Critical Analysis of Snelling's Model for the Folding and Origin of the Tapeats Sandstone, Grand Canyon, Arizona, and Postscript

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Introduction

Andrew Snelling (director of research at Answers in Genesis) wrote a brief article (The Fight for 53 Rocks, December 29, 2021, https://answersingenesis.org/geology/grand-canyon/fight-53-rocks), describing his study of 53 samples that he collected in the Grand Canyon to support his view that two Tapeats Sandstone places and one place each in the Bright Angel and Muav formations were folded soon after all these sedimentary layers were deposited within days or months following Noah's flood. Hereafter, Snelling's comments are in **bold font**. He said: **None of the evidence supports the evolutionary idea that the folding occurred 450 million years after the sandstone was cemented. Instead, it is overwhelmingly consistent with the sand layers being deposited rapidly at the beginning of the global flood cataclysm year. The bending of the still wet, soft layers occurred only months later at the end of the flood year when the plateau was uplifted. The sand layers cemented to sandstone as they dried out at the end of and after the flood. Furthermore, no evidence points to any metamorphic cha nges in the sandstone or its mineral grains, either in the folds or in the samples miles away from the folds.**

Snelling is absolutely certain that his research (Snelling, 2021b) **has convincingly confirmed that Grand Canyon's layers were deposited violently during the yearlong global flood cataclysm only about 4,350 years ago and demonstrates the short time between when the Tapeats was deposited and folded—eliminating the possibility of hundreds of millions of years within the layers.**

He is certain that what he saw in **Grand Canyon's outcrops and through the geological microscope confirmed the biblical account. The evidence pointed to the sand layers being deposited rapidly at the beginning of the global flood and bent when they were still wet and soft at the end of the flood year.**

Andrew Snelling has written other articles that apply to his model (Snelling, 2008, 2021a, 2021c, 2022), but only the 2021b article that applies specifically to the Tapeats Sandstone is analyzed in this website article.

Analysis of Ten Statements that Snelling Gives as Evidence that the Folding in the Tapeats Sandstone Occurred Soon after Deposition by Noah's Flood

1. ***Boulders at the base of the Tapeats Sandstone were transported by rapid hurricane- and/or tsunami-driven water currents.***

Large boulders are commonly found in the basal portions of river-deposited sandstone layers. This is known as the "bed load" and, for example, is quite evident in the modern-day Colorado River in the Grand Canyon. During yearly flood stages of rapid melting of snow in the Rocky Mountains, these boulders are transported and rolled against the Zoroaster Granite and Vishnu Schist bedrock in the Grand Canyon. None of these boulders in the Grand Canyon has been transported by "rapid hurricane- and/or tsunami driven water currents." Of course, these boulders are below the Glen Canyon Dam and are not as effective means of erosion today as they would have been in the past when the dam was not there.

Nevertheless, the boulders that occur at the base of the Tapeats Sandstone in the Grand Canyon area were not necessarily rolled and tumbled by such currents. Snelling (2021b) indicates that the boulders consist of granite, quartzite, conglomerate, and schist. The Vishnu Schist that underlies most of the Tapeats Sandstone in the Grand Canyon is rich in biotite, and, therefore, the overlying Tapeats Sandstone should be unusually rich in biotite mica if this sandstone is locally derived, and that is not the case. The larger masses of granite that intrude the Vishnu Schist in the Zoroaster Complex are biotite granites or biotite-hornblende-bearing granitic rocks, and most are not muscovite-bearing rocks. Only one very small pluton is biotite-muscovite bearing, and a few narrow pegmatite dikes that cut the Vishnu Schist in the area are muscovite-bearing. (See: https://www.researchgate.net/publication/322328128_Grand_Canyon_Geology) Therefore, the large amounts of muscovite and K-feldspar in the large volume of the Tapeats Sandstone have been transported into the Grand Canyon area from Precambrian crustal rocks from a distant source and are not derived locally in the Grand Canyon area by hurricane- or tsunami-driven currents of Noah's flood.

One obvious fact that the detrital particles in the Tapeats Sandstone cannot be locally derived from the erosion of the Precambrian basement rocks below the Great Unconformity in the Grand Canyon area is the fact that once the first bottom layer of boulders and sand particles is deposited on top of the Great Unconformity, moving water from surface streams or from supposed hurricane- or tsunami-generated water in Noah's flood can no longer contact that surface and erode it. Therefore, all quartz sand and clay particles in interlayered shale beds in the Tapeats Sandstone formation above that first bottom layer must come from a distant Precambrian crustal source.

2. **The layering within the Tapeats Sandstone indicates that the sand was rapidly transported and deposited by hurricane- and/or tsunami-driven water flows.**

Yes, the Tapeats Sandstone has abundant layers most of which are much less than a meter thick (**Figure 1**) and in some places exhibit stream cross-bedding typical of rapid transport. But hurricane- and/or tsunami-driven water flows would not sort the grains into nearly uniform grain-size although the Tapeats Sandstone does have a range in grain size that indicate rapid transport and deposition typical of modern-day stream deposition generated by storms. Tsunami driven currents of such large force would make a jumbled mixture of boulders and sand grains. To

emphasize – layering of sedimentary sandstones can just as well result from periodic yearly storms and not necessarily be produced by a less than one year storm during Noah's flood.

Figure 1. Layers of sandstone in the Tapeats Sandstone seen along Deer Creek, a tributary of the Colorado River.

3. **The fossilized tracks in the layers were left behind by trilobites, worms, and other invertebrates that had scurried across or hurriedly burrowed into sand surfaces. To be preserved, those delicate traces had to be buried rapidly.**

Of course, rapid burial is commonly necessary for animal life to be preserved as fossils, but such rapid burial can happen in periodic, yearly, winter storms and has no requirement for the animals to be buried by Noah's supposed rapidly moving flood waters. There is no real basis for Snelling's claim that fossilization requires rapid burial. There are many taphonomic factors. These factors include such processes as burial, decay, and preservation that affect animal and plant remains as they become fossilized. Snelling makes this claim for rapid burial because it meshes with his belief about a short timescale. The overarching

characteristic of sediments and sedimentary rocks is that sedimentation is discontinuous (as seen in **Figure 1**), at a great range of timescales, and, therefore, not attributable to some short-lived global event. Such an observation, by itself, precludes Snelling's global flood narrative.

Moreover, if Noah's flood waters suddenly rushed upon the trilobites, worms, and other invertebrates, these creatures would not have time to scurry across or burrow into sand surfaces. This is particularly true when the Tapeats Sandstone ranges from 30 to 100 meters (100 to 330 feet) thick in the Grand Canyon area, and the fossils in this sandstone formation occur in layers stacked on top of each other throughout its thickness. The hurrying of the animals to escape the flood waters is in the imagination of Snelling, and this hurrying has to apply from top to bottom in this formation. That is not realistic! How would they know in each higher level of the deposits in which they lived that flood waters were coming repeatedly throughout the whole time in which these layers were being deposited?

Moreover, each layer in which fossils of animals are found, the animals there would have been killed by the overlying deposition of sediment. Therefore, animals eventually preserved as fossils at higher levels above a given fossil-bearing layer must have had to start over beginning with new creatures. That is, at the end of the deposition of a layer that buries and kills animals, enough time must exist for new animals to be generated and be alive before they can supposedly scurry around and be buried by the next layer on top of them. Each new generation of animals must take more than a year's time for eggs coming in from outside sources to be fertilized and grow to become adult animals. Therefore, such repeated more-than-one-year-growth times of new-animal-generations in hundreds of layers in a formation that is as much as 100 m (330 feet) thick in the Grand Canyon area cannot happen in the one-year time of Noah's flood. For that reason, the requirements for repeated new generations of animals (each lasting more than a year) at each level in the Tapeats Sandstone and the lack of knowledge by each new generation that they must know that flood waters are coming are two of the strongest arguments against Snelling's model.

4. **The sandstone consists of different-sized grains mixed randomly, indicating that they were rapidly transported and deposited with no time for the grains to be sorted.**

Such an observation is true as is true for the grains in the river sands carried in suspension and deposited by the modern-day Colorado River flowing down the Grand Canyon. Therefore, Snelling's statement **#4** does not make it a demonstration that such grains were necessarily deposited by Noah's flood waters. Moreover, stream and river deposited sediments tend to be less well sorted than in sediments deposited in a shallow marine environment.

5. **Many of the grains of quartz (natural glass) and even the softer pink K-feldspar are not very rounded, also indicating that there was no time for the grains to be completely rounded during their transport.**

Quartz grains transported in water are rarely ever rounded even after a long distance of travel in water. The rounding of quartz grains is more often observed in windblown sands (however, not in all desert terrains) but not in water transported sands. In other words, Snelling **cannot** use the lack of roundness of quartz grains as a criterion for saying that the quartz grains have only traveled a short distance. Because quartz grains have a hardness of 7 on Mohs hardness scale and are not easily abraded and because these grains are mostly carried in suspension in the water, the water that surrounds these very hard grains acts as a lubricant that prevents any abrasion between grains that would cause rounding. However, Snelling (2021) shows that transported, large, former K-feldspar phenocrysts in granite are partly rounded, but otherwise mostly the smaller fragments are jagged because K-feldspar grains break with nearly right-angle cleavage surfaces, making the borders of the eroded grains have ragged and not rounded edges.

6. **The K-feldspar grains were eroded from the nearby underlying granites, indicating that the sediment was transported only a short distance.**

Such a statement simply is not necessarily true because K-feldspar grains can be transported in suspension for very long distances without ever colliding to break them down into smaller fragments. Moreover, as indicated above in statement **#1**, the underlying granites are <u>not</u> mostly muscovite-bearing, and the K-feldspar grains in the Tapeats Sandstone likely came from a distant source that was muscovite-bearing.

7. **The sandstone contains abundant silvery muscovite (mica) flakes. Muscovite is a soft, fragile mineral, and these flakes consist of stacked thin sheets like the**

pages in a book. The edge-on flakes are wedged between quartz and K-feldspar grains, usually aligned approximately parallel to the rock's layering (which is how moving water deposits such flat flakes). Sometimes the flakes have split ends where the thin sheets have been frayed and are even bent and/or broken. These observations mean they were detrital grains (bits broken off other rock) in the sandy sediment that was rapidly transported only a short distance and deposited rapidly before the soft flakes could be completely destroyed.

Again, this statement for "only a short distance" of travel is not true for the Tapeats Sandstone in the Grand Cannot as indicated in statement **#1** and cannot be evidence for rapid deposition by Noah's flood waters because muscovite (mica) flakes can also be transported in suspension for very long distances, but in quiet water mica flakes will settle out with their flat-plate-surfaces mostly parallel to the layering of a deposited sandstone formation.

8. **The cement binding the grains together is primarily quartz (silica). It is always intact, not having been disturbed or shattered since it grew around the detrital quartz grains and cemented them together to form the hard sandstone soon after the flood.**

Quartz (silica) cement that binds grains of quartz to make the sandstone rock solid is common in many types of sandstone although in other places the cementation is calcite (calcium carbonate). The cementation process normally takes a much longer time than just a few days or months to form. Available silica that can become a cementing agent for quartz grains in the Tapeats Sandstone requires that the water carrying the silica becomes basic in composition to dissolve silica. Neutral water (pH 7) or slightly acidic water (lower than 7 pH) because of the carbon dioxide content picked up from the atmosphere existed in Noah's flood (abundant rainwater) or still more acidic water (much lower than pH 7 because of the dissolved hydrogen chloride (HCl) or hydrogen sulfide (H_2S) content in volcanic water emerging from mid-ocean spreading centers from the mantle, which could have been the supposed "fountains of the deep") *does not dissolve silica*. Therefore, water outside of the Tapeats Sandstone which is basic (high pH, greater than 7) in composition must come in, and the diffusion process to bring in dissolved silica does not happen quickly within a few days or months after Noah's flood and likely involves hundreds of thousands of years. The outside source for

the silica cement likely came from upper younger Paleozoic sedimentary rocks rather than from the Tapeats Sandstone because if locally derived from constituent quartz grains in the Tapeats Sandstones, these grains would become scalloped and rounded by local dissolution and that is not the case.

9. **Neither the sandstone nor its constituent mineral grains, either in samples from the folds or in samples from miles away, showed signs of metamorphic change.**

This statement could be true, but further studies and observations must be made to make it true as noted in following comments in statement **#9**. That is, Snelling does not completely explain how he knows that metamorphic change has not occurred except by visual observation. Snelling collected 26 samples of the Tapeats Sandstone (12 from the Carbon Canyon fold, 10 from the Monument fold, and 4 from unfolded equivalent layers beyond the folds). Ray Strom (Calgary Rock and Material Services, Canada) made the thin sections, but there is no indication that these thin sections were cut in every place in two ways, at right angles and parallel to the bedding plane of the folded rocks. On that basis, apparently Snelling has not examined the thin section orientations of the quartz grains and the silica cement in the two orientations to show that recrystallization has occurred that has altered their quartz grain and cement orientations in the folded rocks. He just makes the claim that he did not see any visual evidence of metamorphism. Only under crossed-nicols and universal stage examination and by cathodoluminescent studies can such possibilities be found and not just by visual observation.

A further observation is that the rock layers in the Tapeats Sandstone were buried at least 10,000 feet and at such a depth no metamorphic change would be expected. Metamorphism requires deeper depths where higher temperatures and pressures exist that change sandstone into quartzite, and that is not observed in the Tapeats Sandstone.

Ray Strom also did x-ray diffraction studies of all Tapeats Sandstone samples to determine clay mineral content and found that they contained illite, smectite, and kaolinite with illite being dominant (mostly near 70 percent). The formation of illite results from the alteration of muscovite and K-feldspar weathering and hydrothermal environments. The Tapeats Sandstone contains both

muscovite and K-feldspar, but the formation of illite does not occur quickly in the time frame of 6,000 to 10,000 years (the alleged age of the Earth by Snelling) where granite is weathered to form illite (a) in the volumes of illite reported in the Tapeats Sandstone and (b) in clay (shale) layers interlayered with the sandstone layers in the Tapeats Sandstone layers before Noah's flood 4,350 years ago. The weathering of granite is exceedingly slow as is indicated by observations of dated granite tombstones, measured in thousandths of an inch per year. To produce the illite contained in the Tapeats Sandstone (shale and sandstone layers) would likely take millions of years of weathering and erosion time when the observed erosion rate of granite outcrops on the coast of Maine shows almost no erosion by repeated hurricanes during the 200 years in which people have lived in houses along the coast of Maine and of granite building blocks in Egyptian temples constructed thousands of years ago and of granite closely-fitted building blocks of city houses and temples in ancient Machu Picchu in the Andes Mountains of Peru.

Conclusions

To be fair to Andrew Snelling, his 95-page article (Snelling, 2021b) has been well researched, and he has done a thorough job of reviewing all the literature describing studies by "evolutionists" who have done prior work on the Tapeats Sandstone, and he points out where these studies in his view are inaccurate or inadequate in their scopes of examinations. He has excellent sections on the stratigraphic relationships, the petrography of this formation, many illustrations of textures seen in thin sections, descriptions of the mineralogy of constituent minerals (quartz, plagioclase, K-feldspar, biotite, muscovite, zircon, sphene, calcite, halite, anhydrite, iron oxides, illite, and kaolinite), the depositional environment of the formation, the sorting and roundness of the grains, and the paleontology and fossils of the various animals that occur in this formation. He has many color photographs of the Tapeats Sandstone in the field that show its layering and physical appearance. He indicates the conventional ages of the detrital zircons in the Tapeats Sandstone which give Precambrian ages in billions of years that are found in the granitic rocks and other rock types below the Great Unconformity on which the Tapeats Sandstone is deposited and of zircons in a tuff bed in this formation which produced an age of 563 ± 49 Ma. But then he chooses

to disbelieve these great ages because they do not fit the time frame of 6,000 to 10,000 years for which he thinks the Bible supports as the age of the Earth.

On that basis, in his model, Snelling selectively chooses data that fit what he wants to believe and ignores data that do not. That is, the mineral grains in the sedimentary layers in the Tapeats Sandstone were said to be violently deposited during Noah's flood by powerful hurricanes or tsunamis, but he does not consider the natural laws that God has created that make great ages true and his model untenable. For example, he ignores God's laws that require (a) that the silica cement that binds grains together in the rock cannot be produced within days or months, (b) that the flood waters in which the grains were deposited cannot change to basic compositions within this short time to enable silica to be brought into the pore spaces to produce the cementation, (c) that the quartz, K-feldspar, and muscovite grains found in 30 to 100 meters thickness of the Tapeats Sandstone in the Grand Canyon cannot be eroded by hurricane or tsunami waves when the most powerful hurricanes (category 5) can only move offshore sandbars (25 feet thick) landward in a week's time by as much as 50 to 100 feet and when the hardness of quartz (7 on Mohs hardness scale) and K-feldspar (hardness of 6) make granite so hard that millions of years of erosion time would be required to produce the great volumes of quartz and K-feldspar grains in the Tapeats Sandstone, and (d) that similar millions of years of weathering is required to produce illite, smectite, and kaolinite clay minerals. Snelling can choose to ignore these God-created laws but that is not proper science.

Goethe has said: "We only see what we think we know." And Snelling only sees what he thinks he knows. On that basis, the ten statements made by Snelling and reported in this article which he says are evidence that the Tapeats Sandstone layers were wet and easily folded soon after the layers were deposited by Noah's flood have no merit.

Misleading "Dried Out" Statement

One other statement beyond the ten in Snelling's model that needs to be noted in particular is the opening statement (page 2):

"The sand layers cemented to sandstone as they *dried out* at the end of and after the flood."

How are the sand layers in the Tapeats Sandstone supposed to dry out when they are buried 10,000 feet beneath the overlying sedimentary rocks of younger age and not exposed to air and the heat of the sun's rays – an impossibility!!! I will assume that Snelling knew this and he probably meant, when he said *dried out*, that the sand layers in the Tapeats Sandstone lost water by diffusion (perhaps squeezed out under the pressure of overlying rocks), and then he thought that the loss of this water left behind a precipitate of silica that became the cement that made the sandstone layers solid rock.

Nevertheless, as explained in comments in statement 8 on page 8, the waters in Noah's flood must have been acidic and cannot and did not have any silica in it that could have become precipitated silica cement by the loss of water, being *dried out*. Moreover, Noah's flood water in the pore spaces between the detrital sand grains, when the Tapeats Sandstone formation was supposedly first deposited from the flood waters in his model, could not have been saturated with silica to such a degree in the pore-volume-space to make the volume of silica cement that occurs in sandstone layers in a few days or months following the flood. Such violates chemical solubility laws. Silica is not that soluble in such small volume concentrations. The silica must have diffused as ions into the pores between the detrital grains in solutions that were basic in composition (higher than 7 pH) from an outside source, perhaps from overlying sedimentary formations.

False Statement of Supposed Water Currents

Finally, it is worth commenting on Snelling's statement **# 1**, page 2, where he says:

"Boulders at the base of the Tapeats Sandstone were transported by rapid hurricane- and/or tsunami-driven water currents."

It is well known that there are not any horizontal currents in oceanic waters generated by hurricanes or tsunamis that in Snelling's model supposedly transport sedimentary particles short distances (or long distances as the evidence shows) or cause any erosion by such horizontally traveling water. The motions that occur in hurricanes and tsunamis are circular in form and do not involve horizontal movements of water except where the bottom of a circular-wave-form reaches a

shallow portion of the ocean near a continental shore line where it drags by friction and slows down while the top of the wave form continues at full speed. This slowing down shortens the wave length and increases the amplitude of the wave to greater heights. At some point the top of the wave (the crest) moves forward so fast relative to the bottom of the wave that it spills forward as a breaking wave that surfers love to ride. This spilling forward is the only time in which horizontal motion occurs. That is, for most of the wide breadth of the supposed worldwide Noah's ocean water, there were no moving horizontal currents that could have transported sedimentary particles either short or long distances.

The following two videos show the circular motion of wave forms in water generated by wind, such as powerful winds generated in hurricanes, but the same circular motion is created by tsunami generated waves except in tsunamis the diameter of the circle is much larger than in hurricane generated waves.

https://video.search.yahoo.com/search/video?fr=mcafee&ei=UTF-8&p=circular+wave+motion&type=E211US714G0#id=3&vid=2ad987a11f1b97dba0a2ff20fcfa2625&action=click

At this link, you can choose to view the YouTube demonstrations of circular motion of waves at the third or fifth site to the right in the top row.

Tsunami waves that are produced by a major earthquake can produce spilling waves that can be amplified to great heights, perhaps as much 50 to 100 feet high and could do a lot of coastal damage and drown people who live near the shore as along the coast of Japan during the 2011 Tohoku tsunami and earthquake (magnitude 9.0 to 9.1) and as along the coast of Sumatra during the 2004 Sumatra tsunami and earthquake (magnitude 9.1). Many people in Alaska were also drowned in the 1958 Lituya Bay tsunami and earthquake (magnitude 7.8 to 8.3). However, in all three major earthquakes and tsunami-generated-waves, little to no erosion of the rocks occurred in the bordering coasts in all three places. But note that in Snelling's model he suggested that huge amounts of erosion occurred during Noah's one-year flood and that the eroded sedimentary particles were deposited violently in the Tapeats Sandstone during the yearlong global flood cataclysm only about 4,350 years ago**.** Therefore, in his model, supposedly the

eroded detrital particles came from the Precambrian basement rocks and that this erosion created the Great Unconformity and was done quickly by rushing hurricane- and tsunami-currents**.**

But, the little to no erosion that occurred in Japan, Sumatra, and Alaska is convincing evidence that the eroded Precambrian surface at the Great Unconformity cannot have been produced by erosion during the one-year Noah's flood and must take millions of years. The millions of years of erosion to create the Great Unconformity require pounding of oceanic waves as described in the next paragraph.

The spilling forward of the circular motion of waves generated in large storms are known to pick up pebbles and throw them out of the top of the spilling crests, tossing them in air perhaps a 100 feet beyond the shore line to produce what is called a "storm beach" with deposited piles of pebbles. It is these tossed pebbles that can pound rock cliffs along a continental coast and cause their erosion, but it is not rushing water in currents that does the erosion or transportation of sedimentary particles that Snelling wants to claim in statement #1.

That kind of erosion caused by moving tossed pebbles on coastline cliffs is also true for moving water in stream erosion. It is the pounding of the bedload boulders, rolling and tumbling on the stream-valley-floor that erodes the rocks in the bottom of a stream channel. Smaller sand particles are mostly carried in suspension above these boulders and never touch the bottom rocks, but some of them occur there to polish smooth the metamorphic and granite rock surfaces without hardly any erosion of the minerals in the bedrock. Streams carrying quartz sand particles can erode softer sedimentary rocks, such as shales, limestones, and sandstones, but not the Vishnu Schist or the granitic rocks in the Zoroaster Granite complex.

Final Observation Regarding Snelling's Model

Therefore, the critical comments in the last two sections further show that Snelling's model has no merit. For the most part, the layers of sandstone in the Tapeats Sandstone formation are **stream deposited** as revealed by occasional stream cross-bedding (**Figure 2**) (which would not have been created by hurricanes or tsunamis) or were produced during other kinds of environmental conditions that

are described in the literature published by "evolutionists" that he reported in his article (Snelling, 2021). Such environmental conditions include the fact that the cross-bedding in most of the Tapeats Sandston was produced during deposition of fast moving water in braided rivers or streams or in shallow marine settings.

Figure 2. Stream cross-bedding in Tapeats Sandstone in Deer Creek. (Source: Google Tapeats Sandstone images; permission granted via Steve Semken)

Postscript

Since publishing article #80 on my website on January 15, 2022, new information obtained from two observations has appeared that requires a **Postscript**. The first is an article (Barnhart, 2012) in which he claims that the cross-bedding in the Tapeats Sandstone was created by currents generated by Noah's flood waters. As demonstrated on pages 11-13 of this article, no such currents were produced by Noah's flood. Therefore, his article is utter nonsense.

The second is the fact that Snelling was so focused on winning his legal battle to collect 53 samples in the Grand Canyon that he lost sight of the broad picture of the geologic situation. That is, in claiming that the Tapeats Sandstone had to be wet and soft for the bending to occur in the sandstone without brittle-breaking and in saying that this bending occurred "*only months later at the end of*

the flood year when the plateau was uplifted," he overlooks the fact that if the pores between the sand grains were saturated with water in the Tapeats Sandstone that also means that the pores between sand grains in the overlying sandstones in the Permian Supai and Coconino formations had to be saturated with water. On that basis, (a) when the plateau was uplifted and supposedly Noah's flood waters drained away and (b) when in that process the draining away supposedly created the ancient Colorado River that was superposed on the Kaibab Arch and carved the Grand Canyon, the sandstones in the Supai and Coconino formations would also have been soft and wet and should have slumped without forming vertical cliffs along the walls of the Grand Canyon as much as 200 m (650 feet) high. Obviously such vertical cliffs are present that refute Snelling's model. That is, these sandstones were not soft and wet but well cemented and hard and mostly devoid of water. Thus, his model is even more nonsense.

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