

# Reply to Andrew Snelling's arguments regarding cliffs formed in the walls of the Grand Canyon

Lorence G Collins [lorencecollins@gmail.com](mailto:lorencecollins@gmail.com)

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## Introduction

In the **Skeptical Inquirer** article<sup>1</sup> the first reason as to why Noah's worldwide flood never happened is shown below. See:

<http://www.csun.edu/~vcgeo005/Nr38Reasons.pdf>

1. The stair-stepped appearance of erosion of sedimentary rocks in the Grand Canyon with sandstones and limestones forming cliffs and shales forming gentle slopes cannot happen if all these rocks were deposited in less than one year. If the Grand Canyon had been carved soon after these rocks were deposited by a *worldwide* flood, they would not have had time to harden into solid rock and would have been saturated with water. Therefore, the sandstones and limestones would have slumped during the carving of the canyon and would not have formed cliffs. (Hill et al. 2016)<sup>2</sup>

Andrew Snelling argued against this reason in a YouTube video that can be seen in the following link.

[https://www.youtube.com/watch?time\\_continue=3&v=l9fqMAFABD8](https://www.youtube.com/watch?time_continue=3&v=l9fqMAFABD8).

In this video in the time interval 5.27 to 8.02 minutes Snelling said that he has observed tiny calcareous shells on Caribbean sand beaches that are converted into solid limestone rock in a very short time and that he has seen sand deposited along the banks of the Little Colorado River east of the Grand Canyon that has become quickly hardened so that this sand stands in vertical columns, thus proving that my arguments were false.

Space was not available in the **Skeptical Inquirer** article<sup>1</sup> that would have allowed a response to Andrew Snelling's assertions that arguments in the number 1

reason were false, but discussions of the science involved are presented in this article to show that his assertions are not true.

### Discussion of the formation of the sandstones in Grand Canyon

Snelling's observations about limestone beaches in the Caribbean and sands along the Little Colorado River are true, but such observations are only true for the instances that he describes, and they are not necessarily true for the great thicknesses of sandstone and limestone layers in the Grand Canyon. I discuss the sandstone layers first – for example, for the Coconino sandstone; 57 to 600 feet thick; the Esplanade sandstone; 200 to 700 feet thick; and the Tapeats sandstone; up to 400 feet thick). See **Figure 1** for locations of these sandstone formations.



**Figure 1.** Grand Canyon geology.

There are two facts that Snelling does not seem to have considered when he claims that reason number 1 is false.

The first fact has to do with the bonding strength of water for holding sand grains in place. It is true that wet sand will stand perhaps a few feet high, as likely Snelling observed in the sand that was stream-deposited in the Little Colorado River. Snelling has probably built sand castles at the beach, and such sand-built

castles are capable of standing a few feet high. But those sand castles were not “hardened” into solid rocks. A little bit of force on them would cause them to collapse because the force of water tension and water’s bonding attraction to the sand grains would not be strong enough to maintain a vertical wall of sand as much as 700 feet high. The pull of gravity, created by such overlying great thickness and weight of sand, would be more than the strength of the water to hold masses of the sand grains in an eroded face in the Grand Canyon in a vertical position.

Moreover, if the sands in the Grand Canyon area had been deposited in less than one year, they would have been saturated with water and would have easily slumped if the carving of the canyon was at the end of one year. The arguments made by Snelling lack complete logical scientific sense even though to listening lay people in his video audience, his arguments would have sounded perfectly logical and correct.

The second fact is that Snelling does not seem to take into account the science of crystallization processes. From chemical laboratory experiments, it is well known that there is a latent heat of fusion when crystallization occurs. For example, when liquid water freezes to become ice, 334 joules (about 80 calories) are released per 1 gram (1 cc) of water converting to ice. Similarly, when calcium and carbonate ions in a water solution crystallize to form calcium carbonate (calcite), some latent heat of fusion is released per gram. For calcite this latent heat of fusion is much less than for water and is only 57.35 joules (about 14 calories) per gram. From thin section studies, geologists know that the sand grains in the sandstones in the Grand Canyon are not held in place by water, but most commonly by calcite. In the Esplanade sandstone and the Tapeats sandstone some of the cementing agent is hematite (iron oxide) or limonite (hydrated iron oxide) or mixtures of both minerals that make these sandstone formations range in color from red to orange. In the Grand Canyon because the Coconino sandstone is white, the cement in it is mostly calcite that converts the deposited wind-blown sand into solid rock that can stand in vertical cliffs as much as 600 feet high. (Note that the white color of the Coconino sandstone, instead of red or orange, is further evidence that the sand in this formation was not deposited by Noah’s Flood because water transporting sand does not separate out iron-bearing minerals but carries both together during transportation whereas wind only picks up the lighter

quartz grains and leaves behind the heavier iron-bearing minerals; see <http://www.csun.edu/~vcgeo005/Nr47Coconino.pdf>.)

Now, here is some more science that Snelling also does not seem to consider. If all 14 calories were released per gram of calcite in the cement that crystallizes to hold the sand grains in place and if this release was rapid in less than one year during or soon after the Flood and from hundreds of cubic miles of sandstones in the Colorado Plateau area, the total amount of heat released in this short time would likely cause the sandstones to recrystallize to become quartzite (the metamorphic rock equivalent of sandstone), and that is not the case. Moreover, it takes *geologic* time to move solutions carrying the calcium and carbonate ions into the sand to produce the calcite cement, and, thus, this movement of such ions cannot have happened in one year.

Rocks do have increasing temperatures and heat content with increasing depth below the Earth's surface because of heat coming up from the mantle, but the heat coming up from the mantle is not sufficient to cause the recrystallization of sandstone so that the sandstone formations were converted to quartzite. Therefore, the above scientific observations provide reasons why water from Noah's Flood neither deposited the sand in the Colorado Plateau area nor carved the Grand Canyon.

### **Discussion of the formation of limestones in Grand Canyon**

Now, why are Snelling's arguments false regarding how marine calcareous animal shells in the Caribbean beaches were cemented to make solid limestone, as in the Redwall Limestone and the Kaibab Limestone? See **Figure 1** for locations of these limestone formations.

In comparison of calcite cement in sandstone to that of calcite cement in limestone, there is a vast difference between their volumes. In sandstone the volume of calcite cement would be quite small relative to the great volumes of calcite cement in thicknesses of the Redwall Limestone (500 to 800 feet thick) and the Kaibab Limestone (300 to 500 feet thick) and where these formations extend for hundreds of square miles.

Where calcite cementation occurs in the Caribbean beaches that Snelling observed, these beaches are constantly being washed by cold water. Therefore, the latent heat of fusion during cementation can be dissipated every day as high-tide washes over the beach sands. But for Snelling to say that 14 calories of the latent heat of fusion per gram that occurs in the huge volumes of calcite that cements calcite crystals in the Redwall Limestone and the Kaibab Limestone can be accomplished quickly in less than one year to form hard limestone is nonsense.

His statement is nonsense for the following reasons. In his model Snelling must use one of two different methods for the creation of calcite crystals in these formations. The first method possibility is that the calcite crystals were formed by the precipitation of calcium and carbonate ions that were carried in solution by the Flood water to the Grand Canyon where these ions were then precipitated out of the water after reaching the Grand Canyon area. Scientifically, this option clearly would not be his choice because the amount of latent heat of fusion released by the formation of the great volumes of calcite crystals precipitated across an area of hundreds of square miles wide would be so large that the whole Earth would melt.

Therefore, the following second method possibility is what he would likely choose. However, this second option has three prerequisites that are problematic. As pointed out before, the calcite crystals that occur in these limestone formations have to be transported by the Flood to the Grand Canyon area. Second, the calcite crystals prior to this transportation must have been already been formed. And third, Snelling ignores the fact that the source of the calcium ions in these calcite crystals requires millions of years of weathering of calcium-bearing rocks, such as basalt, to supply these ions in solutions. Otherwise, the calcite crystals that were transported to the Grand Canyon had to have been made by God by miracle, but such a creation is not a scientific explanation which creationist scientists must espouse if they are truly scientists. These three prerequisites already further make his model nonsense.

Nevertheless, in this second option method Snelling has to advocate that the great volumes of calcite crystals had to be loose grains prior to their transportation by the Flood water, and on that basis, the calcite crystals in the Redwall Limestone and the Kaibab Limestone must have been first deposited as an unconsolidated “mush,” saturated with water contained in the Flood. In the video in which

Snelling made his arguments against reason number 1, without saying so, he essentially believes that this “mush” hardened into solid limestone during or soon after the Flood (within about one year), so that residual water left over after the Flood could carve the Grand Canyon and produce vertical cliffs of limestone along the walls of the canyon that are as much as 800 feet high.

But Snelling, in making this argument, ignores the amount of latent heat of fusion that is released (14 calories per gram) from the crystallization of the calcite in the cement to change the “mush” into solid rock. This heat is enormous because these formations are as much as 800 feet thick and extend for hundreds of square miles. Moreover, the overlying deposition of 3,000 feet of Mesozoic rocks (seen in the Grand Staircase)<sup>2</sup> on top of the Kaibab Limestone during that same one-year-Flood would not allow this latent heat of fusion to escape quickly in less than one year, as can happen by the cooling effect of cold water in the Atlantic Ocean on the limey sands of beaches in the Caribbean. A rapid heat escape in the Grand Canyon area would not happen even in 4,350 years since the Flood because it is scientifically well known that rocks are poor conductors of heat. Millions of years are required for it. Therefore, the retention of this great amount of heat in the Snelling model should have converted the Redwall and Kaibab Limestones into marble (the metamorphic rock equivalent of limestone), and that did not happen.

## **Conclusion**

On the basis of all the information above, if science is applied to understanding what factors determine whether vertical cliffs in the walls of the canyon are formed or whether the limey sediment and sand sediment in the Grand Canyon were soft “mush” so that they would slump, the presence of vertical cliffs of both limestone and sandstone formations in this canyon must mean that Noah’s Flood was never global and that Flood runoff moving across the Colorado Plateau soon after the end of the Flood never created the Grand Canyon.

## **References**

<sup>1</sup>Collins, L. G., 2018. Twenty-one reasons Noah’s worldwide flood never happened. *Skeptical Inquirer*, vol. 42(2) (March/April), p. 50–53.

<sup>2</sup>Hill, C., Davidson. G., Helble, T., and Ranney, W. (editors). 2016. *The Grand Canyon – Monument to an ancient Earth – Can Noah’s flood explain the Grand Canyon?* Kregel Publications, 239 pages.