



Examining Young Earth Creation Claims About the Grand Canyon

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Plain Language Summary

In the papers reviewed here, Dr. Andrew Snelling proposes that the Cambrian aged Tonto Group was deposited over a few days or weeks early in Noah's flood. He proposes that the sediments were moved at very high flow rates and deposited very rapidly. He further interprets them to have been deformed by faults and folding while the sediments were soft (unlithified), quickly lithified and then eroded rapidly as the Grand Canyon formed. For Young Earth Creation models to be viable, these same rates of deposition, deformation, and often erosion had to occur in sedimentary rocks all around the world.

Here we will describe features that indicate that the Tonto Group sediments were deposited by many different events at much slower rates, with many significant pauses in sedimentation. Such pauses are evidenced by herringbone cross-stratification, mudcracks, trace fossils and stromatolites. When we look at the folding in the Tonto Group, we find that the rocks are clearly fractured and many of these fractures were associated with deformation. We find that the observations at both outcrop and microscopic scales are consistent with low pressure / low temperature deformation over long periods of time. The data indicate a diverse geologic history over deep time. Our geologic understanding has grown over time and many models have been proposed. Even so, we do not find support for a catastrophic flood interpretation either in the Cambrian rocks of the Grand Canyon or in other sedimentary basins around the world.

This article is in a series examining the claims in these three articles by young earth creationist, Andrew Snelling:

Snelling, Andrew. [“The Petrology of the Tapeats Sandstone, Tonto Group, Grand Canyon, Arizona.”](#) *Answers Research Journal* 14 (2021): 159–254.

Snelling, Andrew. [“The Petrology of the Bright Angel Formation, Tonto Group, Grand Canyon, Arizona.”](#) *Answers Research Journal* 14 (2021): 303–415.

Snelling, Andrew. [“The Petrology of the Muav Formation, Tonto Group, Grand Canyon, Arizona.”](#) *Answers Research Journal* 15 (2022): 139–262.

Introduction

Most lists of the “seven wonders of the natural world” include the Grand Canyon in Arizona. It is spectacular visually but also geologically. This is not just because of the canyon that is carved there but because it exposes so much rock. The modern understanding of the vast majority of geologists is that the rocks were formed over many millions of years. Can they be explained in a much shorter timeframe? Young Earth Creationism (YEC)¹ proposes that the entire universe is approximately 6,000 to 10,000 years old and its proponents have often declared that the rocks along the Grand Canyon and Colorado Plateau can be scientifically interpreted in ways that fit this interpretation. One key component of YEC explanations is the claim that approximately 4350 years ago, the earth experienced a global catastrophic flood, the biblical Noah's flood, that included many unique events and effects that together comprise an interpretation called “flood geology” (FG).

YEC and PhD geologist Andrew Snelling authored four papers from 2021 to 2023 that claim to demonstrate that a group of Cambrian formations in the Grand Canyon were deposited catastrophically by Noah's flood. Dr Snelling is the Director of Research for Answers in Genesis, the largest YEC organization online. In his papers, he claims that this key example should be interpreted to have been deposited early in the catastrophic flood and then folded (deformed) while still soft. He further claims that the sediments were then hardened to solid rock (lithified) quickly and then the Grand Canyon carved through this rock. He applied for permission and collected 53 samples from the Cambrian Tonto Group in the Grand Canyon to study the sedimentary rocks and their deformation at microscopic scales.

Snelling's interpretations sharply contradict modern geologic consensus for these rocks. Despite the length of the reports and the technical details presented, geologists are not likely to be convinced to reinterpret the geologic record in light of this work. Why not? It is *not* because of their bias against the Bible or some sort of atheistic agenda that pervades modern science. Many scientists, including geologists, are Christians and find that their geologic interpretations do not call into question their faith or the Bible. Geologists will find his arguments unconvincing because the arguments against his interpretation are far stronger than any support he finds in his studies as presented to date.

1. A number of acronyms are used through this document. A list of these will be provided following the references section.

In this paper, we examine published data available from various studies of the Grand Canyon and other relevant areas, including Dr. Snelling's reports and the explanations that he provides. Dr. Snelling shows good knowledge of existing publications in his documents. The technical descriptions of the thin sections are well done and have accurate observations. (Thin sections are samples of the rock mounted on glass slides and ground to thicknesses of 30 μm for examination on special petrographic microscopes.) Many non-geologists are likely to be impressed with all of the technical detail and language utilized. It may seem quite impressive to those without the background or skills to critique it, and they may assume his conclusions are reasonable.

Contradictions with the geologic understanding developed for the formations of the Tonto Group can be summarized by the answers to the following four questions:

1. How long did it take for the unit to be deposited? Thousands of millions of years vs. a few days.
2. What depositional processes were dominantly involved? Fluvial and tidal processes vs. catastrophic flood processes.
3. How were the rocks deformed? Slow tectonic processes over millions of years vs. rapid soft sediment deformation over days.
4. What is the general age model for when the rock was formed? ~500 million years ago vs. less than 10,000 years ago.

The differences between these two models are major and as a result, both cannot be true. One or the other is false. In this case, if any of these four questions can be demonstrated not to be reconcilable with FG, then YEC should not consider these Cambrian units as "flood deposits" and it makes the entire YEC proposal questionable. In this current report, we will address primarily the first three questions. We believe that the general age model developed using radiometric dating is sound, but we will leave that question for future reports.

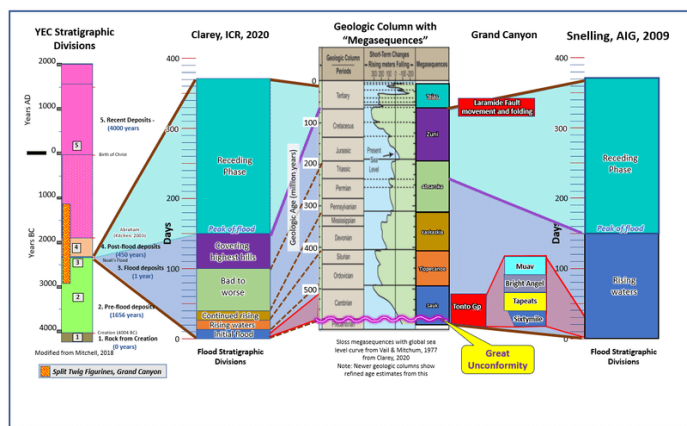


Figure 1: Comparison for interpretations of the geologic column by leading flood geology advocates. This does not include any time for initial erosion. Snelling (2023) proposes a "prolonged period (days or more) in which there was a significant amount of continental-scale erosion to bevel the Precambrian (pre-Flood) land surface to produce the Great Unconformity (GU).

Figure 1² shows two current contrasting YEC interpretations for the timing of Noah's flood in the geologic record from separate leading YEC organizations. Both groups recognize that, regardless of their

2. Clarey 2020; Mitchell, Stephen 2018; Snelling 2009; Vail, Mitchum Jr, and Thompson III 1977

differences with the accepted timescale, the accepted geologic column is a valid summary of many, many observations around the world. The relative order of sediment deposition is recognizable. The key difference in the two interpretations is in the top of the flood interval. Snelling interprets the top of the flood interval as the top of the Mesozoic section and that gives him very limited time for the deposition of the Tonto Group. Dr Tim Clarey of the Institute for Creation Research (ICR) places the top of the flood deposits at the top of the Pliocene and therefore, leaves even less time available for each system of rocks to be deposited, including the Tonto Group as illustrated on the figure. In many places around the world, the differences between these views involves literally miles of sediment thickness.

	Old Age Models	Flood Geology Models	Comments
Depositional Processes and Rates			
Basal Surface	Green	Red	Weathered sections beneath the surface are a problem for FG
Tapscott SS, Bright Angel FM & Muav ls	Green	Red	The sorting and rounding of grains suggest time in transport. Overall source of sediment problematic for FG
Petrology	Green	Red	
Areal Extent	Green	Green	Broad areal extent of sands are consistent with either option. Continuous deposition in some areas is concerning for FG
Basal Breccias & Conglomerates	Green	Yellow	Perhaps the basal breccias and conglomerates could be fit into a FG model, but need next.
Channels	Green	Yellow	Although the channels do not compare to recognized deepwater channels, they may not rule out FG origins. Fluvial braided streams would not fit FG models.
Sedimentary Structures			
General bedding style	Green	Red	One would expect massive, chaotic beds throughout and a dominance of upper flow regime bedforms that are not observed.
Herringbone Crossbeds	Green	Red	Diagnostic features for tidal deposits demonstrate normal tidal cycles over periods of time that were too long for FG models.
Mudcracks	Green	Red	Features indicative pauses in sedimentation that allowed subaerial exposure and drying are incompatible with FG.
Biologic Indications			
Fossil occurrence	Green	Red	Lack of expected modern forms inconsistent with YEC explanation that all kinds created before the flood.
Ichthyology	Green	Red	Multiple bioturbated horizons showing normal distribution of feeding and resting behavior would not have been possible with flood predicted rates of deposition.
Muav ls Reds	Green	Red	In place stromatolitic reefs well above the Great Unconformity in Cambrian contradict FG.
Structural Deformation			
Microfeatures	Green	Yellow	Timing and modeling of the folding not explained by FG models. Features result from flexural folding of hardened rocks. Precambrian rocks were also folded and these certainly hardened prior to the folding.
Microfeature	Green	Yellow	Lack of "metamorphosis" of the sampled slides is not surprising. Other analog areas also interpreted as flood deposits do show expected characteristic. Slides show shearing, fracturing of grains and other features consistent with the deformation of hard rocks.
Diagenetic timing	Green	Red	Quartz overgrowths required much time to fill the pore spaces. Fractures cut through the cement and sand grains. Rocks had to be hardened prior to the draining of the canyons. Canyons cut slowly as the plateau was uplifted.
General Age Model			
General validity of technique	Green	Red	YEC explanations do not explain why many independent radiometric techniques all point to an ancient earth. Accelerated decay would have wiped out all life from the planet.
Consistency in Tonto Group	Green	Yellow	Samples through canyon consistent with depositional order. Multiple populations of grains are found. Some were formed in the Precambrian, while some were formed closer to the time of deposition. Snelling sampled one unit that could be anomalous but this must be confirmed.

Table 1. Comparison of strength of models. Green symbols reflect that the data is consistent with the model. Red lights are given when the data are not consistent with the model. Yellow lights reflect some uncertainty, suggesting that there could be scenarios that might fit. Some are light red or green suggesting that there is overall agreement or disagreement, but some data has not been completely resolved

Table 1 is a summary of our findings in the form of a "stoplight chart", such as is commonly used in the oil industry to convey risks and uncertainties associated with particular plays or prospects. Green signals show that the data support the proposed model, while red signals reflect potentially fatal flaws that would need to be addressed in order for the model to be considered viable. The column for Old Age Models reflects not one single model, but whether or not concerns have been identified that would make depositional processes acting over deep time doubtful. The column for FG also does not reflect a particular FG model, but whether concerns are recognized that would invalidate the general explanation for the Cambrian rocks being deposited by a global catastrophic flood. The colors are subjective appraisals of the evidence but provide a quick visual assessment of what we have found.

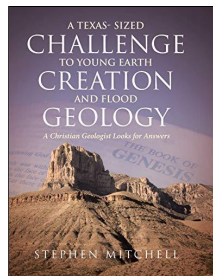
Notice that the stoplight column for Old Earth is all green. That means that we interpret that all of the evidence can comfortably be interpreted within an Old Earth framework. This includes the data provided by the Snelling reports and all other published materials that we have reviewed. Geologists have had different depositional models and structural understandings, but all involve far longer

timeframes than are available in the YEC timelines. Although ideas will continue to develop, there is no reason to believe that future models will alter in ways that call into question the general concept of deep time.

Notice that the spotlight column for the Young Earth models includes largely reds and yellows. This means that we find many observations that are difficult or impossible to reconcile with the YEC models or with FG in general. Dr. Snelling and other YEC authors must provide better explanations for many of the observations that we note in this table. We consider their explanations to be inadequate or invalid in most cases. We plan to provide more detailed information in future papers, but will summarize our findings here.

Part Two will concentrate on how long it took for the Cambrian sediments to be deposited and what processes are evidenced. It is worth noting that for FG models to be considered viable, every hill is a hill to die on. Given their interpretation of the Genesis text, all of the flood deposits had to take place over 371 days. Any rocks that took longer than this to form must be excluded from their flood deposits. This applies not just to individual beds, but to each set of beds and formation.

We will look at several examples that don't fit the flood models. The published interpretations tell us approximately how many days YEC models propose were available to deposit rocks in each of the geologic periods, regardless of how long these periods actually were. The duration of each of these periods, including the Cambrian period provide reality checks that we can use to see if the YEC models are viable. (See **Figure 1**).



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We can also look at the rocks to see if the depositional clues in them are consistent with the proposal of catastrophic flood deposition. Naturally the range of processes recognized in the Tonto Group is more limited than what we would

find in the entire rock record, but if these were, as Snelling asserts, deposited by a catastrophic flood, we can be confident that some processes will not be recognized.

Thus in this part, we will point out several clear indications that sedimentation was not rapid or continuous. It clearly shows that the Tonto group had significant pauses in sedimentation. Parts just were not deposited by water moving at the rates that Snelling claims.

Part Three will look at what happened to the sediments after they were deposited. This is particularly relevant to Snelling's reports. He sampled 53 rocks from the Tonto Group, but the rocks were not selected to systematically examine the depositional facies present. They were selected to help him demonstrate that the folding in the Tonto developed before the sediments were lithified, that is turned into hard competent rocks.

This again is a hill to die on for flood geology. If any of the rocks had been lithified first and then deformed afterward over the Young Earth timeframes, they would not have folded. They would have behaved brittlely, exclusively through faulting and shattering. Snelling sampled beds that were faulted and fractured, but also folded. He seeks to demonstrate that sediments were soft at the time of their deformation. In Part Three, we will look at evidence, including some that comes directly from Snelling's slides, that shows that what we find is just what we should expect to find if hard rocks were deformed slowly of deep time.

We will look at the diagenesis, those changes in the sediments after deposition. Loose sands were hardened over the broad areas of today's Colorado Plateau dominantly by quartz cementation. This takes place slowly over thousands of years or more, and in this case, it occurred prior to carving of the Grand Canyon and the folding. YEC time models predict that this would have happened over 450 years. This, like other findings is problematic for YEC models. While our findings do not support the Young Earth interpretation of the rock record, they do not speak to other interpretations of Genesis or the Christian faith. It is our hope that YEC will recognize that the geology does not support Snelling's conclusions.

References

- Snelling, Andrew. "The Petrology of the Tapeats Sandstone, Tonto Group, Grand Canyon, Arizona." *Answers Research Journal* 14 (2021): 159–254.
- Snelling, Andrew. "The Petrology of the Bright Angel Formation, Tonto Group, Grand Canyon, Arizona." *Answers Research Journal* 14 (2021): 303–415.
- Snelling, Andrew. "The Petrology of the Muav Formation, Tonto Group, Grand Canyon, Arizona." *Answers Research Journal* 15 (2022): 139–262.
- Clarey, Timothy. *Carved in Stone: Geologic Evidence of the Worldwide Flood*. (Dallas: ICR Institute for Creation Research, 2020).
- Mitchell, Stephen. *A Texas-Sized Challenge to Young Earth Creation and Flood Geology: A Christian Geologist Looks for Answers*. (Meadville, PA: Christian Faith Publishing, Inc., 2018).
- Snelling, Andrew A. "Earth's Catastrophic Past." Institute for Creation Research, 2009.
- Vail, Peter R., Mitchum Jr, R. M. and Thompson III, Sam. "Seismic Stratigraphy and Global Changes of Sea Level: Part 4. Global Cycles of Relative Changes of Sea Level.: Section 2. Application of Seismic Reflection Configuration to Stratigraphic Interpretation." 1977.

Acronyms Used

Acronym	Full Term	Acronym	Full Term
AIG	Answers in Genesis	GU	Great Unconformity
BAS	Bright Angel Shale	HCS	Hummocky Cross-stratification
EKM	East Kaibab Monocline	ICR	Institute for Creation Research
FG	Flood geology or flood geologist	YEC	Young Earth Creationism or Young Earth Creationist

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