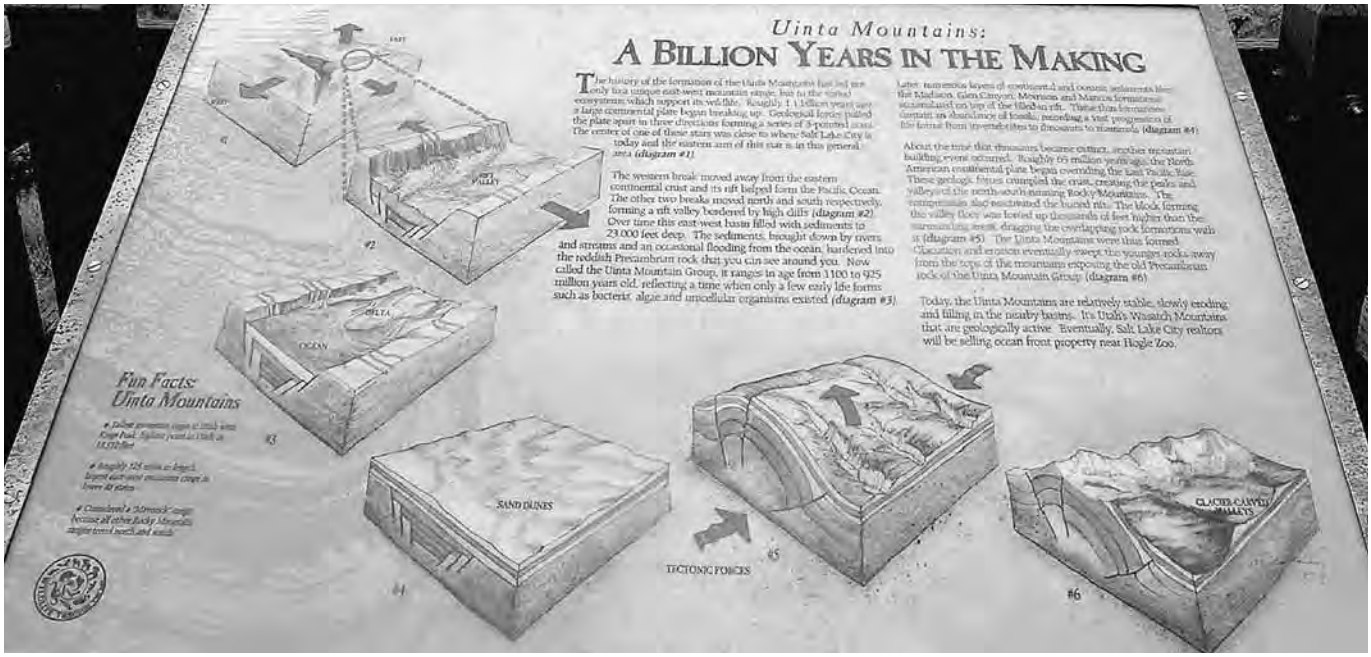

Figure 16. The three phases of the geology of the Uinta Mountains as displayed on a kiosk in the northeastern Uinta Mountains

sediments, all the sedimentary rocks in the Uinta Mountains were deposited by the Flood.

The sequence of the geological timescale is generally followed in the Uinta Mountains and surrounding basins. I subscribe to such a general geological column with many exceptions (Oard, 2006, 2010a, 2010b). So, I think the general sequence of Precambrian-Paleozoic-Mesozoic-Cenozoic is valid in the Uinta Mountains area and large areas of the Rocky Mountains and High Plains. I would not want to argue for any of the finer details of the geological column, such as the basis for the uniformitarian periods of Cambrian, Ordovician, Silurian, etc. However, this sequence cannot be related to absolute time. It may reflect instead sequences defined in part by vertical ecological zonation. The presence of microfossils in the rift basin quartzite without any macrofossils in the same sequence could be due to the destruction of larger organisms by the intense erosion, turbulence, and heat or could be due to their absence during deposition. There is a general vertical fossil sequence of marine organisms followed by more terrestrial organisms in the Mesozoic and Cenozoic. Since these organisms lived at higher elevations than marine creatures, they would likely have been killed later. Other factors that might influence fossil distribution include lateral ecological zonation, hydrodynamic sorting, the differential ability of an animal to swim or float, the differential ability of an animal to run toward higher land, and preservation potential.

As an aside, the late-Flood tectonic uplift suggests a solution for the oft-repeated pseudo-problem of the Flood having insufficient water to cover Mount Everest (e.g., Walton, 2001). If over 40,000 feet (12.2 km) of differential uplift occurred in the Uinta Mountains and 45,000 feet (13.7 km) in Wyoming, it is likely that much of Mt. Everest's current elevation probably also resulted from late Flood uplift (Oard, 2009b).

Acknowledgments

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Creation Research Society Quarterly 2012. 49:122–134.

Whale Evolution: A Whale of a Tale

Jerry Bergman*

Abstract

A review of the evolution of whales from terrestrial land animals finds that the evidence used to support the current theory is either wrong or very questionable. A focus is on the hip bone and fetal teeth evidence because they are commonly used as proof for the land mammal-to-whale evolution theory. The putative fossil evidence for whale evolution from terrestrial animals is also evaluated, concluding that the examples used are likely all extinct mammals and not transitional forms.

Introduction

The term "whale" is a common noun that can refer to all marine mammals called *cetaceans* (members of order cetacea), including dolphins and porpoises. In this paper the term "whales" excludes both dolphins and porpoises. Classification of whales divides them into two groups; toothed whales and baleen whales, the latter of which use large brush-like structures to filter food from the ocean.

Toothed (odontoceti) whales are divided into six main families: pilot whales, fin whales, minke whales, blue whales, humpback whales, narwhal whales, and delphinidae, such as dolphins and killer whales (orca). Baleen whales (suborder *Mysticeti*) are divided into three main families, right whales, rorqual whales, and gray whales. Of the 76 known whale species, 66 are toothed whales, and 10 are baleen whales. Some species grow to be only about 20 feet long, but baleen and blue whales can grow up to 100 feet long. Toothed whales are, on average, smaller then baleen whales, ranging from 3 to 32 feet long, although most are from 10 to 30 feet long. Blue whales can weigh up to 150 tons.

The Origin of Whales

The evolution of whales is one of the most difficult evolutionary enigmas, and numerous theories have been proposed. Historically, whales were classified as fish. It was only when Linnaeus changed his original classification and reclassified them as mammals that their origin became an issue (Slijper, 1962). One current theory is that marine animals evolved into terrestrial animals; then whales evolved from a terrestrial ungulate ancestor (or from some extinct wolf-like animal) back into a marine animal.

A major problem has been determining which terrestrial animal whales evolved from. Charles Darwin proposed one of the first theories of whale evolution, suggesting they evolved from bears. He wrote, "I can see no difficulty in a race of bears being rendered, by natural selection, more and more aquatic in their structure and habits, with larger and larger mouths, till a creature was produced as monstrous as a whale" (Darwin, 1859, p. 184). Other theories include proposals that whales evolved from a cow-like animal, a hippopotamus-like animal, a hyena-like animal called a pachyaena, a wolf-like animal called pakicetid, a primitive group of hoofed animals called mesonychids, or even a catlike animal called a sinonyx.

The hippo theory, long the leading candidate because of its DNA similarities with whales, has recently lost favor because the proposed hippo precursor lived too recently and in the wrong part of the world to be a whale ancestor. Since the 1960s, another popular proposal (based on dental similarities and molecular data) has been that whales evolved from hoofed, carnivo-

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rous mammals called mesonychians, specifically an extinct archaic ungulate (e.g., Thewissen et al., 1998; Harder, 2001). New findings, though, have placed mesonychians in the artiodacty family (even-toed ungulates including camels, hippos, pigs, and ruminants) based on *Artiocetus clavis* and *Rodhocetus balochistanems* fossils (Milinkovich and Thewissen, 1997). Others argue that mesonychians cannot be ancestor to whales for several reasons, including all "phylogenetic studies indicate that pakicetids are more closely related to living cetaceans than to artiodactyls and mesonychians" (Thewissen et al., 2001).

The latest theory, proposed in 2007 (see Figure 1), is that whales evolved from an Indohyus, a putative 48 million-year-old terrestrial animal the size of a small raccoon that looked like an antler-less African mouse long-tailed deer (Thewissen, et al., 2007). Some have even described this animal as an overgrown, long-legged rat, looking nothing like a whale. The main evidence it was a whale ancestor is Indohyus's thickened ear bone, a feature that so far has been seen only in Indohyus and cetaceans (Thewissen, et al., 2007).

All of these proposed theories have some support but also problems. For example, whale evolution from artiodactyls is supported mainly by DNA sequences yet this is problematic because all artiodactyl teeth have three lobes, a trait lacking in both cetaceans and mesonychians. Thus, this lineage would require a complicated tooth evolution that "includes reversals, convergences or both" (Milinkovich and Thewissen, 1997, p. 623). Ellis (1987, p. 8) concluded that "all known fossil whales seem to be fully developed aquatic mammals; we do not know the steps that led to their return to the sea." This conclusion still holds true.

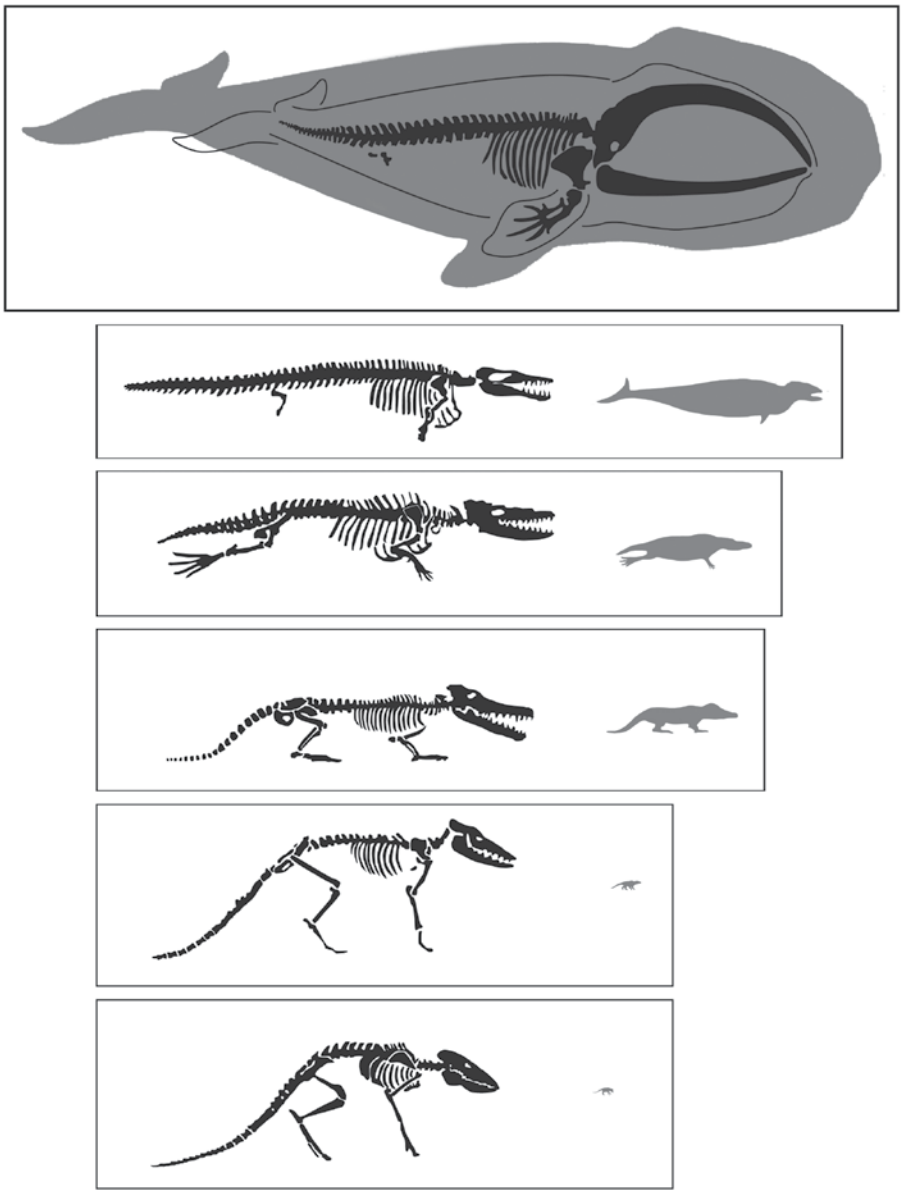

Figure 1. Drawings of the skeletons of one proposal of whale evolution from the first putative whale to the modern whale. The skeletons are shown on the right. On the left is the approximate proportions of the animals themselves. The modern Baleen whale superimposes the skeleton on the size illustration to save space. Note the first putative animals in the evolution of whales are extremely small compared to modern-day whales, a fact obscured when the fossils are shown as a set. This is also a major problem for the theory of whale evolution. The animals, starting from the bottom, are Indohyus, Pakicetus, Ambulocetus, Rodhocetus, Dorudon, and at the top, the modern whale Balaena. (Illustration courtesy of Richard Geer)

Evolution from Terrestrial Mammals

Evolutionists have always faced the problem that whales are mammals. Thus, evolutionists typically hypothesize that they evolved from some type of terrestrial mammal. A problem with this view is that transformation of a land tetrapod into a sea mammal requires virtually all of the tetrapod's hundreds of major

land-adapted traits to be converted into sea-adapted designs. Nonetheless, whale evolution directly from a fish appears even less probable because of the enormous differences between fish and whale anatomy and physiology. As example, fish use gills for breathing while whales use lungs; fish typically lay eggs, and whales breastfeed and give birth to live young.

Other problems with current proposal of whale evolution include the radical changes required in the integument system, lactation, breathing, diving, feeding methods, nervous system, eyes (they must be protected in water) and hearing, and transformation from a walking to a swimming mode of life. Some additional examples include loss of body hair, body streamlining, transformation of forelimbs into flippers, loss of hind limbs, evolution of flukes for swimming, and backward movement of nostrils. Thousands of changes are required to convert a land tetrapod to a fishlike mammal. All of these systems are interrelated and function as a unit, requiring altering the interrelationships of the whole system. Yet other changes required for a large dog-sized tetrapod animal to evolve into a whale include the following:

1. **Body Size**: The body size changes required to evolve from a terrestrial mammal to a whale are enormous—from a 100-pound dog-sized animal to up to a 150-ton sea animal, and from a few feet long to up to a 100-foot-long animal. The tongue of a blue whale alone weighs as much as an elephant. The size changes require evolving a heart from the size of a human fist to one about the size of a Volkswagen Beetle. The heart valves would have to evolve from around the size of a dime to the size of an automobile tire rim. Each tooth would have to evolve from a few ounces to over a kilogram (2.2 pounds) in weight. These changes require not only size modifications, but also major design changes in every body organ and structure.

2. **Weight-bearing**: Land-dwelling animals consume about 40 percent of their energy just to move their bodies, but sea-dwelling creatures use water for support (Zahn, 1988, p. 28). For this reason the transition from land to water requires major muscular and skeletal system design changes. Whales must not only lose their legs but also evolve flippers, pectoral fins, a fluke, and an aerodynamic design, plus a brain and an appropriate nervous system to meet the needs of these many new structures and their requirements.

3. **Heat Retention**: Land temperatures often change rapidly and can fluctuate over a wide range. For this reason, land-dwelling organisms must possess a physical mechanism that can withstand enormous temperature fluctuations. Not only do the temperature changes in the sea occur very slowly and within a much narrower range, but the water is also much colder, and water has high thermal conductivity, a major problem for warm-blooded mammals (Heyning and Mead, 1997, p. 1138). Organisms with a body system regulated according to land temperature demands would need to evolve a whole new protective system to deal with very cold ocean water temperatures. Whales, as warm-blooded animals, have various heat conservation structures, such as countercurrent heat exchangers to minimize heat loss. In contrast to land mammals, whales also largely lack hair and sweat glands and have a thick layer of fibrous fat called *blubber* to insulate them from the icy cold water, all of which involve major marine environment adaptations (Heyning and Mead, 1997, p. 1138).

4. **Water**: Water, essential to metabolism, must be used economically due to its relative scarcity on land. Land animals require skin designed to permit regulation of water loss while, at the same time, also prevent excessive evaporation. Because the skin of land-dwelling animals is not suitable for an aquatic habitat, land-dwelling creatures experience thirst, a sensory system not needed by sea-dwelling creatures. In contrast, marine animals also need to regulate body water, but they must do so in very different ways than terrestrial animals.

5. **Kidneys**: Because water has to be used economically by terrestrial animals, they require an efficient kidney system. The body's protein metabolism system either excretes or converts wastes. The metabolic breakdown of protein produces ammonia, which is toxic and is therefore converted into urea, in the end reducing the amount of water excreted. In addition, a system of ducts and other structures are required for the kidney's functioning. Sea-dwelling organisms, in contrast, discharge waste materials, including ammonia, directly into their aquatic environment. In short, in order to evolve from water to land, living things would have had to develop whole new organ systems to deal with water regulation. Then, to evolve back into aquatic animals, another entirely new system must be evolved especially to deal with salt removal, since whales live in a toxic saltwater world.

6. **Breathing Opening**: Terrestrial animals breathe through their nose and mouth. In contrast, whales have a unique nostril called a blowhole complex (some whales, such as a humpback, have two) on the top of their head in order to take in air. Each breath takes in thousands of times as much air as humans do—enough air to remain submerged for as long as an hour. Whales would have to evolve a hole on top of their head that connects directly to the lungs and a strong muscular flap that covers their blowhole to prevent seawater from flooding into their lungs when they descend below the saltwater surface.

7. **Respiratory system**: Fish "breathe" by removing the oxygen dissolved in water by means of gills. Consequently, they cannot live for more than a few minutes out of the water. In order to survive on land, they would have to acquire a complex lung system. To evolve

back into a sea animal, they would need to re-evolve a new gill system or evolve a new means of taking in oxygen from the water, as a whale does, via a lung system very different from land animals. The orthodox theory teaches that fish evolved a gill system, then a lung system when they evolved to live on land, then a whole new lung system design when the pre-whale land animal transformed back into a marine organism. One of these major adaptations is the whale's enormous lung capacity and a very efficient oxygen exchanger system that allows the whale to stay under the water for long periods of time.

8. **Pressure**: Terrestrial animals must deal with only about 14.71 PSI on land, but deep-diving whales dive as much as 1,640 feet below the water surface and must deal with the enormous pressure levels existing at this depth. Its enormously thick muscular body and its strong frame skeleton are both designed to withstand this pressure level (Zahn, 1988, p. 28). Some whales also can remain submerged for as long as two hours. This feat is achieved due to its ability to reduce its lung volume as the pressure increases, significantly slowing down of the heart rate to reduce oxygen use, and the ability to store large amounts of oxygen in the muscle hemoglobin (Ellis, 1987, p. 8). It also shuts down blood circulation to unessential areas. When on the water surface, the whale takes in enormous amounts of air that is compressed, countering the deep-sea pressure. The blowhole is closed with a special muscle plug, allowing the animal to maintain the internal pressure.

9. **Hearing**: The whale must have a very different hearing design than terrestrial animals. For evolution from land to marine, the animal's external ears must evolve into an internal hearing system that can function under water with eardrums that can withstand the very high pressure existing in water as deep as 1,640 feet. The ears would have to completely disappear and then re-evolve to a system that functions in an aqueous environment.

10. **Vision**: The eyes and lenses not only must evolve to become far larger in a whale, but they also must withstand the enormous pressures of the deep ocean and have a far higher refractive index for water vision. Whales are one of the very few mammals that shed tears, which is one of several mechanisms they use to protect their eyes from the high salt concentration in seawater.

Other major changes required to evolve a whale from a terrestrial animal would include evolution of a "tail," actually a powerful dorsal fin called a "fluke," and its accessory structures. A fluke is a very different structure than that used by either fish or mammals. Fish tails use bones that move from side-to-side by muscles; in contrast, flukes are wide, cartilaginous structures lacking bones that are moved by powerful muscles connected to the whale's spine. The fluke's up-and-down movement can push the whale at speeds of over 30 mph. From tip to tip, a fluke can be longer than six feet. The whale forelimbs, called flippers, are also essential for steering and turning.

Whales give birth to one live young calf at a time. The mother has specially designed nipples that allow her calf to lock onto her with its specially designed mouth and allow the mother to pressure-force her milk into it. The calf must drink two to three gallons of milk in just a few seconds to allow it to surface for air. A calf may drink up to 100 gallons of fat-rich milk in a single day.

The blue whale, in contrast to bottom feeders, swims along the sea surface with its mouth open wide. In one gulp it can suck in as much as 50 tons of water, enough to ingest four tons (about 40 million) of krill. Humpbacks send out clouds of bubbles in a circle below schools of small fish. The bubbles trap the fish, and the whale then lunges up with its open mouth and its throat expands to make room for the food and water that was ingested.

These are just a few of the hundreds of major changes required to evolve a whale from a small terrestrial mammal. The likelihood that all these many dramatic physiological and anatomical changes could have developed in the same organism at the same time when evolving from land to water is a serious challenge to any evolutionary scenario.

Baleen Whales

One of the most striking adaptations in the evolution of baleen whales is the requirement of a major transformation in the teeth of a land animal into the hundreds of comb-like baleen structures. These structures are used to give a whale the unique ability to obtain nourishment by straining zooplankton from seawater. The two- to seven-feet-long combs spaced one-quarter of an inch apart overlap and are fringed on one side, a design feature that functions to effectively catch plankton such as krill, a shrimp-like animal as large as the human little finger.

Baleen whales have two blowholes. They pull in seawater that contains plankton; then their throat contracts, forcing the water out and retaining the plankton on the baleen, which are then swallowed. Whales filter thousands of gallons of seawater and swallow over two tons of krill daily. Gray baleen whales swim at the sea bottom and suck up the sediment to exploit sediment life. They then rise to the surface to rinse their mouths and swallow their catch.

The Evolution of Whales

Up until 1993 the fossil evidence for whale evolution consisted of partial skulls with no postcranial material (Miller, 2003). The amount of evidence for whale evolution is now considered by evolutionists one of the best in the entire fossil record.

> One of the most remarkable series of transitional fossils documents the

> amazing story of whale evolution. From about sixty-five to thirty-seven million years ago in the Paleocene and Eocene Periods, there lived a group of land-dwelling mammals, which, though they were ungulates (hoofed animals), were carnivorous and may have behaved like hyenas. Called "mesonychids," these creatures would not be anyone's first guess as a likely ancestor of the sperm whale. Yet in 1979 ... in Pakistan ... Phillip Gingerich made a remarkable find: an animal that, though only coyote-sized, had the distinctive anatomical traits of a whale, and so was named "*Pakicetus*" (Parsons, 2004, p. 160).

Discussions of whale origins assume various extinct creatures were whale ancestors, an assumption often disproved as a result of more fossil finds. One example is mesonychids, which was shown not to be a viable whale transition after *Archeocetes* was discovered in Eocene strata. Another example is the whale putative ancestor, *Basilosaurus*, which was initially thought to be a serpent-like reptile but was later reclassified as a "whale-like" mammal (Evans, 1987, p. 2). This animal does not provide support for whale evolution, though, because no clear fossil connections exist between *Basilosaurus* and the *Archeocetes* and modern whales, whether toothed (Odontoceti) or baleen, a fact put bluntly by Gaskin.

> Archaeoceti could not be considered as direct ancestors of either modern baleen whales or modern toothed whales…. It was unlikely that they gave rise to the ancestral forms of either group. The Archaeoceti may be regarded as a less successful independent line which died out perhaps 10 million years ago (Gaskin, 1972, p. 3).

Other evidence supports the conclusion that the archeocetes are members of another mammal category unrelated to modern whales.

The Whale Fossil Record

Over 26 fossil species have been claimed by one or more researchers as whale ancestors; proving the evolution of whales from a fully terrestrial to a fully aquatic life. They have been assigned by some researchers to four families: Pakidetide, Ambuloceticae, Remingtonocetidae, and Protocetidae. Depending on the authority, the major skeletal finds claimed to demonstrate whale evolution include the *Mesonychids*, *Pakicetus*, *Ambulocetus*, *Rodhocetus*, *Prozeuglodon*, and *Protocetids*. All of these animals were, judging from their teeth and other features, evidently active, hunting carnivores. In contrast, all whales consume krill, small fish, and other small marine organisms.

1. *Family Pakicetidae* (genera Pakicetus, Nalacetus, and Ichthyolestes) is a fully terrestrial, even-toed ungulate artiodactyl tetrapod. *Pakicetus* was as large as a wolf, *Ichthyolestes* the size of a fox, and *Nalacetus* an in-between size. A major reason for considering this dog-like animal a whale ancestor are certain inner ear traits judged as cetacean from the animal's skull characteristics. The first Pakicetus find was a lone skull and a relatively complete skeleton found in 2001. Although Pakicetus had a few whale characteristics, most of its traits were very different from a whale. For example, the teeth of this wolf-sized land animal "closely resemble those of land-dwelling mesonychids—so closely that paleontologists ... had always regarded such teeth as belonging to mesonychids until they found the jaws those teeth came from" (Parsons, 2004, p. 160). One study of Pakicetus ankle bones determined that it had many similarities to artiodactyls (Thewissen, et al., 2001).

Pakicetidae nostrils were in the same anatomical location as that of dog nostrils, and significantly different than the location of the modern whale blowhole. In fact, artist reconstructions picture Pakicetidae as looking very similar to a medium-sized dog. A major evidence for its whale ancestry is its ears, which are dissimilar to the ears of both terrestrial and aquatic animals. This dissimilarity is cited as evidence of its intermediate transitional status. Based largely on this conclusion, the whole animal is interpreted as an intermediate whale transition. Evidence, though, has established that, except for one small bone, it lacks the sensitive auditory components of marine animals such as whales. Thewissen, et al. (2001) in a study of the bones and structures, found the Pakicetidae's auditory system is well developed for airborne sound, but not underwater hearing.

2. *Ambulocetus nations* (walking whale) is an otter-sized mammal. Enough of the skeleton has been uncovered to conclude that it had tiny front limbs and longer hind limbs with hoofs, large feet, and a strong tail. In spite of being named "walking whale," reconstructions of it look nothing like a whale. It had a long non-whale tail and did not have a fluke, as do all whales. Nor did it display evidence of a whale's posterior, flippers, blowhole, or most of the other unique whale traits. It was actually an amphibious, carnivorous animal with legs and a body that looked very much like a nine-foot-long crocodile. Its eyes were also in the wrong place—on top of its crocodile-like head, and not on the side of its head as is the case of whales. It also had tiny webbed feet like a crocodile and likely could walk on land. Its fossil spine indicated that it could undulate like a modern otter.

Further research has forced the discoverer, University of Michigan Professor Philip Gingerich, to express his doubts that *Ambulocetus* is in the direct line of whale evolution (Werner, 2007, p. 144). In short, he now thinks it is not a whale ancestor, but on a different part of the evolutionary tree. It is not considered a crocodile ancestor either because modern crocodiles date contemporaneously with *Ambulocetus*, indicating its likely was a member of the crocodile

family. Evidence does exist that *Ambulocetus nations* had anklebones similar to those of artiodactyla, but this does "not unambiguously support either of the predominant hypotheses of cetacean relationships" (Thewissen, et al., 1998, p. 452). This finding only confuses whale evolution because it requires "extensive convergence or reversals" to account for the contradictory evidence (Thewissen, et al., 1998, p. 452).

3. *Remingtonocetidae* were similar to the *Ambulocetids*, which may be an evolutionary dead end (Miller, 2003). The cranial anatomy is well documented, but so far only one complete upper molar and a complete lower premolar and molar are known (Thewissen and Bajpai, 2001). This evidence indicates that the animal had a long, slender crocodile morphology and may be a member of the ambulocetus, or crocodile family.

4. *Protocetids* are a diverse group of cetacea, and one of the best known is Genus *Rodhocetus* (Chadwick, 2001). Although dolphin-appearing, judging by the fossils, the animal also looked very much like a crocodile/dolphin hybrid. It had very small hind legs and was once believed to have a fluke-like tail similar to the whale fluke, an assumption that has not been supported by fossil evidence—no evidence of any fluke structure exists on any of the known Rodhocetus fossils. It even lacks a ball vertebrae required for a fluke, a significant problem because all cetaceans have ball vertebrae and flukes.

Furthermore, no evidence exists for the bone structure that is required for the flippers that exist on all whales. It did have nostrils that were located slightly higher on the skull than that of a crocodile, but not near the location of the whale blowhole. No evidence exists that they functioned like a blowhole. Its skull is much closer to that of a crocodile and very dissimilar to that of a whale.

5. The *Archeocete* class is an extinct mammal, and there is no evidence of an evolutionary link between it and any fossil whales. Unlike modern toothed whales, the Odontoceti archeocete fossils had teeth that were differentiated into incisors, canines, and molars called polyform teeth (thus they were heterodonts), which indicates that they were terrestrial mammals. All whales have monoform teeth (only one tooth type exists in a single animal). No evidence of a fossil connection has been found between either the Archeocete teeth or pelvic structures and Odontoceti, toothed whales.

6. *Basilosaurus* (king lizard) was a serpent-like creature that measured up to 70 feet in length. It was a fully aquatic crustacean with sturdy front flippers and small well-developed hind legs complete with jointed knees and toes that were possibly used as copulatory organs. Originally discovered in the late 1800s in the United States, *Basilosaurus* was named "king lizard" because of its resemblance to a large lizard. Stahl (1974, p. 489) concluded that *Basilosaurus* "could not possibly have been ancestoral to any of the modern whales" for numerous reasons, including its serpentine body form and the shape of its teeth, often an important means of classification. Lawrence Barnes, of the National History Museum, noted that *Basilosaurus* lived contemporaneously with modern baleen whales (mysticetes) and toothed whales (odontocetesl) and thus could not be ancestral to modern whales (cited in Werner, 2007, p. 144). *Basilosaurus* was likely an extinct marine animal and not a transitional form.

7. *Dorudon atrox*, a 20-foot-long cetacean with a fluke and small back legs, is another putative whale link. The animal is very similar to a small *Basilosaurus*, and for this reason is thought by some to be a juvenile *Basilosaurus*. The most complete skeleton shows small hind limbs, feet, and toes very similar to those of *Basilosaurus*, indicating that *Dorudon* is a juvenile Basilosaurus.

The Toothed Whales

Fossil teeth are central to the whale fossil record. Unfortunately, this evidence is very problematic. For example, Pakicetus teeth resemble those of Protocetus and Indocetus (Berta, 1995; Bajpai and Gingerich, 1998). Toothed whales first appeared in the fossil record in the Eocene, estimated by evolutionists to be 30 million geological years after the Archeocetes became extinct (Evans, 1987; Alexander, 1975). Evans concluded that the Eocene archeocete fossils were "replaced" by members of four different fossil whale orders in strata judged to be Oligocene. Two separate types of Odontoceti—those with polyform teeth, such as the *Squalodontidae*, and others with no dental differentiation (monoform teeth)—may have existed. Only the monoform dentition groups still exist today.

Darwinists claim that whale teeth evolved from the "differentiated" condition found in fossil whales, to the "undifferentiated" teeth found in modern Odontoceti. This evolution scenario requires a series of fossils linking a long serpent-like creature with tiny back legs (such as the *Basilosaurus)* to modern toothed whales. Furthermore, the comparison of these unrelated and unlinked life-forms is not based on scientific data, and evidence exists that they were contemporary with whales, thus could not be a whale precursor.

The claim that true polyform teeth exist in certain fossil Odontoceti requires more study (Ridgway, 1972). Toothed *Squalodontidae* fossils found in the late Oligocene possessed teeth grouped into functional incisors, canines, premolars, and molars. For this reason evolutionists are forced to claim that teeth became more numerous and *less* specialized as the pre-whales evolved into modern Odontoceti whales (Gaskin, 1972).

In addition, when the fossils are compared, one type of whale fossil is found almost exclusively, or exclusively, in only one part of the world, such as Pakistan, and another transitional form is found

exclusively, or almost exclusively, in a different part of the world (Thewissen, 1998).

Summary of the Fossil Record

Although many evolutionists believe the fossil record for the evolution of whales represents a strong documentation for evolution, valid fossil evidence has been completely lacking to fill the important void between land mammals and whales with valid evidence. This is true in spite of the fact that over two million putative fossil whalebones have been discovered. None of the proposed fossils is a viable transitional fossil, and all are problematic. The best example of a transitional form is the modern-day dolphin, but since they are contemporary with modern whales, they cannot be ancestors of whales.

As Gaskin (1972, p. 5) concluded, there exists "near unanimity among specialists that the ancestors of the Cetaceans were also the ancestors of the land mammals known as the Artiodactyla, of which modern representatives are the camels and rhinoceros." Yet no clear fossil lineage exists between the Artiodactyla and modern whales: "The fossil record which could confirm the origin of the cetaceans from terrestrial or freshwater mammals *still has many gaps*" (Gaskin, 1972, p. 5, emphasis mine). Banister and Campbell (1985, p. 294) summarized the fossil record, accurately noting, "The origins of present-day cetaceans are poorly known." More than two decades later this is still true.

The origin of the first baleen whales is also obscure, and they first appear in the fossil record in the Middle Oligocene as fully formed whales (Gaskin, 1972). There is no fossil evidence linking land-dwelling mammals with teeth to Baleen whales in spite of the fact that the teeth that distinguish them preserve better in the fossil record than any other body part. In view of the problems with the above-proposed transitional forms, it appears that, as Colbert concluded, "whales ... appear suddenly in early Tertiary times, fully adapted ... for a highly specialized mode of life" (Colbert et al., 2001, p. 392). Professor Slijper's statement made in 1962 is still true: "We do not possess a single fossil of the transitional forms between the aforementioned land animals [carnivores and ungulates] and the whales" (Slijper, 1962, p. 17). The lack of transitional forms is explained by some evolutionists by assuming that whales "enjoyed at the outset a series of extraordinarily rapid evolutionary changes that by middle Eocene times made them well adapted for life in the ocean" (Colbert et al., 2001, p. 392).

Whale Skeletal Structures

Whale Pelvis Bones

The so-called "pelvic girdle" of whales and porpoises is located in the general region where hip bones exist in land mammals (Bejder and Hall, 2002). Scheffer (1976, p. 8) described these whale hips as "a pair of slender bones floating in the muscles near the sex organs." Actually, the whale pelvic bones are "freely floating in muscle tissue just in front of the anus" (Evans, 1987, p. 4).

The evolutionary explanation for the whale pelvic bones is that they are the useless vestigial remains of the pelvic girdle and the hind legs that existed when the whale ancestor was a terrestrial tetrapod (Young, 1962; Ridgway, 1972; Alexander, 1975; Watson, 1981; Evans, 1987). Certain extinct whales did have pelvic bones, but this alone does not prove that whale ancestors were terrestrial. An enormous number of major features separate whales from terrestrial animals, and we have no evidence for transitional forms. Many extinct animals have existed with a wide variety of features that cannot be used to prove anything about evolution.

Bejder and Hall (2002, p. 445) conclude simple evolutionary changes in *Hox* gene expression or *Hox* gene regulation are unlikely to have caused hind limb loss, but selection "acting on a wide range of developmental processes and adult traits other than the limbs are likely to have driven the loss of hind limbs in whales." They argue that hind limbs likely "began to regress only after the ancestors of whales entered the aquatic environment" (Bejder and Hall, 2002, p. 445).

Before the limbs could regress, the pre-whale would have needed an effective method of swimming—and once it did, why would the limbs regress? Many Darwinists argue that these bones prove that whales evolved from a terrestrial animal with functional hind legs. Chadwick (2001, p. 69) wrote that, as the "rear limbs dwindled, so did the hip bones that supported them." An example of this line of reasoning from an online discussion group is as follows.

> Whales' hip-bones prove (or suggest strongly) that an "intelligent designer" did not create whales.... an "intelligent" design uses functioning parts for rational purposes. Hip bones have a function: to support legs. Whales have no legs. Whales have no use, function, nor need for hip bones. And yet they have hip bones ... ergo ... the "ID" notion can't explain it. It can only beg the question. "Maybe there is a use we are unable to perceive." Maybe. But "Maybe" is not an explanation; the ID concept has no explanatory value. Evolution, on the other hand, is easily capable of embracing the concept of vestigial organs and structures, and "explains" the mystery.... Whales are descended from animals that had legs ("Silas," 2002).

Crapo (Crapo, 1984, p. 6) concludes, "It is clear that the empirical data fit neatly within an evolutionary argument while posing an unresolved problem for creationists." Russian zoologist Alexy

Yablokov (1974, p. 233) wrote that from the

> time of Charles Darwin to the present, the two small bones in whales in the place of the well-developed posterior extremities of terrestrial mammals, have been considered to be a fine example of vestigial organs.

Awbrey (1983, p. 6) asserts (but cites no evidence) that the fossil record of whales supports the pelvic bone degeneration theory because not two, as seen today, but rather three whale pelvic elements are discernible in the fossil record. But if the fossils demonstrate a modification from three bones in whales' hips to two, this would not in itself demonstrate that the whale pelvis is now a useless structure. Although Awbrey (1983, p. 6) asserts that the pelvis has been reduced by evolution and "no longer connects the hind legs to the axial skeleton," he admits that the two small bones have a function—"to support the reproductive and rectal muscles." Their support role fits either the design, or the descent-with-modification view, but either way they are not vestigial. Creationists also once effectively explained the whale hip bones as evidence of degeneration, but this view is no longer valid because a clear function has now been determined for the bones.

Far less is known about cetaceans than about many other animals. This creates a problem for any analysis. It is partly for this reason why

> the exact identity and development of the elements of the pelvic vestige of extant cetaceans [i.e., are they the ischium, ileum or pubis?] have not been established. Such identification is critical to fully understand the events underlying the evolution of the cetacean pelvis (Pabst et al., 1998, p. 393).

The whale hip bones may not correspond to any of the bones Pabst et al. (1998) listed, and may serve a different function entirely.

The Function of the Hip Bones of Whales

It is now known that the whale hip bones have a function similar to the hyoid bone in humans—to serve as an anchor for various muscles and other structures. As an example, North Sea Beaked Whale has a putative "pelvis" found only in males and serves to anchor the muscle set attached to the penis (Watson, 1981, p. 33). In other whales, the whale "pelvis" bones, together with the separate putative limb bones, serve as an attachment for the penis corpora cavernosa (Young, 1962, p. 667). Tajima et al. (2004, p. 761) concluded from an anatomical study of the porpoise pelvic bone that its function in male finless porpoises is to support the penis.

Work by Yablokov (1974, pp. 234–235) documents that the whale pelvic bones serve a critical copulation function, and the "pelvis" in toothed whales is differentially located in males compared to females in order to make "penis erection possible in the male" and aid in "effective contraction of the vagina in the female." These bones also support certain internal organs and also serve as points of attachment for several muscles, as does the coccyx in humans (Williams, 1970). Thus, like the human hyoid bone, the two small pubic bones in the whale function in a support role for various organs and muscles (Awbrey, 1983, p. 6).

Interestingly, Darwinists now acknowledge that these "formerly held vestiges" play "important functions" in the whale, yet they argue that the bones "still demonstrate descent with modification" (Conrad, 1983, p. 9). Of course, if Darwinism is true, all organs and structures would demonstrate descent with modification because evolution teaches that *all* organs evolved from other simpler organs.

Like the human hyoid bone, the two small whale pubic bones provide structural support for various organs and muscles (e.g., Awbrey, 1983, p. 6). This creates a contradiction for the evolutionists in that they once argued that the whale hip is a vestigial leftover from when its ancestors were terrestrial—just as predicted by evolution. Then when a function was realized, they immediately argue that this proves the whale hip was derived from the terrestrial ancestor's hip—just as predicted by evolution. Hence, this demonstrates the 'just so story' nature of evolution—nothing is explained, just adjustments of the "story" (often without even acknowledging the story has changed).

The Whale Limb Bones

In addition to the small but functional whale hip bones, some whales also have structures resembling limb bones. In some whale species, anterior to the tail exist "rudiments of a femur and even a tibia," both of which are attached to the girdle (Alexander, 1975, p. 431). Blue whales often have a "pelvis" with tiny bones attached to it. In addition, a tiny tibia-like bone is sometimes found in the bowhead whale (Watson, 1981, p. 33). Young described the whale hind legs as "bony nodules … representing limb bones" (1962, p. 667). Andrews (1921, p. 2) described the case of a 31-inch-long whale hind limb, which he concluded shows a "remarkable reversion to the primitive quadripedal condition."

A major problem is explaining why the whale lost most of its limbs—many aquatic animals such as crocodiles have fully functional limbs that serve as both paddles to swim and feet to walk. Awbrey (1983) claimed these whale leg bones are atavisms that can be explained only in terms of mega-evolution, and offered that:

> In many cetacean species, an occasional individual also has one or more poorly formed leg bones that form no joint with the pelvis. When present, these bones are arranged in the typical tetrapod order of femur, tibia and tarsus, and metatarsal. The paired protrusions enclosing these leg bones range from tiny bumps to

> cylindrical structures up to four feet long (Awbrey, 1983, p. 6).

As we have seen, no clear fossil data supports Awbrey's claim that these small bones indicate the descent of whales from an ancestor that possessed fully formed legs. Byers (1983, p. 2) summarized the lack of fossil data for loss of legs in whales:

> The oldest Cetacean fossils are found in Upper Eocene deposits, and in none of these fossils are leg bones better developed than they are in modern specimens. There is nothing aberrant or unusual in these fossils. I have yet to find anything in the fossil record that is surprising or difficult for a creationist to explain.

One explanation for these whale "leg" bones (and similar abnormalities) is they are due to abnormal development caused by mutations or teratogens. Evidence for this includes their rarity in many whale species. The case Awbrey (1983) examined "is the only recorded case" that he knew of among cetaceans, even though "hundreds of thousands of whales have been killed, especially in the last fifty years" (Andrews, 1921, p. 6). If these bones, in fact, are mutational or developmental abnormalities, they tell us little about whale phylogeny. Until more cases are studied, it is difficult to draw firm conclusions about their function or origin.

Conversely, in some species of whale the "leg" bones are very common, if not universal. The most plausible explanation is that the "limb" bones are part of a structure that serve as copulatory guides and provide an anchor for the genital muscles (Chadwick, 2001, p. 73). Such a contemporary function does not support any evolutionists' conclusions that these bones are vestigial evidence of legs.

An example is a *Basilosaurus*, as discussed above, this giant aquatic marine animal had a serpent-like body, flippers, and very small hind limbs. The "well-developed" hind limbs of *Basilosaurus* have been considered evidence that it was a late transitional stage to the legless modern whale (Chadwick, 2001, p. 73).

Gingerich, et al. (1990) discovered several new skeletons of *Basilosaurus* in Egypt that contained comparatively well-preserved examples of the limb and foot bones. From their research on these skeletons, they concluded that they function as copulatory guides to assist the animal in sexual reproduction—obviously a critical role for *Basilosaurus* (Gingerich et al., 1990). One reason for this conclusion is the fact that the putative hind limbs of *Basilosaurus* appear too small relative to body size to have much use in swimming, or to support the body on land, but

> maintenance of some function is likely for several reasons: most bones are present; some elements are fused, but remaining joints are well-formed with *little suggestion of degeneracy; the patella and calcaneal tuber are large for insertion of powerful muscles; and the knee has a complex locking mechanism*. ... The pelvis of modern whales serves to anchor reproductive organs, even though functional hind limbs are lacking. Thus hind limbs of *Basilosaurus* are *most plausibly interpreted as accessories facilitating reproduction*. Abduction of the femur and plantar flexion of the foot, with the knee locked in extension, probably enabled hind limbs to be *used as guides during copulation, which may otherwise have been difficult in a serpentine aquatic mammal* (Gingerich et al., 1990, p. 156, emphases added).

Whale Fetus Teeth

As described, modern whales are divided up into toothed whales (*Odotoceti*) and baleen whales (*Mysticeti*), which use the comb-like plates attached to their mouth roof to strain food from seawater. Adult baleen whales lack teeth but, as a fetus, possess tooth buds in the upper and lower jaws. Ever since Darwin (1959, p. 450) wrote about the presence of teeth in fetal whales, which, when grown, "have not a tooth in their heads," the whale fetus tooth-buds have commonly been labeled vestigial. It is assumed this proves that the baleen whales' ancestors had teeth, and that these embryonic "teeth" are unnecessary because they are not present in the adult.

Darwinists today claim that fetal baleen whales' teeth are

> derived from toothed ancestors [and this] is suggested not only by paleontological evidence but also by the fact that teeth are still found in ... [whale] embryos. The teeth are absorbed as the fetus develops the whalebone characteristic of this suborder (Ridgway, 1972, p. 507).

Darwinists argue that these tooth buds in fetal baleen whales can be explained only by evolution and falsify the design model: the whale teeth are "evolutionary leftovers" that "clearly refute design" (Awbrey, 1983, p. 6).

Functions of Whale Tooth Buds

Fetal baleen whale tooth buds are now known to have several documented functions. Vialleton (1930, p. 164) concluded that, although "teeth in the whale do not pierce the gums and function as teeth, they ... actually play an important role in the formation of the bone of the jaws to which they furnish a *point d' apui* on which the bones mold themselves." Kaufmann (1983, p. 4) elaborated on Vialleton's findings about the function of whale teeth, noting that the temporary development of whale teeth

> guides the formation of their jaw. The teeth are multiplied and the length of the jaw is patterned after this multiplication. This could apply to the baleen whale; after the jaw is properly formed, the teeth are completely reabsorbed into the bone structure.

Dewar (1957, p. 171) also elaborated on Vialleton's research, concluding,

> Darwin was wrong and Vialleton was right, [because the] disposition [of these fetal teeth], their form and their number, different from those of other Cetacea, show that in the whalebone whale, far from being merely the relics of an extinct ancestor, they have an individuality and a causality peculiar to them, since they are multiplied and adapted to the length of the jaw.

Dewar (1957, p. 171) further concludes that the claim that "ancestors of the toothless whales first acquired a number of additional teeth, then scrapped them all and developed in their place the extraordinary baleen plates that occur in the mouth" is highly improbable.

Dewar (1957, p. 171) states that Vialleton's (1930) assertion was confirmed in a paper by Dr. John Cameron (*Transactions of the Royal Society of Canada*, Vol. 12, 1918), which showed "one of the functions of the developing teeth is to enable the jaw to be properly molded." This was

> illustrated by a photograph of a microcephalic idiot of whom the jaws recede like those of an ape, because of the poor development of the teeth. "In many of these individuals" he writes (p. 179) "the teeth never develop at all: The effect of this defective dentition is reflected in the corresponding feeble degree of development of the jaws…. The superior and inferior maxillae (jaws) in the early stages of their ossification, it may be recollected, are fragile bony shells enclosing the dental germs. For example, the lower jaw at birth is simply a thin trough of bone enclosing the developing teeth. The cause (of the poorly developed jaws) is a deficiency or actual total failure of development of the dental gums, the effect being that the investing jaws likewise fail to execute their normal growth and evolution" (Dewar, 1957, pp. 171–172).

Several studies using different animals have found that a feeble, poorly developed jaw resulted in improper fetal teeth development. It would be more accurate to term the tooth-like structures a jaw development system instead of teeth that never erupt from the gums. Similar scaffolding systems are actually rather common in embryology. Examples include the webbing between the fingers in humans and certain animals.

In a penetrating analysis of embryonic teeth as supposed evolutionary vestiges, Dubois (1985) reviewed the logical fallacies inherent with this concept. He concluded that, it is "highly unlikely from an evolutionary point of view that the baleen whales would have developed the extra teeth only to begin the process of losing them," and while Darwinists attempt to construct a

> scenario to "explain" such an occurrence, such scenarios are the evolutionary equivalent of the creationist's God could have done it that way; and in terms of actual explanatory value are equally worthless. Further, that the teeth seem to be "adapted to the length of the jaw" militates against the assertion of vestigiality since one of the characteristics of vestigial structures is that *they are no longer* adaptive and therefore in the process of being discarded. I have actually seen one person maintain that *even the degree to which a* structure has not yet been lost is controlled by considerations of adaptive value. I find this incredible. If a structure is useless, how can it be of any adaptive value to maintain it? If it is not useless, then it is not vestigial (Dubois, 1985, p. 14).

Dubois concludes that the vestigiality question in this case would never exist except for two factors. First, the

> evolutionary viewpoint generates certain artifacts—evolutionists must have evolutionary evidence, and "vestiges" are a phenomenon which would seem to supply it—but given the number of structures which have been alleged to be vestigial and are so no longer, it may be said that this viewpoint has generated a "problem" to be "solved" which is entirely spurious. Second, there seems to be some under appreciation of the fact that not all structures are directly useful to adults (Dubois, 1985, p. 14).

In one study of the development and degradation of the temporary tooth buds in baleen whales, Ishakawa and Amasaki (1995, p. 665) found that "the degradation pattern was little different from that of deciduous tooth buds in terrestrial species." The same claim made about whales losing their teeth is also made about chickens, animals believed by many Darwinists to have descended from toothed dinosaurs. If birds descended from toothed ancestors (both fish and many dinosaurs have enamel-protein processing genes), Darwinism would predict that there should be evidence in many birds, such as chickens, of "vestigial" defective and nonfunctioning but still present enamel-protein genes rather than a total absence of these genes, as is found. A study of the chicken genome has found no evidence that this bird has enamel-protein genes.

No living or any known Tertiary bird has teeth except Archaeopteryx, and all known Cretaceous birds had well-developed teeth. If, as the evolutionist supposes, modern birds are derived from toothed ancestors, many, if not all, birds should exhibit fetal teeth as whalebone whales do, but no known bird embryo shows any trace of teeth. The supposed rudimentary teeth that have been described in parrots are not teeth but papillae. Birds lack embryonic teeth because they are not necessary for the molding of their very slender jaw (Dewar, 1957).

The Cetacean Vibrissal Apparatus

The "vibrissal apparatus" (hairs, such as the whiskers cats use as sensors) in cetaceans are assumed to be remnants

of a former total hairy covering of an earlier evolutionary stage. The remaining "hairs" found on the heads of whales are "usually considered a very clear example" of a vestigial organ (Yablokov, 1974, p. 235). Research has shown that these structures are not "vestiges" but rather are very complex functional sensory organs that have a well-developed nerve supply connected to each "hairlet" (Yablokov, 1974, p. 235).

The blue whale (*Balaenoptera musculus*) has about ten thousand nerve fibers combined in large bundles and connected to each vibrissae. New research on the behavior responses of blue whales that resulted from touching their vibrissae has concluded the evolutionary claim that vibrissae are only "remnants of a previous hair cover" is incorrect. The vibrissae actually play a major role as tactile organs, especially for determining the presence of food (Yablokov, 1974, p. 235).

Recent investigations by Yablokov and others have confirmed these observations. The results of detailed histological investigations of vibrissae from five baleen whale species have documented that it is a complex sensory organ (Yablokov, 1974, p. 235). The hair follicle extends deep into the dermal layer of the skin and is embedded in connective tissue fibers that differ considerably in size from similar structures used in the connective tissue of the cetacean dermis. Yablokov (1974, p. 240) concluded that the pelvic bones and vibrissae are two examples that show not only do these putative "vestigial organs have a function … but they are highly specialized structures, perfected for carrying out complex and delicate functions as in the case of the pelvic bones in the present toothed whales, or vibrissae in baleen whales."

Molecular Studies

In addition to anatomy and fossil studies, molecular studies have attempted to determine whale ancestry, with varying results that support some theories and not others. So far, as a whole, there exists a "wide gulf between the morphological and molecular evolutionary studies" on the question of which mammals are the whales' closest cetacean relatives (Luo, 2000, p. 235). In fact, Luo (2000, p. 236) adds, "There is a big disagreement between morphological and molecular studies … on the broad picture of ungulate-cetacean evolution." After evaluating the molecular studies, Naylor and Adams (2001, p. 444) noted that "the phylogenic position of cetecea within the mammalian tree has long been a subject of debate." Spaulding et al (2009) in an evaluation of extinct taxa using both morphological and molecular evidence, found that the fossils closest to whales are Indohyus and similar fossils. Mesonychids were more distantly related. The closest living relative is the hippo. They also found "mesonychia is only distantly related to Artiodactyla" and that when taxon sampling is altered or other criteria are used for comparisons, the taxonomic arrangement may be changed (Spaulding et al., 2009, p. e7062).

Conclusions

In conclusion, I agree with Stahl, who wrote that "ascertaining the terrestrial stock from which the whales came is exceedingly difficult" (Stahl, 1974, p. 486). Colbert et al. (2001, p. 392) further state that, like bats, "whales (using this term in a general and inclusive sense) appear suddenly in early Tertiary times, fully adapted by profound modifications." Furthermore, the fossil and other evidence of whale evolution contradicts Loxton's claim:

> We also have great series of transitional fossils for many of the most dramatic transformations of evolutionary history. For example, we have an amazingly clear record of the evolution of whales, from bear-like land mammal, to river predators that were shaped like giant otters, to primitive whales, to modern whales (Loxton, 2007, p. 85).

Instead, the half-century-old statement of Colbert et al. (1955, p. 303) that "no intermediate forms are apparent in the fossil record between the whales and the ancestral Cretaceous placentals" is closer to the current state of knowledge. The fact is, which terrestrial animal could have evolved into a whale has been, and still is, a "source of spirited debate" (Harder, 2001, p. 180).

One reason for my conclusion is that the various claims postulated for all of the existing transitional animals are very problematic (Camp, 1998). Another reason is no evidence exists for vestigial organs in whales and the enormous gap between whales and their putative ancestors has only widened with further research. The research work on genetic comparisons finds that there exist major conflicts between the existing whale genetic evolutionary tree and the fossil record (Spaulding et al., 2009; Xiong et al, 2009). Furthermore, even the long time periods postulated by evolutionists cannot explain whale evolution: "There is, in short, neither the time nor the mechanism that could begin to account for so rapid and dynamic an evolutionary transformation from that small mammal to the extraordinary whale is so (relatively) short a period as twelve million years" (Fanu, 2009, p. 120).

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Battlegrounds of Natural History: Actualism

John K. Reed, Emmett L. Williams*

Abstract

Actualism is a fundamental assumption of secular natural history. It replaced the Christian view of causality through providence, and it asserted an absolute physicochemical and geological continuity. Though often confused with uniformity and uniformitarianism due to secular obfuscation, actualism, at root, is a method of geology that limits historical processes and events to observed present-day causes. Actualism fails as an absolute explanation of historical causality: it cannot be precisely defined, it surreptitiously assumes unjustified metaphysical positions, and its secular formulations fail logical and empirical truth tests. Only when justified as a contingent manifestation of providence does it avoid these problems. However, that formulation is of little help in deciphering the rock record, because it was largely shaped by non-actualistic discontinuities.

Introduction

George Gaylord Simpson, prominent twentieth-century evolutionist and formidable foe of early creationists, faced an unexpected attack late in life. His neo-Darwinian/Lyellian views were challenged by secular revolutionary views of biohistory (punctuationism) and geohistory (neocatastrophism). In 1970 he published an argument against critiques of uniformitarianism. He failed to slow the new trend but did a service to all by identifying six foundational topics of natural history (Figure 1). Having addressed the first, naturalism (Reed and Williams, 2011), this paper addresses the second, actualism.

Actualism emerged from the optimistic idea of the eighteenth and nineteenth centuries that science (modeled after Newtonian physics) could unlock Earth's past. But today's climate is different. Christians object to its underlying materialist philosophy, and atheist philosophers, who have embraced postmodern relativism, object to its presumed positivism. This situation reinforces the necessity of assessing fundamental assumptions and methods—all serious intellectual battlegrounds. Errors here have led to many misconceptions. The solution lies in a reevaluation of basic axioms. Some creationists have begun this task (Klevberg, 1999; Lisle, 2009; Reed, 2001; Reed et al., 2004; Reed and Williams, 2011), but much remains to be done.

Delayed and weak efforts in this work have resulted in (1) fuzzy positivism, (2) "methodological" naturalism, and (3) "scientific" history. Although positivism as a philosophical school is defunct, its spirit lives on in the smug superiority of today's science. Methodological naturalism is an unnecessary accretion

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BATTLEGROUND	SIMPSON'S DEFINITION
naturalism	Basic postulate of science; supernatural excluded from scientific explanation by definition.
actualism	Synonym of "uniformitarianism" in Lyellian sense. Present processes only options for past explanation.
historicism	Problems and procedures coming from consideration of state of Earth and cosmos over time.
evolutionism	"historical model or theory of life as changing directionally and irreversibly in the course of descent."
mode of history	Fuzzy gradualism; catastrophes occur, but not sudden, great, and worldwide.
methods of scientific history	Historical inferences are scientific as long as they are based on actualism, naturalism, and evolutionism.

Figure 1. Simpson's (1970) six foundations of natural history.

Figure 2. Constant Prévost, French naturalist who coined term "actualism."

that Plantinga (1997, p. 143) has called "provisional atheism." And nature, as a modern secular idol, has swallowed history (Reed, 2000).

Geology was built in the late eighteenth and early nineteenth centuries on the foundation of a vast prehuman prehistory accessible only through scientific study of rocks and fossils. Thus, actualism is linked to deep time. That is why a strain of anti-Christian prejudice permeates geology. Even creationists are not immune; widespread use of the term "origins science" is indicative of this problem; no one discusses "origins history" as distinct from "operations history." Sadly, "origins science" is merely Simpson's (1970) "historical science" with a theistic façade. It is curious that those who reject a lengthy prehistory accept the corollary that the past is accessible primarily by scientific inquiry. The difference between secular and Christian positions is profound: (1) secular natural history explores time *prior to* human civilization, while biblical natural history addresses details not found in a general narrative that covers the entirety of time, and (2) secular views demand an absolute physical continuity, while Christian views acknowledge physical discontinuity in the immediate (direct) acts of God.

Secular natural history developed when Newton's *vera causa* method was extrapolated to history. But that simplistic view ignored significant differences between history and science, specifically between the objects of investigation: universal laws of nature in science and unique, unobserved events in history. That is one reason *actualism* and *uniformitarianism* were so long misused and misunderstood (Reed, 2010a). Even Simpson (1970, p. 61) recognized that: "The term 'actualism' is widely used … but it is ambiguous, particularly in English, unless given special definition."

Some confusion is semantic. The English *actual* is a homophone of the French *actuel*, which was the original term introduced in 1825 by the French naturalist Constant Prévost (though the concept predated him). Prévost (Figure 2) used it to refer to causes observed in the present that he thought were sufficient to explain the rock record. Lyell's subsequent trick of conflating the method and mode of natural history created the fog of uniformitarianism, which is only now dissipating. The crumbling of 150 years of Lyellian gradualism has created a vacuum filled, in the face of Flood geology, by neocatastrophism, which grasps at actualism as a method that is not Lyellian or biblical. After so many years of trumpeting that uniformitarianism disproved catastrophism, geologists

seek to retain a materialistic history, though they still have not reached a satisfactory solution. Reed (2010a) clarified the semantic problems, suggesting that the term "actualism" be retained and all forms of the term "uniformitarianism" be discarded. Having stripped away the substance of Lyellian gradualism, Christians must now address actualism, which is equally invalid.

Actualism as a method was always *theoretically* independent of the steady-state historical models of Hutton and Lyell, the directional gradualism of the later Lyell, Darwin, and today's neocatastrophism (Austin, 1979; Gould, 1965, 1984, 1987; Hooykaas, 1963, 1970; Reed, 2010a; Rudwick, 1971, 1972, 2005; Simpson, 1963, 1970). But however pristine the theory, the historical reality that actualism was used as a disguise for a metaphysical antagonism to orthodox Christianity cannot be ignored, especially given the 150 years geologists were content to ignore problems, just so long as gradualism battled "religion." That willful blindness to the differences between geological and physicochemical causes is remarkable. In application, therefore, actualism is more than a method; it is a part of a worldview opposed to Christianity.

Simpson (1970) fought his own battles against the new revolutionary views that did not need Lyell. He noted the inherent complexity of actualism and scoffed at those who were attempting to reduce uniformitarianism to actualism. He attempted to argue actualism as a synonym to gradualism, but his arguments were as value-laden as his opponents'. He denied that uniformitarianism could be redefined as (1) induction (Gould, 1965), (2) the principle of simplicity (Goodman, 1967), or (3) the method of Prévost (Hooykaas, 1963, 1970). Like those he criticized, Simpson rejected any role for theology, but positivism cannot justify actualism any more than it can justify Lyellian gradualism. Before addressing the problems of actualism, it would he helpful to review its historical development.

The Road to Actualism

The seventeenth century saw the full flowering of the scientific enterprise that had begun in the medieval universities and culminated in Newton's synthesis. Science was the intellectual golden boy of the age. At the same time, philosophy had metamorphosed from the "handmaid" of theology to its rival. After having driven culture for many centuries, theology was set aside by Descartes' new emphasis on reason. Continental rationalism would have profound implications. It "represent[ed] the revolt of philosophy from theology" (Adler, 1965, p. 258). Reformers like Luther and Calvin insisted that truth was guaranteed by revelation. The new philosophers abandoned that view, with disastrous consequences.

> To make matters worse, the illusion of *epistēmē* [sure and certain knowledge] was now doubly aggravated—on the one hand, by rivalry with the dogmatic certitude claimed by theology; on the other hand, by emulation of the demonstrative rigor attributed to mathematics. Misled by it, Descartes, Leibniz, and Spinoza initiated modern thought with dogmatic systems of philosophy, constructed in a pretentiously rigorous manner (Adler, 1965, p. 259, brackets added).

This illusion of certainty apart from revelation would permeate thinking for centuries, migrating from philosophy to science during the eighteenth and nineteenth centuries. Comte and his followers saw this as a natural evolution; Christians should have seen it as a direct assault. But in their defense, the divorce between science and theology was gradual. As late as the eighteenth century, science was still a way to understand God's world by men who appreciated its theological foundation.

At the same time, the Reformed hermeneutic had sparked new interest in history. Chronology became a rigorous and exact science (Rudwick, 1999), culminating in Ussher's *Annals*. Extending history to the natural world, Steno's diluvial explanation of Tuscany's strata opened the door to speculative natural histories like those of Burnet and Woodward. Rudwick (2005) credited Burnet with originating a new genre, "geotheory," which would become increasingly popular and secularized in the following century.

In the 1600s, reality reflected a pervasive awareness of an ongoing immanent providence. God was the ultimate cause behind phenomena, and His mode of action in maintaining the created space-time continuum followed a regular pattern.

> The Judaeo-Christian view of divine providence … sees God as not only the creator of the universe but also its governor. Historically, the laws of nature had been seen as the law of God. All things live and move and have their being in Him. According to the classic view, all power in this world is derived from the power of God, meaning that the universe does not and cannot function independently from God. The universe is equally dependent on God's power for … its continued existence (Sproul, 2000, p. 91).

Doctrines of creation and providence provided a framework for the axioms essential to science, such as uniformity, the comprehensibility of nature, linear time, and man's status as a transcendent observer (Reed, 2001). Newton's theory of true causes was widely adopted, as was Newton's recognition that explanation ultimately rested on truth guaranteed by Christianity (Figure 3).

Cultural trends elevated science and philosophy over theology by the end of the eighteenth century. British empiricism offered tangible contributions to political and social theory. Heresies

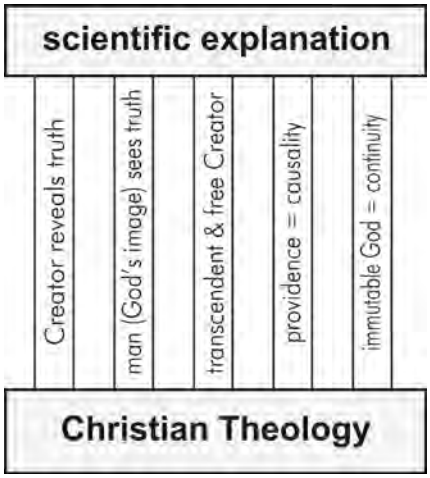

Figure 3. In the new science, causal explanation emphasized Newton's theory of true causes, which limited explanation to only observed causes. This view was explicitly upheld by pillars linking theological truth to scientific explanation (cf.,. Reed, 2001).

weakened the church, and the intellectual class of the latter half of the century became the first post-Christian generation, giving a foretaste of today's world in the French Reign of Terror. Skeptics like Rousseau and Voltaire purposefully sought to turn science against Christianity (Stark, 2003). Science waxed and philosophy and theology waned, as weaknesses in both empiricism and rationalism led to the skeptical reaction of Hume. Hume led to Kant, whose system explicitly divorced God from "reality." In a little over a century, Newton's mechanistic method had degraded to materialism. Enlightenment humanists achieved their goal—a schism between science and faith.

As with science, Christianity lost its grip on history. Rather than a frontal assault on the Bible, savants first created an imaginary period of time—prehistory—outside of the Bible. Arguing that the Bible was silent on that subject, they turned to science. Secular intellectuals like Buffon and Hutton (Reed, 2008, 2009) developed "geotheories" undermining Genesis. Eventually, biblical history was discarded—an old Earth was a staple of naturalists (including many Christians) by the late 1700s. Newton's scientific method extended to natural history, and physicochemical uniformity was extrapolated to natural geological causes, although even then the differences between the two were ignored or minimized.

This secularization was cemented by Lyell's uniformitarianism and Darwin's evolutionism. Lyell, following a host of like-minded predecessors, conflated the actualistic method with his sedate past, and Prévost's term was lost to Whewell's "uniformitarianism." Atheism emerged from its cocoon of deism, claiming that natural laws were inherent properties of matter and that the design argument had been refuted by Kant (Figure 4). By 1900, Europe was no longer Christian, and optimism in science reached its zenith in philosophical positivism (Figure 5).

A Christian Critique

Within a span of 200 years, science mutated from a means of glorifying God to the basis for denying Him. The linchpin of a Christian critique of actualism is that the fundamental axiom of science is not actualism, not even uniformity, but the more basic idea of continuity through time. Discontinuity invalidates absolute uniformity and its derivative actualism, because it calls into question scientific predictability. Orthodox Christianity always placed that continuity in the being of God; secularism, in matter/energy. This underlying continuity is often ignored because materialists emphasize uniformity and "natural laws" as providing predictable cause and effect. In natural history, geological causes must also sustain an inherent predictability across time. Actualism was elevated in importance because secular geology was such a powerful weapon against Christianity. This explains Lyell's tendency toward a static history, his stubbornness in ceding even evolutionism, and geology's vocal defense of gradualism right up to its obvious demise.

Figure 4. The links between Christianity and science were severed. In their place, autonomous science and an absolute actualism were deemed the only valid ways to truth. Actualism, like other assumptions of science, became absolute out of necessity—there could be no metaphysical justification since Kant had "saved" science by separating it from metaphysics.

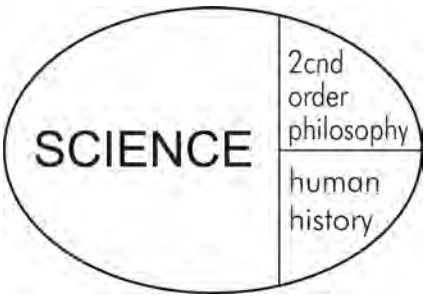

Figure 5. Having used philosophy to help destroy theology, science turned on philosophy. By the end of the nineteenth century, philosophers had retreated to second-order problems or aped "scientific" methods. History remained but was restricted to the recent past and crushed into the template of evolutionary progress.

The recent rejection of Lyell has opened a window to analyze actualism on its own merits. Positivism has given way to an uneasy relativism, but science cannot sustain the repudiation of truth. Furthermore, the politicization of science has led to widespread skepticism of its objectivity and integrity. All of these combine to offer an opportunity to untangle the knot of actualism unparalleled for many years.

Creationists have long pointed out technical or theoretical errors of earth scientists, raising doubts that helped lead to the downfall of Lyell. But more is needed. *We must change the rules.* This includes unveiling errors in actualism, while at the same time offering a compelling alternative to finding truth in natural history that will rescue geology from its secular bonds. It is a difficult task because generations of secular thinkers have focused on the wrong questions. For 200 years or more, the main issue was one of *uniformitarianism* versus *catastrophism*. This false dichotomy was created by secular geologists to combat the biblical deluge and later to attack secular opponents like Cuvier, imputing guilt by association with the scriptural geologists.

This false dichotomy has imploded under the weight of its fallacies. Geology has moved beyond that debate but has avoided the painful evaluation of *why* gradualism ruled the science for 150 years and its effects permeated the discipline. The primary error of that dichotomy was an inability to define the terms with precision, since gradualism and catastrophism are essentially *qualitative* descriptions of energy, rate, and scale existing on a continuum. Though the extremes are obviously different, the area in the middle remains undefined—a problem that always precluded resolution of the argument. Even Simpson (1970) offered no resolution.

The misguided focus on that dichotomy is only part of the problem. Another is imprecise definitions. Like uniformitarianism (Reed, 2010a), actualism is a slippery term. Does it address principles of physics or complex geological processes? Clearly, the two are not one and the same. What is their exact relationship? How are they the same? How are they different?

A Christian critique will show that secular formulations of uniformity and actualism are both invalid. It is essential that Christians reject both absolute physical uniformity and actualism. As Reed and Williams (2011) have shown with regard to naturalism, the problem is that the secular worldview diverts us from the real issues. Geologists assume that physicochemical uniformity is an absolute property of matter, and thus their only concern is how to tie actualism to that uniformity. Christians must ignore Kant's proscription and address the issue in the context of a metaphysical basis for both history and science.

However, before delving those depths, it is worth seeing how others have evaluated actualism. Until quite recently, much of it has followed the error of Lyell in conflating the method with a philosophy of history. We will ignore these efforts, which were clearly wrong. On the other hand, the work of Hooykaas (1963, 1970) was pioneering, despite the limited reach of his query. Although he failed to address the foundations of actualism and glossed over metaphysical links binding actualism, earth history, and competing worldviews, he opened a door that arguably led to neocatastrophism. In his defense, he did not enjoy the benefit of recent insights into the history of geology, which strongly suggest that prehistory was an *axiom* of naturalists, not an *empirical conclusion*. Given the close association between actualism and deep time, it is worth noting that actualism was also an assumption.

Despite these shortcomings, Hooykaas did better than most at dissecting the various meanings of actualism, and so we will use his scheme to springboard to a more complete analysis. After describing his scheme, we will show that the solution lies in the recovery of a theological basis for natural history.

Hooykaas's Approach

Reijer Hooykaas (1963, 1970) was a pioneer in deconstructing the Lyellian tangle that comprised the concept of uniformitarianism. In fact, it would not be too much to say that modern neocatastrophism owes its philosophical roots to his work. Hooykaas first noted that the supposedly "fundamental principle" of geology—uniformitarianism—was a Gordian knot of immense proportions.

> Consequently, the conceptions of the scope and contents of the Principle of Actuality … are widely divergent: they run from strict uniformity of all geological causes (in the Lyellian sense) to such a trivial general verdict as that of the "immutability of the laws of physics…. Nevertheless, however much geologists are forced to adapt their contentions to the facts, generally speaking they all rally around the "Fetish of uniformity", as adherence to it has become a token of scientific respectability. The holy names of Lyell and Darwin are connected with it, and, however widely one may deviate from its original meaning, one has to pay at least lip service to it (Hooykaas, 1970, p. 315).

Simpson, of course, disagreed, and tried to argue that uniformitarianism and actualism were linked.

> Hooykaas, Visotskii, and others have contrasted it with uniformitarianism by confining the latter term to *configurational* aspects [geologic causes] of what is present ("actual") and using actualism to refer only to what is *immanent* [laws of physics]. In that usage, actualism is the postulate or principle that the so-called laws of nature have been and are unchanging…. It is almost always

> implied, although rarely stated, that actualism involves not only that present immanent characteristics have all existed throughout the past (always excepting First Cause or, if one likes, big-bang) but also that past immanent characteristics all exist (with the same exception) and probably are all observable at present. The latter distinct principle might be but, as far as I know has not been, called preteritism…. The two principles are complementary but not necessarily equivalent. There is a good reason for preferring actualism to preteritism: science is necessarily based on the observable; the present is observable; the past is not (Simpson, 1970, p. 62, brackets added).

Then he attempted to defend his position empirically. His desperation is evident in his ignoring Hume's argument that such was impossible to avoid the conclusion that actualism is an "arbitrary axiom."

> Actualism in the full sense of the preceding paragraph is not an obvious *a priori* necessity, for conflicting principles readily can be and in fact have been proposed; but neither is it an arbitrary axiom. There is a large amount of observational evidence bearing on it and agreeing with it, even though in the nature of things its absolute, complete validity cannot be proved. Geologists and paleontologists have now accumulated a truly vast number of observations of recent configurations that have been visibly affected by immanent characteristics over periods up to more than three billion years. These are all consistent with actualism. That is the source and principle support of the canon of actualism, and it is generally taken to justify the acceptance of actualism where relevant in other sciences as well (Simpson, 1970, p. 62).

If that was the strongest case for gradualism, it is little wonder that is has been discarded! The real question is why it took so long to die. Its inherent vagueness probably helped, but we suspect that the role it played in the rejection of orthodox Christianity was significant. The problem for Simpson was that all of his empirical examples were derived by geologists who *assumed* the truth of actualism on the front end, making it ultimately a circular argument. Since he could not successfully define actualism as anything other than Lyellian gradualism, his critique of Hooykaas appears unconvincing.

Hooykaas took a different approach. Instead of attempting to justify gradual-

Non-Actualistic Conceptions	Actualistic Conceptions	
non-actualistic catastrophism ***geological causes*** *Kind* different *Energy* different	**catastrophist actualism** ***geological causes*** *Kind* same *Energy* different	(1) Diminishing energy over time, e.g., cooling earth. (2) discontinuous outbursts of catastrophes superimposed over continuous processes
(non-actualistic uniformity) ***geological causes*** *Kind* different *Energy* same	**uniformitarianism** ***geological causes*** *Kind* same *Energy* same	**strict uniformitarianism** steady-state condition, events are repeated throughout epochs (Hutton & early Lyell) **evolutionism** uniformity in change of events, not in events themselves (Darwin & later Lyell)
	(actual method; not system) ***geological causes*** *Kind* same (but not all) *Energy* same	new causes appear over time; not all present causes are needed to explain past events, and causes are tied to specific time periods

Figure 6. Hooykaas (1963, 1970) discussed the potential classifications of geological causes with respect to their "kind" and "energy." He was careful to distinguish between the method of applying observed causes (actualism) and the resulting systems (uniformitarianism, catastrophism, and evolutionism) that can result from applying the actualistic method. From Reed (2010a).

ism, he evaluated a number of possible logical formulations (Figure 6) using two-valued ("different" and "same") parameters of (1) *kinds* of causes and (2) their *energy*. He included both physical and geological causes, but the differences between them undermine even his careful classification, as do other problems in setting discrete boundaries to the problem.

> The above classification does not cover all differences of system and method and interpretation in geology. How far can we go back into the past in order to be able to speak of uniformity of the situation, or—less stringently—, of the applicability of "actual causes" in the explanation thereof? How long ought to be the period of change one takes into account for deciding whether a change is catastrophic or continuous? Moreover, as to the identity of kind or the identity of energy of geological causes, a wide range of interpretation seems to be possible. It is difficult to establish what is meant by geological causes in contradistinction to physical causes. A good deal of confusion may arise through the ambiguity of the term "actual cause" (Hooykaas, 1970, p. 275).

These are all good questions, echoed in Reed (1998), and illustrate the inherent problems in making the past the domain of science. But first, let us evaluate Hooykaas's work on his own terms. Hooykaas faced a number of problems, some of which have come into clearer focus with the death of gradualism. One example is the need for a clear distinction between causes that are "catastrophic" and those that are not. What makes one event "catastrophic" and another "non-catastrophic"? If it is the energy level, then what is the specific number that differentiates the two? What discriminates physical from geological causes? Are geological causes simple or complex? If the latter, then are all aspects automatically actualistic? Reflecting the confusion that was the legacy of Lyell, Hooykaas debated poorly defined categories, allowing the bias of materialism and positivism to permeate the foundations of natural history. His primary weakness was in failing to address the problem within the domain of philosophy—a testimony to the power of positivism late in the twentieth century.

Analysis of Hooykaas's Possibilities

There are several general problems with Hooykaas's scheme. Although he defended the Christian roots of science (Hooykaas, 1972), he remained heavily influenced by positivism. For example, he wrote,

> Uniformitarianism and catastrophism already existed alongside each other in the 18th century. The cosmogonic systems of Burnet, Woodward and Whiston bore a strongly catastrophist character. Neither the kind, nor the energy of actual causes were considered sufficient to explain former changes…. Over against them, *less speculative*, *more scientific*, systems, which were based on observations of the crust of the earth … were put forward already in the late 17th and in the 18th century (Hooykaas, 1970, p. 276, emphasis added).

Note that cosmogonies based on Scripture were "speculative" as contrasted with "more scientific" systems of deists and atheists. Note too that he allows the methodological criteria of actualism to take precedence over the *truth* of what happened in the past. This was likely the legacy of geology denying Genesis at any cost—a powerful bias to this day. Hooykaas also misrepresented history; studies in geology began with Steno's *diluvial* interpretations that were firmly anchored in "observations of the crust of the earth."

He did not see the fatal flaw—secularists love to pretend theology is invalid, while masking their theology with science. Asserting that Genesis is wrong is *no less religious* than affirming its truth. Hooykaas showed that blindness in discussing Buffon:

> Buffon…having supposed the earth was detached from the sun by collision with a comet and then cooling off gradually, had no further use for this hypothesis. In his explanation of changes in the surface of the earth, he always referred to the actually existing causes (Hooykass, 1970, p. 276).

Note that Buffon was not consistent; his "actually existing causes" only kicked in *after* he defined a godless system and set its initial conditions. Like the current big bang theory, Buffon's failed because he could not account for those conditions. He could not explain scientifically how a comet striking the sun would create a planet or how the rest of the solar system and its intricate, unified operation would be formed. Instead of "In the beginning, God created…" Buffon proposed, "In the beginning, comet created." Although Buffon claimed to be "actualistic," he was not. But Hooykaas granted weight to his secular fairy tales because Buffon claimed the mantle of actualism.

> In order to have a firmer starting point, he intends himself "to take the earth as it is, to exactly observe all its parts and to conclude by inductions from the present to the past…. He will not be affected by "causes whose effect is rare, violent and sudden", as "they do not belong to the ordinary course of nature", but he will use as "causes and reasons" only "effects which occur every day … constant and always reiterated operations" (Hooykaas, 1970, p. 277).

Buffon's basic errors persist. He masked his metaphysics with science. His observational base for "inductions" was severely limited—violating Socrates' dictum of first knowing what you do not know. He claimed to avoid causes whose effects are "rare," "sudden," and "violent"—all terms that cannot be quantified. Eliminating creation and

providence, Buffon explored a cosmos free from God. Many naïve thinkers have imagined that natural history could be explained like Newtonian mechanics. Finally, Buffon's theory was self-contradictory. His history began with the very "rare, violent, and sudden" event he said was invalid!

If actualism rests on uniformity, which in turn rests on causal continuity through time, every approach that asserts an absolute material uniformity and actualism must resort to special pleading to account for initial conditions. The origin of any finite universe is *by definition* non-actualistic. Deep time shoved that discontinuity far into the past, but logic is timeless. Ironically, it is science, in the form of thermodynamics (Williams, 1981), that joins philosophy in refuting an eternal actualistic universe, because entropy's trend creates a hard limit of absolute efficiency at some point in the past. That leaves only two options: the universe is finite or the rules changed at some point. Either choice destroys absolute uniformity. Like today's cosmogonists, Buffon was an actualist only when it suited him! It is noteworthy that later thinkers like Lyell and Darwin learned from Buffon; they studiously ignored origins, allowing a nebulous (and possibly theistic) creation at some unspecified time in the past to mollify the church and mask the inherent contradictions of their systems.

Hooykaas also ignored the necessity of a metaphysical basis for history. His categories rest on unstated assumptions about God, reality, nature, and man. What is the basis for history? For immutable "laws"? For the application of the scientific method to history? To compound the problem for secularists, the metaphysical realm is precisely the area that Kant proclaimed out of bounds in order to save science from Hume's skepticism! Hooykaas noted the basic issue, but did not follow up.

> When, however, the notion of "actual geological cause" has been widened then so far that it is practically considered as equivalent to "physical cause", systems based on a non-actualistic method become virtually non-existent. Only theories introducing super-natural, that is non-physical, causes would be non-actualistic then (Hooykaas, 1970, p. 275).

Christianity offers a firm foundation but only at the expense of the secular worldview. Uniformity and actualism can be justified but are contingent on an underlying, supraphysical continuity (Figure 7). Thus, uniformity is affirmed but is not absolute, and actualism is of little relevance to the rock record because the God who justifies uniformity employed physical discontinuities—Creation and the Flood. Atheism cannot justify uniformity or actualism any more than it can justify the basic axioms of science (Lisle, 2009; Reed, 2001).

Though we will examine specific problems (Figure 8), these general pitfalls are sufficient to invalidate Hooykaas's scheme.

Non-actualistic Catastrophism

In non-actualistic catastrophism, geologic causes and their energy levels both vary through time. Hooykaas cited Count Gregor Razumovsky (1759–1837) as a proponent of this view. Actualistic with regards to physicochemical laws, Razumovsky was non-actualistic with regard to geological causes. He believed that the past was characterized by catastrophes caused by geological forces not in effect today but still consistent with laws of physics and chemistry.

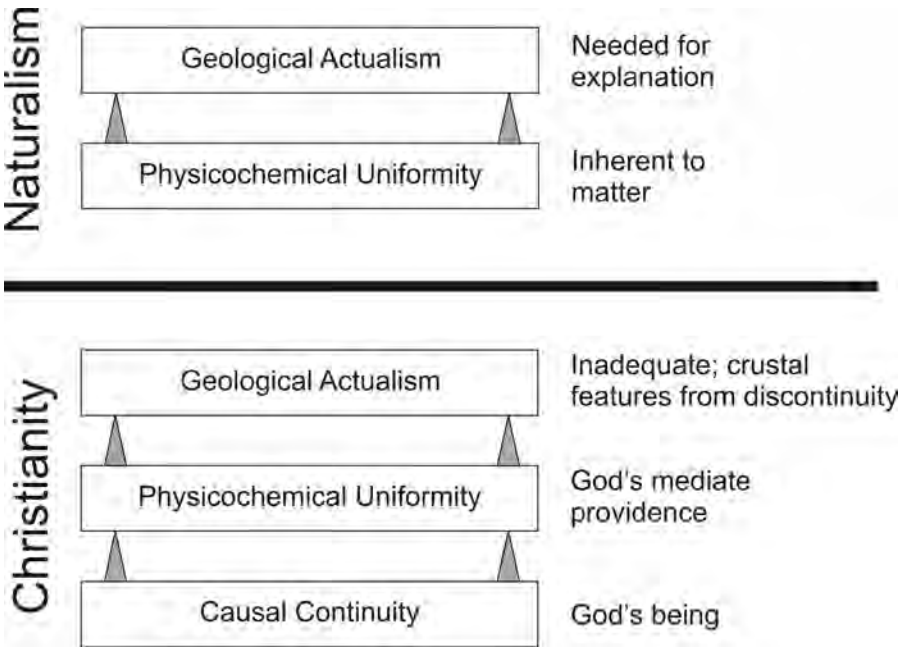

Figure 7. Secular explanations of cause fall short because they ignore the foundational issue of continuity through time, which underlies both uniformity and actualism. Only Christianity recognizes this relationship and provides adequate justification (right column) for each step. Secular attempts at an absolute material uniformity fail, and no coherent justification can be offered for geological actualism. So, secularists continue to conflate it with uniformity to preserve their scientific prehistory.

Non-Actualistic Conceptions	Geological Causes		Problems
	Kind	*Energy*	
1. non-actualistic catastrophism	different	different	Geological causes are inadequate; uniformity is required but it cannot be reliably deciphered from rocks.
2. non-actualistic uniformity	different	same	Unlikely. Different causes likely also vary in energy. Also, rocks remain opaque to science because geological causes are uncertain.
Actualistic Conceptions			
3. actualistic catastrophism	same	different	Assumes that changing energy never changes process per se. Relies on unobserved process to cause events. Incomplete evidence.
4a. strict uniformitarianism	same	same	Gradualism falsified by empirical evidence.
4b. evolutionism			Darwinism falsified by empirical evidence; initial conditions assumed, not demonstrated.
5. actual method; not system	same, but not all	same	Must assume initial conditions; certainty diminished since some past causes are unknown and not unique to rock features.

Figure 8. Analysis of Hooykaas's possible historical systems shows that none can be justified by rational principles.

> But he was also an "actualist" in using physical and chemical *causes* which still are at work now for the explanation of "ancient" phenomena, whereas he was a non-actualist as well, in that he believed that these *phenomena* do no longer occur in nature today (Hooykaas, 1970, p. 279).

This highlights the semantic problem: what is "actualism"? Is it uniformity of physicochemical laws, or is it uniformity of geological causes derived from those laws? Like Simpson (1970), Hooykaas is stuck with trying to find equivalence between the two when they clearly are not identical. Ironically, Razumovsky's position is that of modern neocatastrophists and many diluvialists—causes follow physics and chemistry, but distinct varieties of combinations of those "laws" allow many possible, yet unobserved, geologic causes. For example, while maintaining physicochemical uniformity, Brown (2008) proposes the rupture of subcrustal caverns of water, and Baumgardner (2003) accelerated plate motions.

Likewise, Cuvier and De Luc believed that Earth's crust must be explained by past catastrophes with geological causes much different from those observed today. However, they also believed that actual causes were valid when applied to the time since the last catastrophe and even between past catastrophes.

Hooykaas failed to see that the denial of Christian theism is a metaphysical position:

> In this connection it is of no importance whether Razumovsky's hypothesis seems phantastic or not. What matters is, that he uses an actualistic method (comparison with phenomena occurring now; recognition of the immutability of physical and chemical laws), and that this leads him to conclusions that are decidedly non-actualistic. Moreover, the absence of any appeal to supernatural causes shows that catastrophism is not necessarily connected with "metaphysics" (Hooykaas, 1970, p. 279).

Note how he also did not question the "catastrophism versus uniformitarianism" meme of Lyell. Besides, it misses the point; catastrophism *per se* may not be metaphysical, but *history* is.

Furthermore, non-actualistic catastrophism precludes meaningful retrodiction. If both the kind and energy of geological causes are unknown, then geologists must be able to discern those unknown causes from the sketchy tes-

timony of the rocks. But most rocks do not demand a unique cause. How can interpretation be verified if the causes cannot? And past catastrophes would erode the preceding record, leaving even less evidence from which to draw conclusions. This problem may well be what pushed Hutton, Lyell, and others toward such a rigid version of the past (Reed, 1998). It is no coincidence that the geological timescale was predicated on gradualism and its greater certainty in retrodiction.

Non-actualistic Uniformity

The false dichotomy of "catastrophism versus uniformitarianism" makes "non-actualistic uniformity" seem contradictory. However, Hooykaas uses "uniformity" in terms of energy levels and restricts actualism to causes per se. Thus in his analysis, this option is theoretically possible, yet unlikely. It is difficult to imagine that different geological causes will maintain similar energy levels throughout time. Also, if the kinds of causes differ over time, then geologists cannot be certain which causes are even candidates for a given outcrop. As noted above, since the rock record is amenable to multiple feasible interpretations, certainty in this scheme is a chimera.

Actualistic Catastrophism

This category reflects the old concept of a steadily cooling earth (decreasing energy) generating similar geologic processes with repeated, discontinuous outbursts of catastrophic events having the same underlying cause. Hooykaas points to Jean Baptiste Élie de Beaumont (1798–1874) as an advocate of this position.

> According to his fundamental hypothesis, the irregularities of the crust of the earth, in its outward form as well as in its structure, result from the disappearance of part of the heat that the earth contained when its crust was still in a state of fusion. The "slow and continuous" phenomena of cooling of the earth causes a slow and progressive diminution of its volume, from which ensues the rise of the mountains. This cooling, which acts as a slow and gradual cause, has as its effects violent and sudden cataclysms (Hooykaas, 1970, p. 286).

Like Élie de Beaumont, geologists once attributed tectonics and sedimentation to the gradualistic shrinking of Earth's crust through cooling. Primitive indications of heat flow from mines suggested a general cooling, and geologists extrapolated that cooling into crustal deformation. Like the once-popular diminishing global ocean—what Rudwick (2005) called the "standard model" of the eighteenth century—this simplistic idea made sense but rested on inadequate observation and understanding of the complexities of the planet.

In this model, cooling would have triggered discontinuous earthquakes, volcanism, and mountain building, probably by reaching a threshold, much like an earthquake releases strain. This position would have been congenial to the later thermodynamic arguments of a cooling Earth by Lord Kelvin and persists in the surge tectonics hypothesis (Meyerhoff et al., 1992).

However, this option must posit initial conditions that cannot be determined scientifically. Evidence of planetary cooling might appear reasonable but has not been observed empirically for sufficient time to guarantee the steady trend assumed in this model. Only the *assumption* of actualism *a priori* can validate that set of conditions. Furthermore, the cooling Earth example illustrates the dangers of generalizing from too little data. Modern measurements show heat flow varying widely from place to place. But the ancient trend must be interpreted from the rocks. Again, the evidence is not clear, nor is it unique to this explanation. Increasing knowledge of the mantle suggests that crustal changes are driven by complex phenomena not well understood today. There certainly is no uniform steady contraction like that pictured by Élie de Beaumont.

Today, neocatastrophists employ a variation of this concept; the underlying engine of geological change is plate tectonics—crustal rearrangement, not shrinking. Continuous plate motions create conditions in which both catastrophic and non-catastrophic events occur. Meteorite impacts provide another catastrophic variable—again unpredictable and unclear in the rock record. However, plate tectonics shares a problem with Élie de Beaumont's crustal cooling: it cannot be demonstrated. At best, it is a working hypothesis.

Finally, neocatastrophism has deftly avoided the task of reexamining the influence of the vast body of work done between 1830 and 1980 that is based squarely on Lyellian gradualism. How many of our concepts about geological causes are shaped on even subconscious levels by that body of work?

Uniformitarianism

Hooykaas (1963, 1970) defined two types of uniformitarianism—steady-state and gradual evolution—well prior to Gould's (1965, 1975, 1984, 1987) discussion of the same topic and the contemporary consensus (Figure 9). Both concepts invoke the same geological causes operating at the same energy throughout Earth's past. The steady-state model was made famous by Buffon (though later rejected) before being advocated by Hutton and explored by Lyell. In fact, Lyell was lampooned by Henry de la Beche for his essentially cyclical history (Figure 10). Though Hutton never let go of his ahistorical cycles, Lyell quickly backtracked to a linear gradualism, which was further altered later by the progressive evolutionary view of Darwin. Hooykaas thus subdivided this approach into a steady-state model and an evolutionary one (Figure 6). The latter was that view argued by Simpson (1970).

	Gould (1975, 1984)	Rudwick (1971)	Austin (1979)
methodological	*uniformity of law* a priori claim about science; laws same over time, space	*theological status* primary act of God secondary, "naturalistic" manifestation	*methodological uniformitarianism* agreed with Gould that this is an a priori claim about science
methodological	*uniformity of process* actualism	*methodological status* past geological causes same as present; "actualistic" vs "non-actualistic"	*causal uniformitarianism* argued for both known present causes, unknown present causes, and unique past causes
substantive	*uniformity of rate* gradualism	*rate* gradualistic or saltatory	*actional uniformitarianism* uniformity of process rates
substantive	*uniformity of conditions* non-directionalism, dynamic steady state	*"pattern" of past geological cause* steady-state or directional	*configurational uniformitarianism* steady state conditions through time

Figure 9. Contemporary views of the modern meanings of "uniformitarianism." From Reed (2010a).

Both of the "uniformitarian" options have fallen on hard times. They fail because they cannot justify initial conditions or the only viable option: eternal matter. Eternal uniformity fails by the causal logic of the cosmological argument and the thermodynamic argument. Both Hutton and Lyell simply avoided these problems, as do many today; geologists pass the buck to astronomers. But as noted above, metaphysics are unavoidable.

> With uniformitarians, however, no less metaphysical preconceptions and intrusions occurred. Hutton's "Theory of the Earth" … is steeped in them, and even with Lyell they are not wholly absent. But, these two great geologists … were sober-minded enough not to propound an eternal repetition of cycles. They only declared that we find no vestige of a beginning and we see no prospect of an end in the cyclical course of events presented by the geological record (Hooykaas, 1970, p. 309).

Rudwick (2005) disagreed with this interpretation. He asserted that Hutton's theory at least strongly implied an Aristotelian eternalism (Reed, 2010b). Given the profound bias of both men against orthodox Christianity, neither could be termed "sober-minded" (Mortenson, 2006; Reed, 2008). It is both inconsistent and unintellectual to claim scientific knowledge of unique, unobserved past events back to a certain point in the past and then plead ignorance of what happened before, since what happened in that void of that ignorance might have profound causal consequences.

When Hooykaas wrote (1963, 1970), Lyell and Darwin were still the "gods" of natural history. Today, Lyell has been dethroned, and Darwin is tottering on the brink. Gradualism has been widely rejected for neocatastrophism because of widespread evidence in the rock record, and evolutionism is faced with accumulating exceptions to the paradigm that render it much less likely. Hooykaas at least recognized inherent problems with this position, addressing them obliquely by reference to a few individuals who pushed the logic of the position well beyond Lyell.

> Some uniformitarians, however, went much farther and made Uniformity into a kind of religious dogma. G.H. Toulmin (1780) dogmatically excluded the possibility of a beginning or an end of the earth. He tied uniformitarianism to the metaphysical belief in the eternity of Nature…. In Toulmin's and Volger's theories, then, not only the dogmatic but also the a-historic character of Uniformitarianism has reached its extreme (Hooykaas, 1970, pp. 309, 311).

Or perhaps its logical conclusion.

Laudan (1987) makes an important distinction in Lyell's view of actual

Figure 10. Cartoon of Henry de la Beche lampooning Lyell's steady-state theory. In the endless repeating cycles of history, future ichthyosaurs study human fossils. From www.historyofgeology.blogspot.com.

causes. He was not strictly actualist in the sense of restricting geological explanation to present-day causes. Instead, he tried to apply Newton's method of true causes (*vera causa*) to natural history.

> Lyell also wanted to develop a geological theory with impeccable methodological credentials. In Lyell's mind there was no better way to accomplish this than to adopt the method favored by Newton himself—the so-called *vera causa* method, or method of true causes—and adapt it to geology.... Lyell's particular genius was to adapt the *vera causa* method to the particular problems posed by geology (Laudan, 1987, p. 203).

In doing so, Lyell followed the positivist path of mandating empirical truth. Note how he equates what can be known to what can be observed.

> In the many cases where the observational handicaps of the geologist were so great that he could not use the method of induction, what reasonable limits should the geologist put on the method of hypothesis? Lyell's answer was that all hypotheses about unobserved causes or effects must be founded squarely on what we have observed. The range of entities upon which geologists can draw to hypothesize about the unknown causes of a known effect are those agencies that have been observed in operation (Laudan, 1987, p. 204).

Christians, of course, would argue that God's revelation is among those things that can be known.

Laudan describes Lyell's views as consistent with his desire to implement

Newtonian method to geology.

> The tenets of what William Whewell … called Lyell's "uniformitarianism" were derived directly from the method of true causes. Historians of science have identified three distinct theses within Lyellian uniformitarianism…. The first of these, "law" uniformitarianism, asserts that the laws of nature have not changed over time; the second, "kind" uniformitarianism, that the kinds of geological causes have not changed over time; and the third, "degree" uniformitarianism, that the intensity of geological causes has not changed over time (Laudan, 1987, p. 205).

Upon examination, these are easily shown to be fallacious. The "third" uniformitarianism has fallen to contrary evidence in the rock record of events in earth history of much different scale than that observed today. The second was nothing more than an assumption of method, based on a faulty understanding of the nature of science. Its inherent weakness is seen in the continued default to the "first" uniformitarianism by geologists when pressed as to why the "second" must be true. Finally, physical uniformity is not absolute and not even logically consistent with a secular worldview (Reed, 1998, 2010a).

Actual Method, Not System

In his final iteration, Hooykaas offers an option in which energy remains constant and kinds of causes change. Causes appear and then disappear. But no one can provide an explanation for the birth or death of these causes; it must be accepted on faith. Thus, geological causes are not all unknown, but the total reservoir of causes exceeds what is needed to interpret a given part of the rock record. Geologists thus face more than the difficulty of inferring causes from tenuous and incomplete evidence in the rock record; they also face the additional problem of sorting through a large menu of causes and finding those applicable to that particular section of the rock record, since only a subset of all causes is needed. The present is not the key to the past in the Lyellian sense; instead, only *some* of the present is the key to the past. But which part?

The difficulty is enhanced by the problem of pinning down the period of time in question independent of interpretation of causes, which does not seem even theoretically possible. No one has shown how a timeline of the rock record and an independent timeline of geological causes can be derived. Actual practice muddles the two, increasing the uncertainty. In reality, since both the distribution of the rocks and geological causes are unknown and not subject to observation, being able to confirm both would be circular.

Furthermore, knowledge of causes is supposedly derived from present-day observation. But if causes change over time, there must be some principle that allows geologists to differentiate the extant and extinct causes. How can we define causes that are not in operation absent observation? The answer does not reside in the rock record because that is the phenomenon to be interpreted in the first place. Hence, at best this approach requires circularity. This leaves geologists with a secular version of the "god-of-the-gaps" accusation. But this time, the shoe is on the other foot; it is now a "cause-of-the-gaps" argument, where unknown geological causes are invoked to plug the gaps left by causes observed in the present that cannot explain particular aspects of the rocks.

Defining the Real Issues

Unanswered questions and unsolved problems in the options of Hooykaas (1963, 1970) suggest a need to redirect our inquiry. Clearly, the positivist approach is not valid. It is clear that actualism is linked to the secular paradigm of earth history—an extended prehistory accessible only to forensic study. Both are presuppositions, and the latter is the essence of the positivist approach. Actualism is not clearly defined, but the common denominator in all its manifestations is its providing an alternative to Genesis because (1) extended time dismisses the Flood as a significant geological agent, and (2) finding ultimate continuity in matter contradicts the Christian view of causal continuity residing in God. Yet nowhere is actualism proven or justified. Shea's (1982, p. 456) assessment remains:

> In short, my survey of modern geological literature … reveals no consistent difference in meaning between uniformitarianism and actualism, and I consider them to be synonyms…. Sometimes this fallacy manifests itself when a modern author makes a point of describing his model of a geologic process as "actualistic"…. The text of such articles usually explains that "actualistic" processes or conditions are those that have modern analogs. However, as Gould (1965, p. 921) has pointed out, "actualistic" really means nothing but "scientific" and the adjective is, therefore, redundant in a scientific book or journal.

Shea (1982) also noted that geological actualism cannot be asserted solely on the basis of physical uniformity. But the failures of actualism are even more profound. They include:

1. *Imprecise terminology*. Like "uniformitarianism;" fog swirls through any discussion of actualism. It occurs because of (a) differences between the English "actual" and the French "actuel," (b) the longtime confusion of actualism with gradualism, (c) inability to define "geological causes" in terms of physicochemical laws and the resulting confusion between the two, and (d) the inability to quantify or precisely define the terms "catastrophic" and "uniform."

2. *Guilt by association*. Given a strong secular bias, geologists must demonstrate that "actualism" in all of

its semantic flexibility is not a faith-based excuse to exclude the Genesis Flood from history. That will be difficult because geologists since the late 1700s have been saying just that.

3. *Misplaced focus*. Actualism is a subset of physicochemical uniformity, and there is much discussion of both, but there is virtually no discussion of the fact that both are underlain by the issue of continuity of being: is it found in nature or in God?

4. *Unjustified assumptions*. At the very least, actualism assumes uniformity of both physicochemical processes and geological causes. But that is the question, revealing that actualism is linked to metaphysical assumptions and ones ultimately unjustified by logic (Reed, 2001).

5. *Circularity*. Actualism presupposes what historical geology sets out to demonstrate. Simpson (1970) claimed it was not arbitrary, but his only defense was the congeniality of interpretation using the principle. That is an invalid argument. If one rejects biblical history, assumes deep time, and asserts the sole authority of science in prehistory, then a secular natural history invariably results.

6. *Arbitrary*. Actualism was introduced as a method of interpretation *prior* to significant investigation of the rock record. Thus Simpson's (1970) empirical "justification" further forces a conclusion of circularity. The driving force behind secular natural history was its opposition to biblical history. Setting the rules to determine the outcome is neither scientific nor objective. It is simply the arbitrary exercise of intellectual hubris on the part of those who wanted Christianity not to be true.

7. *Inherent uncertainty*. Simpson (1963, 1970) wrestled with the difficulties of defining geological causes in the same manner that chemical laws can be formulated. However, it is likely that a rigid definition of many geological causes in that manner is impossible. Even areas that are well studied, such as sedimentation and fluid mechanics, are hard pressed to provide a unique interpretation to any given formation. Furthermore, as Reed (1998) noted, secular natural history's view of the past and its causes leaves many unanswered questions. What is the present? 1800 on? 1700? 1600? Knowledge of Earth's processes is affected by geography. Processes observed in Europe date back centuries; those in much of the third world a few decades. What geological causes have we not yet observed or defined? Also, what range of energy is allowed, and when does a quantitative change in scale result in a qualitative change in process? The rock record shows events dwarfing anything seen in the "present." How then are we to address the energy levels of those processes? What about the rare event, the common process, and their effect on the rock record? By any stretch of the imagination, actualism fails as a method because it cannot be applied consistently.

A larger problem comes in examining the categories used by Hooykaas. He based his analysis on two factors: (1) *energy levels* and (2) *kinds of causes* (same or different). His scheme left many questions unanswered. Hooykaas assumed the absence of supraphysical events in the past; instead, he assumed physical continuity and uniformity. But, of course, justifying those assumptions requires metaphysics, which is taboo in secular natural history. Hooykaas was unable to supply a precise definition of "geological causes."

All of these problems are linked. They result from the dismissal of Christian theology from serious consideration. Enlightenment thinkers suppressed the traditional view of reality built on the doctrines of creation and providence. This created inconsistencies, since science rests on Christianity. Science requires causal continuity, and secularism requires that continuity to be located within nature. This creates an immediate contradiction unless eternal matter is affirmed. Atheists admit a past physical discontinuity—typically the big bang. Despite being long ago, the chain of causality has been broken. If it happened once, it can happen again, and the absolute certainty of science is shattered on that one fact alone. In that case, the causal continuity of "natural laws" is not absolute and actualism appears less and less certain as a door to the past.

In summary, secular formulations of actualism fail at every turn. In turning their back on metaphysics, its proponents are self-limited from true explanation and a valid foundation of their discipline. The most fundamental aspect—continuity—is not inherent in nature because, like Buffon's cometary collision, there is always some discontinuity in the system, and their methods are revealed as an arbitrary defining of rules to favor their outcome. If continuity and uniformity are not absolute in nature, then another option must be found, or science cannot provide certainty in the present, much less the past. Christianity not only solves these problems but also provides a coherent and consistent framework for understanding nature, past and present.

Christian Reconstruction of Method

If secular actualism fails, then it is time to change the rules. And if its failures are linked to the dismissal of Christian theology, then it is logical to suppose that the solutions are found in the reassessment of theology. Instead of the "science" paradigm, where history is simply an extension of scientific processes, we need one that is oriented toward discovering truth about past events. If secular method stands in the way of truth, then it is time for a new method.

First, we cannot restrict the pursuit of truth to science. Other disciplines seek truth, and cannot be ignored. The first step in deriving a reliable view of geologic history is to step back from the

lingering effects of the naïve positivism of the eighteenth and nineteenth centuries and understand that natural history is a mixed question (Adler, 1965), if for no other reason than that the most reliable historical text in the world—the Bible—addresses the subject. What are the ingredients of the mix? Since historiography rests on philosophy and theology, and since history rests on narrative, then those disciplines demand a seat at the table. A narrative might be read from a rock or a book, but rules of logic determine which will have priority, not an arbitrary default to the "scientific" answer.

Christianity provides the foundation for natural history by justifying both science and history, as well as by affirming their value. Only Christianity can justify and integrate the various areas of knowledge. After all, the "university" concept was the invention of Christianity. Since Christianity relies on revelation, and since revelation is comprised largely of historical narrative, then clearly that narrative is important to our understanding of natural history (Reed, 2000). This is precisely the opposite of the goal of the early secular naturalists, who sought to divorce revelation and empirical data. That experiment has clearly failed. It is time to correct our course and work to integrate the two once more.

A benefit of this new approach is the solution to the problem with continuity, uniformity, and actualism. Christian theology explains both continuity and discontinuity in the natural world by placing ultimate causal continuity in the person of God. Discontinuity in nature does not, therefore, sever the causal chain but illustrates the importance of reading the past through the lens of God's interactions with His creation. Reed and Williams (2011) show that the doctrine of providence is the antidote to secular assertions that science was inherently naturalistic. Likewise, providence is the antidote to an absolute natural actualism.

Continuity of cause and effect reside in God. That is the essence of the doctrine of creation. God spoke, and physical reality came into existence—*contingent* physical reality. The physical world is an effect, not a cause. Science and other empirical disciplines are possible because providence provides an orderly and predictable basis for knowledge. God's use of mediate (indirect) causes in the operation of the created order allows a contingent natural uniformity, but since God reserves the right to act, it is not absolute. Hence, miracles are real, but miracles do not invalidate science because science does not encompass the totality of truth. There is no inherent contradiction between "natural" and "supernatural" because God is the cause of both. Both reveal different aspects of divine providence and therefore the divine character. God confirms a prerogative to supersede the regular workings of providence in five specific ways: (1) His past work of creation, (2) His past modification of Earth by the Flood, (3) the Incarnation, (4) various "minor" miracles spread throughout history, and (5) the coming re-creation of the cosmos at the end of time.

What does this mean for natural history? First, it shows that actualism misses the point. Hooykaas's scheme comparing the kind and energy of geologic causes is inadequate because it ignores the theistic basis for all causality. A better scheme is one that focuses on continuity and discontinuity in nature, which helps define the places at which pure forensic investigation is preferred and those at which revelatory information is needed (Figure 11).

The consequences of this view are significant. Secular natural history has focused on method and process. Biblical history focuses on truth and meaning. Williams and Reed (2011) noted that the restoration of the theological framework of divine providence is needed to open the door to natural history. God has acted in space and time; therefore His actions cannot be ignored. Some people choose to call that "unscientific," hoping that most will make the emotive leap from "scientific" to "true." However, the implication does not necessarily follow. Knowledge of natural history is possible, but as Christians we recognize a different set of rules. In other words, intellectuals from Buffon to Gould could not find answers because they refused to ask the right questions. Secular geology considers only physical uniformity and actualism, whereas Christianity pushes the door open to supraphysical continuity and physical discontinuity.

Over the past centuries, secular thinkers have been forced by logic and the evidence of the rock record to move from Hutton's static world toward uniformity (not actualism) as the basis for geological interpretation. They have done so grudgingly, resisting every step. And yet today, we are at the point where geologists have finally admitted the disproportionate effects of rare causes (Ager, 1973, 1993). If they continue, and realize that a material uniformity is not possible in a finite universe, then the step back into the metaphysical world will be another in the right direction. Christians should encourage this trend and make sure that our own understanding of natural history does not become truncated by a need to move to meet them.

From the Christian point of view, all the hand-wringing over geologic causes and energy levels is wasted effort. Why come at the problem indirectly when revelation provides general descriptions of actual relevant historical events? Secularists reject the Bible and thus are left stumbling in the dark, unable to make much of the past other than construct imaginative scenarios that cannot stand extended empirical scrutiny. They argue at length over present and past processes and present and past energy levels, when an actual description of events is present in Genesis.

If the goal of our knowledge is truth, we put method in its proper place. It

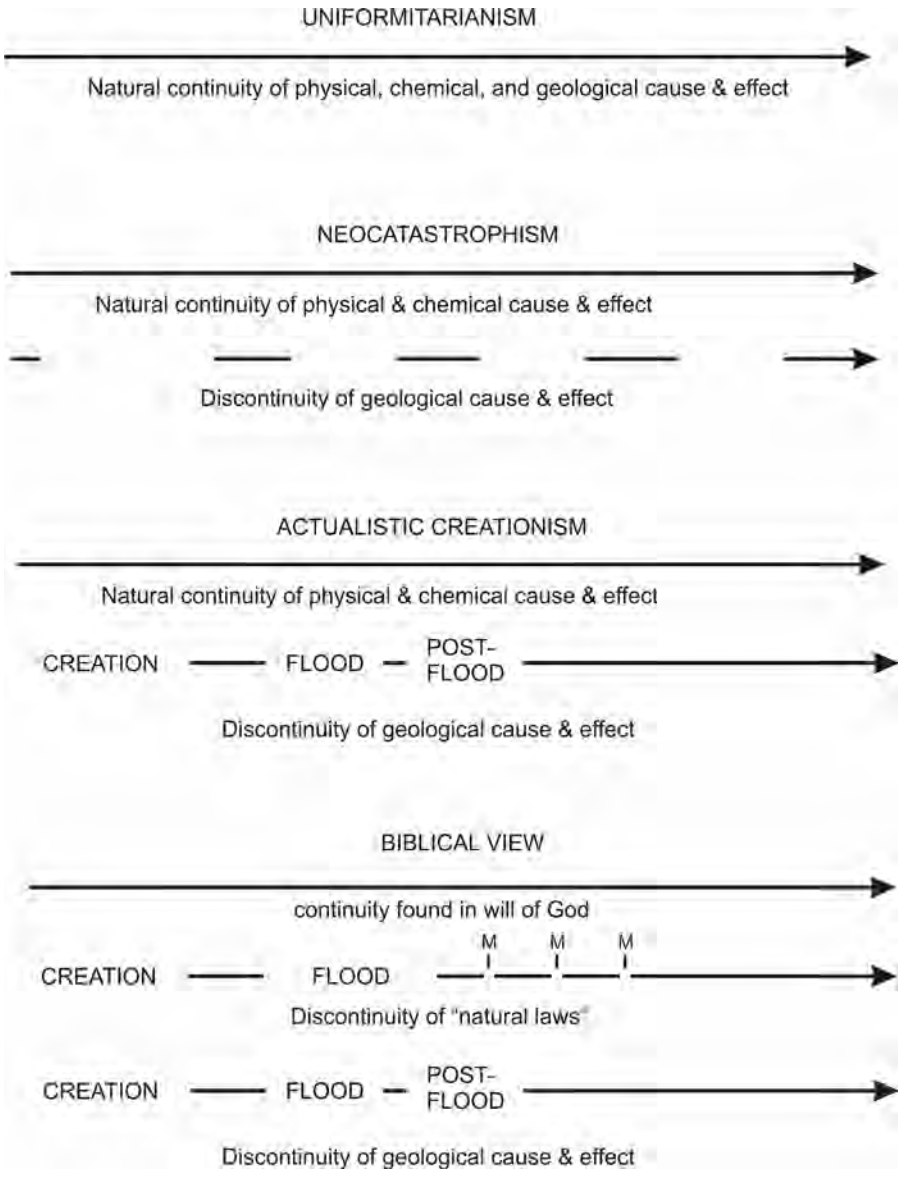

Figure 11. Options addressing the issue of continuity and discontinuity in nature, modified from Mortenson (2004, p. 34). Various ways of explaining causal continuity over time are shown. Note that all presume linear progressive time—a Christian innovation. The uniformitarian view is that of Simpson (1970), which links causal continuity in both physicochemical and geological senses to nature. Neocatastrophists allow variety and discontinuity of geological causes across time because they believe they are underlain by a material physicochemical causal continuity. Some creationists appear to advocate what we call "actualistic creationism" which affirms the historical discontinuities of Creation and the Flood but with the understanding that God used the underlying physicochemical principles once matter and energy had been created and imbued with its properties. However, the proper biblical view, while affirming the historical discontinuities of Creation, the Flood, miracles (M), the Incarnation, and the end of time, do not demand any underlying causal continuity in the properties of matter but only in the mind and will of God. Thus, aspects of the Flood could have been caused supraphysically and would not then be amenable to scientific explanation.

is a servant, not a master. What does it matter if truth is found in a rock or a text, as long as it is truth? Method is secondary; reality is primary. If actualism, catastrophism, strict gradualism, or any other method cannot provide a valid interpretation for any given rock body, then we are free to let historical narratives and the rocks (unencumbered by presuppositions like Lyellian gradualism) speak truth. Austin was correct in noting that

> unusual ancient processes, undiscovered processes, and inversions of actualistic reasoning [are] important problems for causal uniformitarianism. The geologist's technique in deciphering ancient processes, they affirm, relies not only on analogies with products of modern geological processes, but on analogies with products of similar ancient processes, on analogies with products from experimental replicas and other non-geological systems, and on logical deductions from theories or scientific laws. Proper interpretations of ancient processes should, they say, involve complex techniques of inference, not just simple one-to-one association of products of modern and ancient processes. By using complex inference techniques, the geologist retains the maximum flexibility when confronted with anomalous facts, the proper perception of which is probably the crucial step in the act of scientific discovery (Austin, 1979, p. 39).

Actually, actualism has a place in biblical history and can be validated by biblical truth. Outside of the supraphysical discontinuities described in Scripture—Creation, Flood, and end of the world—natural processes follow consistent physical "laws" that are the visible expression of God's regular providence. There is still the incomplete understanding of the relationship between physical laws and geological processes, but since natural history need not bear the burden

of hard science, then such uncertainty is acceptable.

Ironically, while this "Christian actualism" is valid for the vast majority of Earth's time, it is unhelpful in understanding the rock and fossil records because these are almost entirely the products of supraphysical discontinuous events. It is not clear that even principles of physics and chemistry apply completely in these events, because the Bible clearly states God as the causal agent of both Creation and the Flood. The question, then, is the relationship between His use of primary and secondary causes in both cases. The former seems more prevalent in the Creation week narrative, but there also are events occurring during the Flood that may well indicate primary causation. While that would invalidate a scientific approach, we must continually remember that the goal is truth, not the expansion of science into the past.

Having seen the failure of the various possible formulations of actualism per Hooykaas, and having roughed out a Christian alternative, how do these two methods compare? We have seen that actualism cannot provide a true and certain means of interpreting natural history. Strong arguments in favor of the reliability of biblical history reinforce that failure. In an objective search for truth, Genesis would have a seat at the table. Even more, it offers advantages to natural history that naturalism cannot. These include:

1. *Openness to empirical data*. We were taught that Lyell and Darwin provided systems that were better than the Bible because they were empirical and scientific. But they only replaced one set of interpretive boundaries with another. Those of the Bible are less restrictive because they do not limit potential geological causes for particular strata but allow a broad range of possibilities within the fundamental limits of natural history. It is time to let rocks tell their story without rational principles of an outmoded eighteenth-century view of science forcing interpretation. In short, diluvialism offers a more empirical stratigraphy (Reed et al., 2006).

2. *Ties up loose ends*. Unlike naturalism, Christianity is self-consistent and able to justify its assumptions. Since that is done by theology, natural history must set itself subordinate to theology, if truth is indeed the object of the exercise. This relationship is illustrated by the doctrines of creation and providence. This theology justifies our investigation of history, justifies a provisional actualism by providence, and describes the discontinuities of the past sufficiently to allow further forensic investigation. Unlike naturalism, Christianity clearly admits its metaphysical foundations. There is no attempt to mask them as "science."

3. *Focuses on goal of truth*. Secular natural history began with a "religious" goal of undercutting biblical authority. It continued in that vein by using a focus on method to distract from the real conflict. Actualism is merely symptomatic; any method is acceptable as long as it falsifies the Deluge and divine creation. The Bible has been considered a reliable historical document for millennia. Dismissing that reality is anti-intellectual.

4. *Support system*. Most agree that science is in need of better ethical constraints. Christianity provides a system of ethics and a belief structure that promote honesty, objectivity, tolerance, and inquisitiveness.

Given the failure of secular actualism and the benefits of biblical Christianity, it would be foolish to search in any other place. Therefore, we conclude that Christianity alone can adequately define actualism. The price to be paid is the realization that actualism is largely irrelevant to interpreting the rock record.

Conclusions

Actualism in recent decades has experienced a revival as the fallback position for geologists disenchanted with the obvious failures of gradualism but unwilling to accept biblical history. Like gradualism, actualism faces problems stemming from its assumption of tenets of the secular worldview. It cannot be precisely defined, either semantically or conceptually, and attempts typically become confused, mixing geological processes with physicochemical uniformity. And neither actualism nor uniformity is the ultimate issue; that is reserved for the underlying problem of where we can find casual continuity. Hooykaas (1970) attempted to make careful distinctions between kinds and energy levels of causes, but despite an elegant analysis, he did not resolve the basic problems, because that requires a metaphysical foundation.

Reintroducing Christian theology into the discussion not only eliminates secular pitfalls but also provides a self-consistent basis for truth in history and science. It also mediates between the two in a mixed-question approach by setting boundaries with revelation. It even justifies a contingent actualism, although it is less useful for forensic interpretation since the rock and fossil records are largely results of natural and geological discontinuities at Creation and the Flood. Creationists must re-evaluate their methods, rejecting any absolute actualism, uniformity, or physical continuity in favor of an approach that places causal continuity in the person of God. Revelation is thus strengthened as a primary facet of the mixed question that is natural history.

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Author and Title INDEX for Volume 48, 2011–2012

Robert Mullin*

This title/author index covers articles, panorama notes, and other features. For items with two or more pages, the reference is to the first page only. After the page number, a letter indicates which type of entry is involved: article (A), panorama note (P), letter to the editor (L), book or video review (R), cover photo (CP) or other departments (such as editorials, editor's forum, laboratory director's comments, president's remarks, photo essays, etc.) (D).

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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.*

The Original Type of Man Identified

Within the range of *Homo sapiens* there are many forms. Amongst them, of course, is modern man. Also, back in time we have skulls from Dail, Jinniushan, China, that look different from *Homo erectus* and do not resemble the Neanderthals or modern man (Brown, 2011, p. 312).

A recent discovery of a new skull at 11,500 years sees a skull with no chin, like some of the Neanderthals (Anonymous, 2012, p. 4). Skulls at 40,000 years from Siberia, given the name Denisovans, are an old and unique form of *sapiens* whose line may go back to *Homo heidelbergensis* at 500,000 years (from a private source). Neanderthals go back to 300,000 years (Marshall, 2012, p. 10).

Fossil discoveries of our *sapiens* line can be seen in the following examples of Steinheim and Swanscombe, both at 300,000 years. In Israel, at 400,000 years, new *sapiens* fossils have been discovered (Fernandez, 2010, p. 33), as well as in Spain at 600,000 years, with a history pushing back to the one million years marker (Bischoff et al., 2007, pp. 275–280).

At this point, we have bypassed most—therefore enough—of the early *Homo erectus* that left Africa to colonise Europe so as to break any link with the two, pointing to *Homo sapiens*, in some form, giving rise to the rest of mankind. Any further fossil discoveries of *Homo sapiens* further back in time will surely serve to reinforce this position; this is the way the fossil record should be read.

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Author's Correction

It has been brought to my attention that there is an error in my recent article (Barnhart, 2012). Figure 23 from this article is actually a picture of the Hance Rapids rather than the "Garnet area." I accept full responsibility for this error. Although the change in location negates the associated discussion in the paper about parallel layers terminating against a monadnock and chemical weathering, these phenomena are clearly illustrated elsewhere in the paper. For example, Figure 4 provides a clear example of the weathering at the basal contact of the Tapeats Sandstone and Figure 3 shows the termination of basal Tapeats depositional layers by a rapidly moving unidirectional current against a monadnock. While I regret the error, I stand by the interpretation presented in the paper.

W.R. Barnhart

Barnhart, W.R. 2012. A hydrodynamic interpretation of the Tapeats Sandstone, Part I: basal tapeats. *Creation Research Society Quarterly* 48: 288–311.

Biogeography: A Creationist Perspective and a Missed Opportunity

I enjoyed reading Bill Johnson's recent article on biogeography but believe that he is incorrect when he claims that "creationists have largely remained silent on the issue" (Johnson, 2012, p. 212). I am equally disappointed that he, the reviewers, and *Quarterly* editor(s) failed to do a simple keyword search on "biogeography" using the back issues of the *Quarterly* now available on compact disc. My search revealed a total of 34 documents with 130 instances. The Creation Research Society maintains a website (<http://www.creationresearch.org/>) that allows a quick search for the term "biogeography," and it returned several references from the *Quarterly* and *Creation Matters*. I also consulted the Bryan College Creation-Evolution Literature Database (<http://bryancore.org/celd/index.html>) and was able to identify several more references on the subject of biogeography that are directly germane to Johnson's work. I was unable to locate a single reference in Johnson's article to any of these earlier creationist works (e.g., Howe, 1979; Howe and Lammerts, 1980; Helder, 1996; Froede, 2003; Wise and Croxton, 2003; Rucker, 2004; Wise, 2004; Statham, 2010). That an evolutionist claims to be unaware of any creationist work regarding biogeography reveals his own ignorance (Johnson, 2012).

Creationist literature appears to be unable to move beyond the simplest ideas because "those who don't know history are destined to repeat it"; and while Edmund Burke's (1729–1797) words were not directly aimed at technical research/review in creation science, it seems apropos.

If we, as young-earth creationists, are unwilling to do the literature research and investigate the earlier work that is directly related to our subject matter (even if we are in disagreement with it) and those in control of editing and checking that work (at all levels) abandon their role in the process, then we cannot expect our work to achieve the quality that it should. Concepts and ideas presented will simply be "rediscovered" without any advancement of the subject matter.

I encourage all creationist authors to take the time necessary to do the background research and for peer-reviewers and editor(s) to check manuscript keywords against back issues of the *Creation Research Society Quarterly*, *Creation Matters*, and the Bryan College Creation-Evolution Literature Database. This will help ensure that relevant, published creationist work is reviewed and referenced in any/all new work that seeks to add to the subject matter.

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Author's Response

I appreciate Mr. Froede's willingness to take time to read and critique my article, as well as his words on the importance of reading all the material on the subject matter.

With that said, I have just a few thoughts regarding Mr. Froede's response. Considering the mountain of material produced by evolutionists on the geography of life, whether it is articles or journals committed solely to biogeography or the numerous biogeography textbooks, the handful of brief sources Mr. Froede cites doesn't stack up. On this issue, creationists have *largely (not completely)* remained silent—so much so that this is a common accusation from evolutionists (e.g., Godfrey, 1982, p. 183).

Further, I was aware of many of the sources Mr. Froede cited. An author may have a number of reasons, aside from ignorance, for not referencing some or all previously published works. There were many other works I would have liked to include if my article were more than a brief introduction to the subject.

William Johnson

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Faulty Assumptions on Light-Travel Time

Ron Samec made a critical mistake in his recent article "The Universe in Near Real Time and the Light Time Effect" (Samec and Oliver, 2011). He failed to account for the effects of relativistic time dilation, and in doing so he drew the erroneous conclusion that his observations of a binary star system are inconsistent with the ASC model. However, when time-dilation effects are properly included, Samec's observations are actually *perfectly consistent* with the ASC model.

Samec's article investigates the timing of a short-period eclipsing binary, which is apparently orbited by a third, longer-period star. As the third star and binary pair orbit their common center of mass, the timing of the eclipses changes as observed from Earth. When the binary pair is closer to Earth, the eclipse time is advanced; and when the pair is farther from the earth, the eclipse time is delayed. Samec arbitrarily assumes that "this happens since it takes light longer to travel the additional distance" (Samec and Oliver, 2011, p. 6). However, this is true only if one assumes the Einstein synchrony convention (ESC). Under the anisotropic synchrony convention (ASC), the advancement and retardation of the eclipse times is due entirely to time dilation since the light travel time across the system is essentially zero.

As I had already mentioned to Samec, the relativistic time-dilation term has a linear component in the ASC model, which cannot be neglected even at relatively low velocities as shown in John Winnie's paper, "Special Relativity without One-way Velocity Assumptions: Part I" (Winnie, 1970a). Under ASC, the epsilon parameter is set to 0 (or 1 depending on the direction convention), resulting in a linear term in the time-dilation formula as shown in equation 4–9 in Winnie's paper. Only under the Einstein synchrony convention (where epsilon is set to ½) does the linear term drop to zero, leaving only a quadratic term and thereby causing time dilation to be negligible at very slow speeds. Thus, in neglecting the time-dilation term, Samec tacitly assumed that epsilon is ½ (he assumed ESC rather than ASC), which is to say he begged the question. If Samec had used the full time-dilation equation with the correct value of epsilon, he would have found that his observations are exactly consistent with the predictions of the ASC model.

Samec suggests that the issue "has not yet been sufficiently answered in a public forum" (Samec and Oliver, 2011, p. 12), indicating that he is not familiar with the rich field of literature on this topic. This issue has been discussed in considerable depth in the technical literature over the past century. Some of the more important papers were cited in the references to my paper "Anisotropic Synchrony Convention: A Solution to the Distant Starlight Problem" (Lisle, 2010) and in my preliminary article "Distant Starlight and Genesis: Conventions of Time Measurement" (Newton, 2001). I would strongly recommend to Samec and others interested in this issue to read these papers, particularly those by Salmon (1977), Sarker and Stachel (1999), and Winnie (1970a, 1970b), respectively.

It should be clear from history that the type of observations done by Samec cannot—even in principle—distinguish between ASC and ESC. The very first successful measurement of the speed of light was done by Roemer in 1676, using a method that is qualitatively similar to Samec's observations (as Samec correctly notes in his article). Yet, discussions on the impossibility of measuring the one-way speed of light (without begging the question) flourished only in the twentieth century. Obviously, physicists recognized that Roemer's observations could not determine the one-way speed of light since the effects of time dilation are dependent on the one-way speed of light.

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Author's Response

First of all, I wish to thank Dr. Lisle for his letter. I value his input. I appreciate the open forum offered by the *CRSQ* in discussing this important idea, the anisotropic synchrony convention (ASC), which has the possibility of explaining the light-time problem. As the astronomy editor of *CRSQ*, I invite others such as Dr. Russell Humphreys, Dr. Eugene Chaffin, and Dr. Jake Hebert to

contribute their thoughts on the subject in *CRSQ* and perhaps as comments in *Creation Matters*. In fact, John Hartnett (2011) has already studied the controversy and given us a report.

I wish to note that my article, "The Universe in Near Real Time and the Light Time Effect," was in answer to Steve Miller's (2010) idea, "Universe in Near Real Time," which he presented at the 2009 CRS meeting, and I included a challenge to Dr. Lisle as a postscript since the ideas of ASC seemed to apply at the time. I merely offered the challenge so it would be sufficiently answered in a public forum. I want the community to understand what ASC actually means.

In his letter, Lisle states that "Samec arbitrarily assumes that 'this happens since it takes light longer to travel the additional distance.'" Under the anisotropic synchrony convention (ASC), the advancement and retardation of the eclipse times is due entirely to time dilation since the light travel time across the system is essentially zero. The distance across a binary orbit is on the order of astronomical units (1 AU ~ 1.5 X 10^{11} m), which gives an easily observable light-time effect. The light travel time is on the order of minutes. Assuming that this is due to a real orbit, using Newton's form of Kepler's harmonic law, a sum of masses can be determined for the binary+third body. This method has been used for decades to determine the mass of third bodies in binaries. Perhaps hundreds of publications have resulted. In our paper I gave several other examples, which included astrometric (positional) measurements. From these, the spatial orbits were generated as shown in the paper. How could these be due to just relativistic effects? They are due to light traveling across the system at the known speed, c. How would ASC interpret these "relativistically"?

Hartnett states that Lisle contends that the stars really were made on the fourth day of Creation Week and that their light reached Earth instantaneously due to the way clocks are synchronized (time stamped when they reached the earth). Thus, it appears that ASC just involves a synchronization issue. Hartnett (2011) states that the ASC is a convention that defines the occurrence of an event at the moment it is observed. If so, it is really just a convention, a way of looking at things, a coordinate system. In this case, all arguments appear to be moot. It would seem that we cannot get anywhere in an exchange of this sort, and his model cannot be falsified scientifically. It becomes a theological activity. Is ASC the language of the Bible (as Hartnett states)? Should we use it in our physics?

However, there is a scientific problem with the theory. ASC accepts the notion that distant galaxies were *created mature* and that any scientific history of the events leading up to observable phenomena present in the galaxies like pulsating stars, eclipsing or cataclysmic binaries, supernovae remnants and runaway neutron stars, never really happened but were created in place. This has all the problems of the mature universe theory (Hartnett, 2007, 2011). Thus, falsification *is* possible. I might suggest a way of falsifying ASC, which is quite measurable; galactic metalicity vs. redshift (or distance measured by other more accurate means). Due to stellar aging, the quantity of metals (in astronomy that includes atoms that have a greater atomic number than helium) should decrease as we look deeper into space or back into time. I mention this because I have listened, with interest, to talks by V. P. Kulkarni (Univ. of South Carolina) at past Meetings of South Carolina Astronomers (MASC). She has been studying a related effect for a number of years with unclear results (see www.cita.utoronto.ca/~menard/links/IAU199/talks/Kulkarni_VP.ppt).

Again, I hope these thoughts open up future discussion in the CRSQ.

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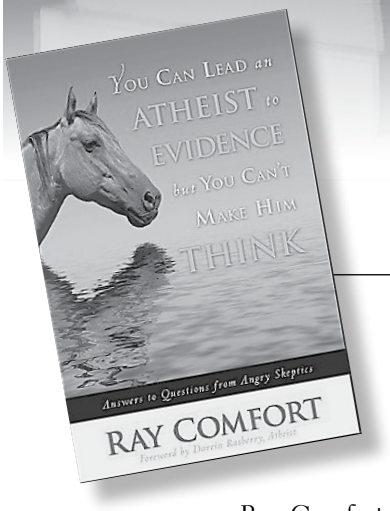
Media Reviews



You Can Lead an Atheist to Evidence but You Can't Make Him Think

by Ray Comfort

WND Books, CA, 2009,
137 pages, $23.00.

Ray Comfort is the author of numerous books on atheism and evolution. This volume, one of his latest, is in question-and-answer format. Written for the layman, it is often thought provoking, as Comfort likes to look at various issues from a different angle.

Unfortunately, Ray Comfort is not a scientist. Though he does a great job of appealing to the reader's reason and common sense, he does not have a good handle on various scientific fields. The result is a book without much solid science as a foundation; in fact, in answer to most of the questions in the book, he often presents a more gospel-oriented idea instead of a straightforward scientific explanation. The result is few distinct answers and vague concepts.

A good example of a lack of academics in this volume is when Comfort attempts to answer the age-old question, "Could you tell me how old you believe the Earth to be, and why?" He answers: "I have no idea how old the Earth is, but I'm not alone in this. Science can't make up its mind either. Just over one hundred years ago, scientists thought that the Earth was about 100 million years old. Soon after, they changed their minds and came to the confident belief that the correct number was 500 million years. Then they changed their minds again and the figure jumped to 1.3 billion years. … Of course, now they think that it may be 4.55 billion years old. … I'm sure that contemporary scientists think they have the right number this time, until they change their minds again when more data comes along … and, of course, none of the 'faithful' will question it" (page 13).

To be blunt, this is simply not an answer. Not even close. Comfort tells us he has no idea and then conveniently sidesteps the question by pointing out how scientists have not been able to find a consistent date. This doesn't prove his point; it simply shows that science is constantly progressing. If we have nothing to replace the failings of evolutionists, then our position is of no value.

In sum, Comfort provides us with an interesting discussion of atheistic theories, though without going into depth. In some cases the answers are entirely unsatisfactory. As a whole, however, this volume will be of some value to the layman as it gives a good overview of the Christianity-versus-atheism debate. In the future, it would be wise for Comfort to provide better justification for his ideas, especially ones that touch on science.

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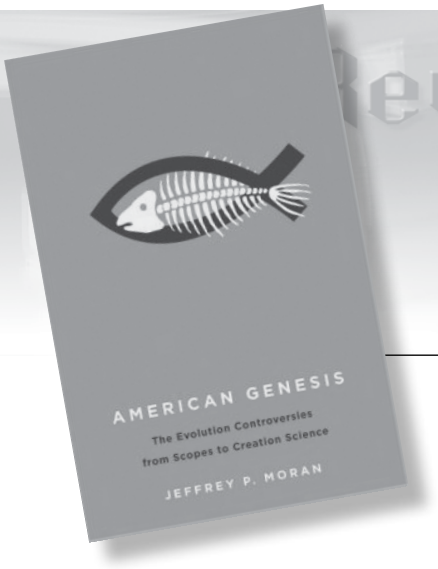
Reviews



American Genesis: The Evolution Controversies from Scopes to Creation Science

by Jeffery P. Moran

Oxford University Press, New York, 2012, 196 pages, $30.00.

It is tempting to view *American Genesis* as just another book on the history of creationism. After all, it paddles briskly through the familiar waters of the Scopes Trial and the anti-evolution movements of early 1900s America. But along the way, University of Kansas historian Jeffery Moran skillfully guides the reader into a number of rarely explored tributaries. In particular, three of his five chapters focus on the roles of women in the anti-evolution campaign, the reactions of the African American churches, and the influence of social, religious, and political differences between the South and North in shaping reactions to evolution. These topics have been largely ignored in the more definitive works on creationist history, which often focus more on the main players in the broader controversy. As such, *American Genesis* brings to light some very useful cultural background.

The excursions are rewarding, and I find Moran's treatment of gender quite intriguing. For example, he notes that women penned nearly 70% of newspaper letters-to-the-editor in Tennessee leading up to the Butler Act of 1925. The letters ranged from directly biblical issues to the broader cultural concerns of the Roaring Twenties, including the erosion of cultural and moral norms. Moran also argues cogently that many of the most important (and all-male) anti-evolutionists of the early 1900s were spurred into action (at least in part) by women. Then, as now, it is often women working in churches, Christian schools, nonprofit ministries, and at home who have been the "boots on the ground" for creationist causes, even though nearly all of the high-profile advocates have been men. Women's role in this controversy obviously has been underappreciated.

The reaction of the African American community to the Scopes Trial was much more distant than the role of women. While some influential African American pastors, such as W. H. Moses and numerous reporters from important "racial" newspapers from around the country came to Dayton, Tennessee, to watch and report on the Scopes Trial, the African American church did not take the same approach to the controversy as did the broader fundamentalist community. Partly, this lack of more direct engagement was due to the smaller overall number of African Americans in public schools, coupled with the segregation of these students into separate and not-so-equal schools (which often lacked trained teachers and adequate materials). From the pulpit, the African American churches sounded off against Darwin and evolution, and though these churches sympathized strongly with fundamentalism, they rarely became directly involved. As a result, the African American churches never played a major role in anti-evolutionism in the early 1900s, nor do they today.

The final two chapters, "Descent with Modification" and "Creationism on the Campus," are perhaps the most disappointing of the book for young-earth creationists and intelligent design proponents, for it is here that the author's own leanings are most evident. UC Berkeley lawyer and ID founder Philip Johnson plays an oversized role here, as Moran focuses his attention on the building of the ID movement and its recent public successes and failures. Yet because Johnson's role in leadership of the ID movement was prematurely ended following a series of strokes, the mantle of ID leadership has been passed, and he has been uninvolved in more recent events (e.g., the Dover court case). Throughout these chapters Johnson is deeply criticized by both Moran and Johnson's in-text opponents (whose accuracy and motives are nowhere scrutinized). The impression of Johnson the reader gets is not of a sharp-minded intellectual who powerfully challenged evolution and philosophical naturalism but rather that Johnson was a savvy man who was in over his head. As one who knows Philip Johnson, he is a much better man than the one described in these pages.

In contrast, both philosophical naturalists and theistic evolutionists fare much better in the final two chapters. The NCSE and its anti-creationist mission are lauded, and Eugenie Scott, Glenn Branch, and Nick Matzke are treated with fawning admiration for their work in combating creation and ID. Even the fevered, conspiracy-laced anti-creationist claims of philosopher Barbara Forrest are never questioned.

While Moran went to obvious

lengths to interview current evolutionary leaders, comparable efforts were simply not undertaken for creationists or ID proponents. For each interview with Scott or Branch, or with old-earth Christians and theistic evolutionists such as Davis Young and Howard Van Till (Calvin College looms large in the final chapter), there are no comparable interviews with John Morris, Ken Ham, Carl Wieland, or any of the professors from young-earth schools from around the country. It's not that Moran avoids creationist writings (though at times his selections are curious ones); he simply avoids direct contact.

The situation is akin to the final chapters in Ron Numbers' *The Creationists*, whose second edition included two new chapters on the rise of ID and creationism's global impact. These chapters are notably weaker than the rest of the book, as Numbers' frustration with the continued persistence of creationism is evidenced by notable differences in style, content, and objectivity compared with the other (first edition) chapters. Like Numbers, Moran is most capable and fair when speaking of creationists from the time of the Scopes Trial. As the calendar turns to the present, both historians run into trouble and lose much of their detachment and spirit of amity.

Ultimately, I find much of value in *American Genesis* and can recommend it to readers, though I do so primarily on the basis of the Scopes-era chapters. The insights into the cultural roots of like-minded alliances, the still-prevalent cultural gulf between the South and North, the overlooked role of women, and the long history of arms-length support for creationism among African Americans may help the creationist community overcome historical barriers and forge stronger support. Moran has done us a service by delving into overlooked problems of the past affecting the church today. May we use these insights to bring glory to God in the coming challenges of the future.

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Begin: A Journey through Scriptures for Seekers and New Believers

edited by Ken Ham and Bodie Hodge

Green Forest, AZ, Master Books, 2011. 236 pages, $13.00.

This unique book is designed for those who, as noted by the title, may be new to Christianity or interested in learning more about the story of the Bible. It is designed to be an introduction to the Book of all books and to answer some questions new believers may have about their faith. Using the ESV translation, and including the first eleven chapters of Genesis, the Ten Commandments, the Gospel of John, the epistle to the Romans, and the last two chapters of Revelation, the book allows those not familiar with the Bible to get a big-picture view of the central message and important themes that are found throughout. Some basic commentary is included, as well as summary of the Scripture not directly included within the text. The end of the book has a number of short chapters that deal with how to be saved and provide answers for some of the classic questions regarding Creation, the Bible, and science. Space is provided throughout the book for taking notes, and thought questions provoke readers to consider the importance of the text and how it may apply to their lives.

A book like this has the potential to draw criticism, since there must be some subjectivity in what Scriptures are considered most important for new believers to digest. In addition, some of the questions included at the end may not be truly relevant, especially to those without a background in science or academics. However, overall the book is well designed, and the thoughts and commentary are helpful for understanding the text. I would highly recommend it for new believers who have some previous knowledge of the controversial issues discussed therein.

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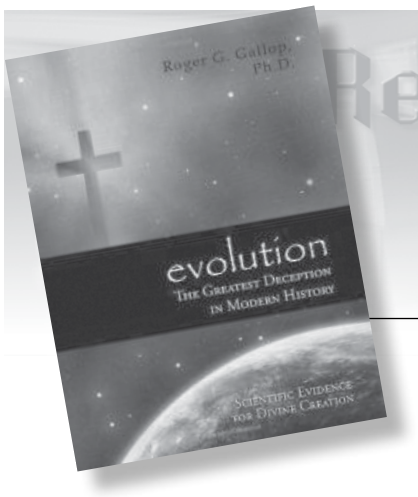

Evolution: The Greatest Deception in Modern History

by Roger Gallop

Red Butte Press, Jacksonville, FL, 2011, 263 pages, $25.00.

Author Gallop has written an up-to-date overview of issues related to the origin of the earth and universe. This book gives an excellent description of the science of creation as we know it today. He discusses secular views followed by the young-earth view and then wraps it all up by putting everything in the context of Scripture. Dr. Gallop integrates the secular and scriptural views into a cohesive discussion that fairly states both sides without treating the secular view in a hostile manner. He simply states the view and then presents the evidence. This is a very readable book and a valuable tool for high school and college-age students for understanding the issues in a clear way. Recent creation science research is included.

The book makes an excellent textbook for an introductory course in creation science, whether in a formal classroom or homeschool setting, and it is also an excellent read for the general reader. A professional geotechnical/environmental consultant for 30 years, Roger Gallop understandably focuses on geology, geochronology, and geomorphology. That being said, he provides an excellent treatment of biology and physical science. Gallop starts with a discussion of scientific creation and evolution theory. This introduction is followed by chapters on physical science, biological science, catastrophic phenomena in geology, geomorphic features of a worldwide flood, sedimentary features, fossil dating, radioisotope dating, other evidences for a young earth and universe, and the biblical account of Noah's Flood. The chapters are followed by nine appendices, an extensive glossary, detailed information on genetic variations, equivocal and unequivocal beneficial mutations, basic geology of planet earth, evidence of rapid limestone formations, mechanisms for rapid accumulation of limestone muds, unconformities and paraconformities, carbon-14 dating and effects of a worldwide flood, and isochron dating.

This book should be on the bookshelf of everyone interested in creation science and the biblical truth of origins. Author Gallop is a recent addition to creation science writing.

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Hitler and the Nazi Darwinian Worldview: How the Nazi Eugenic Crusade for a Superior Race Caused the Greatest Holocaust in World History

by Jerry Bergman

Joshua Press Inc., Kitchener, Ontario, Canada, 2012, 347 pages, $26.00.

Reading this book is an experience. It grabbed not only my attention but also my emotions. Adolf Hitler, the German leader (Führer), "was inspired by Darwinism to pursue a utopian project of biologically improving the human race" (p. 95). This application of Darwinism to society was based upon an evolutionary ethic. When the Germans put members of the "inferior races" (especially Jews) in concentration camps, it was like the quarantining of "sick people."

"In Hitler's mind, evolution and its ultimate end—a superior race—justified any available means, even the murder of over 11 million Jews and Christians" (p. 12).

Interestingly, Bergman's book includes 36 figures with photographs and drawings. The first figure is of Charles Darwin (1809-1882), whose "survival of the fittest theory of evolutionary progress propelled the Nazi eugenics theorists forward as they looked to create a master Aryan race" (p. 3).

The second Figure is of Ernst Haeckel (1834–1919), who "was one of Darwin's most devoted disciples in Germany," thus "influencing Hitler, the Nazi Party leadership and a whole generation of German scientists, professors and doctors" (p.7).

Clearly a German evolutionary perspective was the reason multiple millions of Europeans died during the late 1930s and early 1940s. Information in the book is well documented: I counted a total of 1,031 footnotes. At the end of the book are 13 pages of bibliography. Bergman's book with its 347 total pages is a captivating read.

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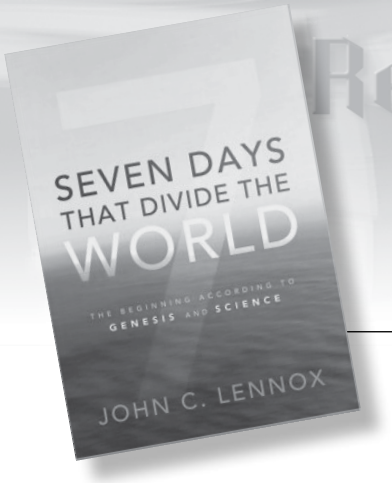
Reviews



Seven Days that Divide the World

by John C. Lennox

Zondervan, Grand Rapids, 2011, 192 pages, $17.00.

John C. Lennox is professor of mathematics at the University of Oxford, fellow in mathematics and philosophy of science, and pastoral advisor at Green Templeton College, Oxford. He is also a frequent speaker at Ravi Zacharias's international ministries events and on the RZIM associated radio programs. In this book, he presents a compromise position for Christians that would reconcile the six days of Creation with the scientifically determined old age for the earth. He contrasts his new proposal to previous positions from both sides of the controversy about Earth's origin and age. The main point is that the controversy arises from how Christians interpret the six days of Creation in Genesis 1–2.

The book is well organized with five chapters, five appendixes, and a general index. Notes for clarification are included at the end of each chapter and appendix. In chapter 1, titled "But Does It Move? A Lesson From History," Lennox introduces the controversy about whether the Scriptures state that the earth is stationary (geocentricism) or that all solar planets orbit the sun (heliocentricism). In chapter 2, he compares the age-of-the-earth controversy to the great controversy concerning Galileo in the 1600s. Lennox believes that the controversy surrounding Galileo was settled by a change in the interpretation of Bible references about the earth-to-sun relationship based on observations by astronomers at that time. Lennox asserts that this same method for a solution, which he calls *convergence of interpretations*, should be applied to the controversy about the age of the earth.

In the same chapter 2, Lennox makes a common interpretation error when he states, "The word *earth* is first used for the planet, and then a little later for the dry land as distinct from the sea" (p. 23). Nowhere in Genesis 1 is the Hebrew word for earth used to describe a planet. On the contrary, the earth that is described in Genesis 1:2 is nothing like any known planet. Which known planet is entirely fluid (waters), utterly formless, and does not emit electromagnetic radiation (light)? A sphere is hardly formless. Also, does Lennox know if the concept of a planet even existed at the time of Moses? The ancient Hebrew language does not have a word for planet. The Hebrew word for *earth* simply means a universal substance consisting of energy and matter. It took the form of soil, ground, and land on the third day, when it was named earth in Genesis 1:10. There is no verse in the Bible where that definition does not suffice and where the notion of planet would be required in order to make sense.

The author uses chapter 3 to describe how the interpretation of the Hebrew word for *day* can be used and still bring convergence to questions about the age of the earth. He proposes that the interpretation of the days as reported in Genesis 1 just emphasizes the order God used to create the universe (which is at odds with the "scientific" order on several points). The verses should not be interpreted as six consecutive days forming the first week but as six days upon which God created something new. (But if that order still disagrees with the evolution model, where is the convergence?) In the Lennox view, there can be as much time as needed between the days for the age of the earth and universe to be significantly older than one week after the creation was completed.

Lennox uses the next two chapters to explain how this new interpretation remains compatible with the doctrines found elsewhere in the Bible. He brings up the subject of biblical authority for humans made in God's image on the sixth day (pp. 67–68). But he neglects to explain why Jesus uses the words "but from the beginning of creation, God made them male and female" (Mark 10:6). According to the Lennox interpretation of days, this act of God would have taken place thousands or even millions of years later, not six literal days after God started creating the universe. Would anyone refer to an event being from the beginning of creation if millions of years had already passed since the creating started?

The appendixes are used by the author to give a brief background for Genesis and to counter several old-earth models with their arguments for scriptural interpretation. The old-earth models include the cosmic temple view, the big bang, two different creation accounts (Genesis 1 and 2), and theistic evolution theory involving a god of the gaps. In my opinion, Lennox also proposes a god of the gaps between all six days. All these models have been popular at some point in recent years. According to Lennox these models do not meet his

criteria for being compatible with what is reported in the Bible.

This book was obviously written for the general Christian public, and it may convince many to change their opinion of what the first two chapters of Genesis really say, thus avoiding a science-generated controversy. But anyone who is familiar with the Bible and the controversy concerning the age of the earth will not be satisfied with such a compromise position. The arguments are not strong enough to convince this reviewer that a change in interpretation is required. One problem is that Lennox does not question any scientific interpretation that the age of the earth is older than that found in the interpretation of Genesis 1–2 as narrative history. He just accepts without proof that scientists have shown the earth has existed for a much longer time (pp. 86).

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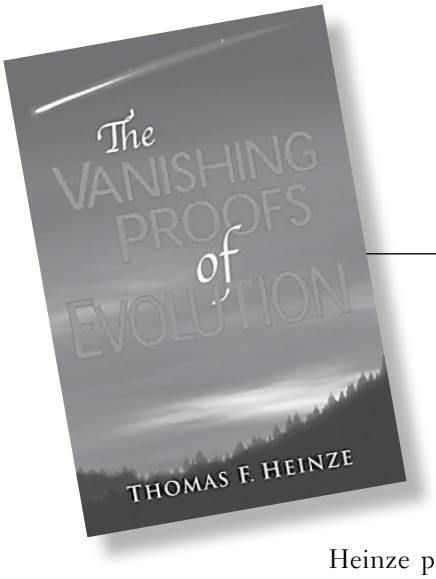
Creation Research Center



The Vanishing Proofs of Evolution

by Thomas F. Heinze

Chick Publications, Ontario, CA, 2005, 96 pages, $7.00.

Heinze presents an extended tract addressing some of the classic proofs used to influence students as to the veracity of the evolutionary model. The volume is strongly endorsed by Duane Gish as an "excellent source of the positive evidence for creation."

In eight chapters, the author discusses the peppered moth, Haeckel's drawings, comparative anatomy, information from natural selection, vestigial organs, uniformitarian geology, fossils, and chemical evolution. A publication of this size does not permit a detailed explanation of each topic, but the discussions are logical and easy to follow.

Heinze assumes that the reader has a basic working knowledge of the principles discussed. My wife and I enjoyed going through the book during our daily reading. Neither an index nor illustrations are included. God is first mentioned on page 84, following a discussion of cell function. The work concludes with a logical discussion of God at work in creation, how the Bible can be trusted as the Word of God, and the return of Jesus Christ as Savior. The reader is invited at the end of the work to commit to a saving relationship with Jesus Christ. The book makes a great gift for a high school or college student.

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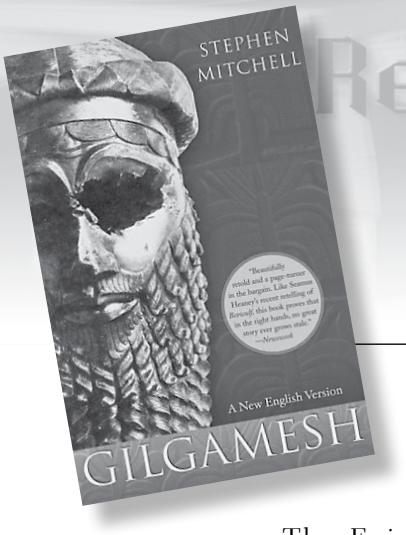
Reviews



Gilgamesh: A New English Version

translated by Stephen Mitchell

Free Press, New York, 2004, 304 pages, $15.00.

The Epic of Gilgamesh is considered one of the world's great masterpieces. Its origins are based in Iraq, in the region of the Tigris and Euphrates Rivers, at approximately 2100 BC. Until this recent paraphrase, most translations of this epic have been difficult in their readability.

Stephen Mitchell is well known for creating easy-to-read, dynamic versions of many of the ancient world's great literature. This new translation is a wonderful example of his skill, having created an easy-to-comprehend, yet accurate, rendition.

The tale of Gilgamesh is of special interest to the creationist, as it gives us a relatively accurate image of the world directly after the Genesis Flood. Of special interest are the references to the Flood itself. On page 181 we find a very obvious reference to the Flood, with clear descriptions of the supernatural cause, the landing on a mountain, the raven and dove sent to look for dry land, etc.

Perhaps the most interesting part is that of Humbaba the dragon. Like the well-known references to dragons in the tales of Beowulf and the book of Job, we find clear descriptions of a fire-breathing monster that is extremely difficult to catch. In the tale, the god Shamash helps Gilgamesh to defeat this menace in the land, forever immortalizing him as a dragon slayer.

In sum, this new translation is refreshing, easy to understand, and perfect for both layman and scholar alike. This epic can be of assistance to creationists as it gives us a glimpse of the early post-Flood world. The references to the Great Flood help to add credibility to the actual event recorded in Scripture. The vivid descriptions of the fire-breathing dragon correspond with what we find in Job 41, adding credibility to the case that there may actually have been dragons (aka dinosaurs) in existence shortly after the Flood. Though there are obvious mythological elements to the tale, myth often has its roots in fact. We clearly can't take the poem literally; however, there are pieces of information that help confirm the biblical record.

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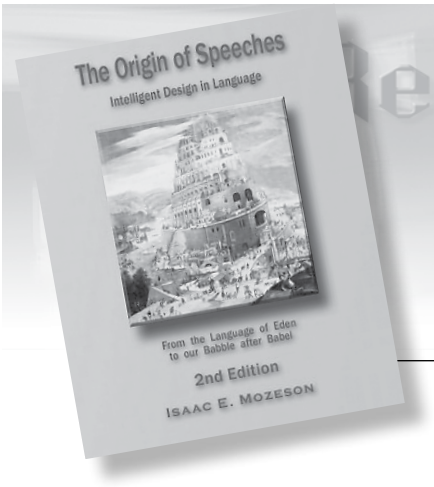

The Origin of Speeches: Intelligent Design in Language

by Isaac Mozeson

Lightcatcher Books, Springdale, AR, 2011, 392 pages, $25.00.

This book documents a new system called *Edenics*, which explains the origin of all languages. The science of linguistics involves a detailed empirical study of the origin of all language families by studying the sounds and meanings of language. Mozeson argues that what he calls Edenic language, a proto-Semitic language similar to biblical Hebrew, was hard-wired into the brain of the first humans. This brain program, which Mozeson calls the software design, matches the human speech hardware, i.e., the anatomy of the lips, throat, teeth ridge, nose, tongue, and voice box design, which he concludes was designed to pronounce the letters and sounds of language.

The author concludes that only one human language existed until in Sinar (Sumer, later Babel) there occurred a neuro-linguistic "disturbance" that produced all of the language families existing today. This event Mozeson calls the "Big Bang" of language varieties that caused the dispersion of the people from Babylon. As a result, the single, species-wide human language program was diversified into about 70 language families by a mechanism Mozeson calls *nasalization and bilabial shifts*. The ongoing natural breakup of these languages, such as the proto-Germanic language, now gives us 6,000 "languages," many of which Mozeson concludes are actually closer to dialects, not separate languages.

Genesis 11 does not reveal the mechanics of the "confounding" of language that occurred at the Tower of Babel location, but Edenicist researchers are making great strides in analyzing the ensuing language diversity that resulted from this event. As a result of this intensive study, they have adopted a plausible theory. One insight is that there occurred immediate sound-based letter shifts within seven anatomical groups that correspond to music's seven scaled notes, do, ra, mi, fa, so, la, and ti.

Edenics research also helps to explain why words mean what they do. For example, Spanish firemen are *bomberos*, or water pumpers, and French firemen are *pompiers* because firemen pump water, and history's first word for pipe was the Hebrew word *aboobh*, meaning hollow reed. Author Mozeson concludes from his detailed study of languages that all languages ultimately come from the shift that occurred at Babel.

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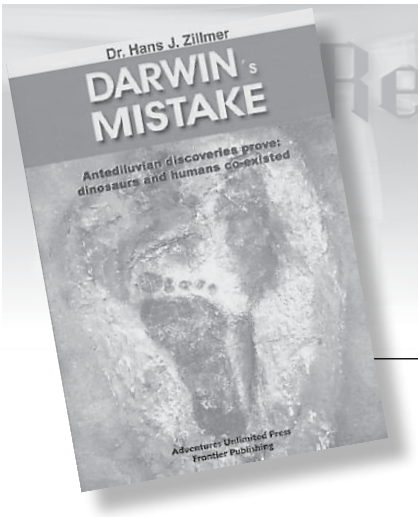

Reviews

Darwin's Mistake

by Hans Zillmer

Frontier Publishing, Enkhuizen, Netherlands, 2002, 239 pages, $20.00.

Originally published in Germany, this book provides a different angle on the creation-evolution debate. Here Dr. Zillmer gives a rather unconventional look at earth's history, particularly in the areas of paleontology, archeology, and *OOPARTs* (Out Of Place ARTifacts). The main focus of this volume is the latter.

Throughout its pages, the author examines anomalies of all types, including the Texas Glen Rose tracks and London artifacts, as well as the unexplained knowledge of the ancients. The author begins with the statement, "If one can prove that species that are assumed to have lived in succession, actually existed simultaneously, one denies that there could have been such a thing as evolution" (p. 10). This serves as a sort of thesis for this volume, launched by a discussion of the Glen Rose tracks.

Zillmer toys with numerous unorthodox ideas, such as Atlantis, planet X, a planet between Mars and Jupiter that gave rise to the asteroid belt, and other intriguing ideas. Clearly, he does not hold to the conventional creationist theories and believes in an ancient universe. He does, however, spend much of the book defending a recent, global flood, going to great length to build theories around some of the tremendous catastrophes this world has experienced.

Though this book definitely expresses theories and ideas that are not believed by the creationist community, it still is of use. If we confine all our reading of creationist books to those who stay on the beaten trail, we will never learn to think outside the box, thereby stunting the growth of different or new theories. Obviously some elements of this volume are not worth serious research; however, it should be a captivating read for biblical scholars just the same.

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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.

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Creation Research Society

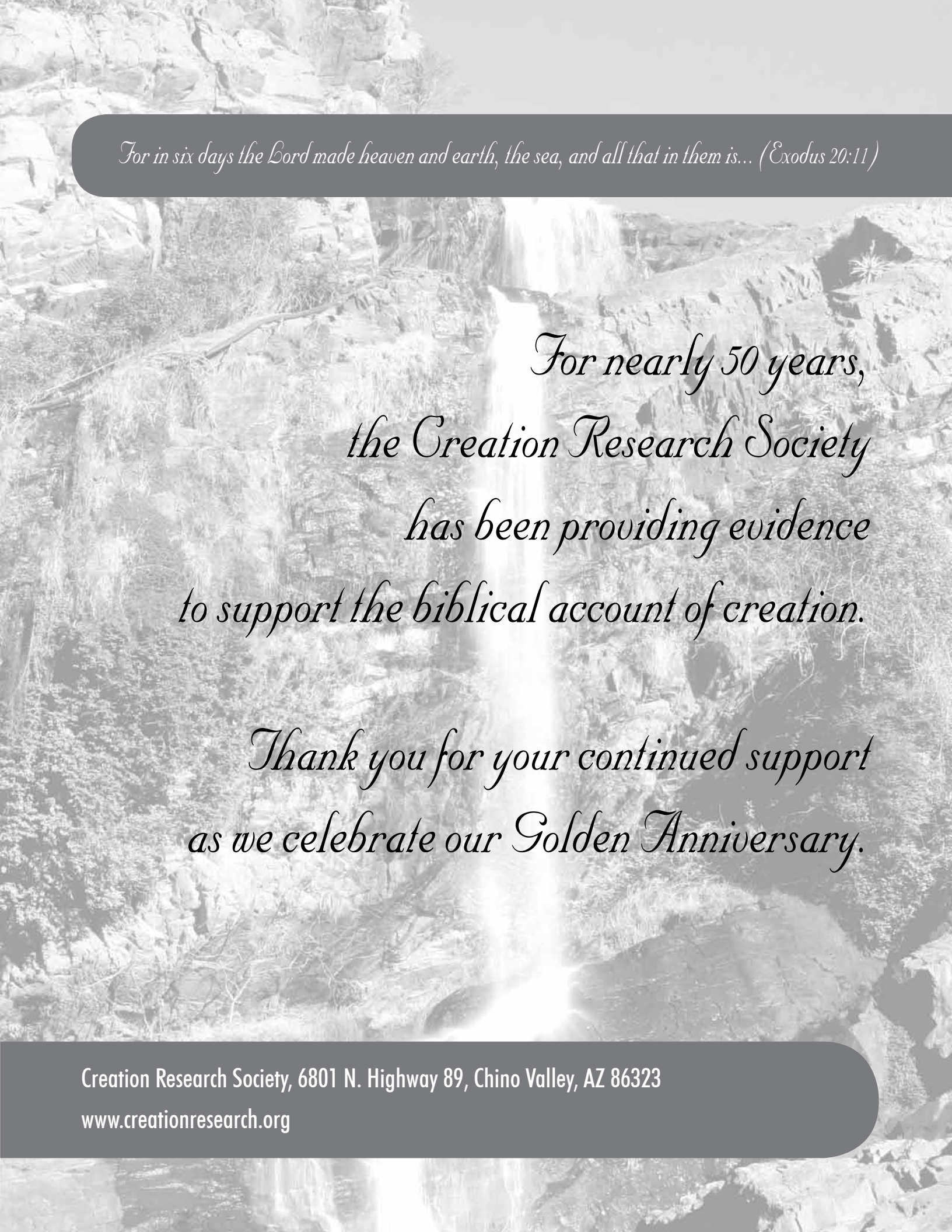
History—The Creation Research Society was organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a need for an association devoted to research and publication 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.



For in six days the Lord made heaven and earth, the sea, and all that in them is... (Exodus 20:11)

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