CSS-67a

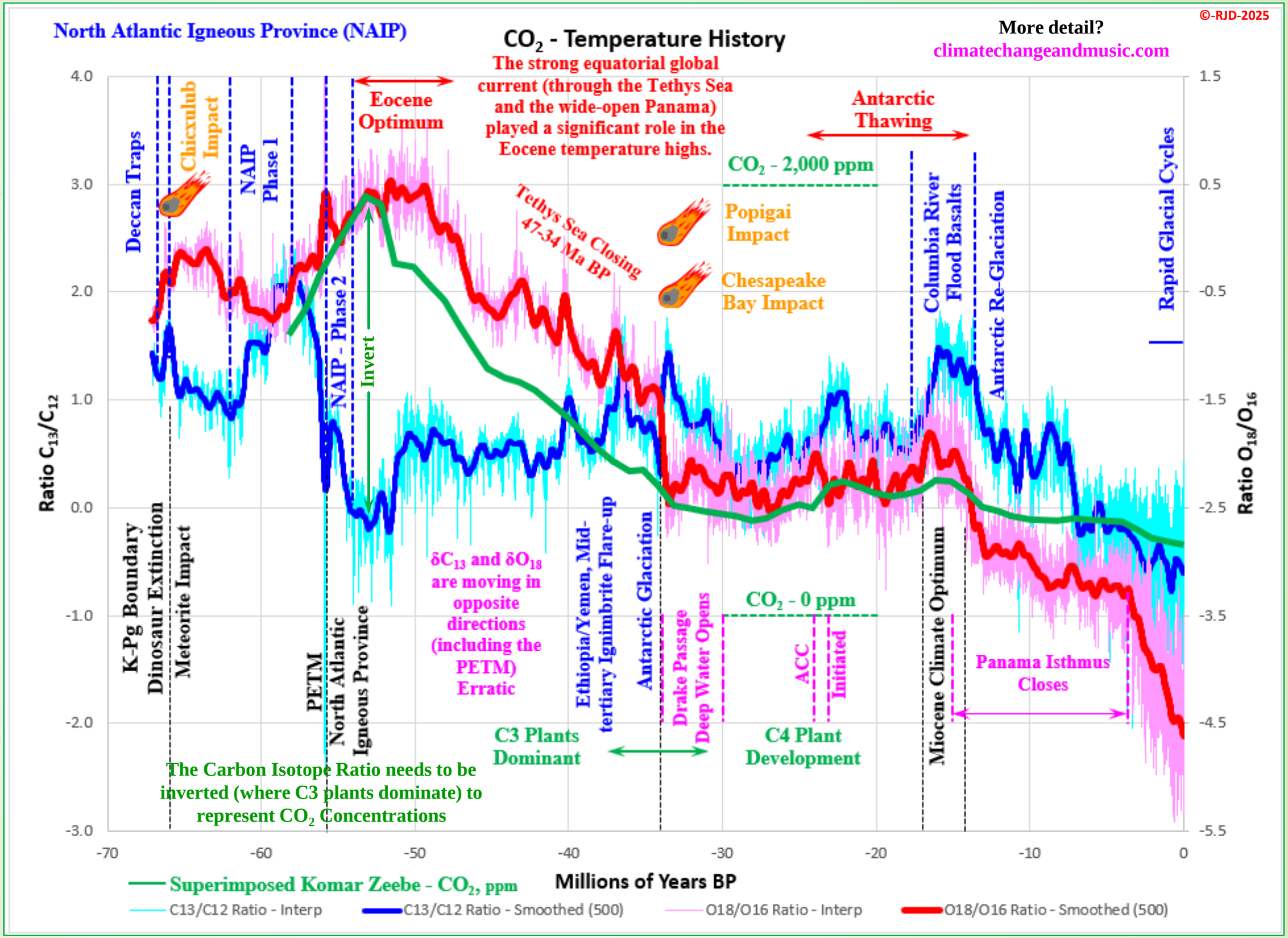
# Westerhold et al (2020) Cenozoic Isotope Data

**Oxygen Isotope Ratio**
**Temperature Indicator**
$\delta O_{18} \equiv O_{18}/O_{16}$
**Carbon Isotope Ratio**
**$CO_2$ Concentration Indicator**
$\delta C_{13} \equiv C_{13}/C_{12}$

**Back in 2020 Westerhold et al published their "*An astronomically dated record of Earth's climate and its predictability over the last 66 million years*" paper. In Westerhold's words, "Much of our understanding of Earth's past climate comes from the measurement of oxygen and carbon isotope variations in deep-sea benthic foraminifera".**

**$CO_2$/Temperature Cenozoic**

**The carbon and oxygen isotopes represent $CO_2$ and temperature levels. The isotope ratios (covering the Cenozoic) are plotted to the right. Note, when C3 plants dominate, the carbon isotopes have to be inverted to represent $CO_2$ concentrations. I have added the Komar-Zeebe $CO_2$ reconstruction to show the $CO_2$ changes. More detailed discussion in CSS-10 – A Ride Through the Cenozoic.**

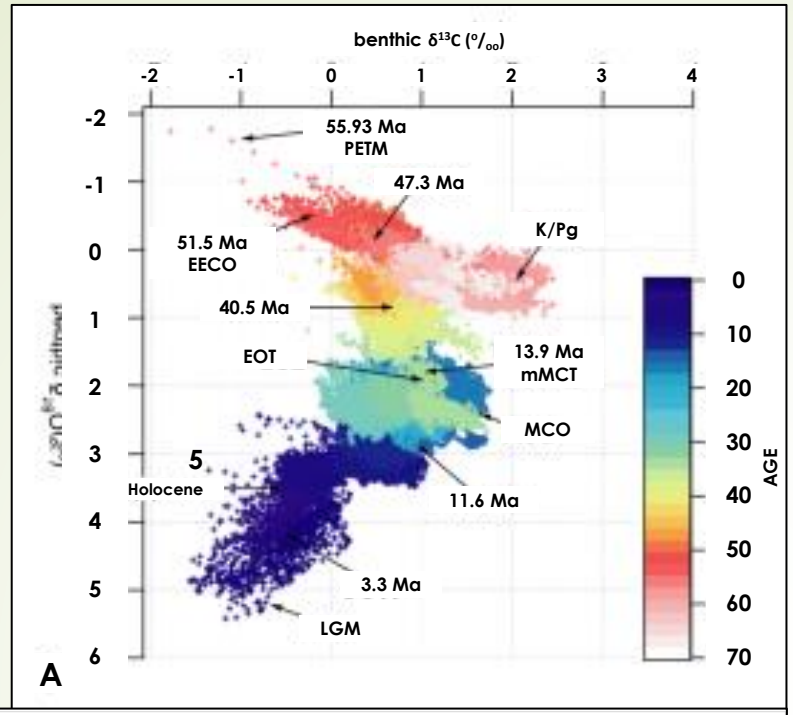


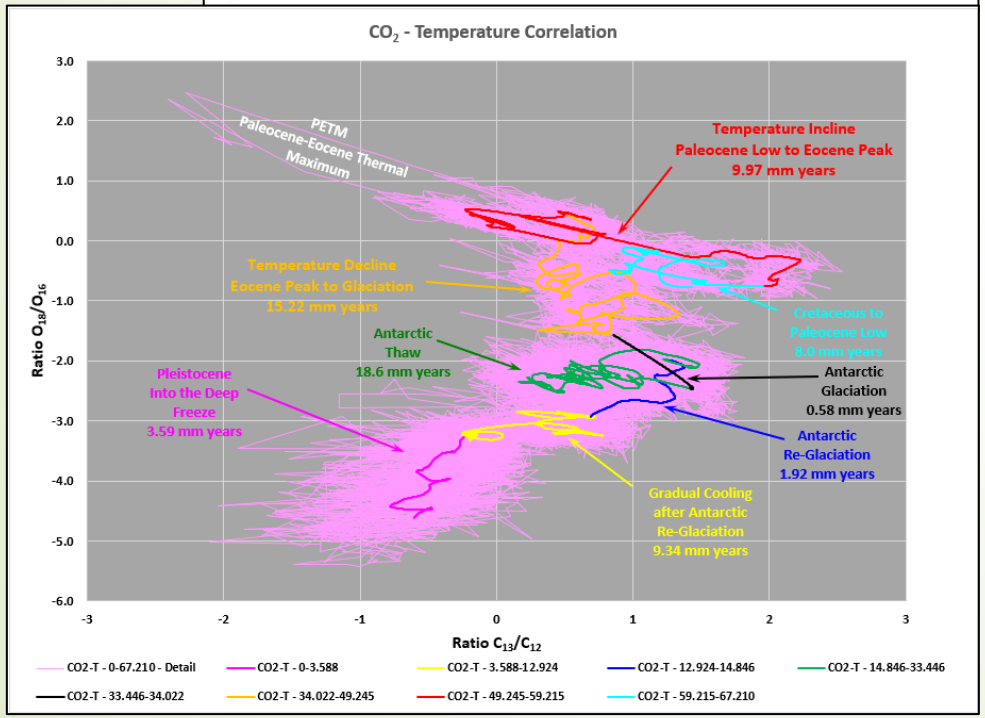
# $CO_2$/Temperature – Cenozoic – $\delta O_{18}$ and $\delta C_{13}$ X-Plots

The Westerhold plots to the right are directly from the paper. $\delta O_{18}$ is plotted against $\delta C_{13}$ in the upper left plot (A) and $CO_2$ in the lower right plot (D). Clearly $CO_2$ and temperature are not correlating over the Cenozoic. The plot directly to the right is just an inverted plot of Westerhold's 'A' plot. I generated the bottom left plot (like Westerhold's inverted plot). I do not have the algorithms/conversion factors (or data tables) to reproduce the $CO_2$ concentrations. $CO_2$ ($\delta C_{13}$) and temperature ($\delta O_{18}$) do not correlate over the Cenozoic. Climate change over the Cenozoic is being driven by plate tectonics and the

$\delta C_{13} \equiv C_{13}/C_{12}$
$\delta O_{18} \equiv O_{18}/O_{16}$
Xplots

associated changes in ocean currents (i.e.: heat distributions). The planet cooled as the Tethys Sea closed (moving from the Eocene temperature highs to the Oligocene glaciation, helped by two celestial impacts). The Panama Isthmus closing, added on.

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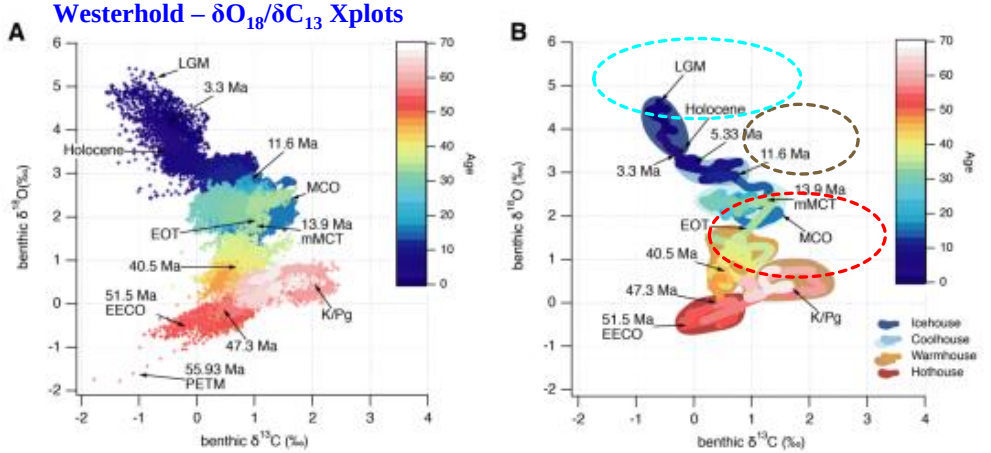
From Supplementary Resources (2) (Link below)

Science AAAS

https://www.researchgate.net/publication/344230305_An_astronomically_dated_record_of_Earth%27s_climate_and_its_predictability_over_the_last_66_million_years

Westerhold – $\delta O_{18}/\delta C_{13}$ Xplots




Westerhold – $\delta C_{13}$ & $\delta O_{18}/CO_2$ Xplots

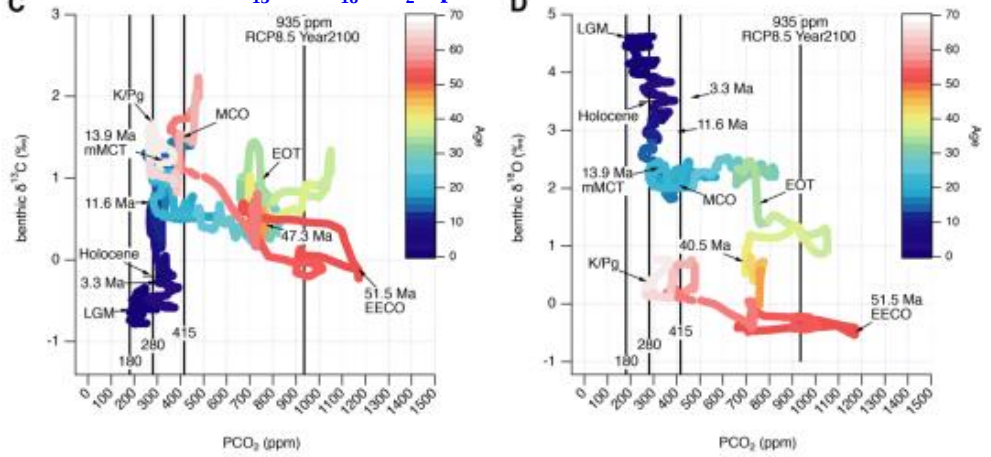


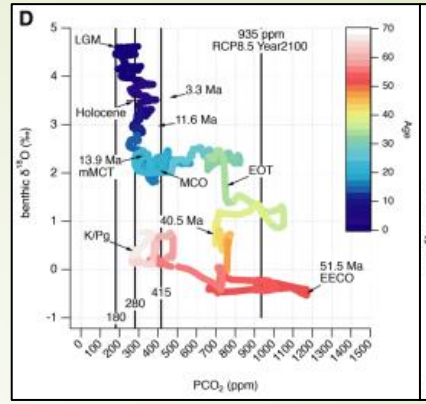

**Fig. S35.**

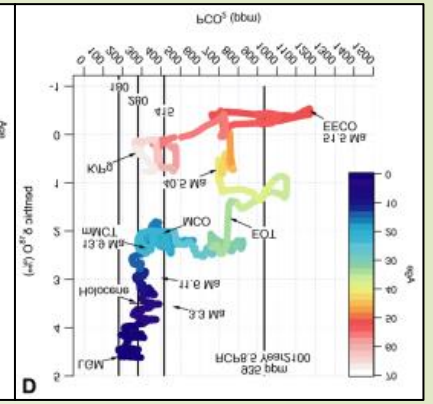
Scatter plots of deep-sea benthic high-resolution (A) and long-term (B) carbon versus oxygen isotope data variations as well as long-term atmospheric $CO_2$ concentrations versus benthic carbon (C) and oxygen (D) isotope data. The relation to atmospheric $CO_2$ concentrations for both carbon and oxygen, as representative for the global carbon cycle and temperature trends, suggests that the present climate system as of today 415 ppm $CO_2$ is comparable to the Coolhouse in the Miocene, but will move abruptly into the Warmhouse or even Hothouse by 2100 if emissions of $CO_2$ are not diminished.

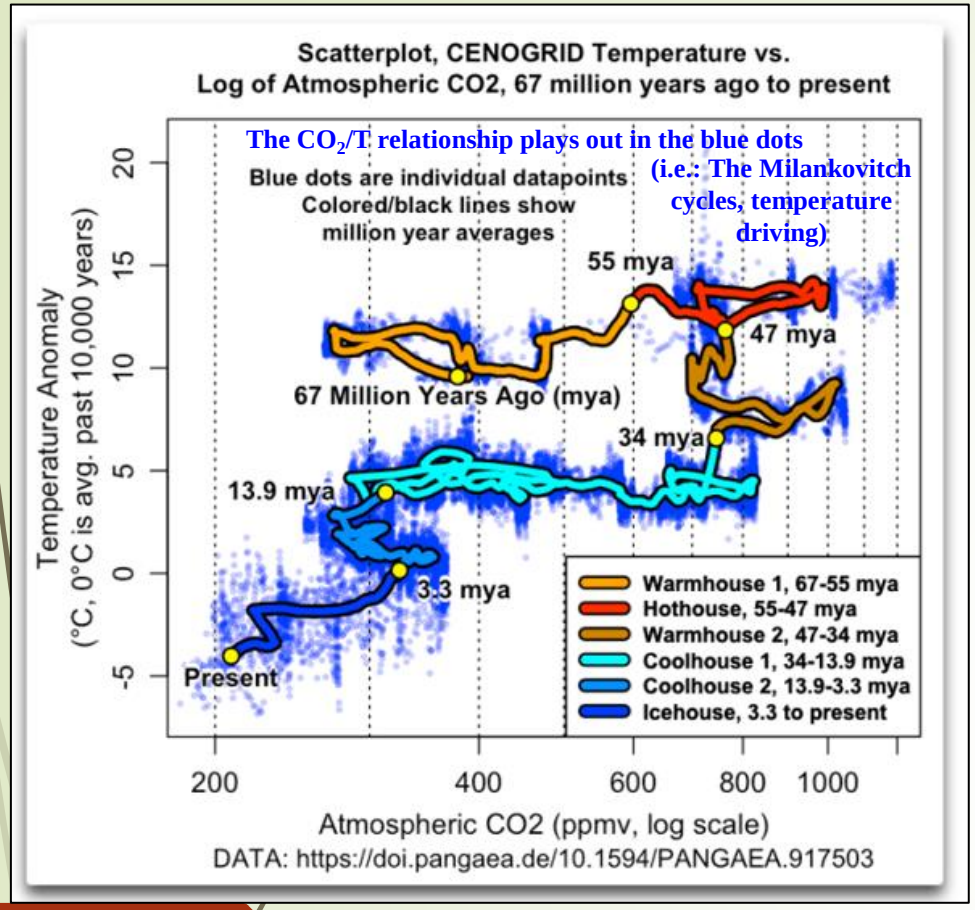
CSS-67c

# $CO_2$/Temperature – Cenozoic

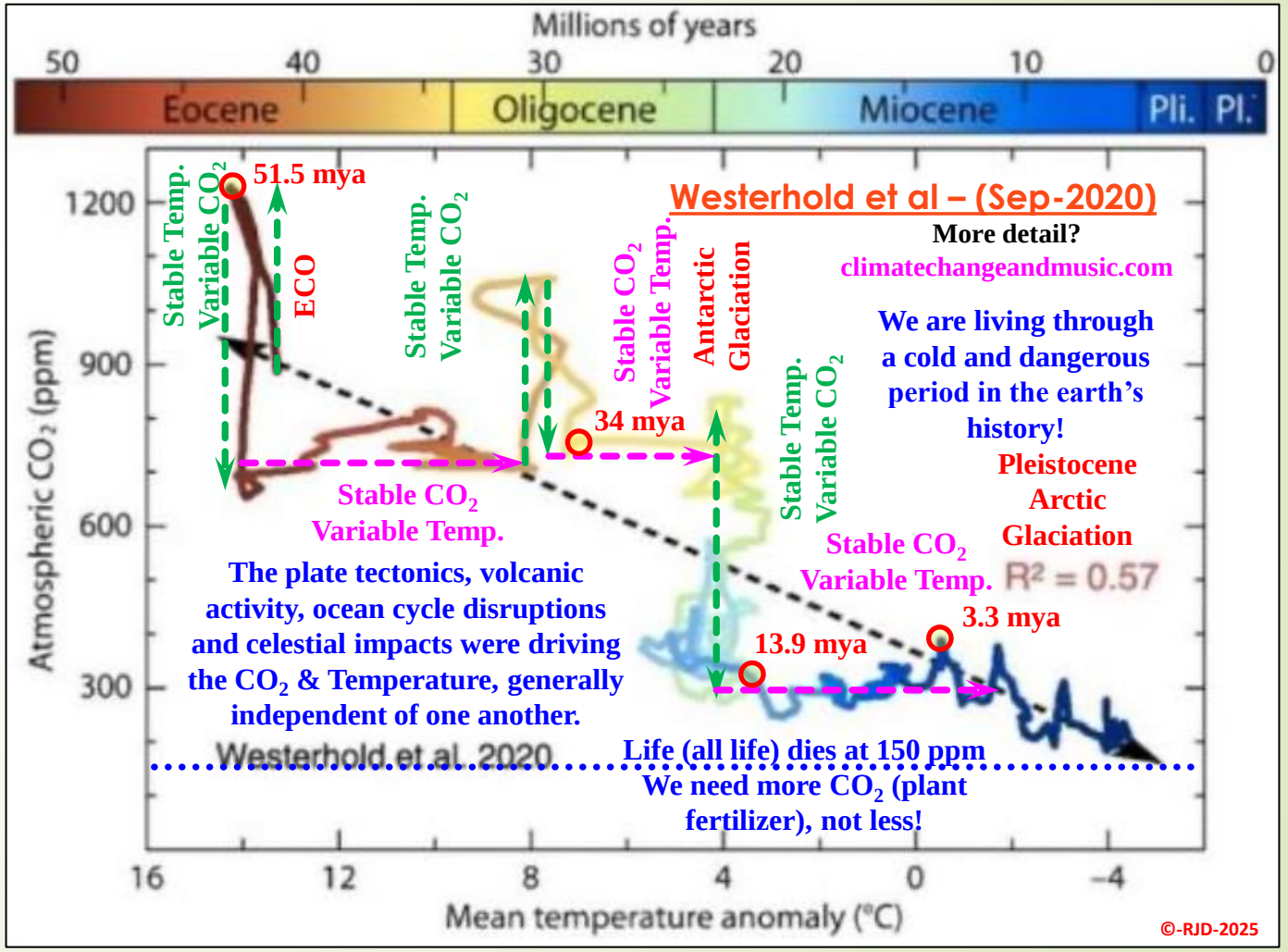
**The two plots to the right are the same data set (plot D from the previous slide), the plot to the far right has just been turned upside down to use as a transition to Willis Eschenbach's version using log($CO_2$) on the x-axis. The next slide comes from my CSS-10 post and has some detailed visuals and discussion based on the Eschenbach version, but applicable to the other versions shown here.**




**The large graph, bottom right, just switches the X and Y scales, showing the $CO_2$ and temperature declines during the Pleistocene Ice Age we are currently living through. The data Westerhold has put forth/analyzed is informative and important. Sadly, he has chosen to throw in with the alarmist community by superimposing the model output for an RCP8.5 emission run on plot 'D'. Implying that if $CO_2$ levels get to 935 ppm (they won't), our temperatures will be back up to Eocene Climate Optimum levels (a time where life thrived). That totally contradicts the $CO_2$ /temperature data over 99.98% of the Cenozoic. Up until the Pleistocene Ice Age (roughly 3 million years ago), temperatures and $CO_2$ moved independently of one another, switching between periods of relatively stable temperature and variable $CO_2$ levels and periods of stable $CO_2$ and variable temperatures. Temperatures (driven by orbital dynamics) have driven $CO_2$ levels over the Pleistocene Ice Age. The general trend in both has been lower.**




**$CO_2$/Temperature Cenozoic**

# CSS-67d (CSS-10a) $CO_2$/Temperature – Cenozoic - Summary

More detail? climatechangeandmusic.com

I am starting this Climate Short Story (CSS) with the (spoiler alert) main take away. This plot summarizes the Cenozoic climate patterns fairly succinctly (more detail in further slides). The dominant features of this plot are outlined below.

1. The Cenozoic is roughly divided into six stable climate platforms typified by relatively stable temperatures despite wide ranges of $CO_2$ (FECKLESS indeed).
2. The platforms are separated by a variety of geological and catastrophic events that appear to initiate/transition the climate to the new platforms (celestial impacts, major volcanic intrusions, major oceanic current disruptions (whether new or shutting down).
3. The cooling from the Eocene Climate Optimum (Hothouse) to the Pleistocene Deep Ice Age (Coldhouse) is correlated directly to the rising Cosmic Ray Flux that underpins the general cooling.

## QUICK SUMMARY

**$CO_2$ is not playing a major role and is likely rising and falling with the changes in the detailed global temperatures. The main drivers are the major geological and catastrophic events combined with the continuous natural cooling associated with increasing cosmic ray flux.**

1.3 Reference Bar Discussion (next page)- Virtually all $\delta C_{13}/CO_2$ is within the range of historical temperature influence throughout the Cenozoic.

Apart from $CO_2$ being a FECKLESS GreenHouse Gas (CSS-7), the historical information does not provide a lot of information that helps us predict our climate future. $CO_2$ is rising and will exert a warming effect (magnitude (?)). So, what parameters might push cooling?

**$CO_2$/Temperature Cenozoic**

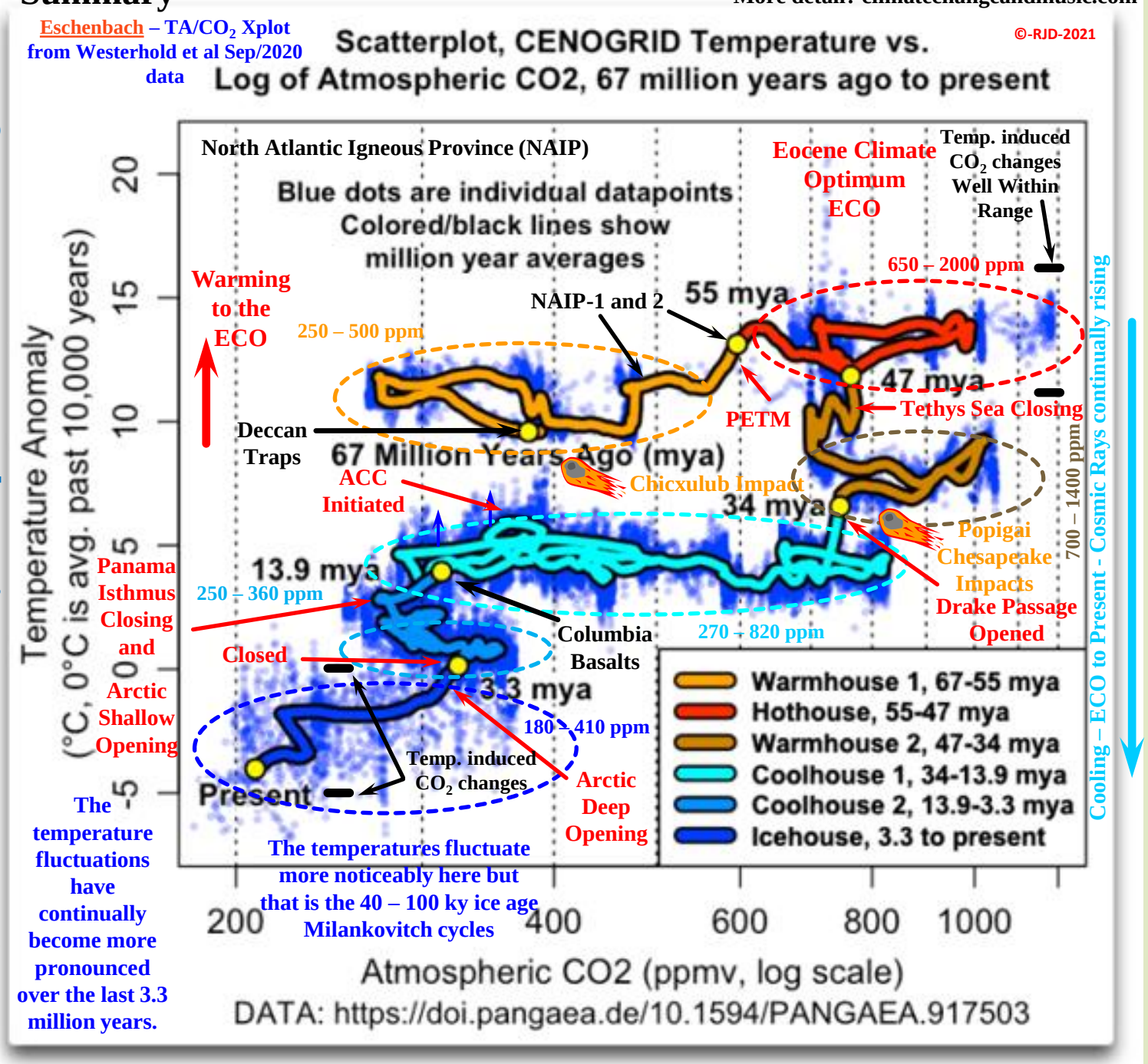
3-4: Panama Isthmus, Arctic Deep
13-17: Panama Volcanics, Columbia Basalts, Glaciation, Arctic Shallow
30-40: Chesapeake, Popigai Impacts, Ethiopian Volcanics, Glaciation
34-47: Tethys Sea closing
54-56: NAIP-P2, PETM
58-62: NAIP-P1
66-67: Deccan Traps, Chicxulub Impact

1. Milankovitch Cycles (eccentricity, obliquity and precession all headed cooler, Insolation, slightly cooler).
2. Ocean Cycles (AMO – cooling, PDO – cooling, ENSO – cooling)
3. Solar Activity (TSI decreasing and accelerating as we move further into the Modern GSM).
4. Volcanic Activity (increasing aerosols (i.e.: cooling), typical in GSMs)
5. Possible near-term catastrophic events (Beaufort Gyre release, lower latitude ice migration, solar micro-nova, Bill Gates' geo-engineering)

But sure, we need to worry about $CO_2$, a, non-toxic, essential to life, trace gas!!

GSM – Grand Solar Minimum. The real "Climate Change" existential threat is right around the corner. Do the Research!

Eschenbach – TA/$CO_2$ Xplot from Westerhold et al Sep/2020 data




The temperature fluctuations have continually become more pronounced over the last 3.3 million years.

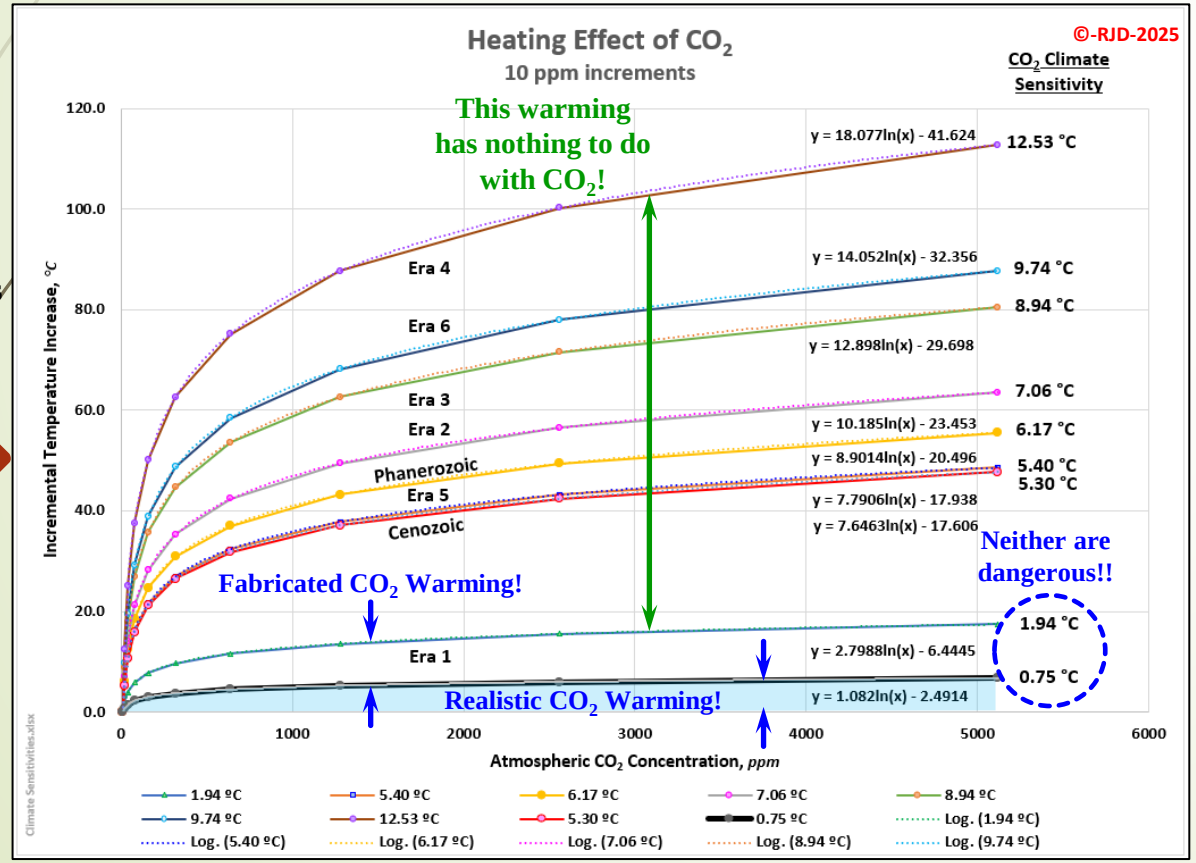
The temperatures fluctuate more noticeably here but that is the 40 – 100 ky ice age Milankovitch cycles

# CSS-67e Westerhold et al (2020) – $CO_2$ Climate Sensitivity

**Westerhold et al's 2020 data set covers Eras 2 through 5 (the bulk of this data). The relationship between $CO_2$ and temperature is defined by $CO_2$'s climate sensitivity (i.e.: how much warming can be expected if $CO_2$ doubles?). The IPCC uses a range of sensitivities in their models (1.8 °C to 5.7 °C, the Equilibrium Climate Sensitivity, ECS). Their models have been self-acknowledged to "run way too hot" (i.e.: the ECS is lower than 1.8 °C). Hardly "settled science". With the Urban Heat Island effect and a proper recognition for solar activity rolled in, the ECS is more likely in the 0.8 °C range. A more detailed discussion can be found in my OPS-80 – $CO_2$ Affects Temperature but Does $CO_2$ Drive Climate post. These two charts are from that post. The chart to the right shows a general correlation between $CO_2$ and temperature. However, that is not the whole story. Correlation does not equal causation, the temperature curve is linear while the $CO_2$ curve is logarithmic, and the $CO_2$/temperature relationship must be factored in. There is only one correct answer to the question, what is $CO_2$'s ECS. And it must be applicable to every situation. An analysis of the entire dataset definitively shows that there is a lot more going on than just $CO_2$. Any value above 1.94 °C (which assumes that all the ±1 °C recent warming is from $CO_2$) is due to natural forcings (not $CO_2$).**

## $CO_2$ Climate Sensitivity

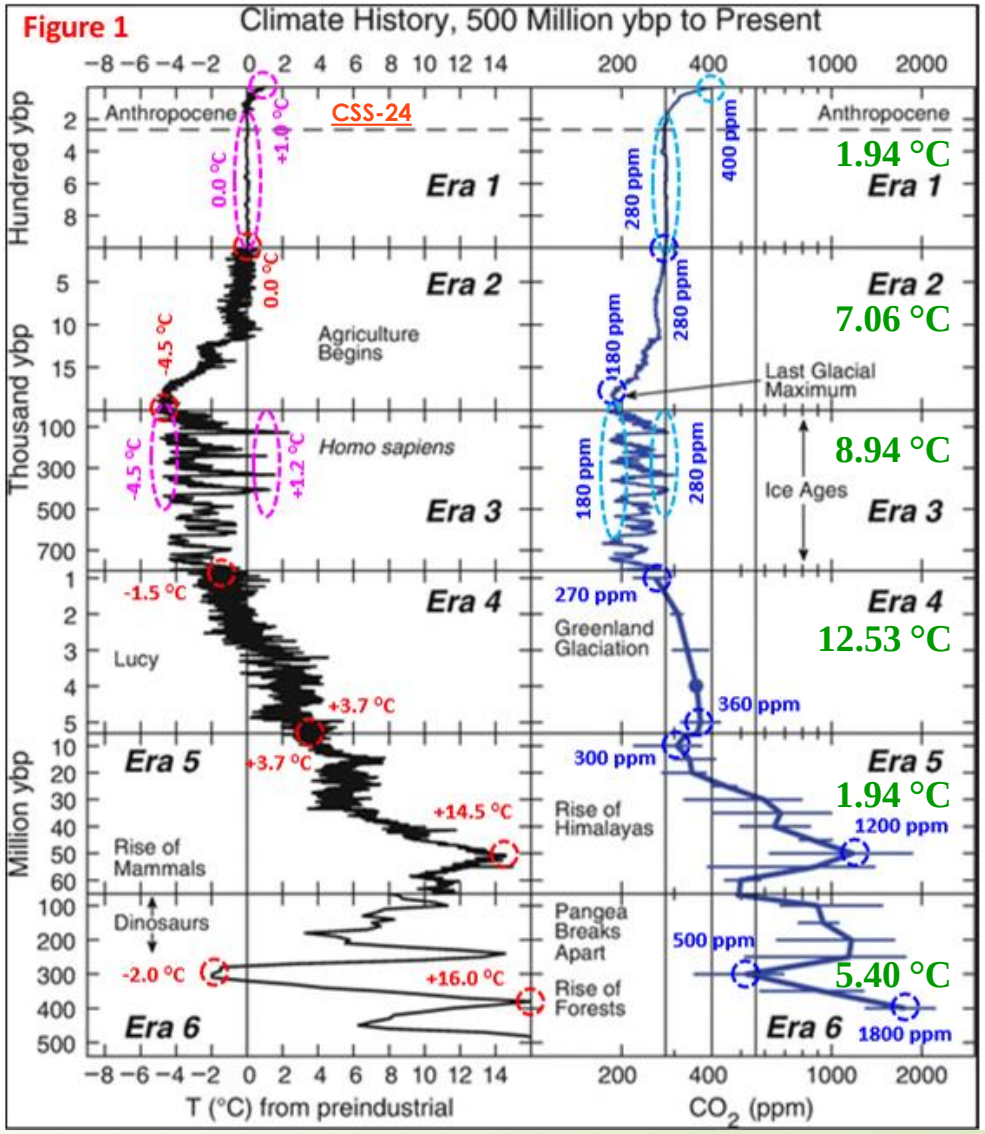
**Only one of the calculated ECS curves to the right could be considered correct. Given that the ECS must be lower than 1.8 °C (as discussed above) they are all wrong!**




More detail? climatechangeandmusic.com

CSS-24 – Is the Holocene really a New Epoch?

## $CO_2$ Concentrations Affect Temperature, but Does $CO_2$ Drive the Climate?




**A couple of quick points from the chart above. The calculated climate ECS for each Era is shown in green. Note, this is an alarmist generated chart that includes the ridiculous "Anthropocene" reference. And the temperature fluctuations over the last 1,000 years should have been shown as erratic as the previous 10,000 years. But that would have obscured that "scary" (minor) ±1 °C warming attributed to $CO_2$!**