Post-Flood Migration of Ectothermic Tortoises to the Americas: A Terrestrial Route

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Abstract

Michael Oard presents a global flood Ice-Age model that not only highlights how the Ice Age initiated and was sustained but also inadvertently provides a migratory route for ectothermic species within its coastal isotherms. By incorporating Oard's calculations and what is known about the thermal requirements of extant ectothermic tortoises, a window of opportunity of approximately 87.5 years presents itself to allow intercontinental migration to the Americas. This assumes that the present elevation of the Bering Strait land bridge is not consistent with what existed in the immediate post-Flood environment but has undergone erosion. The fossil record does appear to display a terrestrial expansion if the Flood/post-Flood boundary exists at, or near, the Cretaceous/Tertiary boundary. But there are a few fossils that seem problematic to this placement, which may open the door to other interpretations in regard to the boundary's location. The placement of the boundary, however, doesn't negate the possibility of a terrestrial intercontinental migration of tortoises to the Americas.

Introduction

When approaching the biogeography of North American tortoises, an old-earth creationist (OEC) can simply go to the library and pull out virtually any publication on tortoises to learn more about the biogeographical histories. Though studies have been done on the migration of animals in general in the post-Flood environment, the discussion of biogeography of ectotherms from the young-earth creationist's (YEC) perspective is nearly nonexistent (Statham, 2013; Taylor, 2014). If the Flood was global, as the Bible clearly states, then the YEC position should be able to account for how the various ectothermic tortoises migrated to the Americas following the Flood's recession. What makes the migration of ectothermic tortoises so difficult is their dependency on external heating sources. This is problematic because for terrestrial species like tortoises to migrate to North America, they likely required a terrestrial route through Beringia. The latitude of Beringia sits so far north that one would think their migration through this region was impossible, especially if the land bridge was only exposed during maximal glaciation. Greg Moore, an OEC, acknowledges this difficulty in an article from 2004:

> According to their model, the Flood was followed by a major Ice Age that lowered sea levels and exposed

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> land bridges between the continents. However … some species would have difficulty using the known land bridges. The distance would be too great for slow, delicate species. Other species couldn't tolerate the temperatures, such as the chilling cold of the land bridge between Siberia.

Unfortunately, this problem has not been directly addressed yet. Therefore, this research attempts to provide a case for the post-Flood migration of ectothermic tortoises through Beringia to North America from a YEC perspective in order to demonstrate the reliability of a literal interpretation of Scripture in yet another area that has caused some concern.

Post-Flood Environment

The global flood described in Genesis was a catastrophic event, with a magnitude beyond our human experience. Only the One who is omnipresent, omnipotent, and omniscient can describe every single cause-and-effect relationship that occurred during this massive event. Only He can provide the details we earnestly seek. Within His Word, He provided just the right amount of information for paleoclimatologists to get a basic idea of what the lasting effects of the Flood would have been like on the Earth and its climate. Numerous evidences portray an incredibly harsh climate that existed immediately after the Flood, and this period is known as the Ice Age. Michael Oard proposes a model that not only describes how the Flood caused the Ice Age but also created a contrasting environment that would have aided in the intercontinental migration of tortoises while the earth was still in the process of reaching its equilibrium (Oard, 1990).

Warmed Oceans

Oard lists several contributors that would have aided in the warming of the oceans. One of the mechanisms was the vapor canopy that is suggested in Genesis 1:7. It is believed that the vapor canopy created a uniformly warm climate from pole to pole in the pre-Flood world. Oard does acknowledge that "most creation scientists do not believe it anymore" but thinks "a very thin canopy still has merit" (M. Oard, 2017, personal communication). A second mechanism included "all the springs of the great deep," which ruptured during the initial phases of the Flood (Genesis 7:11 NIV). This likely refers to the eruption of all the volcanoes and water springs that were once used to water the plant life in the pre-Flood world. Another contributor consisted of all of the tectonic activity that would have occurred during and after this global catastrophic event. These mechanisms together would have contributed to the warming of the vast oceans. Due to the massive size of the world's oceans, it would have taken several hundred years for it to cool. That is because once the surface water cooled, the increasing density of that water would cause it to sink, being replaced with lighter, warmer water until the present values had been achieved after several hundred years. Oard estimates that the average oceanic temperatures were about 30°C when the Floodwaters receded and that the current temperatures had not been reached until about 700 years after the Flood (Oard, 1990).

Cooled Climates

The continents experienced a climatic situation that was far different from that of the warmed oceans. They were cooled from a number of factors, such as volcanic dust and aerosols, cloudiness, albedo, and barren land (Morris, 2004; Oard, 1987). The volcanic dust and aerosols came from the volcanic eruptions that took place during and after the Flood until an equilibrium was reached (Oard, 1987). As a result of these eruptions, the various forms of debris that were spewed into the atmosphere created an inverse greenhouse effect that prevented solar radiation from reaching and warming the earth. The next two mechanisms, cloudiness and albedo, would have also contributed to increasing solar reflection. Cloudiness would have been a factor as these contrasting environments would have resulted in a precipitation factory over the oceans, where it would then cool, condense, and fall onto the continents as rain or snow. This increased rate of cloudiness would have increased solar reflection. Another mechanism that would have increased solar reflection is albedo, which refers to the reflective capacity of snow. Once fresh snow had been dumped onto the continents, 70–90% of the solar radiation that was able to penetrate through the volcanic dust, aerosols, and clouds would have been reflected back up into space due to the snow's highly reflective surface qualities. To make matters worse, the areas that existed far from the warmed waters were wiped free and left barren (Oard, 1990).

Barren land aided in keeping the continents cooled by reducing the amount of surface area available to gather the radiant heat that was able to reach the earth's surface. This is an important contributor, as the raging Floodwaters would have dislodged all the trees and most likely deposited them on the surface of the water, similar to what happened when Mt. Saint Helens erupted in 1980, acting as a radiant absorber and insulator for oceanic waters. Due to this factor, the oceanic waters may have remained warmer for a bit longer than what Oard calculated.

Coastal Isotherms

This collision course of warm, moist air and cooler continental temperatures created coastal isotherms that would have been consistently warm, even in the upper latitudes. In regard to ectothermic migration, these coastal isotherms are key to understanding how terrestrial-bound reptiles may have been capable of crossing the Bering Strait land bridge during the Ice Age. That is because the thermal gradient that existed within the immediate post-Flood environment's coastal isotherm was unlike anything that is experienced in the present-day climate. It would have been uniformly warm regardless of one's latitudinal location, but it would have been gradually cooling in temperature as the oceans cooled. Based on Oard's calculations (Figure 1), by approximately 21.87 years after the Flood the ocean temperatures would have been around 28°C. They would have been about 26°C in 43.75 years and 24°C in 87.5 years (Oard, 1990). These estimates will prove to be invaluable to the post-Flood migration of ectothermic tortoises.

Due to the cooled continental temperatures from the various factors, it would have been too difficult for the tortoises to migrate through the interior of the continents. Instead of relying on radiant heat as their primary source of external heat in the post-Flood world, tortoises would have relied on the convection from the ocean winds as their primary heat source. These different sources of heat will be covered briefly in the next section. This uniform thermal gradient along all the oceanic coastlines, however, would have provided a suitable habitat for ectothermic tortoises to remain active year-round, but for just a brief period of history.

Thus, the consequences of the global Flood did not end with its immediate recession. Instead, it left behind an imbalanced earth that took several hundred years for an equilibrium to be reached. As a result, the immediate post-Flood environment consisted of warmed oceans and cooled continents, creating coastal isotherms that were consistent in temperature regardless of latitudinal positioning. These isotherms likely aided in the intercontinental migration of tortoises into the Americas.

Tortoise Thermal Requirements

In order to determine the available window of opportunity the coastal isotherms would have presented the tortoises, an understanding of the tortoises' minimum thermal requirements is absolutely necessary.

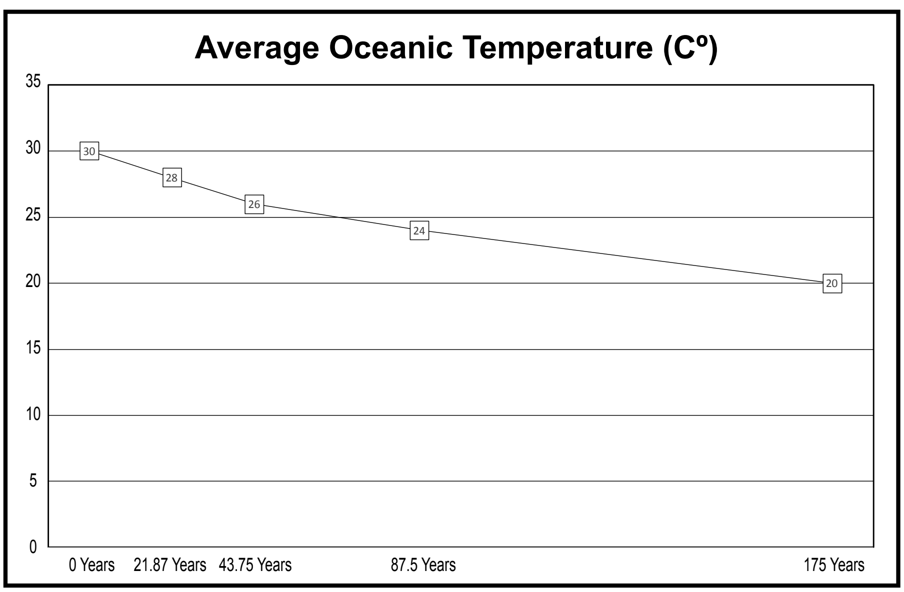

Figure 1. Post-Flood Average Ocean Temperatures—This figure illustrates average ocean temperature after the Floodwaters receded. Based on Michael Oard's calculations, it focuses only on the first 175 years after the Flood.

Ectothermic

Tortoises are ectotherms, meaning they rely on the environment as their source of heat, whereas endotherms produce their own heat at the cellular level (Hickman et al., 1998). There are three methods reptiles utilize in order to raise their body temperatures: conduction, radiation, and convection. Conduction refers to the transfer of body heat to and from the environment through direct contact. Radiant heat refers to the heat that is emitted from all objects that have a temperature above absolute zero. Convection, on the other hand, refers to the transfer of heat through air movement (Campbell et al., 1999). In order for tortoises to remain active, they must rely on at least one of these three sources of heat at all times in order to maintain their desired ranges of internal temperature.

Many reptile species can effectively maintain their body temperatures within rather narrow limits. They accomplish this by adjusting their posture, or by relocating in order to thermoregulate (Heatwole and Taylor, 1987). Thermoregulation, the ability to monitor and adjust internal temperatures, is regulated by the brain's hypothalamus region (Vitt and Caldwell, 2014). Every species of ectotherm has a voluntary thermal minimum (VTmin) and voluntary thermal maximum (VTmax), as well as critical thermal minimum (CTmin) and critical thermal maximum (CTmax) that they can be exposed to. The former two focuses on the temperatures the animal voluntarily exposes itself to, whereas the latter two refer to limits; exposure to temperatures beyond this will lead to the death of the organism.

The VTmin of *Gopherus* tortoises in their natural habitats have been reported down to 18°C (Rostal et al., 2014). However, it is unclear if this is the result of the tortoises' thermal inertia. The CTmin, however, is different, and they can tolerate temperatures down to negative 5.25°C (Rostal et al., 2014).

CTmin commonly occurs when the body's fluids freeze beyond their tolerable range, or from spontaneous freezing, which results in death (Heatwole and Taylor, 1987). Though it appears these two minimum thermal tolerances would have been extremely relevant to the post-Flood migration of ectothermic, terrestrial-bound tortoises, especially since the immediate post-Flood world experienced an Ice Age after the Flood's recession, there is one more minimum temperature that must be considered.

Embryonic Development

In regard to embryonic development, most embryos successfully develop between 24° to 32° C (Wyneken et al., 2008), with death resulting if temperatures go above this range, and embryos ceasing to grow when temperatures are below this minimum threshold (Wyneken et al., 2008; Ferri, 2002). This minimum temperature of 24°C demonstrates that all biological functions are operational, and it will serve as the primary minimum temperature for the window of opportunity's far right limit. To make matters more complicated, the sex of reptiles is determined by either genetic sex determination (GSD) or temperature-dependent sex determination (TSD) (Valenzuela, 2004). Those that employ GSD only have to reach temperatures that permit embryological growth in order to produce a mixed ratio of males and females. That is because their sex is determined by sex chromosomes. Those that utilize TSD, however, will typically have to reach higher incubation temperatures in order to produce females, which would be difficult to do in higher latitudes of the post-Flood environment, or once the coastal isotherm temperatures decreased. But there is an exception (noted presently). The problem this poses is that each of the four North American *Gopherus* tortoises that exist today—the desert tortoise (*G. agassizii*), Texas tortoise (*G. berlandieri*), Bolson tortoise (*G. flavomarginatus*), and gopher tortoise (*G. polyphemus*)—employ the standard variation of TSD, where females are produced only at higher incubation temperatures (Valenzuela 2004, 2005). But that doesn't mean the stem tortoises that exited the ark also incorporated the TSD variation that extant species display today.

If the taxonomical classification of "family," is equivalent to the "kinds" that were on the ark, and if all these tortoises, turtles, and other animals have been properly classified, that would mean the original "kinds" had the genetic potential to create offspring that may also utilize GSD or TSD (Froman, 2016; Sanford, 2014). One simply may be recessive to the other. This is apparent in the aquatic turtle family *Emydidae*. Here members of the same family utilize different sex determining strategies; the North American wood turtle (*Glyptemys insculpta*) uses GSD, whereas the box turtle (*Terrapene Carolina*) uses TSD (Valenzuela, 2004). That means the stem *Emydidae* turtles, the original pair that exited the ark, had the genetic potential to create offspring that used one of the two sex-determining strategies, while another one from the same family utilized another. This situation may have applied to other groups of turtles outside this one family, such as the tortoises in the *Testudinidae* family.

Another exception exists, but this time it applies to the incubation temperatures that are necessary for the development of females for those that utilize TSD. The alligator snapping turtle (*Macroclemmys temminckii*) follows a different set of rules. With this species, females can be produced at both the ends of the spectrum, whereas the production of males is reserved for the intermediate temperatures that exist between the two extremes. If either of these two situations can be applied to the stem tortoises that exited the ark, the production of females would not cease when temperatures within the isotherm dropped. Instead, female production would have been possible during the entire duration of the coastal isotherms, as long as the minimum temperature for embryological development was met. Sadly, the massive number of tortoise extinctions may have obscured this information indefinitely (Rhodin et al., 2015).

Cold Weather Survival Strategies

Gopher tortoises have the ability to survive subzero temperatures by incorporating a freeze-avoidance strategy known as supercooling (Rostal et al., 2014). Another North American terrestrial species of turtle, the box turtle (*Terrepene Carolina)*, hasn't been grouped together with the tortoises by biologists, but it can utilize two different cold-weather survival strategies, freeze avoidance and freeze tolerance (Costanzo and Lee, 2013). Freeze tolerance refers to the box turtle's ability to survive several days with 50% of its bodily fluids frozen, with their lowest lethal temperature determined by the critical minimum cell volume (Storey and Storey, 1996). To prevent ice crystals from forming inside the cells, cryoprotectants are delivered to help protect them and their tissues from ice formation by limiting cell shrinkage when the water is drawn out of the cells into extracellular regions, where ice formation is permitted. The second strategy, freeze avoidance, refers to an overwintering strategy that allow the organisms to go beyond their freezing point without freezing. They can also enhance their supercooling capabilities by employing cryoprotectants as well (Costanzo and Lee, 2013).

Tortoises that do experience cold weather can apparently supercool to temperatures as low as -5.25°C (Rostal et al., 2014). Aquatic species can go well beyond this point, down to -12°C (Storey, 2006). Spontaneous freezing can occur at any time the organism is below freezing temperatures, either by going below the minimum threshold or by coming into contact with any ice-nucleating agents (INAs). INAs serve as a catalyst to ice formation. They can exist internally, as in organic matter that has not been flushed from the system prior to hibernation, or externally. For instance, if an ice crystal comes into contact with the animal's skin within their hibernacula, it will spontaneously freeze and result in the organism's death (Costanzo and Lee, 2013). These strategies may have aided in the migration of North American tortoises if severe weather had been encountered for brief periods of time.

Thus, by understanding and applying these thermal minimums to the immediate post-Flood environment, a window of opportunity for ectothermic tortoises presents itself within the global Flood Ice-Age model's coastal isotherms.

Post-Flood Coastal Isotherm Migration Model

The temporary window of opportunity of the coastal isotherms would have been sufficient for terrestrial-bound ectotherms to migrate through the Bering Strait land bridge before temperatures dropped below a point that would not support embryological growth. Comparing the average oceanic temperatures with the minimum temperature for such embryological development allows approximately 87.5 years of migration to occur. Depending on the sex-determining strategy employed, GSD or TSD and its variations, the left and right limits of the window may vary somewhat. The progression of fossils also appears to coincide with a Flood/post-Flood boundary at, or near, the Cretaceous/Tertiary boundary. But there are fossils that seem problematic with this placement. Therefore, other interpretations are encouraged and welcomed. Regardless of where the Flood/post-Flood boundary exists in the geological column, the global Flood Ice-Age model would still provide the necessary terrestrial route for ectothermic species to expand their territory into the Americas at an accelerated rate.

Biblical Overview

God and the Animals

There is biblical support for a unique relationship between God and the animals. This peculiar relationship certainly may have aided in the post-Flood migration of terrestrial-bound reptiles to the Americas. There are numerous examples in the Bible of God using animals to perform some special activity, such as when ravens fed Elijah (1 Kings 17:2–6), the great fish transported Jonah (Jonah 1:17; 2:10), the lions refrained from attacking Daniel (Daniel 6:21–22), bears attacked Elisha's tormentors (2 Kings 2:23–25), and serpents bit the complaining Israelites (Numbers 21:4–9). It is clear that animals are readily employed according to the will of God. Whether this was necessary in a special way for the post-Flood migration of tortoises remains to be seen. In other words, we cannot fully rule out other modes of migration, as the animals may have willfully obeyed their Creator by mounting a log mat, something that is contrary to what is observed today. Such a possibility simply cannot be ruled out by those who accept the Scriptures as their infallible source of truth, a source that reveals many situations where the natural world is obedient to the commands of God in ways that may seem to be unnatural from our limited perspective.

Dispersal

Once mankind and the animals came out of the ark, the immediate dispersal of the animals, along with the delayed dispersal of mankind, gave the various animals a 106-year head start, according to Archbishop Ussher's chronology (Ussher, 2003). By the end of that period, the coastal isotherms would have been closed for the various ectothermic reptiles to traverse the Bering Strait land bridge if the minimum temperature that permits embryological development, 24°C, is used as the barrier for when these reptiles had to have traversed the areas in the higher latitudes. As stated earlier, though the Gopher Tortoise has been reported outside of its burrow when temperatures were above 18°C, it is unknown whether this was due to its thermal inertia. Therefore, the minimum temperature that permits embryological development has been set as the minimum temperatures, since it allows for all biological functions to effectively operate.

Determining the Window of Opportunity

It is important to reiterate the fact that the coastal isotherms didn't exist forever and that the window of opportunity to utilize them was greatly limited. That is because the gradual cooling of the oceans brought to a close the opportunity for ectothermic tortoises to migrate to North America (see Figure 1). The isotherms also would have been decreasing the size of a livable habitat, forcing the tortoises into intercontinental migration or territorial expansion. Based on the average ocean temperatures (Figure 1) and the minimum temperature of 24°C for embryological development, the opportunity would have ended about 87.5 years after the Flood. This means the tortoises would have had to have entered North America before maximal glaciation was achieved according to the global Flood Ice-Age model and before God multiplied the languages at the Tower of Babel to force their dispersion. Therefore, this model assumes that the present values of the Bering Strait land bridge are not consistent with those in the immediate post-Flood world. Instead, the increased precipitation and oceanic storm intensity contributed to the land bridge's rapid erosion.

To get a general idea of how long it would take the tortoises to walk from the ark to Southern California, the tortoises' walking speeds must be taken into account. This will demonstrate that the limited window of opportunity of 87.5 years is adequate to allow them to migrate from the ark to the southern United States. For instance, according to the National Park Services, the desert tortoise (*G. Agassizii*), a medium-sized tortoise, has a walking speed of 0.2 mph (Davidson, 2016). The mean velocity of five separate Galapagos tortoises (*Chelonoidis nigra*) was much faster at .34 mph (Zani et al., 2005). This leads to the mean speed of 0.27 mph for these two vastly different species. If we apply the mean speed of a walking tortoise to the estimated 24,000-mile trip from the ark to southern North America, as demonstrated in Figure 3, and apply the thermal requirements for reproduction, a few limits become evident.

First Limit: Applying Extant TSD Variant

This option requires the tortoises to utilize the variation of TSD that North American tortoises utilize today to determine when the production of females would cease within the coastal isotherms, which is around 21.87 years. If the distance, 24,000 miles, is divided by the amount of years, 21.87, that the coastal isotherms would permit the production of females, an annual average of 1,097 miles would have to be covered. This number can then be divided by the amount of days there are within a year, and this equals 3 miles per day. If the average speed of a tortoise walking is .27 mph, then it would have to spend about 11 hours of walking a day in order to walk 3 miles a day.

Though this seems problematic, it is possible that the original pair of tortoises that exited the ark were natural foragers that were constantly on the move, or God could have instilled the desire to fulfill a task that is otherwise unnatural, such as the examples from Scripture mentioned above. Though that is not an exhaustive list, it demonstrates that various creatures exhibited uncommon behaviors that were necessary in order to fulfill the will of God. Though this explanation will not be accepted by those who do not adhere to the teachings of Scripture, it cannot be dismissed by a Christian. Thus, this first limit is possible from a biblical perspective.

Second Limit: GSD and/or Other TSD Variation

If GSD or a different variation of TSD was incorporated by the ancient tortoises that utilized the coastal isotherms, then 24,000 miles could have been divided up by 87.5 years to determine the number of miles of progress necessary per year;

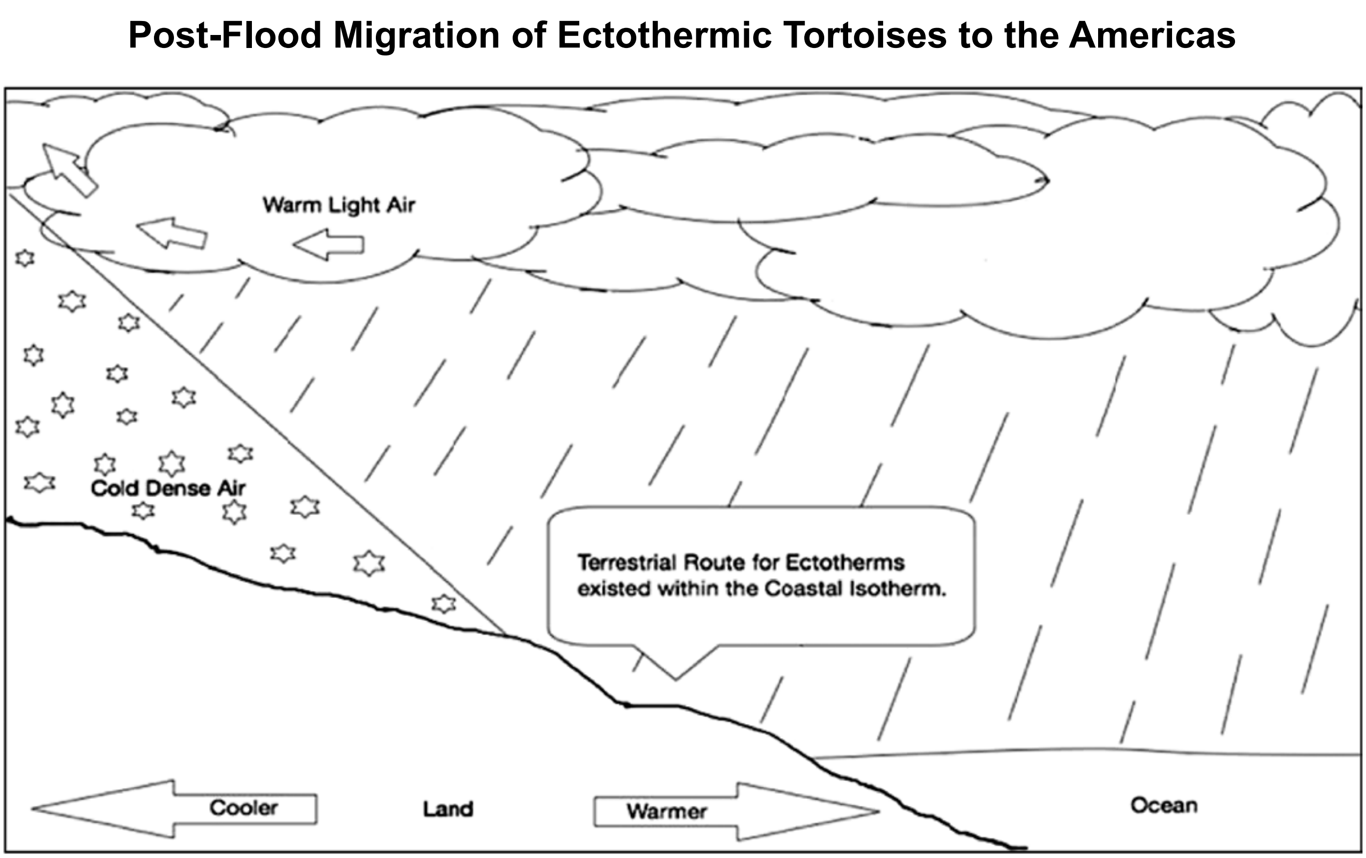

Figure 2. Coastal Isotherm Illustration—This figure provides a general idea of what a coastal isotherm consisted of. It is not drawn to scale but instead provides a visualization of how warmer temperatures existed near oceanic coastlines, while cooler temperatures were experienced farther inland.

Figure 3. Map of Migratory Route—This figure provides a generalized route that likely would have been utilized by the tortoises in their territorial expansion, or migration, toward the Americas as they lived within the coastal isotherms of the global Flood Ice-Age model. (Adaptation of a map by Petr Dlouhy. C.C. Attribution-Share Alike 2.5 Generic.)

this equals 274.28 miles a year. Dividing that number by 365 requires the tortoises to cover only ¾ of a mile per day, or 2.7 hours of walking per day. If either of these exceptions can be applied, it wouldn't really require a migration. That is because the potential world population of tortoises 87 years after the Flood's recession would have grown rapidly without human interference. It also wouldn't require any divine assistance, as it could have naturally occurred in the environment that resulted from the Flood and its contributors. The limited window of opportunity was created by a shrinking isotherm that forced its occupants to forage farther down the coast in order to take advantage of the shrinking resources, encouraging an accelerated rate of expansion. But can this model be validated?

Progression of Fossils?

This section will highlight the two different interpretations of what appears to be a progression of fossils. The first position is based on the presupposition that the Flood/post-Flood boundary exists at, or near, the Cretaceous/Tertiary boundary. The second view places the Flood/post-Flood boundary higher up in the geological column within the late Cenozoic period. It is important to note, however, that the location of the Flood/post-Flood boundary has been a topic of debate for years, and there is not one universally accepted view at this time. Regardless of where the boundary is located in the geological column, the migratory model presented here remains probable and necessary.

Cretaceous/Tertiary = Flood/post-Flood Boundary

Placing the Cretaceous/Tertiary boundary as the approximate location of the Flood/post-Flood boundary would appear to be the most natural way to explain the biogeography of tortoises in the Americas. That is because the emergence of fossils from the various epochs after the Cretaceous appear to present a global progression and diversification of the tortoises in the post-Flood world as they fulfilled the purpose of their Creator to increase and fill the earth (Genesis 8:17; Isaiah 45:18). For instance, the earliest known Testudinidae, *Sinohadrianus sichuanensis*, was discovered in the Paleocene of China, while the first appearance in North America was the *Hadrianus majusculus*, discovered in Ellesmere Island, within Eocene strata (Hai-Yan et al., 2016; Rostal et al., 2014). Tortoises were then discovered throughout North America during the Oligocene, which is also when they first arrived to Central America. Following that, tortoises then emerged in South America during the Miocene (Cadena et al., 2012). This pattern shows exactly what one would expect if the global Flood Ice-Age model is applied with the Cretaceous/Tertiary boundary serving as the Flood/post-Flood boundary. A YEC simply cannot accept the amount of time that is typically associated with them by uniformitarians.

The Pleistocene epoch, however, was probably the worst time to be a tortoise. According to *Turtles and Tortoises of the World During the Rise and Global Spread of Humanity: First Checklist and Review of Extinct Pleistocene and Holocene Chelonians*, 32 North American species of turtles had gone extinct during the Pleistocene epoch. Most of this was the result of human migration and exploitation, as turtle bones have been recovered from a number of archaeological sites, such as inhabited caves and trash heaps with hack and burn markings (Rhodin et al., 2015). Of the 32 North American species that went extinct, twenty-six of them were tortoises.

There is one major hurdle that becomes exposed when analyzing the tortoise fossils by themselves if the Flood/post-Flood boundary exists at, or near, the Cretaceous/Tertiary boundary; a group of tortoises have been discovered in the interior of North America and dated to the Oligocene. *Oligopherus laticuneus* and O. *quadratus* were uncovered in Weld County, Colorado, O. *praeextans* in Niobrara County, Nebraska, and O. *thomsoni* in Ziebach County, South Dakota (Rostal et al., 2014). That would have required these tortoises to experience the frigid continental temperatures during glacial accumulation. At first glance the geothermal springs seem adequate to explain this pattern. However, upon closer examination, these fossil locations become very problematic. There simply aren't any geothermal springs in Weld County, Colorado, Niobrara County, Wyoming, or Ziebach County, South Dakota. In fact, a tortoise would have to walk for several weeks to get from the only two geothermal springs in South Dakota to Ziebach County. This certainly may serve as a devastating blow for placing the Flood/post-Flood boundary at, or near, the Cretaceous/Tertiary boundary.

Alternative Explanations?

If the Flood/post-Flood boundary existed farther up the geological column, then the appearance of the ancient tortoises' territorial expansion based off the fossils that were just presented would be incredibly misleading. It doesn't mean their migration through the coastal isotherms would be debunked, as the route remains necessary regardless of the Flood/post-Flood boundary's position. But it would mean that the previously stated fossils are nothing but coincidental depositions at best. The strongest argument for this designation is magnified by the greatest weakness of the prior placement, and that is the discovery of the Oligocene-dated tortoises in the interior of North America, when glacial accumulation would have been occurring if such a placement occurred.

Michael Oard believes "the boundary is in the late Cenozoic, which means Miocene, Pliocene, or Pleistocene and that every area has to be determined on its own merits" (Oard, 2017, personal communication). If that were the case, it would not be able to explain how various tortoise species of the *Gopherus* genus have been recovered from Oligocene strata in North America only, unless the locality of the strata the *Gopherus* tortoises were deposited in can be proven to be post-Flood depositions and/or mistakenly attributed to the wrong epoch. Andrew Snelling highlights the same problem when he makes a case for a Flood/post-Flood boundary farther down the geological column. In *Earth's Catastrophic Past*, he stated that it is common to see

> the fossil record and modern distribution limited to only one continent. For example, kangaroos are only found in Australia, and so are their fossils, in upper Tertiary strata. It hardly makes sense to suggest that the kangaroo fossils represent kangaroos buried in the Flood, and that the extant kangaroos are thus back in Australia after having traveled there from the Ark after the Flood. On the contrary, it is logical that the kangaroo fossils represent kangaroos that were buried by local catastrophes after the kangaroos traveled to Australia from the Ark after the Flood. Thus, the upper Tertiary strata containing kangaroo fossils must be post-Flood, and the Flood/post-Flood boundary is therefore farther down in the strata record. (Snelling, 2014, p. 173)

It doesn't seem logical to suggest that gopher tortoise fossils were deposited only in North American Flood strata and that they exited the ark to go back to the same exact location where they lived in the pre-Flood world. This would also seem to require more than a single pair of tortoises on the ark from the Testudinidae family. In this case, the kind would have to be dropped down to the genus level, requiring nearly two dozen pairs of tortoises. Otherwise, the turtles would have diversified into the same genera that existed before the Flood, which seems far more unlikely.

This study may act as only one small piece of a very large puzzle. To solve the riddle requires the cooperation and understanding of many godly men and women to take on the task to settle the intense debate on where the Flood/post-Flood boundary exists. It is safe to say, however, that regardless of where the boundary is located, the global Flood Ice-Age model would provide a terrestrial route for tortoises to enter into the Americas in the immediate post-Flood environment. Due to the severe limitations of tortoises and the head start God provided for the animals, the other methods of migration would remain unnecessary and unsuitable for large, terrestrial-bound tortoises to reach the Americas.

Thus, the 106-year head start would have allowed the various kinds to establish a significant foothold in the world before mankind was encouraged to follow. By the time the Tower of Babel's dispersal occurred, the coastal isotherms would have weakened beyond the stage that would allow embryological developments to occur in ectotherms. The tortoises' opportunity to cross into the Americas would have remained open for up to approximately 87.5 years after the Flood's recession. It also appears that the progression of fossils coincides with the coastal isotherm migration model that was presented in this paper, if the Flood/post-Flood boundary is at, or near, the Cretaceous/Tertiary boundary. But one major problem prevents this cut-and-dry explanation, and that may very well mean that the appearance of progression is misleading and that the Flood/post-Flood boundary exists farther up the geological column. Regardless of where the Flood/post-Flood boundary exists, this terrestrial route would have been necessary, and it would certainly explain the past existence and present existence of tortoises in the post-Flood world.

Summary

The global Flood Ice-Age model that Michael Oard proposes not only highlights how the Ice Age was initiated and sustained, but it also inadvertently proposes a migratory route for ectothermic species within its coastal isotherms. With Oard's calculations and the thermal requirements of ectothermic tortoises, a window of opportunity avails, which varies in length based on the sex-determining strategy employed, that allows for a mixed ratio of male and female tortoises migrating and establishing a breeding population within the Americas. By placing the Flood/post-Flood boundary at, or near, the Cretaceous/Tertiary boundary, the fossils appear to demonstrate a global expansion and diversification that remains consistent with the migratory model presented here, but the existence of inner continental fossils during glacial accumulation seems problematic. If the boundary exists farther up the geological column, then the appearance of global expansion and diversification would be grossly misleading. However, regardless of where the boundary exists, a terrestrial route seems necessary for the global expansion of tortoises.

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