

Can Flood Geology and Catastrophic Plate Tectonics explain Sedimentary Rocks?

By Lorence Collins*

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During the last week of May I had the privilege of sitting in as a guest during a seminary course on Scientific Apologetics: The Age of the Earth. Presentations were made by Solid Rock Lectures representing old Earth creation, and by Answers in Genesis representing young Earth creation. Answers in Genesis speaker Andrew Snelling presented a testable hypothesis that the Paleozoic and Mesozoic sedimentary rocks that are exposed in the Grand Canyon and the Grand Staircase were deposited rapidly by tsunamis during the one-year of Noah's Flood. I found his explanations to be inadequate. I suggest that these rocks require a much more detailed examination to support their models than what he provided.

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Critical analysis of models by Andrew Snelling and John Baumgardner

I did not have the opportunity to address the class on my objections to some of the statements made by Andrew Snelling and John Baumgardner, so I am taking the opportunity to do so in this article and will discuss ten different topics.

1. The Redwall limestone.

Andrew showed an image of jumbled crinoid fossils in the 500 to 800-foot-thick Redwall limestone of Mississippian age in the Grand Canyon.



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He explained that crinoids are ancient "sea lilies" in which the animal was perched on a long stem with a larger body at the top with long waving arms. This image shows the body at the top but not the entire stem which might extend for one foot.



Andrew said that the jumbled mass of fossils was evidence that the Flood swept over this area. What he did not point out is that (a) if all those sea creatures were living at the same time prior to the Flood, (b) if all crinoids were perched on fragile stems with waving arms at the top, and (c) if all were spaced at intervals of one foot apart to make room for them to grow and reproduce, they would cover the whole Earth. That necessary extensive worldwide distribution of sea creatures in the young-earth creationist (YEC) model seems unlikely to me.

Moreover, if that is not a reasonable conclusion, then there is another possible way of looking at the problem. If these crinoids were swept in by the Flood waters from some theoretical outside source so that their broken bodies were deposited at many different levels throughout the 500 to 800-foot-thick limestone, – in each of many, many “sweeping times” that deposited them in these various levels – the crinoids had to have grown to their full, mature, one-foot heights before they could have been swept away. Logic says that such growth could not have been so fast that it could happen many, many times in less than one year over the course of the deposition of the full thickness of the Redwall limestone. Surely God did not grow these crinoids supernaturally fast.

Even if jumbled fossils do not occur at many different levels from bottom to top in the thick Redwall limestone, the presence of massive volumes of calcium carbonate would have had to exist somewhere already prepared supernaturally prior to the Flood so that these carbonate volumes could be eroded and carried with the swirling Flood waters and deposited simultaneously with the fossils. Such preparation cannot logically happen in less than one year. The only way by natural processes to get all the calcium ions necessary to combine with the dissolved carbon dioxide in the Flood waters to produce such a great thickness of limestone is to weather huge volumes of basaltic volcanic rock (or Precambrian rocks) that

contains calcium-rich plagioclase feldspar crystals. Where in the Bible verses is the reported existence of volcanic basaltic eruptions and for the long periods of time necessary for such weathering of basalt prior to and/or during the Flood to occur? If Andrew is going to suggest possible, scientific, plausible solutions to this enigma, then he has not done so, and he also has not used proper biblical interpretations. His model requires every process to be supernatural miracles.

Below are two images of a Silurian Hopkinton Formation (“limestone”) in two quarries in Iowa, which show the layer-cake geology of many layers of limestone, one on top of another, and in which the fossils that are in these layers are not commonly in jumbled masses.



You can see that the layers of the limestone beds seem to be horizontal, but they have a regional dip of 5 degrees. Those layers are consistent in their sequence of

thickness in feet of say: 1.2, 0.8, 2.2, 2.3, 1.8, 0.4, or whatever feet, for miles and miles such that the whole, same-consistent, ordered sequence of limestone thicknesses could be determined that applied to a huge area in Iowa, Wisconsin, and Illinois. This Silurian limestone formation is as much as 200 feet thick.

When I was mapping in Iowa one summer for the U.S. Geological Survey in 1954, I could find, for example, a 6-foot-thick vertical outcrop of this Silurian limestone in the side of a hill in the middle of a pasture and measure the thicknesses of each layer and find where that outcrop fit into the geologic column of the sequences. This limestone in the tri-state area in which these layers were formed must have been deposited in quiet water, probably mostly by chemical precipitation of calcium carbonate, and sequentially from bottom to top with breaks in deposition across hundreds of square miles to create the distinct consistent thicknesses of layers. That quiet deposition definitely does not support the concept by Andrew that all North American limestone layers deposited during Noah's Flood resulted from water being swept over the Earth.

At any rate, Andrew has selected data that fit his model of a young earth and chaotic Noah's Flood and ignored those data that do not. In good science you should not do that. I should point out; however, that I do not think Andrew purposely did that. He is an honest scientist, but once he found what he was looking for, why continue to look for other evidence? Goethe has said: "We only see what we know." I am just as guilty of these errors and have done exactly the same thing.

Now let me give you my interpretation. I picture the Mississippian Redwall limestone and its same-age equivalents traced in other limestone layers across the United States as being formed in a shallow sea where colonies of crinoids could grow at depths shallow enough that sunlight would reach the animals so that the protozoans that the crinoids fed on could get that sunlight for energy and reproduction. Depths to which sunlight can be reached in clear ocean water can be as much as 660 feet, but in murky water in which abundant protozoans are living and causing the murkiness, sunlight depth can be only 50 feet deep. Therefore, the Mississippian sea depth could have been much less than 800 feet.

This sea would also be shallow enough that evaporation of water would cause it to become saturated with dissolved calcium carbonate so that much of the limestone that was deposited on the sea floor was by chemical precipitation. This origin by chemical precipitation would also apply to the shallow sea that formed the many layers in the tri-state Silurian Hopkinton "limestones." Both areas through long

periods of time could accumulate calcium ions from the weathering of basalt as the result of distant volcanic eruptions. Moreover, because of the shallow depth of the Mississippian sea, the circular motion of large waves created in big storms could reach the depths in which all the sea animals lived. You can see an animation of such motion at:

https://www.classzone.com/books/earth_science/terc/content/visualizations/es1604/es1604page01.cfm?chapter_no=visualization. Huge waves in hurricanes with 500 to 900-foot wave lengths (crest to crest) [with shorter wavelengths closer to the shore] can agitate the ocean floor to depths of 600 feet. This observation is based on the fact that continental off-shore wave-built terraces (the continental shelf) are produced by hurricane waves, and these terraces extend out from the coast for an average distance of 50 miles to depths of 600 feet – 110 miles wide off the coast of New York. (Note that a continental shelf extending that far cannot have been created by natural erosion processes in 4,363 years after the Flood.) So it is not unreasonable to suggest that large storm waves could strongly disturb animals at shallow depths of 100 feet or less below the surface of the Mississippian sea. Such large storms (perhaps 100 years apart or more) would break these crinoids with fragile stems and disrupt the positions of corals in colonies and transport their broken fragments (mixed with other sea creatures) back and forth during circular motions of waves. In that process the eroded animals would have mixed together in jumbled masses and deposited locally where the animals would later become fossils. Then, later new biome colonies of the sea animals would form, and the process could have been repeated over and over again during millions of years until thicknesses of jumbled fossiliferous masses would in some places accumulate and stack-up to become localized layers that eventually became part of the formation that reached a thickness as much as 800 feet. In other words, natural processes produced the Mississippian Redwall Formation (and the Silurian Hopkinton Formation) over a very long period of time rather than during a few days in miraculous events in a one-year Flood.

2. Source of quartz sand grains in sedimentary rocks.

At one point, Doug Benesch asked Andrew: “Where did all the sand grains (quartz) come from?” Andrew responded that the sand resulted from cavitation and used the example that when gates were opened at the bottom of Glen Canyon Dam in northern Arizona for several days, there was so much cavitation of the concrete in the bottom of the dam that the dam operators had to shut down the water flow for fear of destroying the dam. This illustration turns out to be poor evidence for Andrew’s model. The concrete has cement in it with a hardness of 3 and the quartz grains rushing through the concrete have a hardness of 7.

Consequently, the concrete was being rapidly eroded. If the bottom of the Grand Canyon is examined where granite surfaces in the Precambrian rock are being eroded, the following observation can be made. Where these granite surfaces are exposed when the Colorado River has little water in it so that the granite surfaces can be seen prior to periods of great floods of water carrying sand (like the sand that went through the concrete at the base of Glen Canyon Dam) and not just for a few days but for weeks, and then when these granite surfaces are revisited during low flowage of water in the Colorado River, what is found is that there is just microscopic erosional changes in the granite surfaces, resulting mostly in a polish. Therefore, there is no evidence of any cavitation. At the rate at which the Colorado River is now eroding the Precambrian rocks in the bottom of the Grand Canyon, it would take millions of years to cut to the depth that is shown in the Grand Canyon.

Even if the Grand Canyon were created by the rush of a large amount of water released from a lake left over at the end of Noah's Flood, this lake water might rapidly erode the Paleozoic rocks in the wall of the canyon if these sediments were still soft and not hardened into solid rocks. A possible similar analogy is the rush of water from glacial Lake Missoula in western Montana that carved the "channeled scablands" where this water rapidly drained through the valley of the Columbia River to the Pacific Ocean. But there is no evidence that the Paleozoic rocks in the Grand Canyon were soft because the sandstones and limestones form steep cliffs instead of giving evidence of slumping which would be expected if they were still soft. There is no geologic process that I know of that can cause sediment to harden into solid rock in less than one year. The sediment deposited by the Flood should still be saturated with water and soft. Sediments dumped into the delta in the Gulf of Mexico by the Mississippi River are not hardened in less than one year. Moreover, such a rush of left-over lake water after the Flood could not have eroded the hard Precambrian rocks in the bottom of the canyon to the depth that occurs there now in less than one year or even in 4,363 years since the Flood.

3. Catastrophic plate tectonics.

In an article by John Baumgardner that describes catastrophic plate tectonics <http://creation.com/catastrophic-plate-tectonics-the-geophysical-context-of-the-genesis-flood>, he says that the salt deposits were created by the extreme heat of the steam in the high speed jets coming from fractures in the earth's crust as "fountains from the deep." That is, this very high heat caused sea water to evaporate so quickly that halite (common salt), gypsum, and other salts were formed (page 5 in

the above article). Just 100 miles northeast of the Grand Canyon in Utah, the Colorado River has cut down to expose 200 feet of salt layers in the Pennsylvanian Paradox Formation, which is the same age as the Pennsylvania Supai group in the Grand Canyon. The same age is indicated by the fact that both the Supai and Paradox Formations lie between the overlying Permian Hermit Formation and the underlying Mississippian Surprise Canyon and Redwall Formations. This salt in the Paradox Formation is a very long way from any jet source in a mid-ocean spreading center, and the layers show no evidence of rapid deposition by waters being quickly *swept* there during Noah's Flood as is claimed for the other formations in the Grand Canyon. In no place in modern ocean waters where steam at temperatures over 400°C are emerging from black smokers is there evidence of any salt (sodium chloride) deposits ever found nearby. Moreover, if any salt created by high-speed evaporation of extremely hot jets of water were present, because the chlorine ion in salt is so very soluble (see <http://www.csun.edu/~vcgeo005/collins.pdf>), any transported salt crystals in swirling Flood waters would immediately be dissolved back into the ocean water so that none could be deposited in the Paradox Formation in Utah. Moreover, just a few miles to the north near Moab, Utah, is the Arches National Monument where natural arches occur in the Jurassic Entrada sandstone. Underlying this formation are nearly 3,000 feet of salt beds, which is again far away from any spreading center and which is a different age from the Pennsylvanian Paradox Formation. Furthermore, these observations also apply to the thick salt deposits in the Silurian Salina Formation in Michigan (up to 1,000 feet thick) and in Austria and Germany (up to 3,000 feet thick). All of these thick salt-formation-deposits are in places far from possible high speed jets of steam rising in the "fountains of the deep" in mid-ocean spreading centers. As an alternative possibility, if salt crystals were transported by being blown out into the stratosphere from these spreading centers by high-speed jets and then landed in these places in the interiors of continents, the salt crystals would still have dissolved in the Flood waters on the continents long before they could remain as accumulations of salt in these places. *Moreover, such salt formations are commonly associated with either adjacent or interlayered shales (former muds) that have preserved desiccation mud-cracks in them which could not have formed by the high-speed, extremely-hot, steam jets of the "fountains of the deep."* The salt deposits with the coexisting mud-crack-bearing shales strongly support the concept that all evaporite deposits (calcium carbonate [at the bottom], then gypsum, and finally halite [at the top]) were formed from isolated seas under desert drying conditions on the continents. Such salt deposits on all continents in all geologic ages cannot exist in the midst of the sedimentary rocks being deposited by the Flood because the Bible only reports one period of

drying at the end of the Flood when Noah was waiting for the Earth to be dry enough so that he and his family could disembark from the ark.

4. Ayers Rock in Australia.

Andrew talked about Ayers Rock in Australia which occurs in a desert in central Australia and consists of sandstones and conglomerates that are turned up on end.



Andrew then showed thin sections of the sandstone from Ayers Rock in Australia in which he emphasized the angularity of the mineral fragments in the thin section as evidence for rapid violent erosion and deposition during Noah's Flood. Having taught the identification of minerals in thin sections for 33 years, I recognized the minerals in these thin sections. Because they showed quartz, microcline potassium feldspar, and plagioclase feldspar, I knew that an eroded granite had to be the source rock. Andrew said that the source rock was 60 miles away. However, there is no way that both kinds of feldspars (hardness of 6) will ever form rounded grains regardless of the distance of travel. They always break in angular fragments, whereas quartz has a hardness of 7 and is a mineral that generally does not break in an angular fashion but breaks with a curved conchoidal surface and will commonly erode having rounded or curved surfaces. I noted that the quartz grains in the two thin sections, however, showed little to no spherical rounding. The reason for this is likely: (a) that the granite source rock was in a place where it was sheared in a fault zone by earthquake movements so that the rock was crushed and more easily eroded, and (b) the quartz had only traveled 60 miles so that there was not enough time for the angular quartz grains to rub against

each other to cause rounding to occur. (Movements along the possible fault zone may have been the cause of the sedimentary rocks in Ayers Rock to have become tilted.)

Would it be possible that the angular fragments in the Ayers Rock sandstone could have been created by cavitation caused by the high speed steam jets from the “fountains of the deep” as proposed by both Andrew and John Baumgardner? The answer, again, is logically “No!” because Ayres Rock is in the interior of the Australian continent far from any mid-ocean spreading center which could direct a jet of very hot steam in that direction.

In my point of view, what Andrew demonstrated was not that the sandstone in Ayres Rock was violently eroded and deposited by Noah’s Flood but the distance in which the grains had traveled. For example, near CSUN where I taught geology for 33 years are several 100-foot layers of Cretaceous sandstones of the Chatsworth Formation in Rocky Peak Park. These sandstones have some small angular feldspar grains in them and zircons that indicate that they came from granitic rocks in the Sierra Nevada mountain range. The distance of travel is, thus, not 60 miles but 400 to 800 miles. Most of the quartz grains are sub-angular in shape instead of sharply angular, and the angular grains of feldspar are less abundant than those in Ayres Rock. On that basis, there has been more time for rounding of the quartz grains. Most feldspar grains have been broken-down into tiny fragments that have been washed out into streams and carried away.

Now what is important to realize is that the average composition of quartz in granitic rocks in the Sierra Nevada is about 10 percent. This fact means that for every 100-foot layer of Cretaceous sandstones near CSUN, 1,000 feet of granitic rocks in the Sierra Nevada must have been eroded. Examination of tombstones in graveyards in which the dates of the burial of dead people are recorded shows that the weathering and erosion rates of granite is exceeding slow – so slow that to supply the grains of quartz by 1,000 feet of erosion of the granitic rocks in the Sierra Nevada would take millions of years. Cavitation by pounding of high speeds of jets of water (proposed by John Baumgardner and Andrew) could be possible to cause such rapid erosion, but those jets would have to be concentrated directly on all granite surfaces everywhere and not by jets of water (steam) emerging from isolated fracture openings in mid-ocean spreading centers far from the granite surfaces. Pounding by wave erosion does not accomplish this rapid erosion because one can observe the pounding of hurricane waves on granite surfaces along the coast of Maine, and that pounding does cause some erosion but

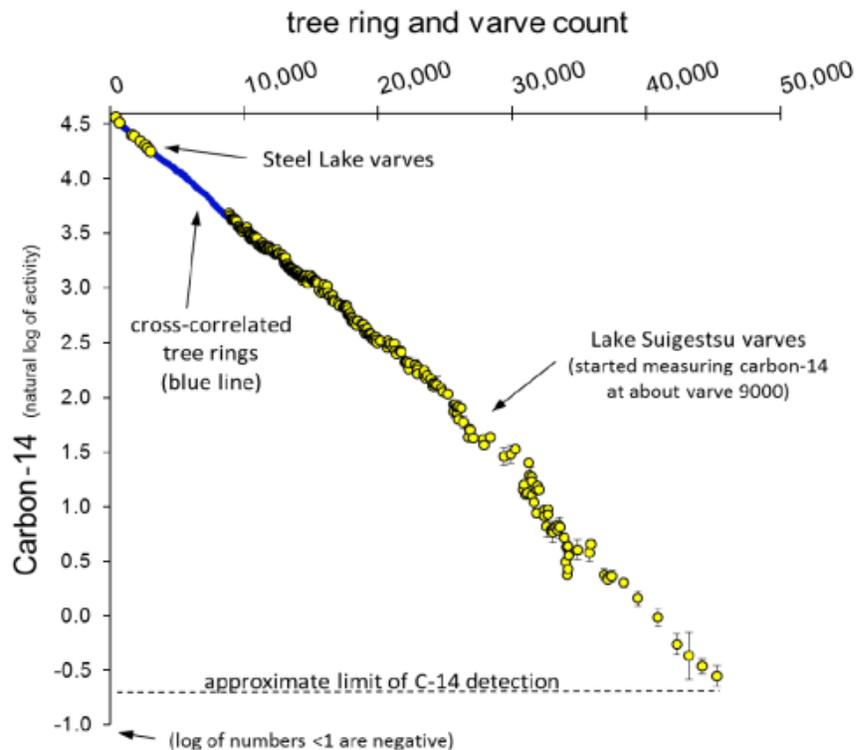
very little. Several tsunamis created by Noah's Flood would also just pound against granite outcrops with little erosion occurring.

Andrew pointed out that zircons in the Permian Coconino sandstone indicated that the source of the sand grains in this rock likely came from the Appalachian Mountains more than 3,000 miles to the east coast of the U.S. That is likely true because at that geologic time these mountains formed a long, high range perhaps more than 12,000 feet high, and the direction of drainage from these mountains was west across the continent – hence, the NE to SW direction of currents as reported by Andrew. The Coconino sandstone has much smaller sub-angular quartz grains and little to no feldspar grains in it than in the Ayres Rock sandstone because of the greater 3,000-mile-distance of travel. Dr. Kathleen Marsaglia at CSUN has a sedimentology laboratory exercise for her students in which they can observe the gradual loss of feldspar and dense minerals in beach sands as you move south along the Florida Gulf coast (several locations). The source of the sand is the Appalachians. In other words, if the violence of Noah's Flood were the criterion for showing that the Coconino sandstone was eroded and deposited by the Flood waters, then the sand grains, being swept for 3,000 miles in just a few days, would surely have contained many, similar, large, angular quartz and jagged feldspar fragments as in the Ayers Rock sandstone, and that is not the case. That is, there would not be any wave action, repeated over and over again for many years, to grind the grains against each other and sort them to smaller sizes – just a sudden rush of water in tsunamis to dump the grains in the Grand Canyon area.

5. Numbers of tree rings.

When the issue of number of tree rings per year was raised, Andrew pointed out that in Australia, the trees there had five or more rings per year and that the number of rings correlated with rainfall that occurred throughout the year. I do not doubt this observation. However, rainfall in California and southwestern U.S. is seasonal with rain occurring during the winter and drought occurring in the summer. If C-14 dating of the tree rings in the Australian trees were ever done, the dating should show that 5 rings in one year would give dates that applied during a single year. If the C-14 data on rings in the bristlecone pine trees in California for the period of 6,000 years (which YEC claim is the age of the earth), and if there were times in this 6,000 years in which 5 rings were produced in a particular year (or several particular years) in this 6,000-year interval, the graph which Ken Wolgemuth showed should not extend in a straight line but show a stair-step pattern in those years in which 5 rings were produced, and that is not the case. This observation also applies to dating of varves in lake beds, if many varves per year happened to

occur, and no stair-step pattern is found, except perhaps about 30,000 years ago as shown in the graph.

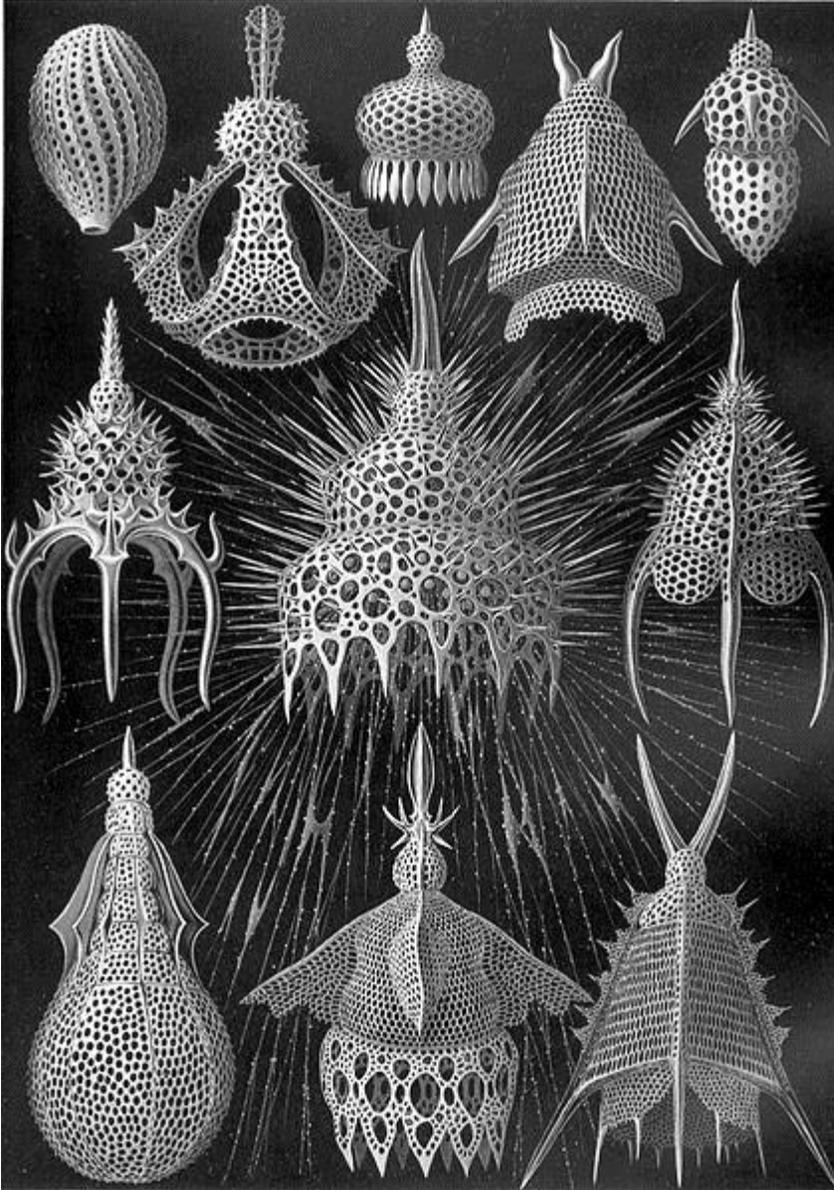


6. Radiolarians.

In the wrap-up summary session Saturday afternoon, I was given an opportunity to talk about radiolarians. I was given 5 minutes with no time to complete what I would have liked to have presented. I will summarize what I said and more that applies to the above-reported John Baumgardner's catastrophic plate tectonic model. On the Pacific and Atlantic Ocean floors there are "oozes" that consist of shells of tiny animal life (radiolarians, coccoliths, foraminifera, globigerina, and pteropods) and plant life (diatoms). On the continents there are also layers of radiolarians (more than 50 meters thick) that are interlayered with the so-called Flood deposits in every age of the geologic column. (Such layers are not in the Grand Canyon rocks.) I indicated that radiolarians are protozoans that have a hollow silica structure (like a hollow glass lantern) with pores and elaborate spikes extending from this structure, and these structures are 0.1 to 1.0 mm in diameter (mostly much less than 1.0 mm). Inside are marine algae in a symbiotic relationship with the radiolarians, and, thus, the radiolarians must float near the surface to obtain sunlight. The green chloroplasts in the algae produce oxygen gas

bubbles that cause the creature to float near the surface. During the 40-day and 40-night period of rain there would be cloud cover and no sunlight, and following this time, cloud cover produced by hot or warm water that was evaporating but originally created by ejection and condensation of steam from the “fountains of the deep” would also have prevented any sunlight from being present. Therefore, no radiolarians could have lived and reproduced themselves during the time of Noah’s Flood or soon after. On that basis, the existence of thick radiolarian deposits throughout the geologic column in which 4,000 different radiolarian species in an evolutionary sequence occur poses a real problem for the YEC model for the 6,000 year age of the earth. Radiolarians in Devonian rocks are different from radiolarians in Jurassic rocks. How could swirling waters of Noah’s Flood be able to sort out such different species of radiolarians when all of them are essentially the same size?

If it is assumed that a thickness of sedimentary rocks in the geologic column were deposited in a one-year flood to be 5,000 meters and if it is assumed that all the various rocks were deposited by flood waters *sweeping* across the earth and all at about the same rate, then a layer of radiolarians, 50 meters thick, would be deposited in 1/100 of a year or about 4 days. So, how fast do radiolarian skeletons accumulate on an ocean floor? Japanese scientists have made such a determination and have found that it takes 2 to 56 weeks for radiolarians to fall through a water column that is 5,000 meters deep which is far longer than the theoretical 4 days that are available in the young-earth model for radiolarian deposition. (See <http://www.csun.edu/~vcgeo005/Collins3.pdf>) The slow rate is because radiolarian skeletons have pores and projecting spines (see illustration next page) that cause friction and slow their descent. It also must be recognized that all those radiolarians were not living at the same time else the dense concentrations of all the creatures living together would have blocked out sunlight for those occurring below the surface, and there would not be enough nutrients on which they could feed or enough silica in the water to produce their skeletal structures. Thus, the radiolarian fossil layers could not have formed during a one-year Noah’s Flood.



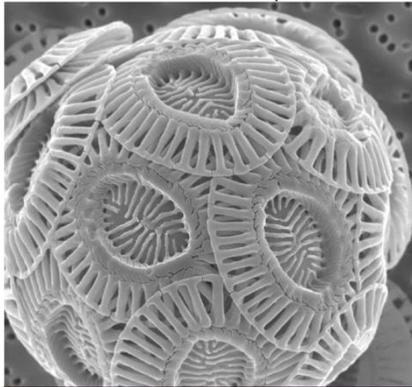
A further objection to John Baumgardner's accelerated plate tectonics model is the following. On the Pacific Ocean floor where basalt lava has recently emerged from the mid-ocean spreading centers, there are no radiolarian fossils that have yet fallen on the new basalt surfaces. In the conventional view of plate tectonics, as basalt emerges from the spreading center, its solidified masses subsequently are progressively transported farther and farther away from the center in time. That observation means that radiolarians falling on the moving basalt in the oceanic plate can progressively get thicker and thicker at increasing distances away from the spreading center. As much as 48 percent of the Atlantic and Pacific Ocean floors are covered by various oozes, and the skeletons in the oozes accumulate at a

rate of 0.3 to 5 centimeters per 1,000 years. Radiolarian oozes range up to 1,400 meters thick (over 4,000 feet) at their farthest distance from a spreading center. On that basis, because of the slow rate at which radiolarians possibly grow and reproduce and the dead creatures then fall as porous silica-rich skeletons, such thicknesses could not have been deposited in the 4,363 years since Noah's Flood. Millions of years are required. Therefore, the catastrophic speed of oceanic plate motions proposed by John Baumgardner of 10 feet/sec (calculated to be 7 mph), which is much faster than speeds proposed in the conventional plate-motion models, is not supported. The plate motions recorded by Ken Wolgemuth of 2.8 cm to 3.5 cm per year are supported as well as by evidence from GPS measurements.

7. White Cliffs of Dover – Chalk

As a further comment, on page 12 coccoliths were mentioned as one of the types of "oozes" that occur on ocean floors. Coccoliths are very tiny fossilized forms of life with calcite shells that are created from *Coccolithophores* (one-celled marine algae).

Heres what chalk looks like under a microscope:



In modern times these accumulate at rates of 0.01 to 0.10 mm/yr. Billions and billions of them occur in chalk in layers of Cretaceous age in the White Cliffs of Dover in England, and this chalk formation also occurs in widespread areas in France and other parts of Europe.



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These chalk layers are as much as 400 meters thick. Andrew showed a picture of chalk with a large coiled ammonite fossil in the chalk and claimed that this was evidence of a Flood-produced tsunami that swept this creature into the chalk.



There are many problems with Andrew's model. For example: (1) because *Coccolithophores* are marine algae, they must have sunlight to live. I have already shown in the discussion of the existence of great numbers of radiolarians in layers 50 meters thick throughout the geologic column which also required sunlight and that it was not available. Therefore, sunlight in Cretaceous time would not have been available for coccoliths to live and reproduce. (2) Even if the sun were present and shone on the oceans, all those billions and billions of *Coccolithophores* could not have been living at the same less-than-one-year-time because such masses would have blocked out the needed sunlight for them to occur a few meters below the ocean's surface. Moreover, enormous amount of dissolved calcium ions would have been required to produce the shells, beyond what would be locally soluble in the ocean waters in less than one year. And (3), if masses of

Coccolithophores were present in an algal bloom, such blooms consume oxygen and create toxins so that dead zones would have been created, and great amounts of other fossilized creatures (such as marine fish and reptiles) beside the ammonite should have been found in the midst of the chalk layers, and that is not the case. Therefore, these three factors indicate that millions of years of time were needed so that *Coccolithophores* could live and die and then settle out to produce the billions and billions of coccoliths in the chalk layers. Moreover, the coccoliths in the chalk layers of chalk in the White Cliffs of Dover cannot be a jumbled mixture of fossils as the result of transport of these fossils by tsunamis in the Flood because there are (a) multiple undisturbed horizontal layers of “hard zones” throughout the chalk containing preserved burrows of bottom dwelling organisms and (b) vertical changes in evolutionary types of foraminifera fossils coexist with the coccoliths which would have been totally mixed by such transport.

8. Logs in river channels.

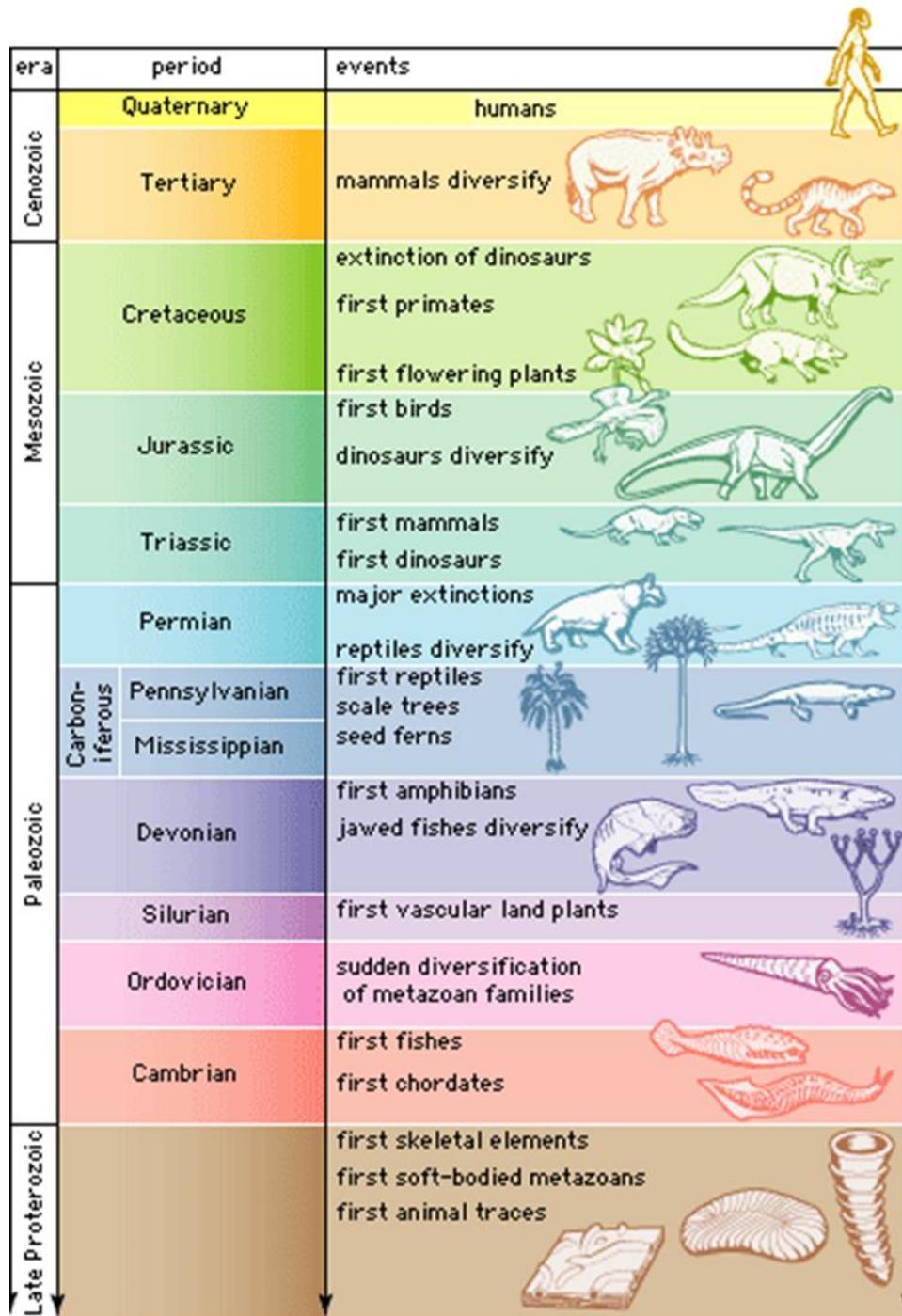
In the summer of 1953, I worked for the U.S. Geological Survey in the Circle Cliffs area of Utah, helping to map the geology in quadrangles in this area and to assist in finding uranium ore deposits. In this area the uranium ore was associated with wood in fragments or in logs in stream channels where the river was eroded down into underlying shale-bearing formations. (Some logs were almost entirely replaced by uranium minerals.) The uranium ions, transported by hydrous fluids, tended to replace the carbon atoms in the wood. In my mapping process, I observed large logs of trees in some stream channels in Cretaceous sandstone layers. When a tree was uprooted during a flood, it could be floated down stream until the butt of the trunk was lodged into the bank so that the top of the tree would swing around parallel to the bank. Therefore, I could plot the orientation of this tree trunk and predict the orientation of the stream channel under the overlying rocks and project where some possible uranium ore concentrations might occur. The point of mentioning these observations is that there was absolutely no evidence that the trees were deposited by a catastrophic tsunamis that was created by *swirling* Flood waters moving across this area in Utah. Such tsunamis should have made a jumbled pile-up of logs like what was observed after the tsunami in Japan. Instead, the outcrops looked exactly like what would be expected during natural stream erosion. In the first place, why would any meandering stream channel be found in Cretaceous sandstone layers being deposited by a rapidly moving tsunami? Furthermore, there is not enough time in less than one year to develop a flood plain on which a meandering river system could develop. Andrew’s model makes no geologic sense.

Moreover, what kind of mechanism is God going to use during a one-year Flood to produce and cause the uranium-bearing fluids to come into the logs in these stream channels after these logs have been deposited there near the end of the Flood? Now, of course God can do it supernaturally, but that is not science, and Andrew has been attempting to show you that God operates by scientific processes. I think God does it by natural processes involving much longer time than less than just one year or even during 4,363 years since the Flood.

9. Lateral distribution of fossils

When Andrew Snelling discussed how Noah's Flood buried the animal life that we observe in the geologic column, he mentioned that groupings of dinosaur eggs, which conventional geologists thought were evidence that dinosaurs built nests, were really examples of where female dinosaurs, fleeing in panic from rising Flood waters, dumped their eggs as they were rushing to higher ground. He also described how in some places all that were found were tracks of animals, but their fossil animal skeletons were not found until they appeared higher in the geologic record. For example, he showed some supposed vertical trilobite trails on an image the trails went up nearly a vertical face. I speculate that in that place, however, that the bed had been turned up in a nearly vertical position, and the trails were originally horizontal or almost so and not vertical. I doubt that trilobites could ever climb a nearly vertical wall of loose sand. The sand grains in that position would have slumped.

Nevertheless, on that basis, Andrew suggested that this relationship was evidence for how evolution in the geologic column could be achieved. He then gave an illustration of stromatolites that were formed in a "hot reef" and suggested that as a tsunami of the Flood would move laterally over the reef to a lagoon, the tsunami would then flow over a floating island of trees, then over coastal dunes, and finally to higher ground of the mainland. In that process different ecologic conditions and life forms away from the reef would be encroached upon. On that basis, he proposed that as the rising Flood waters began to reach higher and higher ground, these waters in succession first buried, for example, fleeing amphibians (appearing first in Devonian rocks), then reptiles (appearing first in Pennsylvanian rocks), and finally, the fleeing dinosaurs (mentioned above) to produce the evolutionary changes. The floating forests could eventually have become coal beds. See illustration of animal life in the geologic column shown below.



If I restrict the following comments to sediments supposedly deposited during the Flood and not to sediments deposited after the Flood, these sediments would be represented by the Paleozoic rocks in the Grand Canyon and the Mesozoic rocks in the Grand Staircase and Zion Canyon north of the Grand Canyon. The periods in

the Paleozoic and Mesozoic ages in these places are shown in the geologic column, except that the rocks in the Silurian Period are missing in the Grand Canyon.

If Andrew's model for lateral changes in fossil types were correct by shifting of rising Flood waters laterally to higher ground and which would produce the superposed rock layers in fossil-bearing layers of today, then such shifting would have to happen simultaneously everywhere on Earth. That simultaneous shifting-condition *everywhere* is completely illogical. No place on Earth can it be demonstrated that Mesozoic rocks represent places of higher ground and at distances laterally farther away from Paleozoic rocks. Instead, everywhere both sedimentary rocks of older and younger ages are found in the same vertical arrangement.

Moreover, coal beds in the Illinois Basin were shown by Professor Harold Wanless, whom I took a class from in 1958, to be formed in layers that were in multiple cyclothems (as many as 40) on top of each other. Cyclothems are cyclic sequences of alternating marine and continental sedimentary rocks (many meters thick). In many places preserved tree trunks could be seen with roots penetrating into a soil horizon. In the summer of 1952 I worked at the Illinois Geological Survey in the Coal Division where an example of one of these tree trunks anchored in soil is on display. River channels with sands and gravels cut the coal beds that likely formed from trees (e.g., *Lepidodendrum*) and ferns growing in adjacent swamps. (The many river channels caused problems for the miners.) Thus, the trees did not necessarily float into some place and later became coal, although floating to other places could happen in other parts of the world. For example, in China are some ultra-thick coal beds as much as 23 feet thick. Meandering river channels would certainly not be expected to exist on floating islands of trees in the model proposed by Andrew, especially when (a) trees in these supposed islands occur at multiple levels one above another (as many as 75 individual coal seams), (b) the *Lepidodendrum* trees must grow to heights of as much as 130 feet high and 7 feet in diameter in less than one year at each level before the Flood supposedly floated them there, and (c) these supposed floating islands are within an area 200 by 400 miles wide. His model makes no geologic sense. Furthermore, how can Flood waters alternate many times with fresh water and then salt water in the midst of a less than one-year Flood? Salt water coming over and among the trees and ferns likely killed them and helped preserve them so that they could later become

coal. That is, bacteria that could have destroyed the submerged plants would not have been able to survive in salt water, and the marine sediments that buried the plants would have cut off oxygen that could have oxidized the organic cells.

In the midst of these cyclothem is a layer of bright blue clay (about 1-2 inches thick) that is the alteration product of volcanic ash (blown into the stratosphere from a distant volcanic explosion) which settled from air over many hundreds of square miles. How can falling volcanic ash settle out as a single thin layer in a swirling moving tsunamis that is claimed to occur in Noah's Flood. The water had to be quiet for this to happen. Otherwise, the ash particles would be mixed with sediment in a slurry of settling particles. Therefore, Andrew's model of Noah's Flood, with swirling water moving in tsunamis across the Earth's surface and forcing the animals (and trees) to move up to higher land, is not supported by what is observed.

In Andrew's model, he has chosen data that fit his model and ignored data that do not. That is not good science. It is true that some creatures that God first created in the geologic column are still living in today's oceans. One example that Andrew used, is *Lingula*, which is a kind of brachiopod that is known as a living fossil. It first appeared in the Cretaceous Period and is living today.



But there are many, many creatures that only lived in each of the periods (Cambrian, Ordovician, Silurian, and on up the geologic column), and many of them were free swimming. How does swirling water in a less-than-one-year-Flood sort and separate free-swimming creatures so that some of them are only found in one geologic period? Shouldn't free-swimmers be able to move anywhere in the Flood waters throughout the geologic ages and all be mixed with other fossil former-swimming creatures? Shouldn't sperm and eggs released from immobile creatures (e.g., clams and corals) freely move through the Flood waters of one-year duration, so that the union of these gametes in fertilization would result in adults being created at higher levels in the geologic column such that these same

immobile creatures would be found as fossils mixed with other fossils at all age levels? Why did 19 percent of all animal families and 50 percent of all genera go extinct at the end of the Devonian Period (the top of the Temple Butte Formation in the Grand Canyon) and why did 90 percent of marine life and 70 percent of land life disappear at the end of the Permian Period (the top of the Organ Rock Formation just above the Kaibab Formation at the top of the Grand Canyon)? Note that both extinction events are supposed to have occurred in the middle of swirling waters of the Flood. How can swirling waters in Noah's Flood accomplish that? Also, note, that I am not saying that Andrew cannot come up with a possible explanation, but where in the Bible are verses in which Noah's Flood is described is there justification for providing that explanation except by supernatural means?

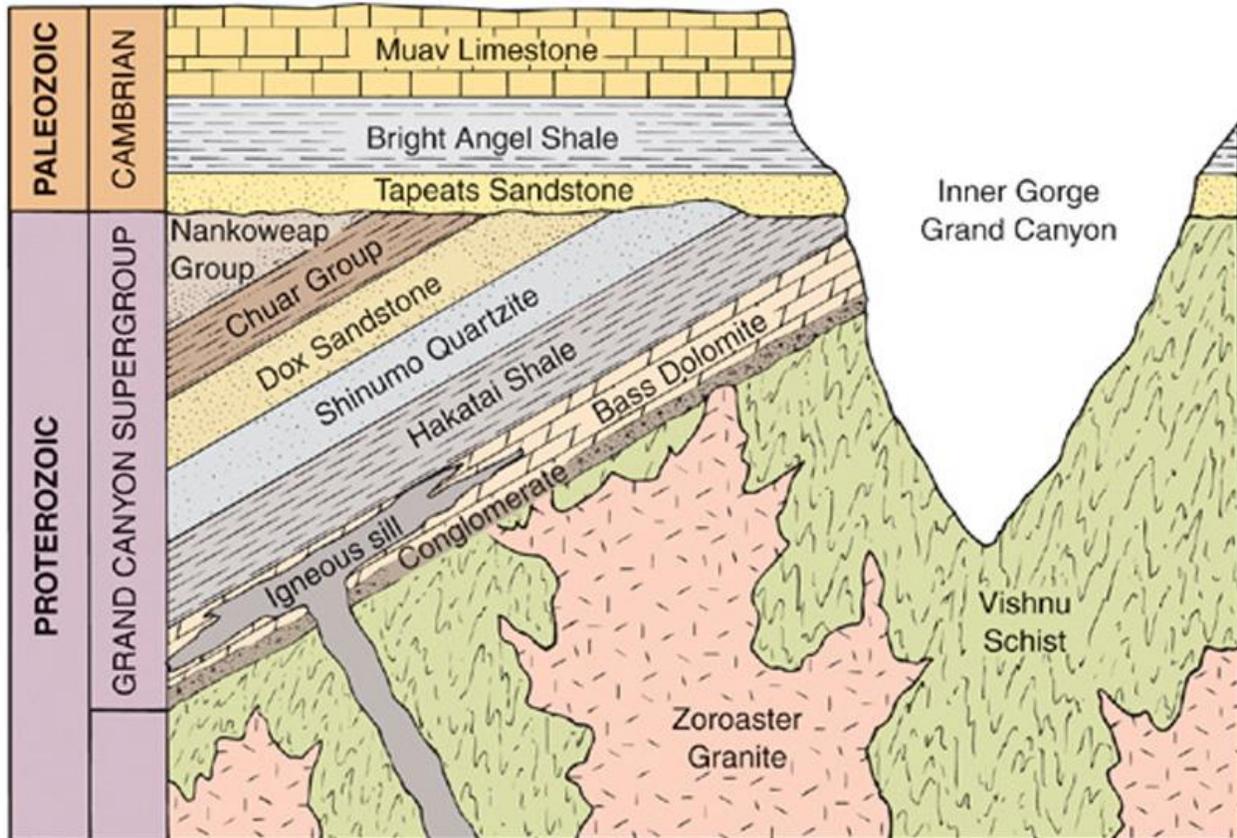
It is too bad that Joel Duff, a biologist and expert on living and fossil plant life, did not have an opportunity to present data that could have given other interpretations that would not have supported the views offered by Andrew. What logically can or cannot happen to plants during the Flood offers an entirely different perspective from what can be interpreted as to what happened to the animals.

10. Precambrian rocks.

Between 1959 and 1972, I studied some Precambrian rocks in New Jersey in the Dover Magnetite Iron Ore District. Magnetite is magnetic and is an iron oxide that is found in rocks formed at high pressures and temperatures. The Precambrian rocks were in folded igneous and metamorphic rocks of the Split Rock Pond isoclinal anticline.

compensate for the squeezing of the layers into the isoclinal arrangement. (You can observe such sliding if you fold a telephone book and look at the movements of the pages.) This sliding at high pressure deformed and broke the minerals, creating fractures through which hydrous fluids could move. These fluids at high temperatures progressively removed the iron from the silicate minerals and caused the residual minerals to become progressively more magnesium rich. The iron that was removed from the crystals was deposited as magnetite to form the iron ore concentrations.

If I understand the YEC model of forming the earth in 6,000 years, all processes that occurred in the Precambrian had to occur supernaturally in Day Three of the Genesis Week or at least in a very short time at the beginning of the 6,000 year history. In my study of the Precambrian rocks in the Split Rock Pond anticline, I found no reason to suggest that the Creator had to act supernaturally in order to produce the iron ore concentrations. In fact, all that I observed could be explained by physical laws operating under natural conditions that must have taken place over millions of years and not nearly instantaneously during the Genesis Week or soon after. Moreover, all the different Precambrian rocks observed in the Grand Canyon seem to be logically formed in millions of years and not in a very short time period.



For example, the liquid magma that formed the large Zoroaster granite mass must have been injected into the rocks at temperatures in excess of 800°C and the liquid magma that formed the diabase igneous sill must have been injected into the Bass Dolomite between the Hakatai Shale and the basal conglomerate layer at temperatures in excess of 1200°C , on the basis of laboratory studies. Because of the study of rates of cooling of magmatic igneous rocks in laboratory experiments on rocks of the same chemical compositions, these molten rocks must have cooled very slowly, and because rocks are very poor in conducting heat, for masses of igneous rocks as large as are in the Grand Canyon and which probably once were at great depth (as much as 5 kilometers below the Earth's surface), millions of years of cooling could be required before crystals could start to form. Certainly, they could not have crystallized by natural processes during Day Three of the Genesis Week or soon after. Therefore, YEC must rely on supernatural processes which defy any scientific knowledge that I have. Obviously, I cannot argue against miracles, but I see no point in creating miraculous Precambrian rocks in order to be a Christian and follow the teachings of Jesus. If the Bible was meant to be a true history of the origin of how all rocks were created in the Earth, as recorded in Genesis 1, then I think God should have inspired the writers of the books in the

Bible to give us a more complete history. God left out almost 90 percent of the history.

11. Critical analysis of presentations given by Dr. Terry Mortenson

I am not qualified as a biblical scholar to write a critical analysis of the presentations given by Terry Mortenson. I could only make comments that relate to my 65 years of studying geology. Terry did an excellent job of summarizing his viewpoints as a young-earth creationist which is expressed in his book that is also co-edited by Thomas H. Ury. This book is titled: “Coming to Grips with Genesis – Biblical Authority and the Age of the Earth.” I appreciated hearing Terry speak, essentially giving a summary of what he wrote in this book. As I listened to him, I recognized his thorough biblical knowledge, and I learned of his complete conviction that he has the only right interpretation of Genesis 1 and Noah’s Flood. However, Dr. David Clotfelter, senior minister at the Community Christian Alliance Church in Northridge, California, has given a critical analysis of Terry’s viewpoints in a U-tube video series that can be found at:

<https://www.youtube.com/playlist?list=PLCmwj09gXQDa9WFcKZCEaU2X3sNC11gx3>. Of this series, I recommend looking at all of them, but particularly at five of them: 07 The Traditional Reading of Genesis 1, 08 Must We Take the Days Literally?, 09 When Did Animals Begin to Die?, 10 Did the Fathers Settle This For Us?, and 11 Are Geologists Scoundrels? Each of these videos is about 15 to 20 minutes long. In the first three of these five, David gives alternative interpretations to that given by Terry which I think need to be considered.

12. Last comments.

I give a quote from Dr. Joseph Peter Becker who is a minister at the Steamboat Evangelical Church in Steamboat Springs, Colorado.

“According to Romans 1:18-20, the created order is a reliable witness which testifies truthfully, even about heavenly things. So, unless God speaks with a forked tongue, good scientific research, properly conducted, and properly interpreted, ought never to contradict good biblical research, properly conducted, and properly interpreted.”

On the basis of this quote, I suggest that the results of my research that I have conducted through many years as a geologist do not contradict the Bible. This research reveals an awesome God that can do geological, physical, chemical, astronomical, and biological processes that are consistent over millions and billions

of years which is just as miraculous to me as doing these processes in the Genesis Week or during Noah's Flood, if not more so. God seems more awesome to me in that He is in control of the universe even in billions of years of time.

Speaking to the disciples, Jesus said (John 16:12) "I have much more to say to you, more than you can bear now." Because Jesus is God, I speculate that He could have been saying that He knew of all the scientific discoveries that were to be made in future years and because the disciples had no training in science, he could not give this knowledge to them at that time.

Having said the above, I am still grateful to have been able to listen to the presentations by Andrew, John, and Terry Mortenson as well as to hear the comments and questions from all of the students in the class as everyone was searching for the truth in the Bible. I was impressed by the thoughtfulness that went into the various discussions on each topic and for hearing the reasons why each person was led to take the positions that were most meaningful to them. I was impressed by the scholarship and biblical knowledge that everyone had, far more than the knowledge of the Bible that I have. I was also impressed by the dedication with which each person was attempting to follow Jesus in his or her life. For me, I am doing the same. I have committed my life to Christ, and I am not sure where that will lead me. I note that Jesus never said: "Here are a list of things that you must believe before you can follow me." He just said: "Come follow me." That directive frees us all in the way in which each person can choose to follow Him. I am glad that we are forgiven for being human, that I have the love of Christ to guide me throughout my life, and that He offers this same love to you. We can have differences of opinion, and it does not matter to Jesus because He accepts all of us for being the sinners that we are.

I am hoping that at some time in the future young-earth creationists and "old-earthers" are not working against each other but are presenting an agreed-upon view of an awesome Creator (God, Jesus, and the Holy Spirit), who intelligent thinking people can believe in. People need to realize that there is no conflict between science and the Bible. Both sources of knowledge reveal this awesome Creator. Christians need a unified position among all church denominations which can confront the forces of evil that exist now in the world around us and can attract anyone to follow Jesus.

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