What is the meaning of limestone–marl alternations?

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Secular scientists love cycles in sedimentation, and there are many types of cycles at different vertical scales. Varves are defined as regularly repeating two or more sublayers, such as alternating silt and clay, deposited in one year. Rhythmites are two or more sublayers that are *not* necessarily deposited in one year, and in some cases, there can be numerous rhythmites deposited in one year. Varves occur today in lakes at the edge of glaciers and even in some non-glacial lakes.

A favourite for secular scientists is varves because they believe they can count varves in one location and correlate them to varves in other locations to build up an Ice Age chronology of thousands of years. Varve dating has been used to estimate the number of years since the ice sheets melted in Scandinavia and North America.[1,2]

So-called varves are also prevalent throughout the geological column and are called varvites if they are lithified. As an example, Bradley estimated 5–8 million ‘varves’ in the Green River formation.[3] Since the Green River Formation is very likely a Flood deposit,[4,5] there must have been processes causing numerous rhythmites quickly in the Flood.

Such pre-Pleistocene rhythmites and other cycles have been used to push the Milankovitch mechanism well beyond the idea of showing the cyclicity of multiple Pleistocene ice ages.[6] Because the Milankovitch mechanism is applied to oscillating variables in deep-sea cores, secular scientists now claim there were 50 ice ages of variable intensities during the 2.6 million years of the Pleistocene.[7] It is only the ‘last’ ice age that would correspond to the biblical Ice Age caused by the Flood. Glacial deposits on land predominantly show one ice age.[8] Where several tills (ice-age sediments) are superimposed with non-glacial sediments like sand or gravel between, such as near the edge of the ice sheet, the deposits can be explained by fluctuations during one ice age, just as what is observed with modern glaciers.[9]

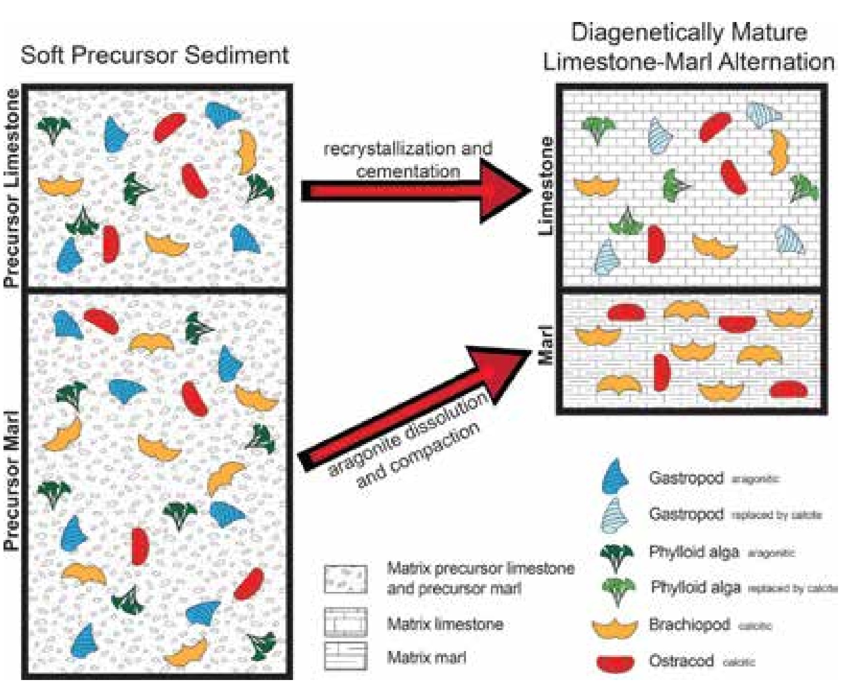

Figure 1. The early diagenesis model of a uniform sediment.[15] During compaction, the aragonite fossils in the future limestone sublayer are recrystallized to calcite with rapid lithification and little compaction. The future model is compacted with the total dissolving of the aragonite fossils and the reorientation of the fossils.

Limestone–marl alternations used to support Milankovitch cycles

Limestone/marl alternations (LMA) are another type of cyclic sedimentation that can show hundreds of couplets. Marl is loosely defined as a muddy limestone usually with greater than 35% fine-grained particles.[10] LMA are then purer limestone alternating with less pure limestone. Marls are softer, less cemented, and compact more with overburden, compared to limestone. Each component can have different proportions of limestone and fine-grained sediments. These alternations are commonly assumed to record cyclic sedimentation caused by the astronomical or Milankovitch mechanism (astrochronology):

> “Limestone–marl alternations (LMA) are rhythmical successions of carbonate-rich sedimentary rocks. They are often assumed to record cyclic sedimentation linked to Milankovitch cycles … . Numerous astrochronological and isotopic analyses, as well as environmental reconstructions, are based on data derived from LMA.”[11]

Origin of LMA unknown

However, researchers really do not know how LMA originate:

> “In spite of the importance of LMA for a range of questions in geosciences, it is not unequivocally understood how they originate. … Interpreting a LMA and its genesis correctly is as important as it is difficult.”[12]

As such, this is yet another way that uniformitarian analogies between present and past break down.

LWAs can form by diagenesis

Some researchers urge caution in using LMA since diagenesis can affect, or even *produce*, the alternation, and therefore the 'right' rhythmites must be carefully chosen for Milankovitch analysis.[13] Diagenesis is alteration of sediment due to chemical, physical, and biological processes that act on sediment between deposition and lithification, excluding alteration due to surficial weathering and metamorphism.[14] Furthermore, carbonate rhythmites are especially prone to diagenesis, and as a result it is difficult to detect any primary cyclicity.[12]

The timescale must first be estimated by radioisotope, paleomagnetic, and biostratigraphic methods to see if the sequence is in the right ballpark, chronologically. Then they need to determine if the cyclicity is primary, originating from sedimentation, as opposed to an artificial cyclicity formed during diagenesis. During this process they would automatically estimate if the cyclicity is close to one of the Milankovitch frequencies. Thus, picking the right sequence and dating the sequences is likely a subtle exercise in circular reasoning.

Because carbonates are especially prone to diagenesis, such as the addition of magnesium ions from fluid flow to form dolostone, carbonate can be redistributed vertically (i.e. it can move up or down within the sediment). It is, therefore, possible that diagenesis can actually cause the LMA alternations from an originally homogeneous muddy limestone, and that the LMAs have nothing to do with Milankovitch cycles.

A test shows that LMA, at least many, are diagenetic

Although tests are available that can check to see whether LMAs are suitable for fine-tuned dating by astrochronology, a new test was recently derived to see whether diagenesis can explain the alternations.[15] Two models, late diagenesis and early diagenesis, were ingeniously tested. The early diagenesis model, which assumes differential diagenesis, worked.

The researchers tested their idea by starting with a homogeneous soft muddy limestone sediment containing small fossils (figure 1). The aragonite fossils in the limestone changed to calcite as the future limestone sublayer cemented early with little compaction (top part of figure 1). Aragonite is a different metastable atomic arrangement of calcite. The sublayer that becomes marl is compacted with total dissolution of the aragonite fossils, which are reoriented during compaction while being buried (bottom part of figure 1).

The researchers gathered four sets of thin sections from Paleozoic carbonate formations. This model passed three tests for the early diagenesis model: (1) recrystallized aragonite fossils appear only in the limestone, (2) the calcite fossils are the same in marl and limestone, and (3) the fossils in the marl have been reoriented due to compaction.

Therefore, a homogeneous muddy limestone can be diagenetically altered to form LMA cycles that have nothing to do with Milankovitich cycles. This would disqualify most LMAs from showing pre-Pleistocene Milankovitch cycles:

> "If further diagenetic process can distort an originally homogeneous sediment until it is undistinguishable from an original difference in lithology, it may become impossible to discern whether the LMA rhythmicity reflects changing depositional conditions [from Milankovitch cycles] or diagenetic processes."[16]

And, worse yet, many researchers do not bother to check for possible diagenesis: "What is more, many scientists still do not consider differential diagenesis in their work on LMA."[15] Based on this research LMA should not be used for showing Milankovitch cycles.

Creation science deductions

Deriving Milankovitch cycles from LMAs is a house of cards and very likely based on circular reasoning. Not mentioned in much research on pre-Pleistocene Milankovitch cycles is how such weak cycles can be translated into such dramatic changes in deposition from purer carbonate to a muddy carbonate, if the LMA cycles are really primary.

Sedimentary rocks are commonly cyclical. These can be explained by abundant internal waves during the Flood.[17] Internal waves are propagating waves on any density discontinuity. They are common today in the oceans, but during the Flood they would be orders of magnitude more common. These have the potential to explain the so-called varvites and other types of rhythmites.

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