Issue #6: Stromatolites

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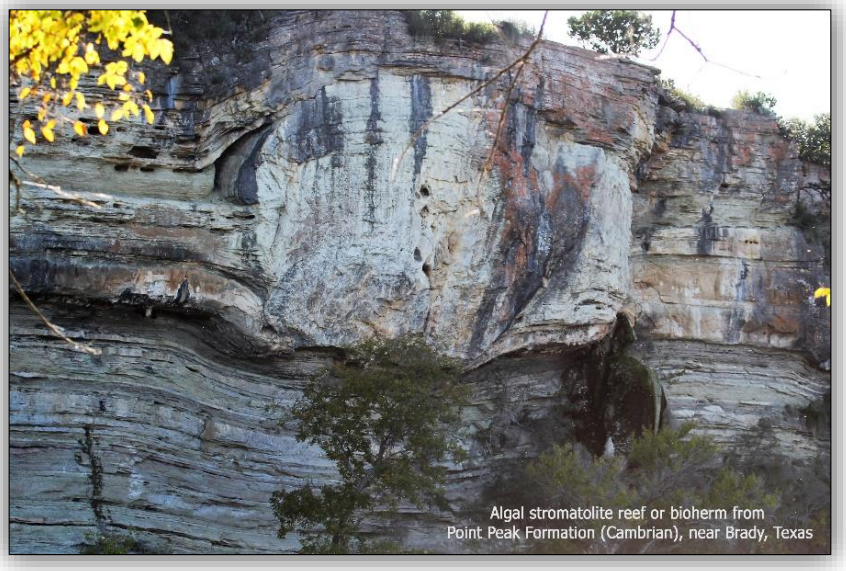

Cambrian algal stromatolite reef

Mitchell, 2018; Nielson and Barker 2013; Ahr 1971; Chafetz 1973

Assertions:

1. We observe algal deposits known as stromatolites developing today in many places.
2. Stromatolites formed as sediment was trapped by microbial mats of cyanobacteria ((blue-green algae), showing alternate periods of flooding and exposure, typically by tides.
3. Modern laminations have been measured to grow at rates of 1.6 to 5.6 years per lamination. (Petryshyn 2013). Certainly, rates may have been faster in the past, but there are limits to what we should see.
4. Ancient stromatolites developed throughout the geologic record.
5. Many ancient stromatolites show birdseye or fenestrae, that formed as the packages were exposed and developed shrinkage features, sometimes filled with calcite or anhydrite.
6. Repeated periods of alternate flooding and exposure are not consistent with a global flood origin for those intervals.

Key assumptions:

a) When we recognize sediment that look exactly like modern stromatolites, they were formed the same way.

b) When we find a thick stack of stromatolites, basically tidal deposits, it didn't form during a massive flood

c) When we see stromatolites with features that show strong evidence of exposure and dissolution, this formed by similar processes at the time.

d) Deposits that formed during a massive flood would not have been exposed long enough for dissolution features to have formed.

Discussion:

One of the amazing things about our planet is its oversized moon. One of the benefits is that it helps bring about the tidal cycle that proves to be critical to advanced life. Sediments deposited by tides take many forms, but in this case, I want to highlight stromatolites. These laminated sediments formed as sediment was trapped by microbial mats of cyanobacteria, and they demonstrate alternate periods of flooding and exposure, typically by tides. We find mounds of them growing today in Australia and throughout the geologic past. (**Figures 1 and 2**). We find then as mounds, as reefs, on ancient tidal flats and in ancient lakes. They represent the oldest forms of fossils, though they are more of evidence of biologic activity than a pure fossil, such as an ancient shell or bone. Modern laminations have been measured to grow at rates of 1.6 to 5.6 years per lamination (Petryshyn 2013). Modern examples from Shark Bay, Australia, have been studied and found to grow at average rate of less than 0.4mm per year (Chivas, Torgersen, and Polach 1990). They determined that the classic columns found in Shark Bay developed over the last one thousand years. Certainly, rates may have been faster in the past, but there are limits to what we might expect. Cyclic growth of algae mats and sediment trapping forming thick piles demonstrates a period of time, though we cannot be precises about how long it was. Sediment formed during a global flood would not have developed such layers. Deposition would have been too rapid. The periods of exposure would have been short and disrupted.

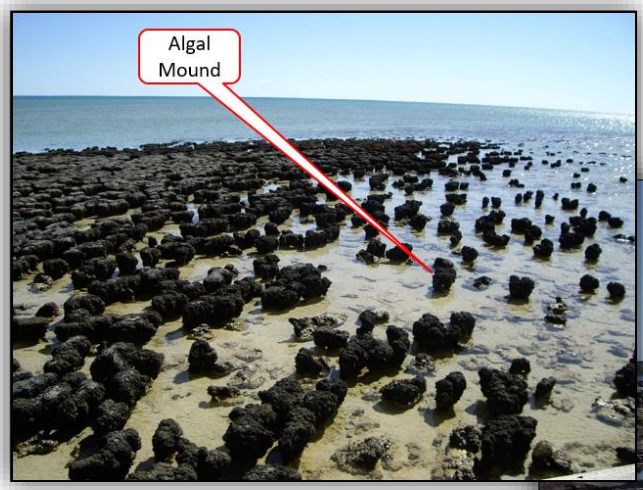

Figure 1. Modern stromatolite mounds, Sharks Bay Australia

Figure 2. Ancient stromatolites, Ottawa, Canada

When stromatolites are exposed over a period of time, shrinkage features known as "birdseyes" or fenestrae develop. These enlarged pores can remain open or commonly they are later filled with calcite or dolomite or evaporative minerals such as gypsum or anhydrite. These show that the stromatolites were not just formed and immediately buried. They actually set at the surface for some period of time. **Figure 3** are photos from core that I described in West Texas. Photo A shows several phases of development. Stromatolites were deposited. They were exposed and the birdseyes were developed. Later a big storm came through, ripping up the algal mats and evaporite nodules. Brown dolomite was carried in and it filled the birdseye pores with brown dolomite. Photo B shows stromatolites with birdseyes filled with anhydrite. Such events were repeated hundreds of times in West Texas. Such units are not part of any global flood deposit.

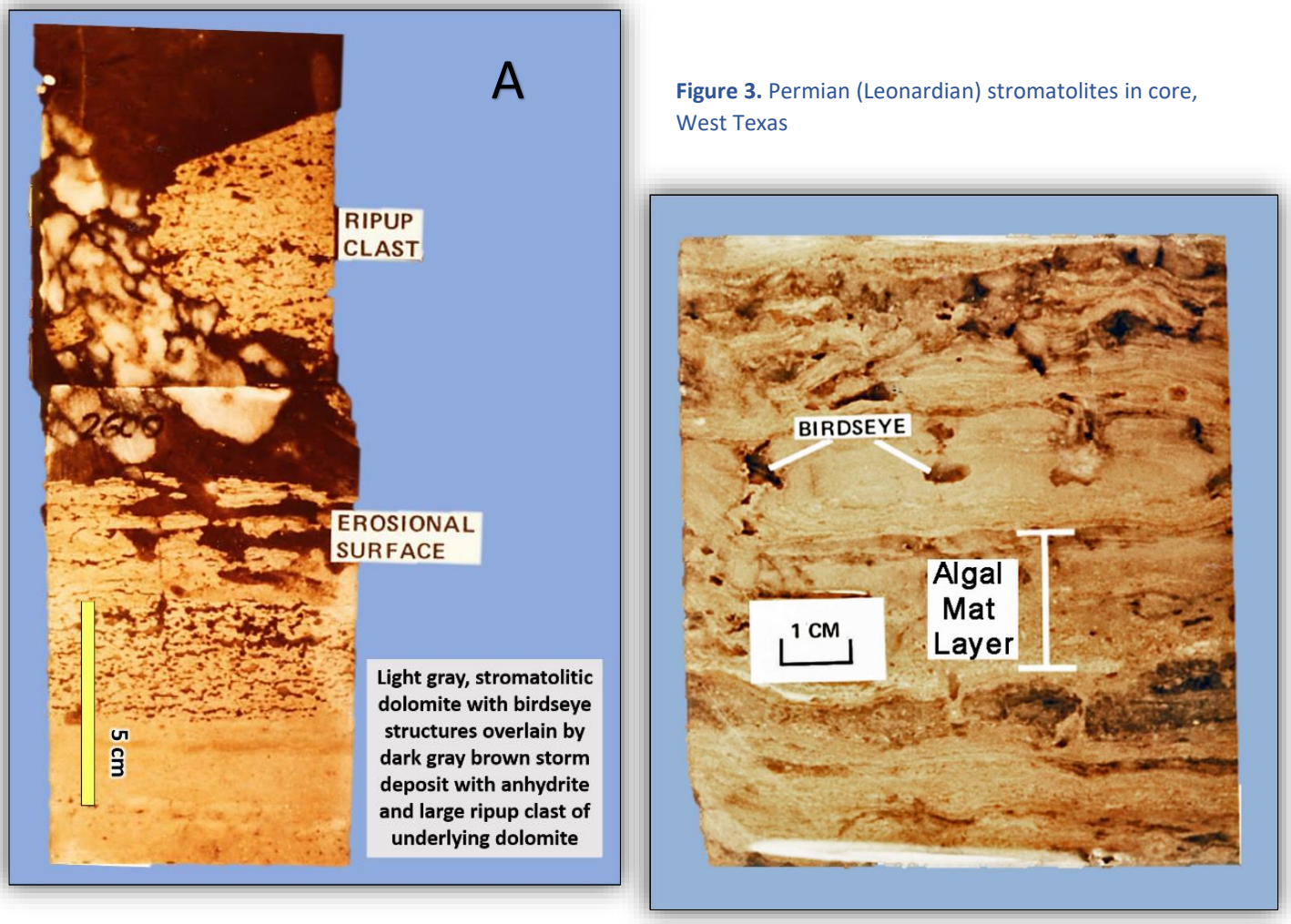

Figure 3. Permian (Leonardian) stromatolites in core, West Texas

Let's consider scenario that might have occurred involving the cores in the photos. Our company was having problems with its wells but others around were being successful. The company decided to do a study and have spent millions of dollars to collect 2000 ft of core and to study the entire field in detail.

Why? Because they want to spend many more millions to drill more wells. I went out to oversee coring operations while two wells were drilled, the core had preliminary analysis done. The cores were slabbed and polished. Then I completed my studies of them. I described the core in great detail, foot by foot and sometimes inch by inch, often using thin sections. Now for the scenario. In it, I bring the management down to review the core, as did happen. First, I walk him and several others interested along the core describing what we have learned. In due course, he comes to one of the units called here "stromatolites". He asks what are these? I now have to say that I don't know. He would be likely to ask, "Aren't these algal stromatolites such as we find today as tidal deposits?" I could answer, "Yes, they look exactly like tidal deposits but they can't be. Algal stromatolites like these would have formed from tides bringing sediment over algal mats over and over. These rocks were formed during Noah's flood so they cannot have formed that way." He might ask, "how would you tell the difference between stromatolites and flood deposits from examining the rock?" I would have to say, "I don't know". He might ask, "aren't these holes in the white layered rocks called birdeyes that formed as the mats were exposed to the air for a long time and the sediment shrunk? Why are so many of them filled with anhydrite or gypsum? Aren't those evaporites? Don't these look just like sediments from the sabkhas (salt flats) in the Persian Gulf today?" I would have to answer, "yes, they look like them, but they cannot be, because these formed during the middle of the global catastrophic flood. Don't look at the rooted intervals either. I don't know what they are either. He might ask, "if these formed in the global flood, then how will that affect how fluids move through the rock today? How extensive are they? How should we develop the field?" I would have to say, "I really don't know. We don't have anything to compare to. The flood processes must have been incredibly rapid, but we really can't say much about past processes or rates of deposition or distribution today."

YEC explanations:

The challenge of explaining stromatolite reefs in YEC flood models has been noted and discussed by several authors. One of the most significant articles was by Dr. Andrew Snelling in 2013: "*Survey of Microbial Composition and Mechanisms of Living Stromatolites of the Bahamas and Australia: Developing Criteria to Determine the Biogenicity of Fossil Stromatolites*". Using the modern analogs, Snelling concludes that many Archean features are biogenic stromatolite reefs. One of the criteria used to test features as valid ancient reefs is: "*3. Be found in sedimentary rocks from the appropriate apparent depositional paleoenvironment, such as laminated limestones composed of lime silts, and cherts characteristic of peritidal and evaporitic carbonate environments*;" I find this significant because it provides a written statement from a key YEC author that shows that he uses the same assumption that Christian and non-Christian geologists use daily. We study the rocks on both regional and local scales in order to recognize the depositional setting at the time. No doubt some settings are more unique and can be identified with higher confidence. Stromatolites are an example that are easily and confidently identified.

How does Snelling make the case that stromatolites could have grown in the pre-flood or flood periods?

> *"Both Bahamian and Hamelin Pool stromatolites are believed to grow less than a millimeter a year (Jahnert & Collins, 2012). If the periodicity of the lamination could be determined then age estimates could be made for living stromatolites. Although the oldest living stromatolites are not considered to be more than a few thousand years old (Macintyre et al. 1996; Chivas et al. 1990),*

> *the periodicity of lamina formation is highly variable. This also lessens the possibility of determining the time period necessary to form ancient/fossil stromatolites. However, it seems possible that stromatolite formation could occur rapidly under certain environmental conditions that may lend support to their rapid formation during Creation Week and the Flood*." (emphasis added)" (Snelling, 2013)

His preferred model, however includes stromatolite reefs created in progress and dying with the flood, as he wrote here:

> *"Within the biblical framework of earth history microbes, fully functioning stromatolites and even stromatolite reefs may have been created by God before Day 3 of the Creation Week, as an integral component of the carbonate sediments on the floor of the global ocean. … The onset of the Flood cataclysm marked the demise of living stromatolites. Unable to establish themselves and grow during the devastation of the Flood, today's rare stromatolites are still being built by those mat-building microbes that survived in a few isolated places with conditions suitable for their growth."* (Snelling, 2013)

Ken Coulson's 2021 paper, "*Using Stromatolites to Rethink the Precambrian-Cambrian Pre-Flood/Flood Boundary*" does a great job of demonstrating that stromatolites grew in the Cambrian Period around the world, and he demonstrates particularly well that those he studied in Utah were biogenic growths that formed in situ. His description of the stromatolitic growth is very good and he has great photographic examples. He notes that the same types of growths are found in the Ordovician, Silurian and Devonian periods. He also rejects the idea that such reefs could have developed during a 1-year long flood as he wrote here:

"*From a creationist perspective, given extremely favorable conditions of growth, it is not implausible to consider rapid growth rates on the order of a few meters per year for upper Cambrian microbialites. Even if incredibly high growth rates such as this can be verified, however, such rates are still completely inadequate to account for hundreds of meters of accumulated microbialite growth in the Flood year. Moreover, this rapid growth is supposed to be taking place while up to 1 km of the continental shelf is being removed by Flood-generated tsunamis below)…. Given that many Cambrian microbialites contain sponges as well as other encrusting metazoans, a credible growth rate solution is virtually impossible*." (Coulson, 2021)

His proposal is to move the base of the flood interval to above the Devonian periods. What about stromatolites in the Pennsylvanian or Permian or Triassic periods? He believes that rates far beyond those that exist today may have existed during creation week and during the period between Adam and Noah. I would argue that key controls on stromatolites such as tidal rates and basin subsidence are unlikely to have been different during this period.

I am encouraged that YEC such as Snelling and Coulson recognize that stromatolites are incompatible with deposition from a global catastrophic flood. I find them also incompatible with a period of 1600 years or even a few thousand years. This is particularly problematic for YEC interpretations when you take into account the fact that stromatolitic zones are just a small part of the overall sedimentary packages that must be accounted for in this time.

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