Truth in Geology Series
The Truth About Varves

By Greg Neyman

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For years young earth creationists have made a frontal assault upon a geologic feature known as varves. In this article, I will explain what a varve is, what the standard geologic thinking is concerning varves, and the young earth arguments against varves. At the end of each claim, I will show the flaws in the young earth arguments against varves. In the end, you will see that the claims fall far short of disproving the standard geologic thinking about varves.

What are Varves? The Standard Geologic Explanation

Horizontal bedding structures exist in many types of depositional environments, such as lake bottoms, gently sloping beaches, or in a deep marine environment. One of the main categories of horizontal bedding is known as "rhythmites."

A rhythmite is bedding that is in a repetitious sequence, generally thin, and contains alternating types of sediment particles. The varve is a type of rhythmite. In a varve, there are alternating layers, with a thicker, coarser layer, followed by a thinner, fine-grained layer.

The standard explanation for the alternating layers states that the summer months represent the thicker, coarser layer. This is due to the increased precipitation during summer, thus you have more water entering the lake. The increased water flow has the capability to carry larger sediment particles, hence the thicker summer layer has larger grain sizes than the winter layer. During winter, when the water is not entering the lake, the still waters allow the deposition of fine-grained sediment.

This model provides an excellent fit for the cyclic pattern of our four weather seasons during the year. Thus, each varve couplet is considered to represent an annual layer of sediment accumulation.

The most well-known of the varve formations in the world is the Green River Formation of the western United States. For the remainder of this article this formation will be referred to as the GRF. The GRF contains up to six million layers. Using the standard varve explanation above, that would mean this formation represents over three million years of sedimentation. Because of this, young earth creationists have always sought to tear down the arguments about varves, seeking to undermine the three million years that they represent. Let's look at their claims.

Young Earth Arguments Against Varves

Young earth arguments against varves appear in many locations. To simplify matters, here I will consider their arguments from websites, which are easily accessible to you as you read this article.[2,3,4,5] Basically, most of the arguments against varves amount to a discussion of the length of time it takes to deposit a varve. To dispute the bi-annual cycle of standard geology, they point to several instances of finely laminated sediment which are not bi-annual. These are discussed separately.

CLAIM: Young earth authors mention the claim of the modern lake that has been observed to create more than two annual layers. This would give support to the fact that varve layers could be from individual storm events, thus if you had an area that had 40 storms in a year, you could have 40 layers. In the example they use, there are 300 to 360 layers which had formed over a 160 year period. In another article, they mention a Swiss lake where five pairs of varves built up in a single year. (I don't know if this is the same lake in each case.)

REBUTTAL: First, the 300-360 layers in 160 year period. Since varves are couplets, or two layers annually, twice 160 gives you 320, so this example fits the standard geologic explanation for varves. I'm not sure what they hoped to gain with this argument, since it clearly presents no argument for varves forming at more than the two per year rate.

For the Swiss lake example, let's assume that they are correct, and varve couplets contain layers from individual storm events. In the example of the Swiss lake, there were five pairs of varves annually. For the sake of fair play, lets say that a pair represents a storm, thus there are 5 storms per year represented. In the GRF, there are over 6 million varves. Dividing this by 5, it would take 1,200,000 years to deposit all the layers of the GRF.

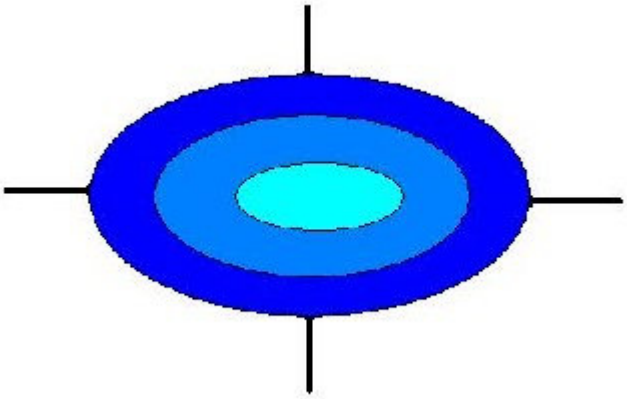
Now, let's assume there was more rain at the GRF location. Let's assume it rains 40 times a year at the GRF location. This would give you forty couplet layers. There are 6 million varves in the GRF. At an accumulation rate of 40 couplets per year, it would take 75,000 years to deposit all the varves. This is much longer than the 6,000 to 10,000 years that young earth creationists claim as the age of the earth. In order to get down to the 10,000 year range, you would need 300 storm events per year for the last 10,000 years. At this rate, the storms would be so constant that you would not get the finely layered couplets that we see in the rocks, nor is it realistic to say that it rained that much in that location over the last 10,000 years. (Lower it to 6,000 years, which most young earth creationists claim as the age of the earth, and you have 500 storms per year!)

Although the five couplets of the Swiss lake is something to consider, it does not provide a good rebuttal to the standard geologic model for varves.

CLAIM: Young earth creationists use the argument of the two volcanic layers. There are two volcanic ash layers in the GRF. Volcanic ash layers are special because the volcanic ash is viewed as a single event, and wherever it appears in the formation, it can be assumed that it is the same age. This is important because it can date the ages of the layers relative to each other. As the young earth argument points out, between these two ash layers, the number of varves varies. They state, "The number of shale layers between the ash beds varied from 1160 to 1568, with the number of layers increasing by up to 35% from the basin centre to the basin margin! The investigators concluded that this was inconsistent with the idea of seasonal 'varve' deposition in a stagnant lake.

REBUTTAL: Actually, this supports the old earth model. Please note that the number of varves increased as you went from the center of the basin to the outside edges. To fully understand this, consider this simplified diagram of a closed lake system.

With the GRF, we have a closed basin, i.e. the water is not draining out anywhere. The four black lines are rivers bringing in fresh water. The sources of the sediments forming the varves are brought into the lake by the rivers. Once the waters enter the lake, they immediately slow down, and the sediment that they carry falls out of suspension to the lake



floor. We would expect to see the most layers closer to the basin edges, where the water velocity drops, as evidenced by the darker blue area. The closer we get to the center, we would expect to see less sediment from the rivers, hence, less varves. Therefore, the layers between the volcanic ash would reflect this pattern of less layers in the middle.

This young-earth argument has no merit. Why then did the scientists they mention not see this? We don't know. Either they overlooked this simple observation, or they saw only what they wanted to see (i.e. they were young-earthers).

CLAIM: Third, they discuss the formation of many layers quickly at Mount Saint Helens. They use this as evidence that it doesn't take long periods of time to deposit thin layers of sediment.

REBUTTAL: I agree, you can deposit volcanic ash in fine layers very quickly. Unfortunately, the GRF is not made up of volcanic ash layers. Of the six million varves, only two volcanic events appear. If the GRF were totally volcanic, then the young earth creationists would have a point. As it is they are comparing apples and oranges. There is no relation between Mt Saint Helens and the GRF, since they are two completely different geologic sedimentation systems.

CLAIM: Fourth, they use the argument from a hurricane. Hurricane Donna in 1960 left a six inch thick layer of thinly laminated mud-lime.

REBUTTAL: Again, I agree that a hurricane can lay down thinly laminated sediment quickly. However, the GRF is a lacustrine environment, not a marine environment. None of the layers of the GRF can be attributed to a hurricane. Again, the young earth creationists are comparing apples and oranges.

CLAIM: One of the most popular arguments young earth creationists use is fossils. They claim that GRF fossils must have been buried rapidly because the fossils that are recovered are in excellent shape. Also the individual fossils are contained in multiple layers of varves. For example, if a fossil fish is contained in 10 varve layers, then that would represent five years of deposition by the standard geologic model. The claim is that the fish would have decayed long before the five years were expired, thus the burial of the fish must have happened rapidly. They claim that "a fish carcass, even if it did get to the bottom of a lake would not remain undecayed and unscavenged for several years, slowly being covered by seasonal deposits." To this, they add mention of the study where fish decayed in a week's time when lowered into a marsh environment.

REBUTTAL: There are many factors that go into fossil preservation. Time is not the only consideration. However, time is the only variable that the young earth creationists allude to. The condition of the water in the lake is extremely important. Consider the bog people of Europe. These bodies are very well preserved after many years, in some instances in excess of 2,000 years. In terms of the GRF, that would be 4,000 varve layers. How could this happen?

Decay is slowed dramatically in conditions of anoxic water. In other words, there is virtually no oxygen at the bottom of the lake, and thus other living organisms could not reach the bottom of the lake to scavenge the carcasses. This is what we see with the bog people. When you throw in the two additional variables of oxygen level and scavenger population, the young earth theory clearly does not pose a threat to the standard geologic explanations.

CLAIM: Young earth creationist Walt Brown's so-called theory of liquefaction explains how varves can form in his young earth model. [5]

A good rebuttal to this claim can be found here (http://www.geocities.com/earthhistory/pflood.htm). Some important points to consider...if all fossils were the result of the flood, then one would expect all fossils so show evidence of rapid burial, but in fact, only a small minority fit the rapid burial model. Second, if liquefaction sorted the layers of sediment quickly, it would also sort the fossils together, however, fossils occur all throughout the GRF.

Conclusion

Although the young earth arguments provide food for thought with varve geology, they do not come close to tearing down the standard

geologic thinking about varves. They amount to empty arguments without scientific merit.

[1] Depositional Systems: A Genetic Approach to Sedimentary Geology, by Dr. Richard A. Davis, Jr., Prentice-Hall Inc., 1983. Pages 68-69.

[2] Do Millions of Laminae in the Green River Shales Document Millions of Years?, Institute for Creation Research website (http://www.icr.org/pubs/btg-b/btg-169b.htm)

[3] Dr. John's Questions and Answers, Do Millions of Laminae in the Green River Shales Document Millions of Years?, (Duplicate copy of #2), Institute for Creation Research website. (http://www.icr.org/newsletters/drjohn/drjohnjan03.html)

[4] Green River Blues, Answers In Genesis website (http://www.answersingenesis.org/creation/v19/i3/greenriver.asp)

[5] The Theory of Liquefaction, from Walt Brown's website, Center for Scientific Creation (http://www.creationscience.com/onlinebook/Liquefaction6.html)