Ocean sediments and Deep Time

by Stephen Mitchell Jan 27, 2025

Email: Jesus.inHistandS@gmail.com

Photo by David Boca: https://www.pexels.com/photo/underwater-photo-of-sea-bottom-5466505/

Are there "incontrovertible" reasons to affirm a young Earth? What does it mean to be incontrovertible? Some YEC seem to believe that this means that it is claimed by any YEC author that they appreciate. It is easy to list claims that might sound impressive. What happens if we dig into those claims? Can they stand up to analysis?

If the Earth is 4.5 billion years old and water has been eroding sediments and dumping them into the oceans, why aren't the oceans all filled with sediment? This sounds like a reasonable concern. "Reasons to Affirm a Young Earth". (Humber 2013)

The reason given in this case is:

23. Ocean Floor Mud

Humber gives very little explanation on this particular "reason", but it is used by other prominent YEC authors. For instance, Dr. Andrew Snelling stated, "*If sediments have been accumulating on the seafloor for three billion years, the seafloor should be choked with sediments many miles deep*." (Snelling 2012). Apparently, he believes that geologists consider the oceans to have begun 3 billion years ago and that the processes today can be extrapolated directly back over the intervening time. Some YEC believe that this is inherent in the uniformitarian claim that the present is the key to the past.

The claim is that the amount of sediment that is shed into the oceans and the sediment thickness found there are known. Then, taking into account that a known amount of sediment could have been removed by other processes (plate tectonics), they have used these three numbers to estimate how long it would have taken to deposit that amount of sediment. They then, using the time that geologists believe that these oceans were filling, compare to see if the assumption for sediments depositing over deep time is reasonable. This type of claim involves two sides. It involves the numbers that are used to support the claim. It also involves understanding if these numbers are valid for this use.

First, let's look at the input numbers.

1. How much sediment is shed into the oceans?

Snelling reported on this issue in the 2012 article referenced above and in his book, "Earth's Catastrophic Past: Geology, Creation and the Flood". (Snelling 2009) In 2009, he reported that "*the average rate from a dozen studies is 24,108 million metric tons per year*." He says that these do not include sediment carried along the base of rivers as bedload. In 2012, he reduced his number to "about 20 billion tons of dirt and rock debris". One key paper that he cites is Milliman and Syvitski, (1992). This quote from them should serve as a warning regarding basing too much on the quantitative estimates of sediment discharge.

"What Is the Sediment Flux to the Sea? This question really has two parts: how much sediment is carried by rivers, and how much escapes the present-day land/estuarine environment? The answer to both is more or less the same- we don't know."(Milliman and Syvitski 1992)

A couple of more recent studies can serve as comparison. Dedkov and Gusarov (2006) reported "*The total global suspended sediment yield into the World Ocean equals 15.5 × 10^9 t year*." Notice that they include only the suspended sediment, not the bedload. In another paper, Cohen, et al.,(2022) reported the following, "*Total global particulate load of 17.8 Gt/y is delivered to global oceans, 14.8 Gt/y as washload, 1.1 Gt/y as bedload, and 2.6 Gt/y as suspended bed material*."

Cohen, et al (2022) started their abstract this way, "*Bedload is notoriously challenging to measure and model; its dynamics, therefore, remains largely unknown in most fluvial systems worldwide*." Perhaps this difficulty should be recognized, and we must recognize that the range in uncertainty in these estimates is large. It does tell us that the numbers quoted by Snelling are larger than newer estimates, though this alone would not really change the conclusion.

If we are looking to see the rate of sediment supplied to the sea over geologic time, the present rates are not representative. We will talk about more reasons for this later, but at this point, A key point to the study by Dedkov and Gusarov (2006) was to examine the human impact on sediments supplied to the ocean. They report, "Recent human activity has increased suspended sediment yield into the World Ocean by 2.6 times." Human cultivation and effects on river drainage has had a major impact. If we take Cohen's total particulates and reduce it by 2.6 times, this would mean a total load of 6.8 billion metric tons, significantly less than the 20 assumed by Snelling (2012). Said another way, he is overstating the "problem" by 62%.

Suffice to say that there is considerable uncertainty in the quantity of sediment supplied to the sea off of the current continent configuration that might be used to calculate how much sediment to use in equations to assess this claim.

2. How much sediment is in the oceans?

How well do we know how much sediment is in the ocean? Fortunately a number of studies have been published. Snelling and young earth authors reporting this issue refer to a 1988 paper by Hay, Sloan and Wold (Hay, Sloan II, and Wold 1988). This is a good paper, but one issue is that it is really studying the sediment that is found on the ocean floor without addressing the sediment on the continental shelf, following the practice of earlier studies (**Figure 1**). Along active tectonic margins like California, this not included shelf area is narrow, but along many margins, this represents a thick area with major deposition.

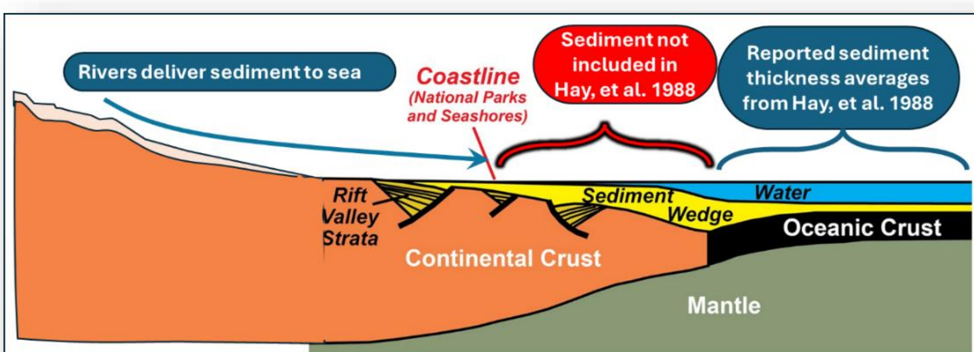

Figure 1. *Illustration of ocean sediment not in the models used. (figure expanded from https://www.nps.gov/subjects/geology/plate-tectonics-passive-continental-margins.htm)*

The most current estimates include this shelfal area and also are able to include other sediments that just were not included in earlier estimates. Straume, et al (2019) provide the latest major study and they estimate the average thickness to be over twice the estimates given by Snelling and other YEC authors. They report: “In addition, we calculate the total volume of sediments in the oceans, which shows an increase of 29.7%, compared to previously published global maps.” (Straume et al. 2019)” **Figure 2** shows this in map view. The large blue areas on this map represent large areas with very little sediment accumulation. Why would that be? In fact, this is not surprising at all. It would be very difficult to get any sediment from the erosion of continents onto these. Locally thicker sediments can be shed off of volcanic islands, but the main source of the sediments is the slow rain of organic matter forming an ooze, a real technical term for slimy muddy material formed this way. Thick sediments in these areas would really require special explanation but we don’t find them.

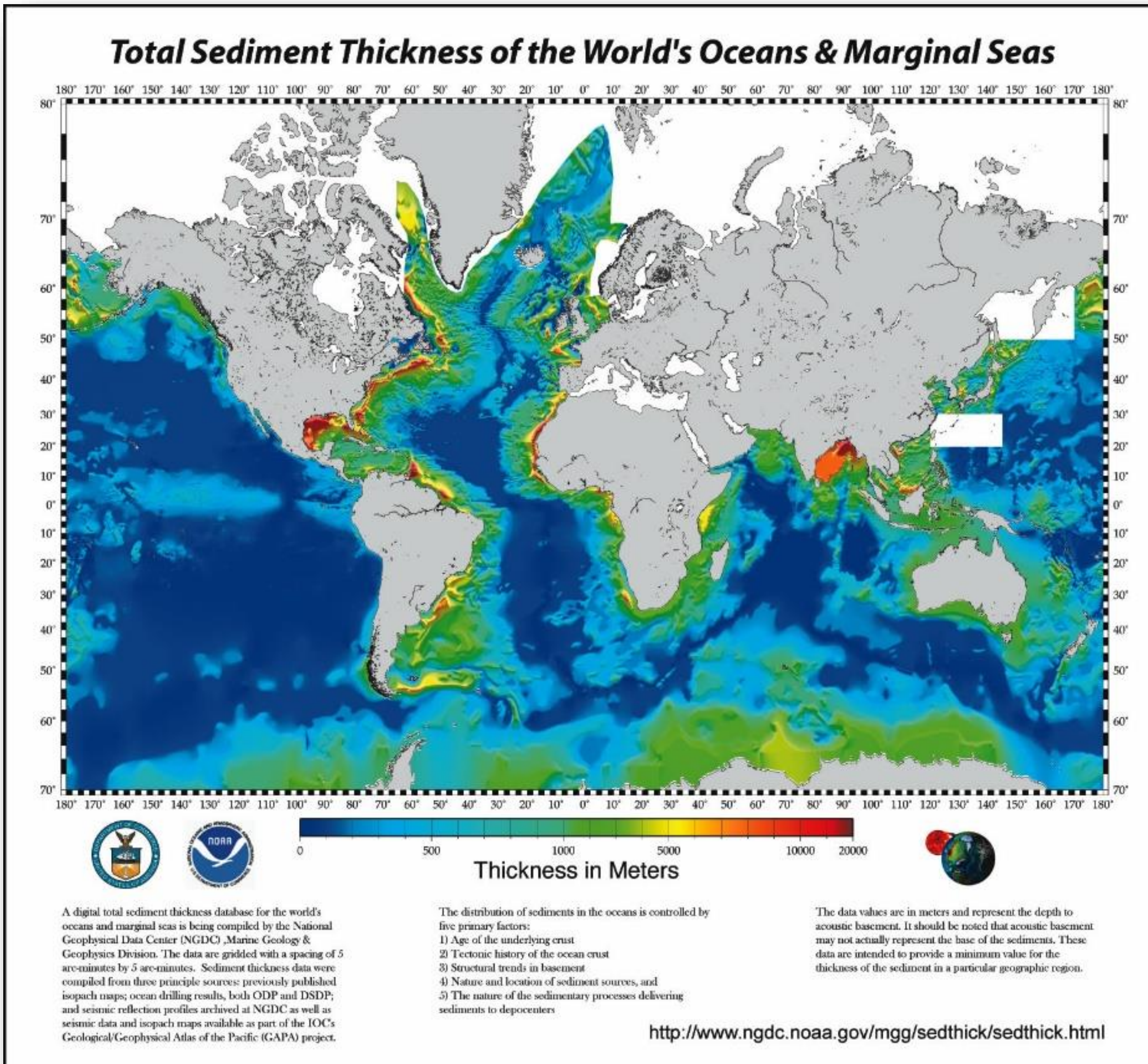

Figure 1: *Sediment thickness of the World's Oceans and Marginal seas. (Straume et al. 2019)”*

Notice that the thickest sediments in the ocean are in the Gulf of Mexico and in the Indian Ocean where they were shed off of the Himalayan Mountains. Much of the thickest sediment accumulation would not have been included in the study by Hay, et al, 1988. Hay's study had the purpose to study the accumulation on the abyssal ocean bottom. YEC estimates report that the thickness is less than 400 meters thick, based on Hay's study (Snelling 2009; 2012; Humber 2013; Tomkins and Clarey 2021). Straume, et al. (2019) reported an average sediment thickness of 927 m.   Thus we have an increase in the amount of sediment in the ocean by 56% over the estimate quoted by YEC authors. So far, the sources of data used seem to have been inappropriate and/or passed by with newer data.

3. How much sediment is removed by other processes?

So far, we have less sediment flowing into the ocean and we have more sediment in the oceans. The effect of these, less input and more output, suggests that the sediment accumulation would have taken longer to form.   Are there other ways that could remove sediment and thus increase the amount of time required? One key component of plate tectonics is that along plates that are colliding, sediment is caught up with subducting plates and lost to the crust. Snelling reports, "Only 1 billion tons (5%) are removed by tectonic plates" (Snelling 2012). Again, several estimates have been made. Stern (2002) observed this:

> *"Estimates of the mass of sediments subducted annually range from about 1 10^{15} g/yr [Veizer and Jansen, 1985; Hay et al., 1988] to 3–4 10^{15} g/yr [von Huene and Scholl, 1991]"* (Stern 2002)

It is worth noting that Hay, et al (1988) considered their estimate of *1 10^{15} g/yr* a minimum number. While the first numbers quoted formed the basis for the estimate quoted by Snelling, what if the later number by Von Huene and Scholl (1991) is valid? Consider this scenario, with the units converted. If we take the total particulates presented by Cohen, et al. (2022), reduce them by 2.6 times as proposed by Dedkov and Gusarov (2006), this would mean a total load of 6.8 billion metric tons supplied by rivers each year. The plate tectonics loss determined by Von Huene and Scholl (1991) of up to 4 billion metric tons per year, then, taking into account the increased sediment thickness when the continental shelves are included, it begins to look like the amount of sediment is almost balanced by the amount lost by plate subduction.

4. How long do geologists believe the ocean floor sediment took to be deposited?

Last May, my wife and I took a driving vacation including a short excursion into Washington, D.C. We didn't go straight there by any means and it took much more time than would have been required to go directly there. Imagine that a friend asks "how long did it take you to get to the capitol? I could have answered truthfully that it took me 68 years to get there. Such an answer would have been factual, but probably not helpful to the questioner. Given that we went approximately 2000 miles to get there, our average rate of travel would have been really slow considering the 68 year time. We would have been travelling at a gruesomely slow rate of 0.003 miles per hour, roughly a literal snail's pace. We actually spent 12 days traveling, including a bit of unscheduled layover for car repair. This equates to about 7 miles per hour and given that we weren't actually driving for much of the time, that is a bit more representative.

Calculating the time it took to deposit the sediment in the ocean is a bit like this as well. If YEC want to say that the deep time explanations for the filling of the oceans do not work, then they need to use the actual time durations accepted my modern geology. Dr. Snelling, as quoted earlier referred to 3 billion years of ocean filling. In a since it is true that geologists believe that oceans have been filling for that time, just as it took me 68 years to get to Washington, D.C. On the other hand, geologists believe that the current oceans have been filling for much less time. One could consider the current configuration of the continents and the sediment filling the oceans to have been taking place perhaps since the beginning of the Jurassic, approximately 200 million years ago. Olson, et al., (2016) writing on "Variation of ocean sediment thickness with crustal age" used roughly the beginning of the Cretaceous period, 150 million years ago as the period of time to be investigated. That tells us that if we compare these numbers to Snelling's figure of 3 billion years ago, geologists believe that much less time was involved (93 – 95% less) in the deposition of the sediments on the seafloor. This fact is recognized by Snelling (2009) and Tomkins and Clarey (2021), but it is more dramatic to misrepresent modern geology by speaking of 3 billion years.

Other Factors

The factors discussed so far can easily account for the modern sediment supplied to the oceans. But wait… there's more (a bit like the adds for wonderful devices sold on TV). **First** remember that geologists believe that the Earth's history was dynamic. We cannot look at the rivers of today and assume that what we see today was constant over the last 150 million years. This becomes important in several ways. First, at times in the past, oceans covered much of today's continents. Thus rivers in those periods were dumping sediments into the seas, but the sediments that were laid down are on today's continents and were not included in the sediment thicknesses used for YEC claims. **Figure 3** shows a paleogeographic map of what we believe the continents looked like 94 million years ago. (Scotese, n.d.). Notice that large portions of the modern continents were covered by seas. Rivers dumped sediments into these ancient seas but it does not appear in the YEC calculations. When I was exploring for gas in South Texas, I wanted to study outcrop analogs for the Cenozoic wave-dominated deltas that formed the sands that were our targets. I went on a great field trip to Utah to study Cretaceous wave-dominated deltas there. They were sands fed by rivers to the sea. How significant are these onshore deposits? **Figure 4** shows the total sedimentary thickness maps for North America and the surrounding oceans. (Mooney and Kaban 2010) Much of that sediment is less than 150 million years old and would then add to the sediment record of ancient river deposition.

In assuming that geologists view the present as same as the past, the YEC interpretations are strawman arguments in another way as well. Geologists recognize that over the last 3 billion years many changes have taken place that would have dramatically impacted the amount of sediment shed to the ocean. Over the last 150 million years the overall climate trends have varied. If we zoom into the last 450,000 years, it has varied very sharply. (**Figure 5**) Colder periods are expected to have higher rates of sediment washed to the seas. Colder wet periods had more rainfall. Large continental glaciers pushed continents lower, but when the glaciers retreated, the continents rebounded as we measure them doing today in North America and the Nordic regions. In fact, the amount of sediment delivered to the sea over the recent thousands of years still feels the effect of glaciation to increase rates over earlier rates and then we have the added impact of human that increased them even more.

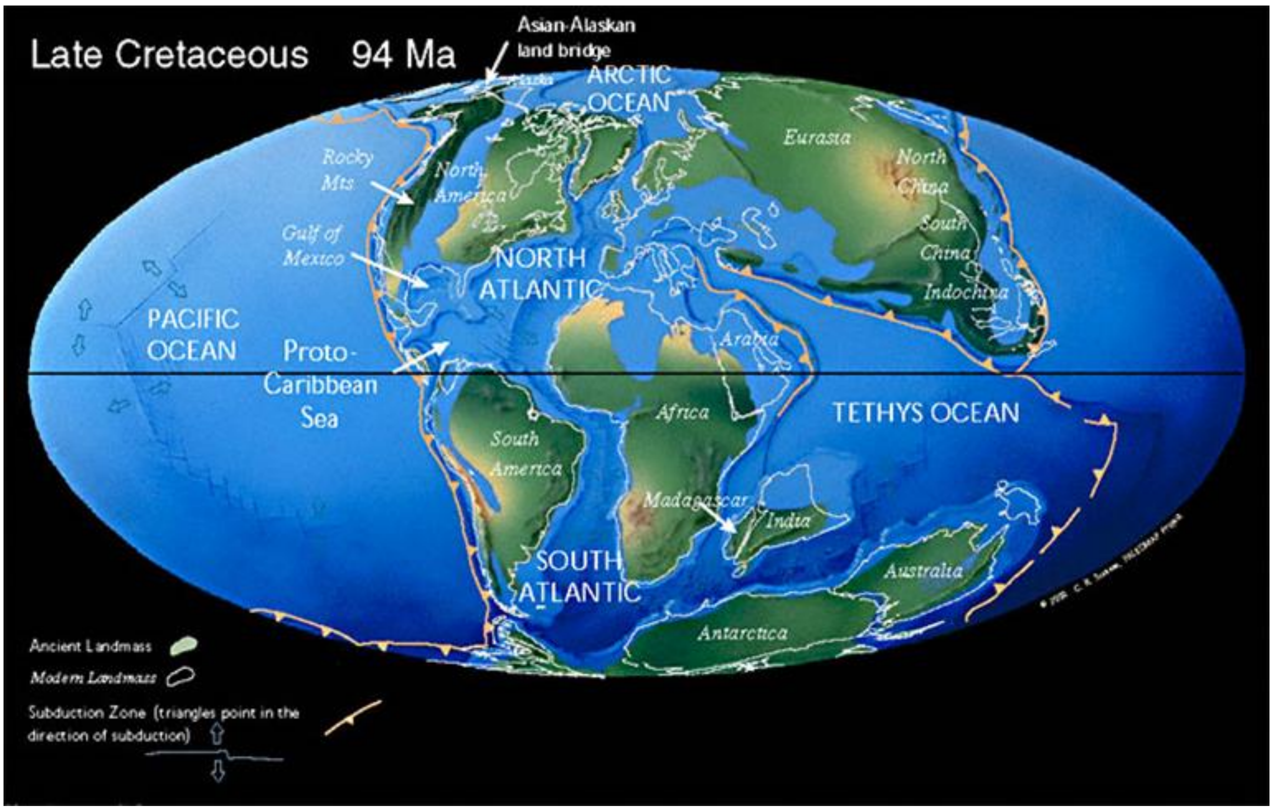

Figure 2. *Where did ancient rivers dump their sediment? This helps. Paleogeographic map of the Late Cretaceous from Christopher Scotese.* [*http://www.scotese.com/cretaceo.htm*](http://www.scotese.com/cretaceo.htm)

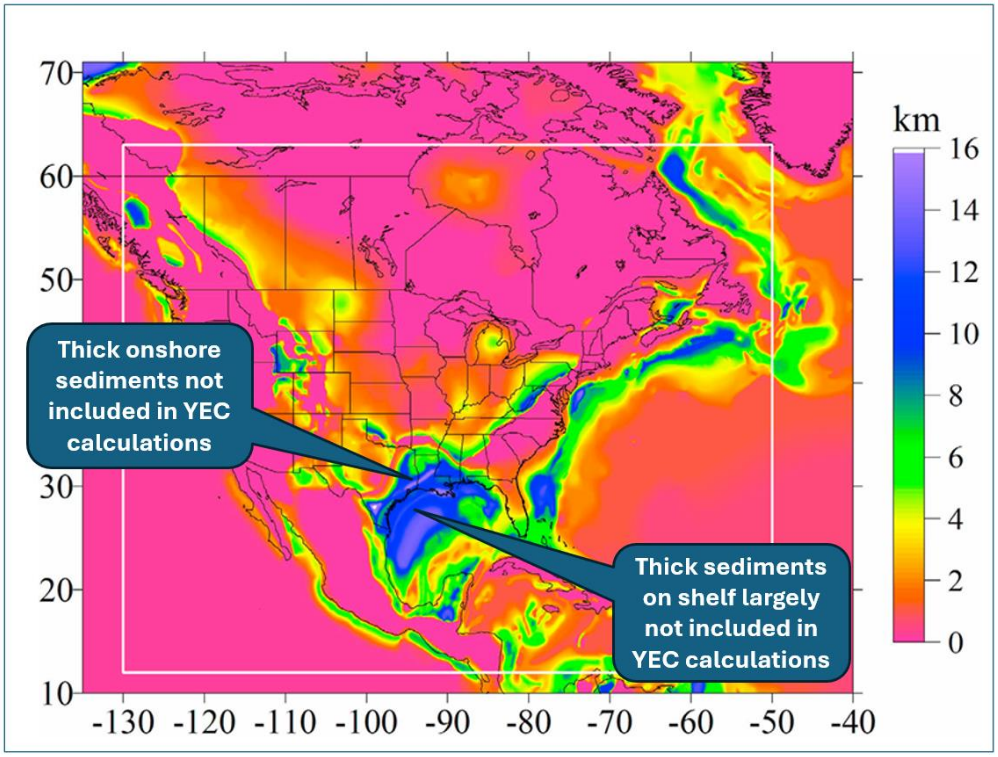

Figure 3. *Sediment thickness map for Norh America. Note that the colors are reversed from Figure 2. Thickest sediments are blue in this map while they are dark red on the other map. (Mooney and Kaban, 2010)*

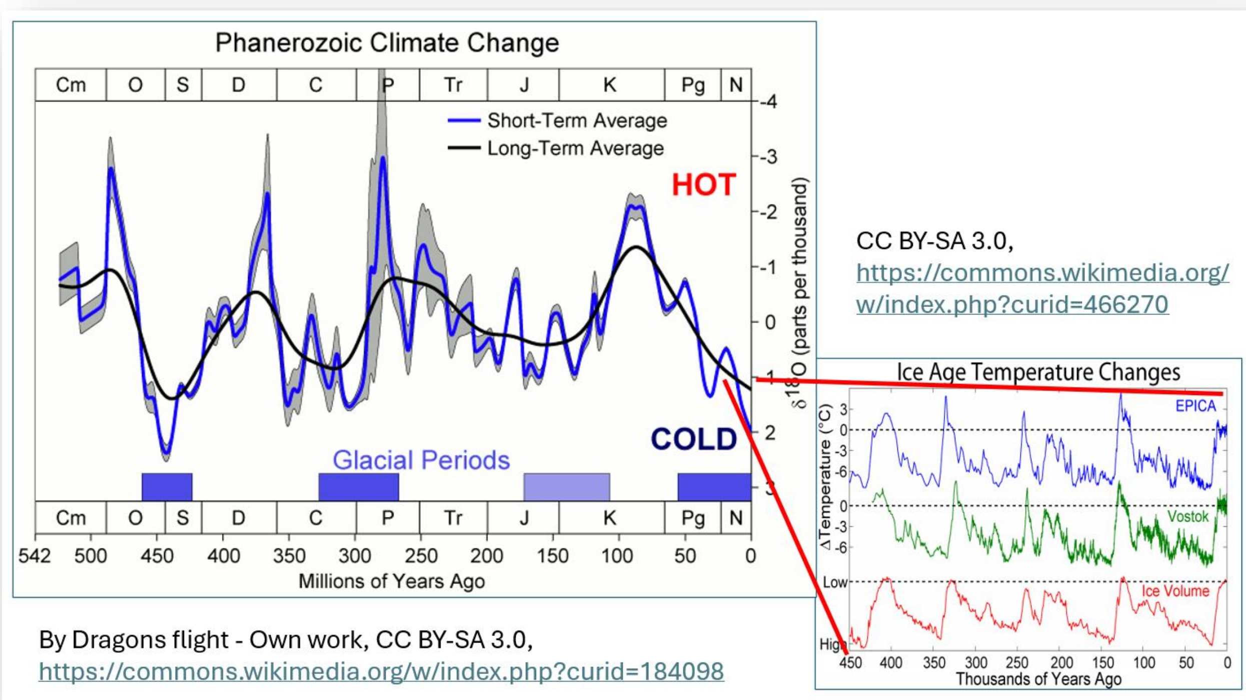

Figure 4. *Major climate changes recoded through geologic time. Inset shows that the last 450 thousand years has experience many shorter order cycles. Figures from Wikipedia.*

Conclusion:

In this post, I have examined the sources and support for the claim that there just isn't enough sediment on the ocean floor to support deep time. This claim is not isolated to Paul Humber or Andrew Snelling. In general, the reports seem to just parrot earlier claims without anyone looking at later work or critically assessing the details.

They overestimate the sediment supplied to the oceans today and neglect to compensate for the impact of humans on current rates. They assume that the current rates should be extrapolated back over hundreds of millions or billions of years despite abundant evidence that for much of the last 150 million years of deep time, less sediment would have been delivered to the oceans. Much of that which reached the seas would be found on today's continents and this is not included.

The average thickness on the ocean floor is reported to be 400 meters. We have seen that this neglects to include the major deposits by rivers along the continental shelf. If included this would have more than doubled the average thickness. Thick deposits on the abyssal floor should not be expected because sources from the continents just would never have reached them. No one proposes a way to estimate how much sediment is shed each year from the continental shelf to the lower slope or basin floor. Ultimately this alone invalidates the YEC proposals.

Their assumption of how much sediment on the ocean floor exits by way of plate tectonics and plate subduction is likely low. It is reasonable to conclude that the sediment input from rivers fits well the amount of sediment on the seafloor. The balance of inputs with that exiting by subduction is what one should expect from a system designed by a highly intelligent benevolent creator preparing a planet for mankind.

References Cited

Cohen, Sagy, Jaia Syvitski, Thomas Ashley, Roderick Lammers, Balazs Fekete, and Hong-Yi Li. 2022. "Spatial Trends and Drivers of Bedload and Suspended Sediment Fluxes in Global Rivers." *Water Resources Research* 58 (6): e2021WR031583. https://doi.org/10.1029/2021WR031583.

Dedkov, A P, and A V Gusarov. 2006. "Suspended Sediment Yield from Continents into the World Ocean: Spatial and Temporal Changeability." In *Sediment Dynamics and the Hydromorphology of Fluvial Systems*, 3–11. Dundee, UK. https://iahs.info/uploads/dms/13527.05-3-11-Dedkov---Gusarov-306.pdf.

Hay, William W., James L. Sloan II, and Christopher N. Wold. 1988. “Mass/Age Distribution and Composition of Sediments on the Ocean Floor and the Global Rate of Sediment Subduction.” *Journal of Geophysical Research: Solid Earth* 93 (B12): 14933–40. https://doi.org/10.1029/JB093iB12p14933.

Huene, Roland von, and David W. Scholl. 1991. “Observations at Convergent Margins Concerning Sediment Subduction, Subduction Erosion, and the Growth of Continental Crust.” *Reviews of Geophysics* 29 (3): 279–316. https://doi.org/10.1029/91RG00969.

Humber, Paul G. 2013. *Reasons to Affirm a Young Earth*. Vol. e-book revision. https://static1.squarespace.com/static/54235fb7e4b0dab08d8d81dd/t/57d6e6b3d482e999611d7888/1473701556828/ReasonsAffirmYE+CRS+e-book.pdf?fbclid=IwZXh0bgNhZW0CMTAAAR0J_JCi_6zH1KuNlHYrglJjTAhCgOm4zwio8ks44k5CGnJIAiETnqThXLI_aem_BA94GfB1gm5q86tQj_pW2w.

Milliman, John D., and James P. M. Syvitski. 1992. “Geomorphic/Tectonic Control of Sediment Discharge to the Ocean: The Importance of Small Mountainous Rivers.” *The Journal of Geology* 100 (5): 525–44. https://doi.org/10.1086/629606.

Mooney, Walter D., and Mikhail K. Kaban. 2010. “The North American Upper Mantle: Density, Composition, and Evolution.” *Journal of Geophysical Research: Solid Earth* 115 (B12). https://doi.org/10.1029/2010JB000866.

Olson, Peter, Evan Reynolds, Linda Hinnov, and Arghya Goswami. 2016. “Variation of Ocean Sediment Thickness with Crustal Age.” *Geochemistry, Geophysics, Geosystems* 17 (4): 1349–69. https://doi.org/10.1002/2015GC006143.

Scotese, Christopher R. n.d. “Paleomap Project: Cretaceous.” Paleomap Project. Accessed January 14, 2025. h.

Snelling, Andrew A. 2009. *Earth’s Catastrophic Past*. Institute for Creation Research. http://isgenesishistory.s3.amazonaws.com/digital%20downloads/earth-catastrophic-past-1-preview.pdf.

Snelling, Andrew A. 2012. “Very Little Sediment on the Seafloor; Best Evidences from Science That Confirm a Young Earth.” Answers in Genesis. October 1, 2012. https://answersingenesis.org/geology/sedimentation/1-very-little-sediment-on-the-seafloor/.

Stern, Robert J. 2002. “Subduction Zones.” *Reviews of Geophysics* 40 (4): 3-1-3–38. https://doi.org/10.1029/2001RG000108.

Straume, E. O., C. Gaina, S. Medvedev, K. Hochmuth, K. Gohl, J. M. Whittaker, R. Abdul Fattah, J. C. Doornenbal, and J. R. Hopper. 2019. “GlobSed: Updated Total Sediment Thickness in the World’s Oceans.” *Geochemistry, Geophysics, Geosystems* 20 (4): 1756–72. https://doi.org/10.1029/2018GC008115.

Tomkins, Jeffrey P., and Tim Clarey. 2021. “The Oceans Point to a Young Earth.” ICR. Acts and Facts. November 30, 2021. https://www.icr.org/article/oceans-young-earth.