THE KING MIDAS MODEL

About anthropogenic tempering with Earth's natural response system

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Naturalis
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Center

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Introduction

From the deep past to the present humans have endeavored at deciphering their origin for which anthropomorphic deities were invoked. Not so long-ago religion, consisting of belief through learning, was abandoned to be replaced by deduction following from trial and error. Such results are rarely unequivocal and the building of a narrative explaining most results leads to a gradual increase in insight, like the slow construction of the Tower of Babylon.

The education of the new generation, that instead of repeating the numerous deduction pathways related to the rules of logic, happens too often through learning. I say "too often" because learning holds elements of the believes of old religions and often reflect a view grown in isolation (geographical or topically because of specializations). Fortunately, the internet alleviates this isolation.

The narrative that I am presenting here is a first effort at distilling a single model for System Earth from the results of numerous disciplines. This multidisciplinary approach puts constrains on the interpretations of results in the various specializations, but these constrains represent new information not to be overlooked. So instead of following either of the most influential scientists from the various disciplines, I chose to show that on the internet a series of very recent results are presented that all together can explain System Earth, global warming and the increasing drought that we have been experiencing lately.

I must confess that similarly to Lisle I think that the present is a key to the past because the laws of physics did not change over time. Moreover I am by nature a gradualist because, in spite of the ubiquitously accepted expectation that "the sky in the form of a meteorite could be falling on our heads", I first would like to exclude the possibility that System Earth itself doesn't hold unexpected surprises.
And as you will see in the following: System Earth does hold unexpected surprises.

Please note in this fantastic piece of art of Pieter Bruegel the elder (1530-1569), placed in the background of this slide to illustrate the point of this introduction, that in the 16-th century one was quite aware of the irregularity of the scientific progress. Please note the emphasis put by the artist in the front left on the pondering on where to place the building stones and realize that distance is required to see where the stone from this immense puzzle belong. I hope that this digital presentation will stimulate both specialists and modelers to co-operate.
So, thank you very much for having me in this session!

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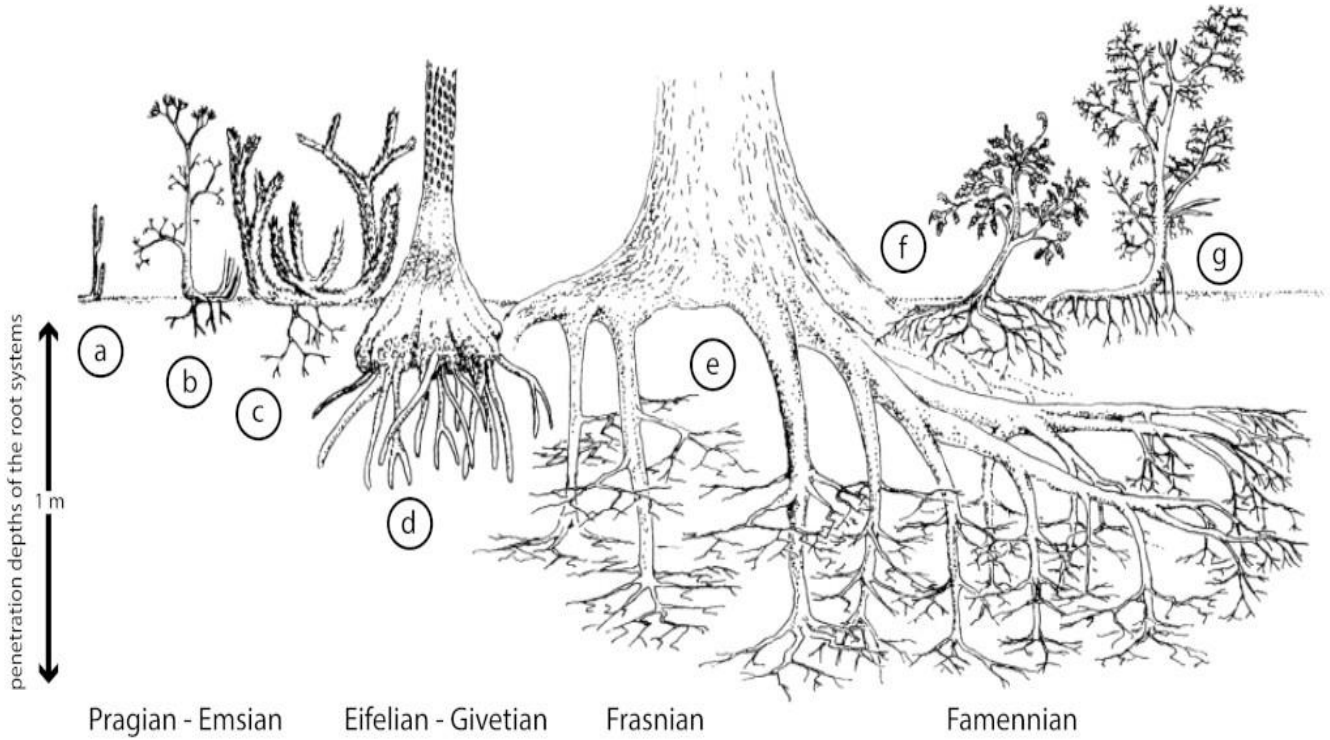


Morphology, size and depth of root system penetration during the Devonian. (a) embryophytes, Aglaophyton type; (b) tracheophytes, Psilophyton type; (c) herbaceous lycophytes, Asteroxylon type; (d) arborescent lycophytes, Lepidodendron type; (e) progymnosperms, Archaeopteris type; (f) spermatophytes (seed plants), Moresnetia type; (g) monophytes, Rhacophyton type. Modified from Algeo & Scheckler (1998)

The relation between stomatal densities and CO_2 concentration in the atmosphere was already described in the early 90-ties (Berner 1991, Beerling and Chaloner, 1993 and numerous others) and the important drop of CO_2 concentration in the Paleozoic was elaborated by Algeo and Sheckler (1998) as part of the colonization of the land by the growingly complex plant life forming deeper and deeper soils.

HYDROLOGIC CYCLE & PEDOGENIC WEATHERING

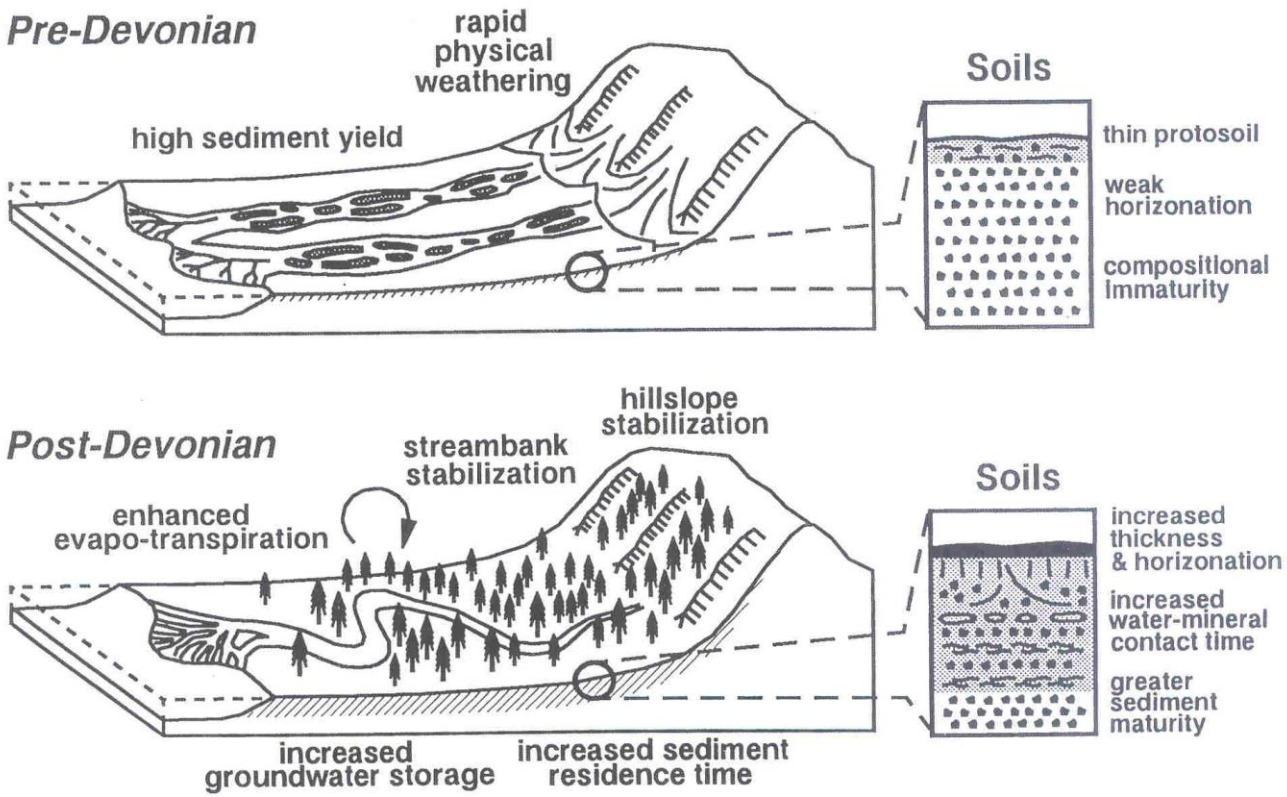


Figure 12.5.
Changes in the hydrologic cycle and pedogenic weathering processes as a consequence of the Middle-to-Late Devonian spread of vascular land plants (see text for discussion).

Algeo, Scheckler & Maynard, 2001.

These soils occupying higher and altitudes and latitudes changed the fluviatile system from an anastomosing braided system to a meandering system, where fresh water and organic carbon was retained in spongy soils.

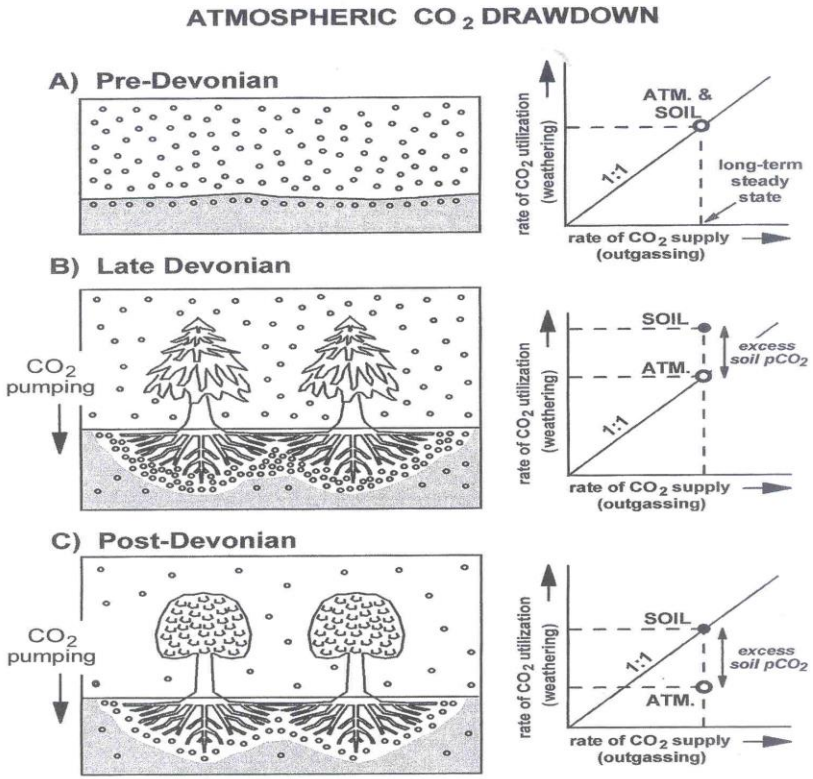
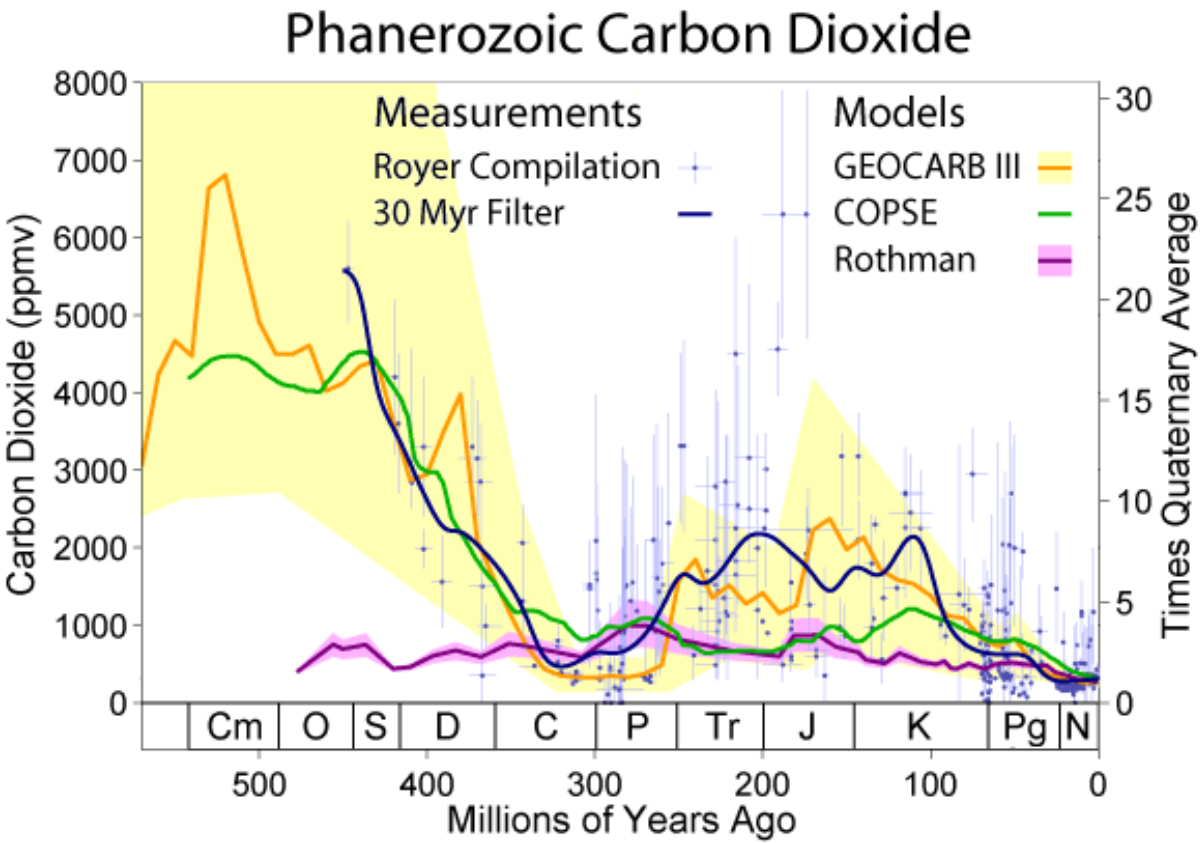


Figure 12.6.
Changes in atmospheric and soil CO_2 levels as a consequence of the Middle-to-Late Devonian spread of vascular land plants. **A:** In the largely unvegetated pre-Devonian world, atmosphere and soil CO_2 levels were similar. **B:** During the Middle and Late Devonian, active pumping of carbon into soils by land plants initiated atmospheric pCO_2 drawdown. **C:** in the post-Devonian, terrestrial floras maintain artificially low atmospheric CO_2 and high soil CO_2 levels via intensive carbon pumping. Because of a long-term steady state in CO_2 supply via volcanic and metamorphic degassing and the requirement that geochemical sources and sinks balance, CO_2 levels in the soil environment (where silicate mineral weathering takes place) must have been similar both before and after the spread of land plants. However, during the transient interval in which CO_2 uptake by terrestrial floras first intensified but atmospheric CO_2 levels remained high, soil CO_2 levels are likely to have been much higher than at present, resulting in enhanced pedogenic weathering.

The expansion of the soils to higher latitudes and altitudes led to what Algeo, Scheckler and Maynard (2001), coined as the atmospheric CO_2 drawdown, which instrinctively also implied the H_2O drawdown, which H_2O, despite being ubiquitously present, doesn't always have the pH at which it can easily be used for plant life and we shall see in the following that fresh water can get depleted.



The early study on the composition of the troposphere through time as initiated by Berner (1991) was corroborated by numerous other studies followed, each addressing a different proxy for the CO_2 concentration and being modelled in a different way, but in broad lines the very important CO_2 drop from the Palaeozoic remained, as did the rather impressive error margins, which in my philosophy that all results in accepted papers should be considered as true, ***may also represent true fluctuations of the system***, instead of non informative proxies or indeed the error margin following from our incapacity at pinning down the true CO_2 drop.

In the next slide we look at the work of Feulner (2017) detailing the Carboniferous-Permian Period, which as you will see had lower values for the CO_2 than in the present.

Feulner (2017) detailing the Carboniferous-Permian Period, showed that orbital forcing and carbon drawdown together determine CO_2 and climate. The results of Feulner (2017) have been corroborated by my own work in South East Asia on the Asselian, which I will discuss next.

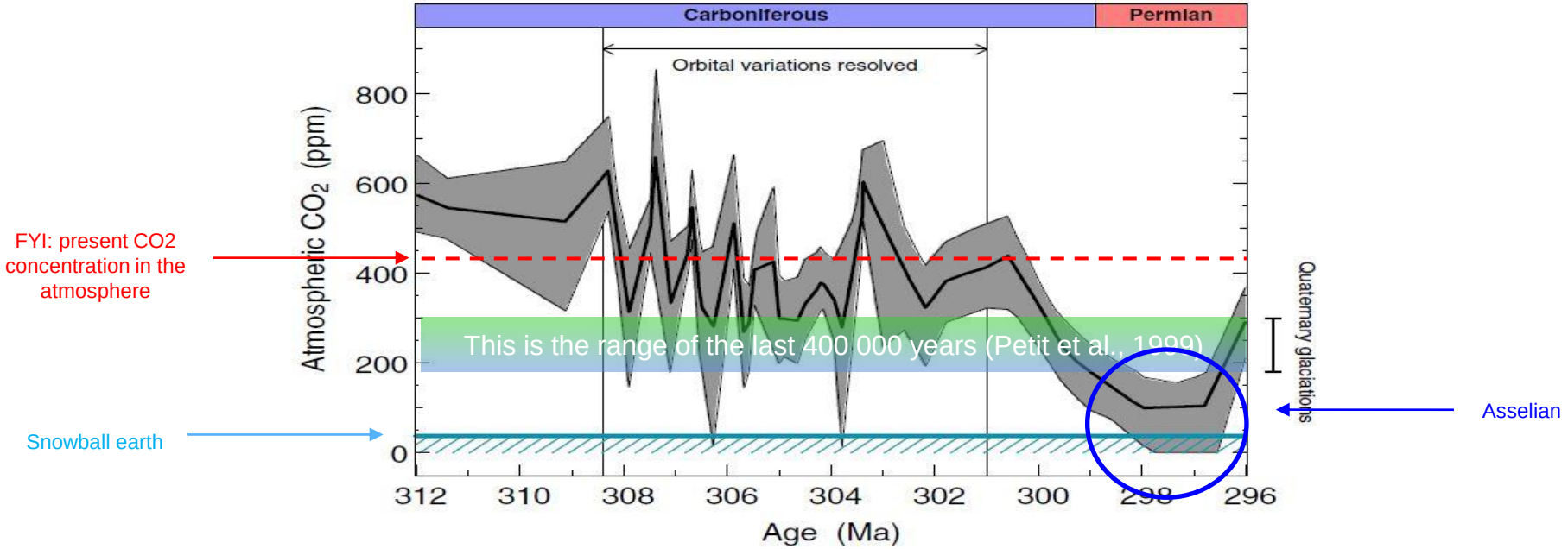


Fig. 3. Estimates of atmospheric CO_2 and the global glaciation threshold ~300 million years ago. Critical level of the CO_2 concentration of 37.5 ± 2.5 ppm, below which Earth enters a fully glaciated state (cyan; this work), is compared with empirical estimates of the atmospheric CO_2 level during the latest Carboniferous and earliest Permian (17) (black and gray shading indicates 2.5%/97.5% uncertainty ranges). Note that the temporal resolution of the empirical estimates is considerably lower before 308 Ma and after 301 Ma; in particular, orbital-scale fluctuations during the CO_2 minimum at the beginning of the Permian are not resolved. The range of CO_2 variations during the Quaternary (18) is indicated on the right-hand side.

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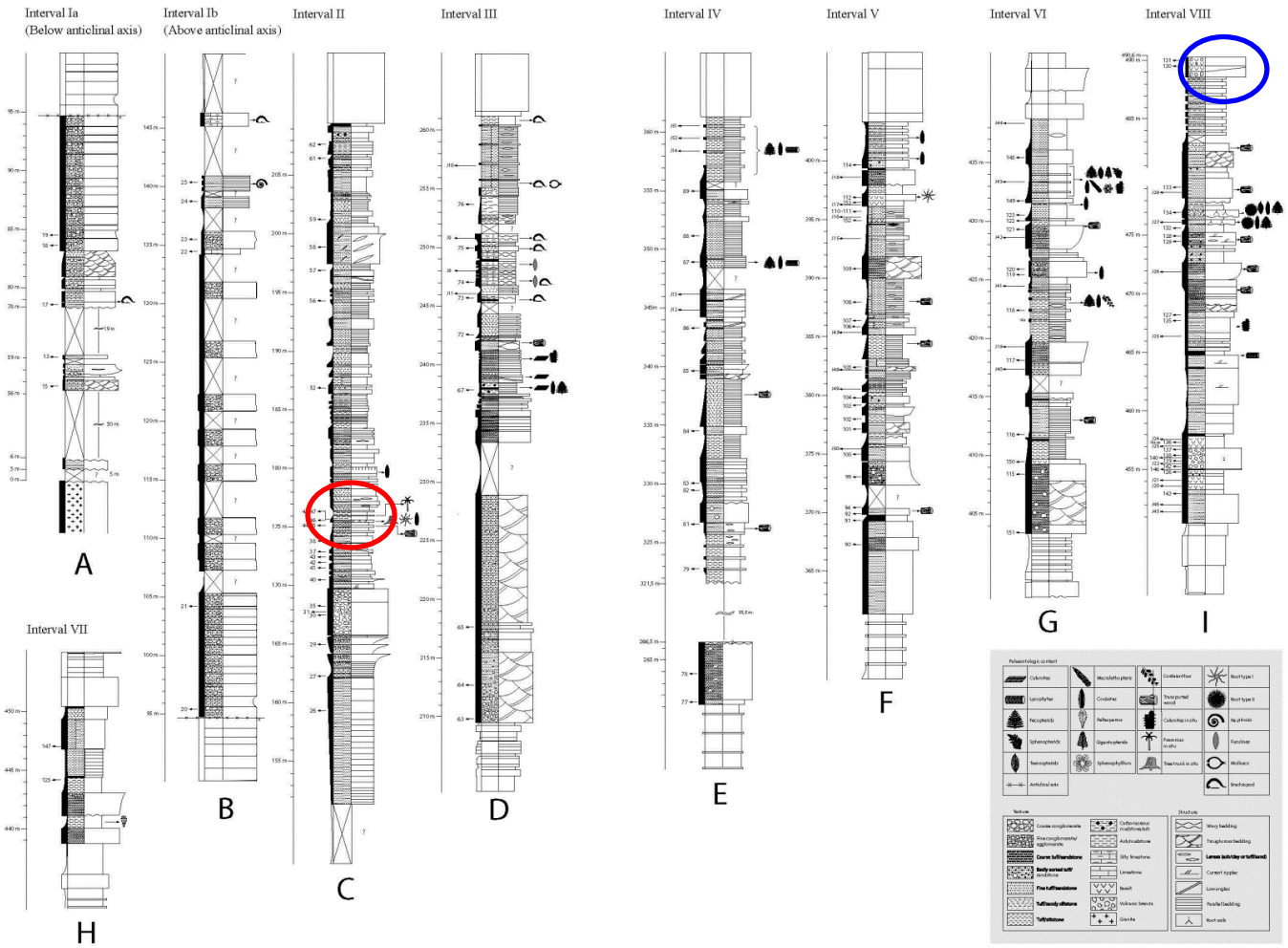
The results of Feulner (2017) corroborated the results of the work on the Merangin section through the Asselian Karing Formation on West Sumatra where volcanic, fluviatile and marine deposits are interfingering (Van Waveren et al., 2019).

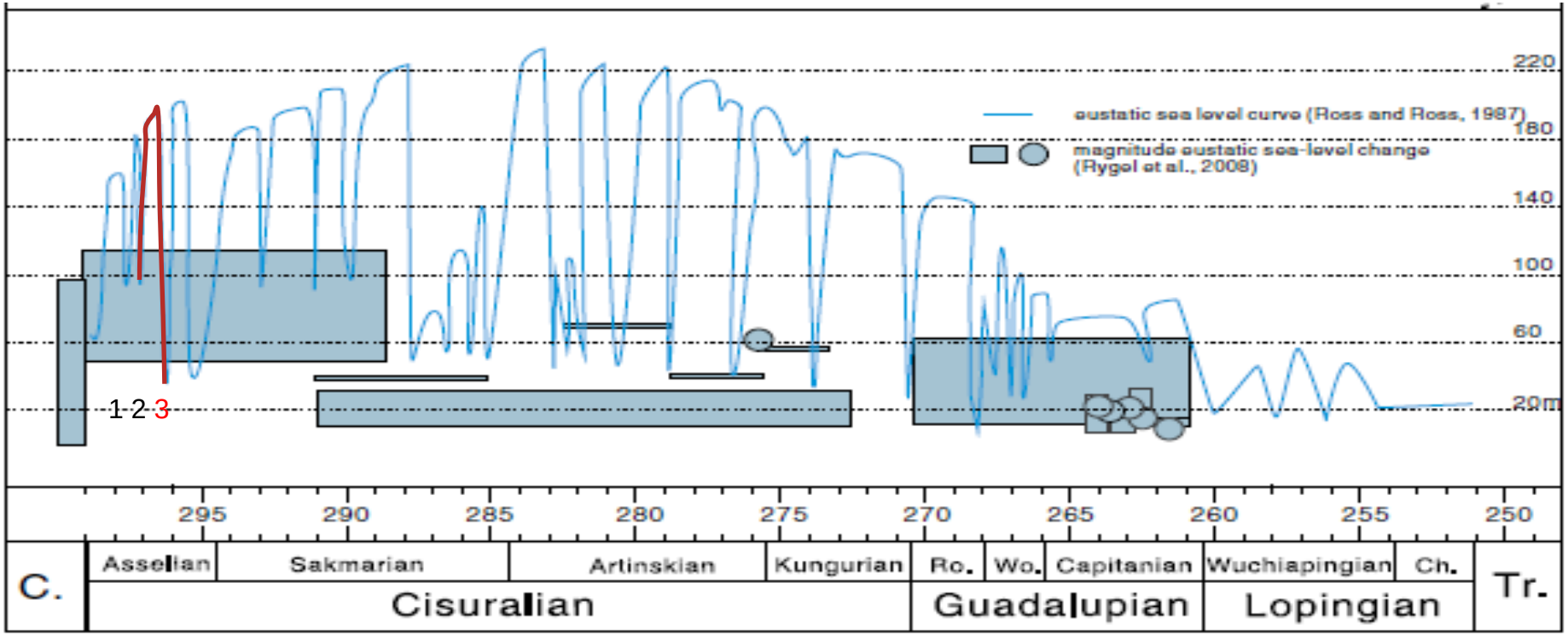
During the Early Asselian West Sumatra occupied low latitudes (Crippa et al., 2014)

The volcanicity that provided the sediments led to the rapid and rather spectacular entombment of a Permian palaeoflora at the base of the volcano (Matysova et al., 2017) and it also allowed for very detailed isotopic age evaluation (Van Waveren et al., 2018)

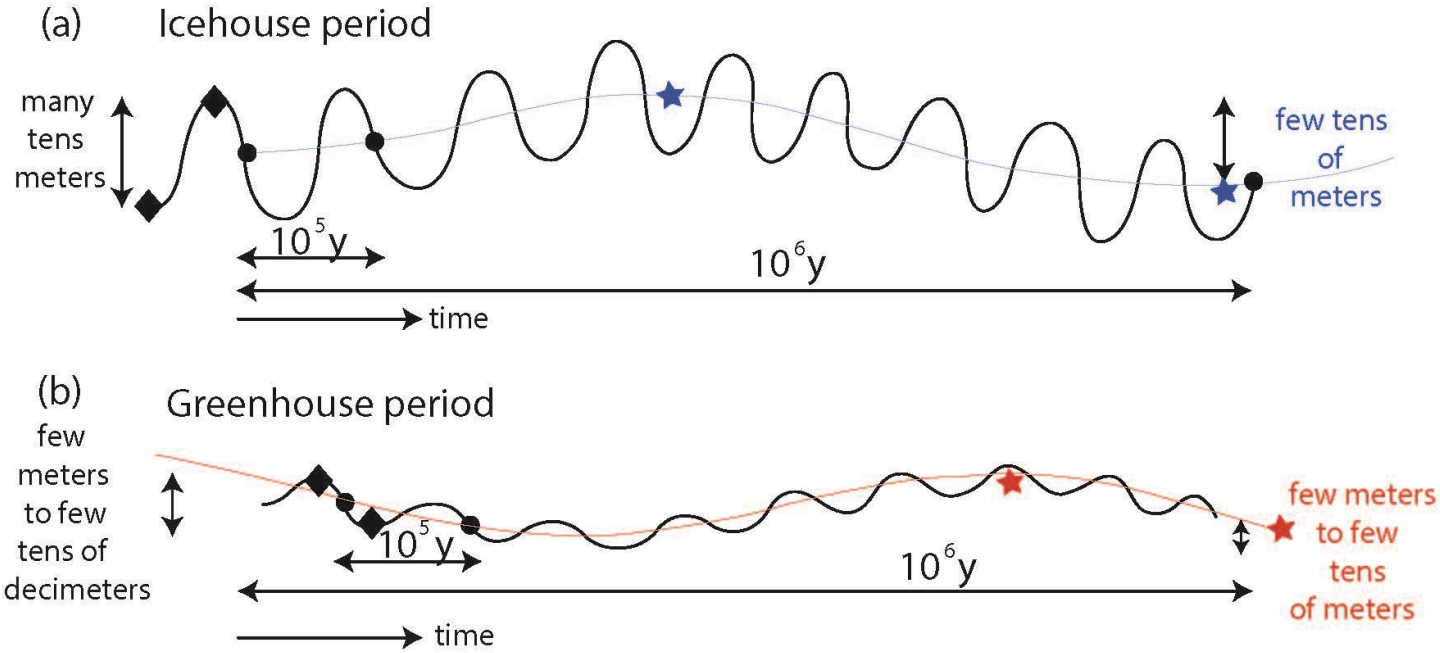


The Merangin River section on Western Sumatra (Van Waveren et al., 2019) indicated the top of the section as 296.14 +/- 0.09 Ma yr, the centre at 175 m on the section as 296.77 +/- 0.04 Ma yr, and the total section extrapolated as =/- 800 kyr.

This (in red) is the third third-order eustatic sea level fluctuation from the Permian, as depicted by Chen et al. (2013)



Please note that in the former diagram of Chen et al. (2013) the amplitude is strongly exaggerated, while in the present model of a third order eustatic sea level fluctuation during an icehouse period (in blue) and a greenhouse period (in red) the third order eustatic fluctuation as redrawn after Coe et al. (2005) appears to have a milder amplitude (this is just a matter of representation). As seen in Feulner (2017) the Permo-Carboniferous reflects an icehouse period. In the present example of Coe et al. (2005) a single third order eustatic fluctuation is constituted by eccentricity cycle, this is not a dogma, they consider inclination can also play a part. An eccentricity modulated third order eustatic fluctuation happens to be comparable to what was found along the Merangin section through the Karing Formation in Sumatra (SE Asia) (see the next slide).



Along the Merangin River section, eight fining upwards intervals were observed over a period of 800 kyr thus indicating 8 eccentricity cycles.

Now this is a bit surprising, as normally fining upwards means deepening, and after the deepest point (Interval III, see the blue limestones), one would expect coarsening upwards as the system gets shallower again, but this did not happen because precipitation decreased and the volcano had reached its climax just after Interval III, so we get a decrease in sediment load (Van Waveren et al., submitted).

It is slightly more complex sequence analysis but write to me if you have questions.

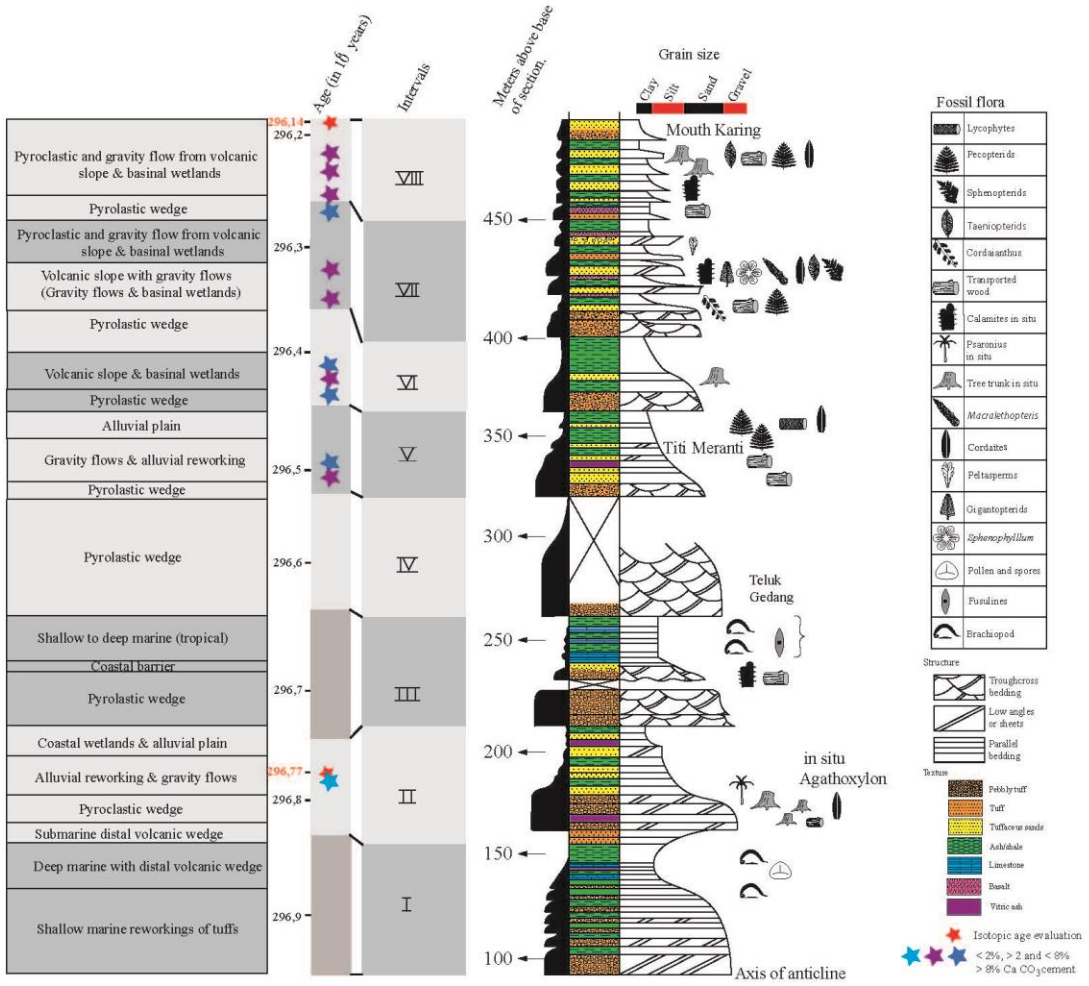
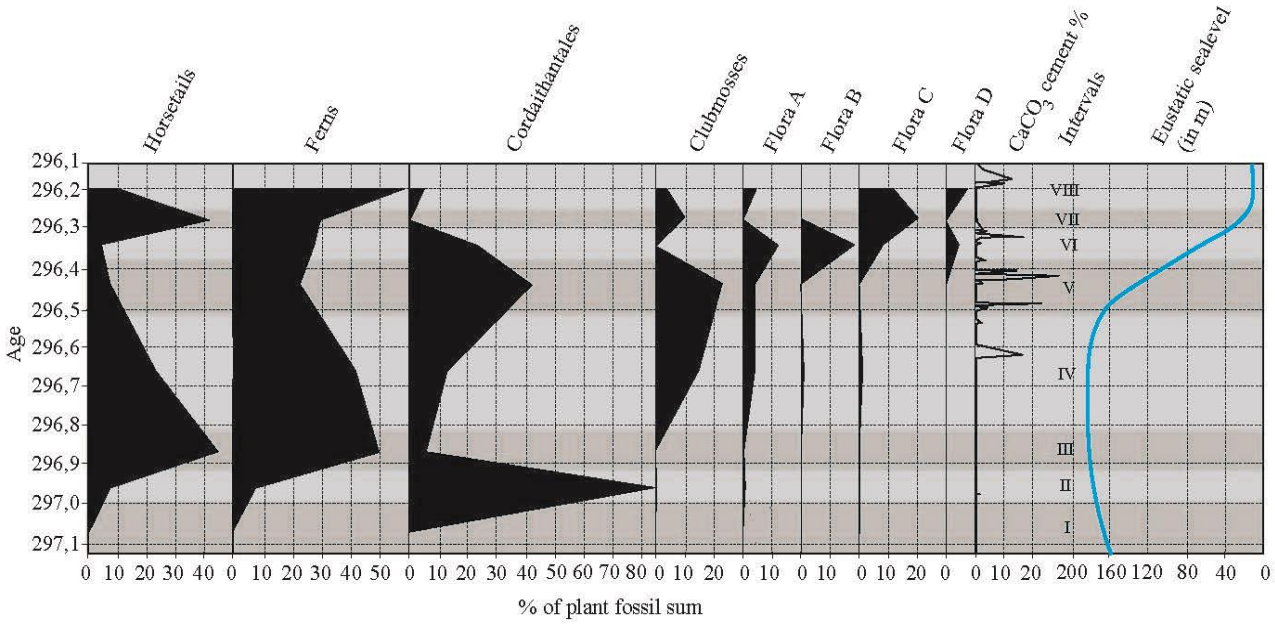


Fig. 4



The eustatic sea level curve of Ross and Ross (1987) still represents the most detailed global eustatic record and was found to be generally applicable to Gondwana and tropical to temperate region of the Northern hemisphere (Frank, Birgenheier, Montanez, Fielding & Rygel, 2008). This curve, composed of the third-order eustatic sea level fluctuation of Haq, Hardenbol & Vail (1987), was calibrated lately for the Permian and proved to be of use in comparison to the Cathaysian continent of southern China (Chen, Joachimski, Shen, Lambert, Wang, Chen & Yuan, 2013), thus indicating the global eustatic sea level fluctuation curve can also be employed here for West Sumatra which is considered to be the southern part of Southern China (Van Waveren et al. , 2018)

The comparison of the paleofloral transition on West Sumatra to the 3-rd third order eustatic fluctuation from the Permian, indicates that a mesic/xeric seed fern flora appears at a low eustatic level, and that tree ferns are even found to invade the wetlands at the section top (a sign of extreme xericity and low temperatures) where the xeric Voltzian conifers also appear (Van Waveren, 2019) while the wet taxa appear during the high eustatic level (Van Waveren et al., 2018).

We even see in Interval VII, a drop of the vegetation line (Van Waveren et al., submitted) as gravity flows holding seed ferns are gradually replaced by Cordaites again.

At any rate, the Merangin section indicates that a low sea level relates to low CO_2 concentrations (Feulner, 2017) and low temperatures, which were chiefly modulated by orbital forcing (eccentricity in particular).

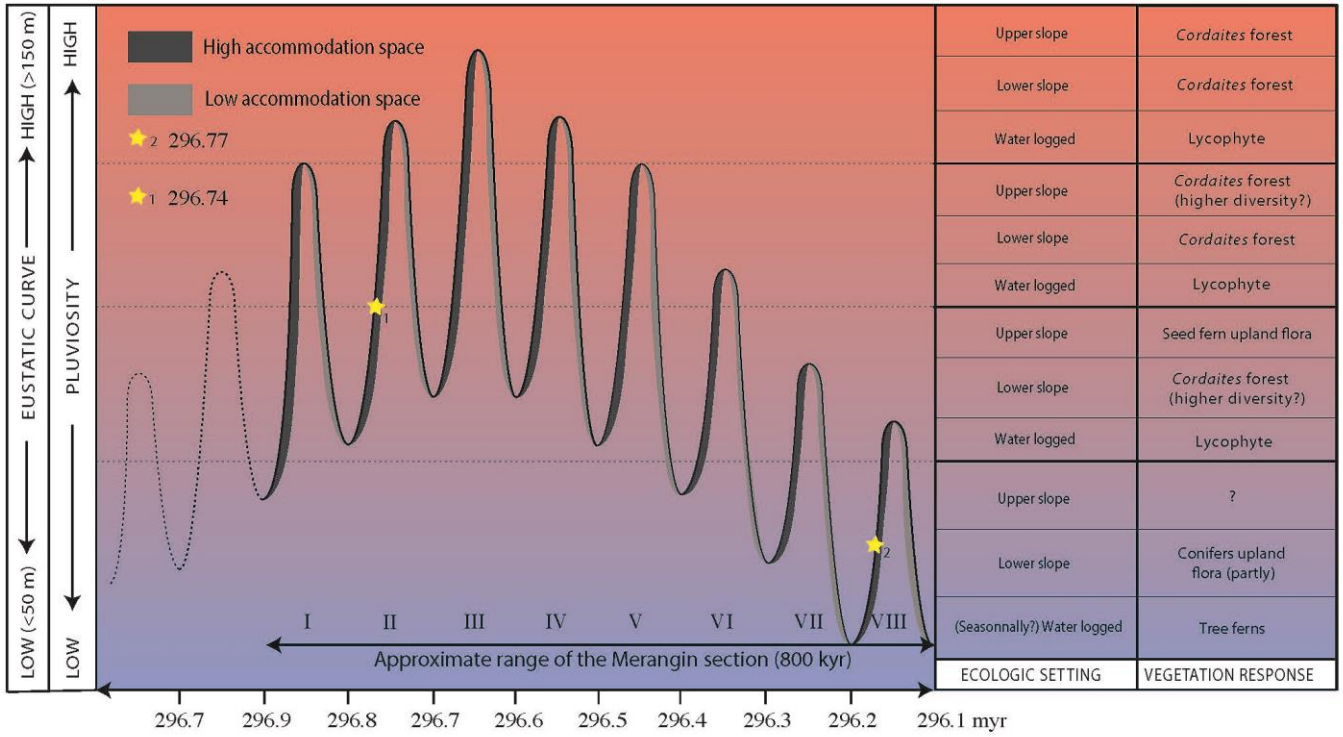


Fig. 7

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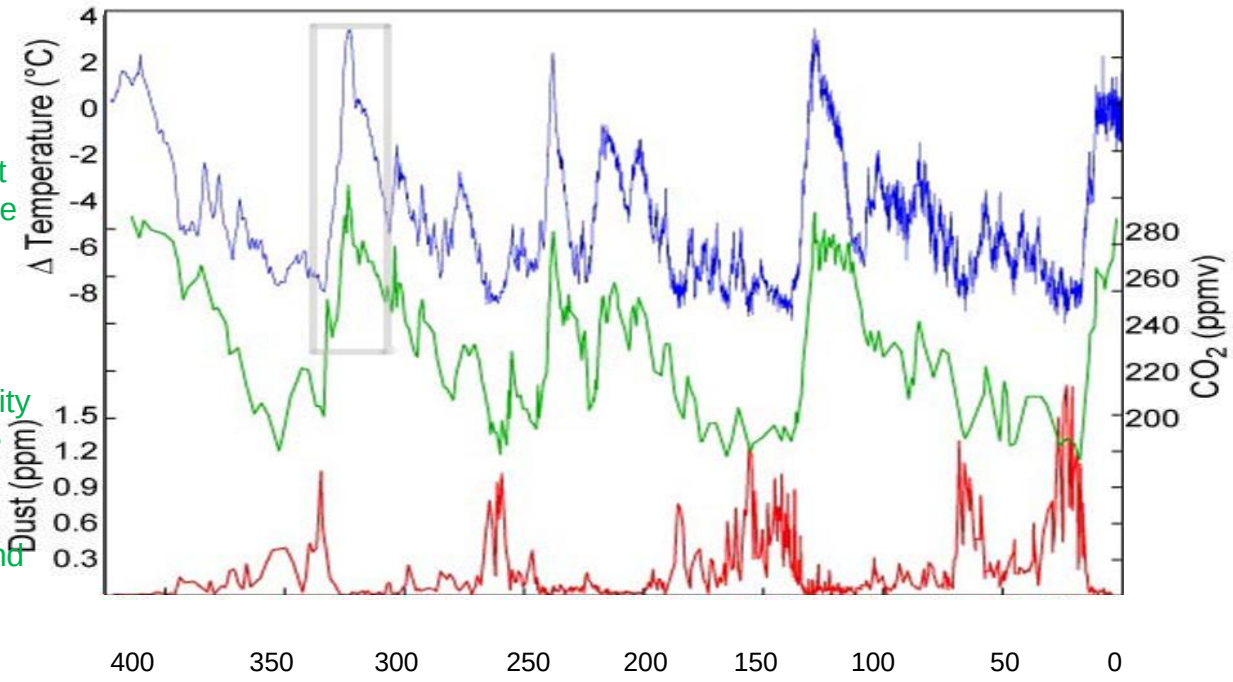
These are Petit et al. (1999) results from the Vostok ice core:

1. Just like for the Merangin section we see an eccentricity signal, but knowing that at present we are half way an eccentricity cycle (Berger et al., 2002), we can NOT say that eccentricity is driving climate and CO_2 concentration.

2. What is different from the eccentricity cyclicity as observed along the Merangin section is the asymmetry of the CO_2 and temperature curve, which, when considering that eustatic level reflects the size of the ice cap, temperature and CO_2 concentration, should be symmetrical. *This is not what we see.* We see that CO_2 concentration rises fast and drops slowly. We have seen above that photosynthesis draws down the carbon, into plants, soils and sinks. It is tucked away. So what is the new CO_2 source each 100 kyr?

3. Dust in this diagram precludes the CO_2 peak.

Could dust, in the *NATURAL SYSTEM,* be triggering the release of CO_2?



Petit, J.R., J. Jouzel, D. Raynaud, N.I. Barkov, J.-M. Barnola, I. Basile, M. Benders, J. Chappellaz, M. Davis, G. Delayque, M. Delmotte, V.M. Kotlyakov, M. Legrand, V.Y. Lipenkov, C. Lorius, L. Pépin, C. Ritz, E. Saltzman, and M. Stievenard. 1999. Climate and atmospheric history of the past 420,000 years from the Vostok ice core, Antarctica. *Nature* 399: 429-436.

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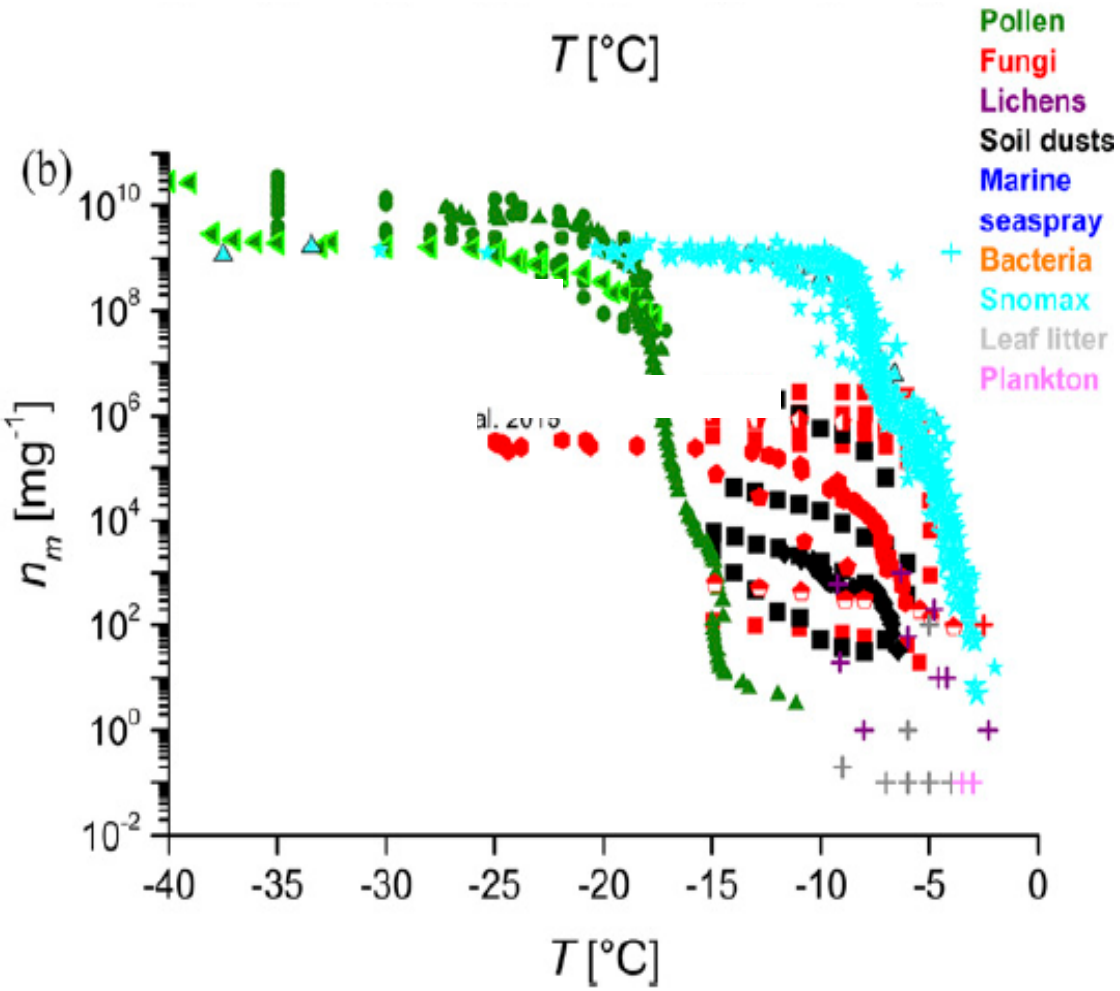


Dusts can contain numerous diverse particles.

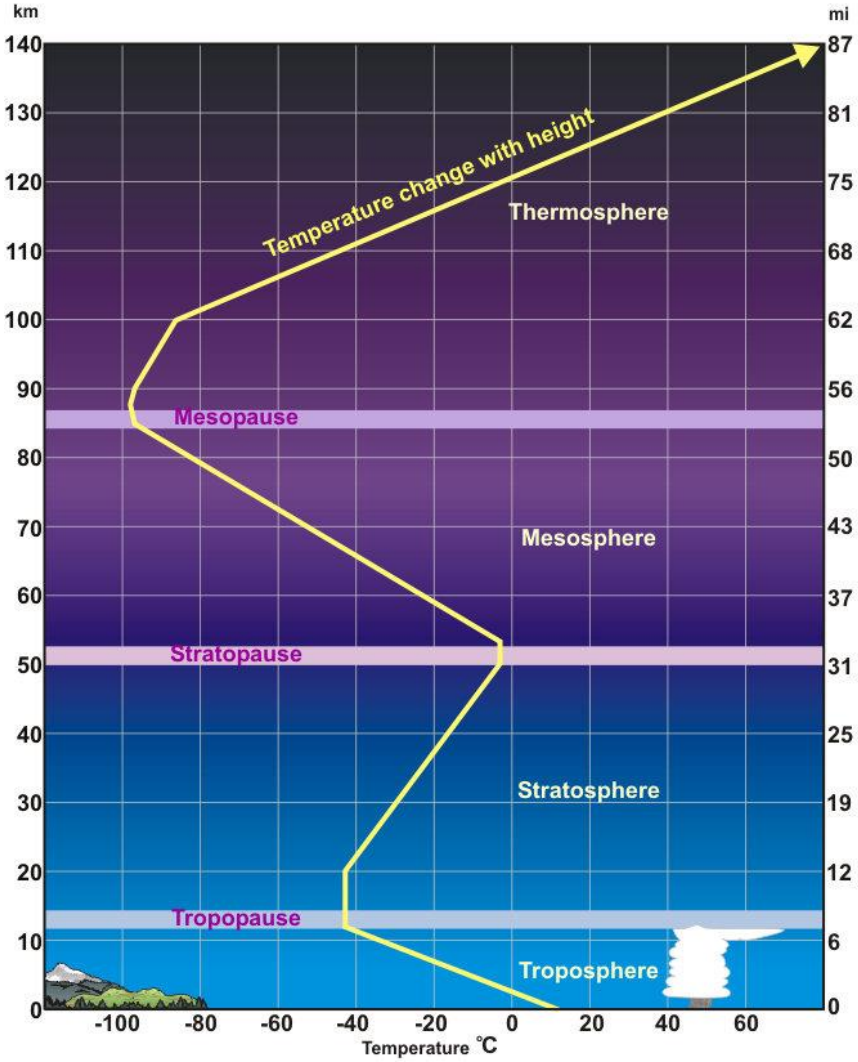
Kanji et al., (2018) compiled in a diagram numerous experimental studies on what particle type functions as crystal core until what temperature.

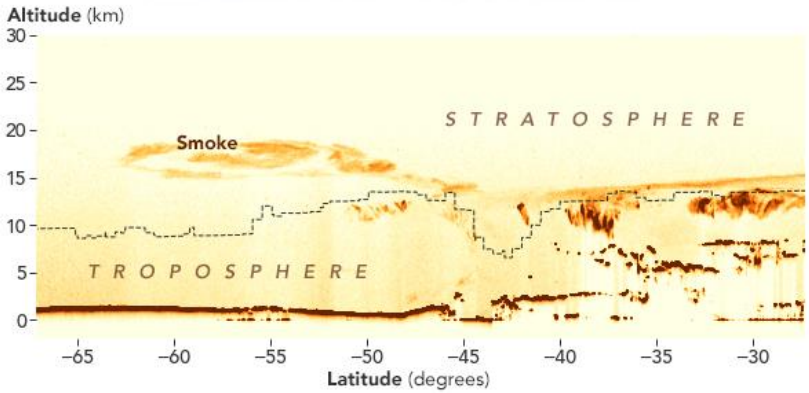
Why did he do that?

He did that because he wanted to know if aerosol particles still functioned as ice cores for cirrus clouds at the base of the Stratosphere were temperatures are extreme low.

Below you see a temperature profile from the atmosphere.

As you can see, the cumulo-nimbi get into the stratosphere, and this is quite relevant because we wonder of course how all that dust in the natural system gets that high up.





January 6, 2020

That is in fact no so surprising.

As a matter of fact, the fires we just had in January in Australia (see picture on the left), were spotted by satellites as smoke in the stratosphere, within a week. This isn't a novelty, the Hadley cell reach into the stratosphere and pyro-cumulonimbi in temperate zones also attain the LowerMost Stratosphere.

So as these airmasses rise into the stratosphere, they takes charcoal, dust, spores, rusts and in fact all kinds of particles into the stratosphere.

So, cirrus clouds at 12 km in the LowerMost Stratosphere (LMS), are ice clouds, and the ice forms as crystallization around numerous kinds of aerosols particles (dust!), all kinds of particles, in fact the more diverse the particle population, the denser the cirrus clouds (Kanji et al., 2018).

Moreover slight heating of the crystals makes the crystals bigger and increases their optical depth (Kanji et al., 2018).
This can be seen to happen through momentary insolation related to orbital forcing.

High, thin clouds (=cirrus) primarily transmit incoming solar radiation; at the same time, they trap some of the outgoing infrared radiation emitted by the Earth and radiate it back downward, thereby warming the surface of the Earth
(Nasa Earth observatory, March 1-st 1999).

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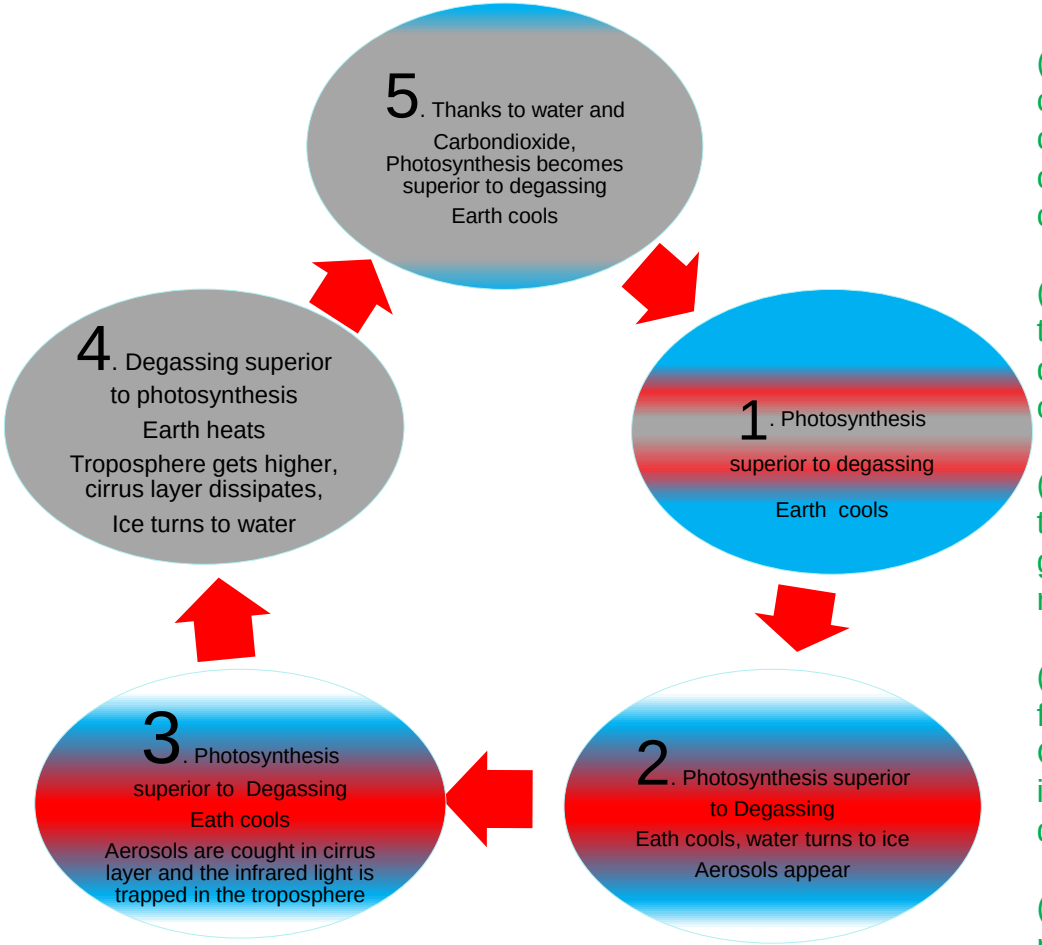

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(1) The atmosphere gets CO_2 depleted by the photosynthetic carbon drawdown phase we just hypothesized to be the case in between the temperature and CO_2 maxima as observed in the ice cores of Petit et al., (1999) (=towards carbon depletion).

(2) The lower green house gases concentrations in the troposphere lead to lower temperatures and liquid water depletion, ice gets stored at high altitude and latitude, or into oceans (= towards water depletion).

(3) Low temperature lead to dust, aerosols that come to feed the cirrus layer, which as seen above in Kanji et al. (2018) gets a higher optical depth and captures the infra red light reflected from earth in the troposphere (=optical forcing).

(4) The lithosphere undergoes extreme temperature fluctuations, but the hydrosphere get warmer, the solubility of CO_2 in oceans decreases and the hydrosphere gets depleted in CO_2 which is returned to the troposphere (=ocean degassing).

(5) The cirrus layer dissipates, water is liquid and feeds the photosynthesis, carbon drawdown becomes superior to degassing again (=back to carbon depletion)

In the three citations from 2015 to 2019 (in various excellent journals) you can read in the highlighted red propositions that there is gradual change in the evaluation of the net ocean CO_2 flux shifting from uptake in 2015 to degassing due to ocean heating in 2018.

(1) Heinze et al., 2015: Carbon dioxide (CO_2) is, next to water vapour, considered to be the most important natural greenhouse gas on Earth…..The oceans have a key role in regulating atmospheric CO_2 concentrations and currently take up about 25% of annual anthropogenic carbon emissions to the atmosphere… Major future ocean carbon challenges in the fields of ocean observations, modelling and process research as well as the relevance of other biogeochemical cycles and greenhouse gases are discussed.

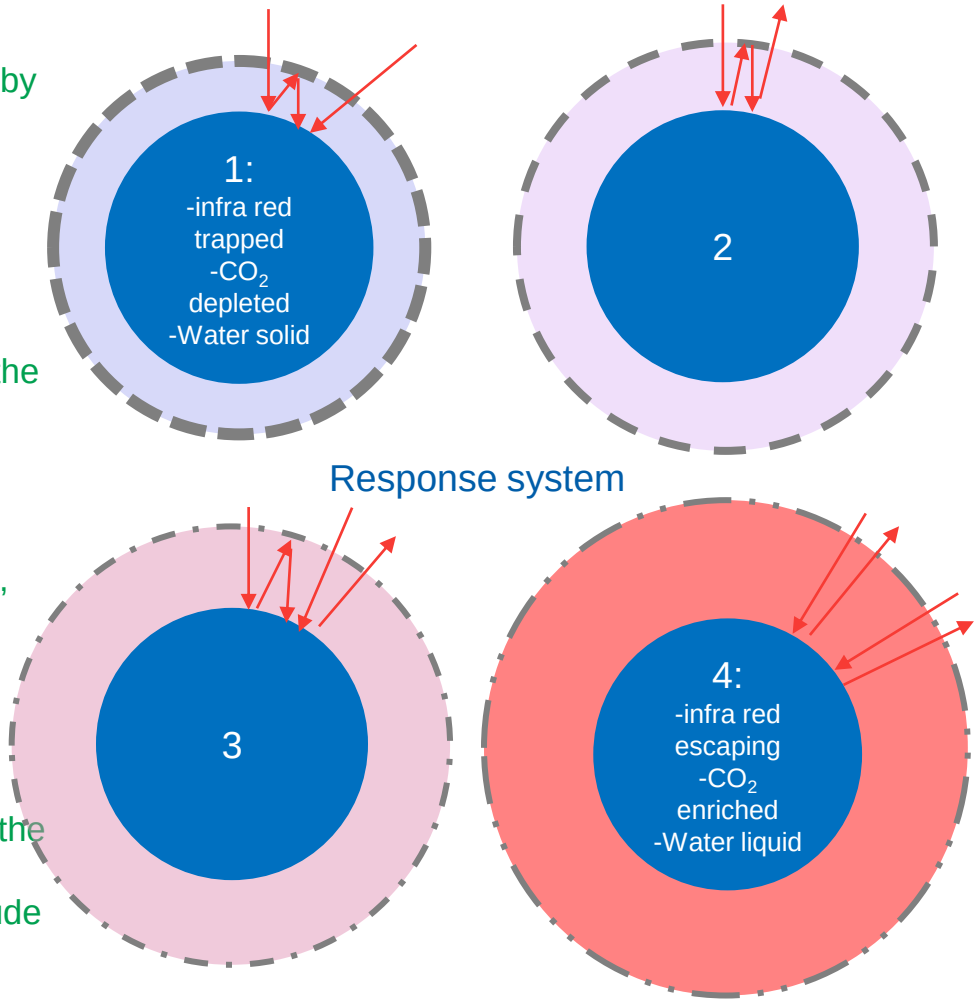
(2) Le Queré et al. 2018 (76 authors): A detailed comparison among individual estimates and the introduction of a broad range of observations show
(1) no consensus in the mean and trend in land-use change emissions,
(2) a persistent low agreement among the different methods on the magnitude of the land CO_2 flux in the northern extra-tropics, and
(3) an apparent underestimation of the CO_2 variability by ocean models, originating outside the tropics.

(2) Resplandy et al., 2018.
We show that the ocean gained 1.29 ± 0.79 × 1022 Joules of heat per year between 1991 and 2016, equivalent to a planetary energy imbalance of 0.80 ± 0.49 W watts per square metre of Earth's surface. ….We also find that the ocean-warming effect that led to the outgassing of $O_2$and CO_2 can be isolated from the direct effects of anthropogenic emissions and CO_2 sinks. Our result – which relies on high-precision O_2 atmospheric measurements dating back to 1991 – leverages an integrative Earth system approach and provides much needed independent confirmation of heat uptake estimated from ocean data.

In this model, we focus on the troposphere where we differentiate between two processes:
(1) The amount of heat in the troposphere (determined by aerosol density at 12 km of altitude)
(2) The composition of the troposphere (determined by gas exchange between reservoirs)

Orbital forcing plays but a very modest part, where an increase in insolation momentarily heats and increases the size of the ice crystals in the cirrus layers and shift the CO_2 depleted system from a chiefly photosynthetic to a chiefly degassing phase.

Clearly in Petit et al., (1999) we see at four consecutive moments that the CO_2 replenishment stops at 300 ppm, and there must consequently be a response system, which is, in fact, quite straight forwards: as our troposphere gets filled again with CO_2 the troposphere heats up and expands, and the cirrus layer, being the frontier between the troposphere and the stratosphere expands with it, thus thinning the cirrus layer, reducing the organic particle density and letting the infra red heat trapped in the troposphere escape again to higher altitude (as explained here in an exaggerated way, this altitude change is probably not so strong).



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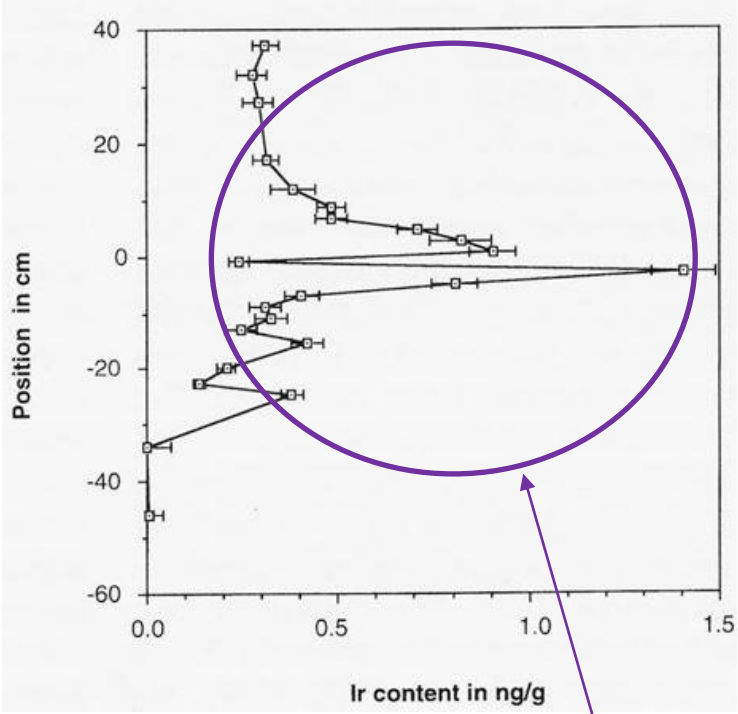
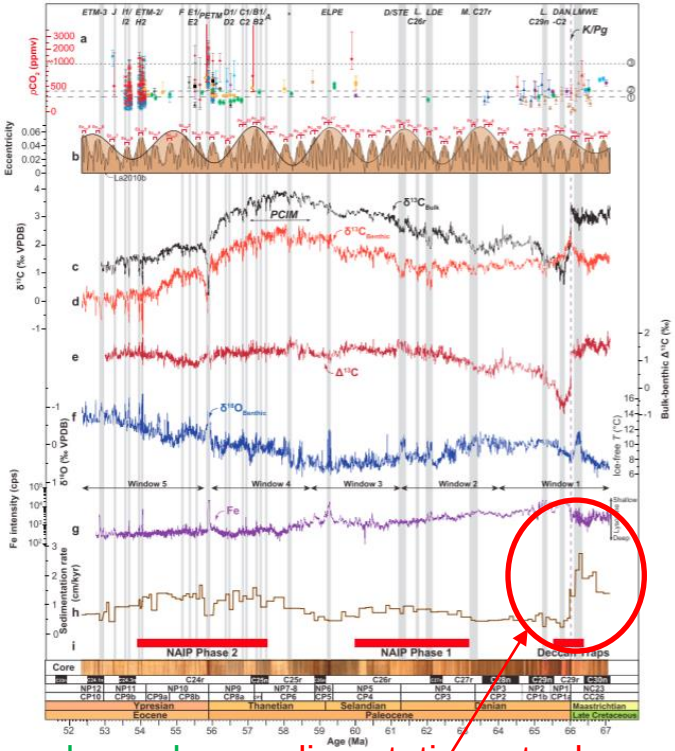
Rocchia et al., 1996



Barnet et al., 2019



An unexpected surprise has since long been detected at the KT boundary, when sedimentation rate dropped gradually to levels so low that the slow rain of iridium from out of space **"suddenly"** displayed high concentrations. Decrease in sedimentation rate started long before the KT boundary (as can be seen here) and considering it relates to water transport it clearly holds a climatic element which, when applying the Midas Model, should also be reflected in an aerosol component.

The dust flux at the end of the Cretaceous was extremely high. This dinosaur dust peak deserves scrutiny. We know from that period that dinosaur grazers were numerous, and “overgrazing” destabilizing the precious soils that formed over millions and millions of years, should not be overlooked as a reason for the dust peak.

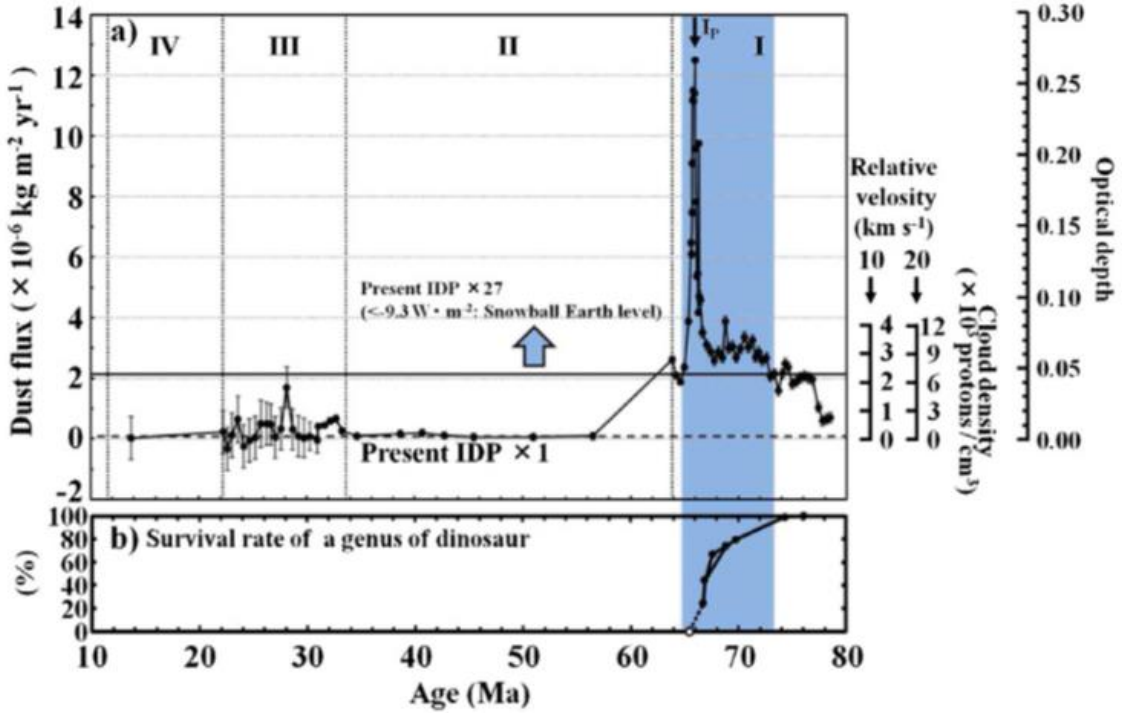
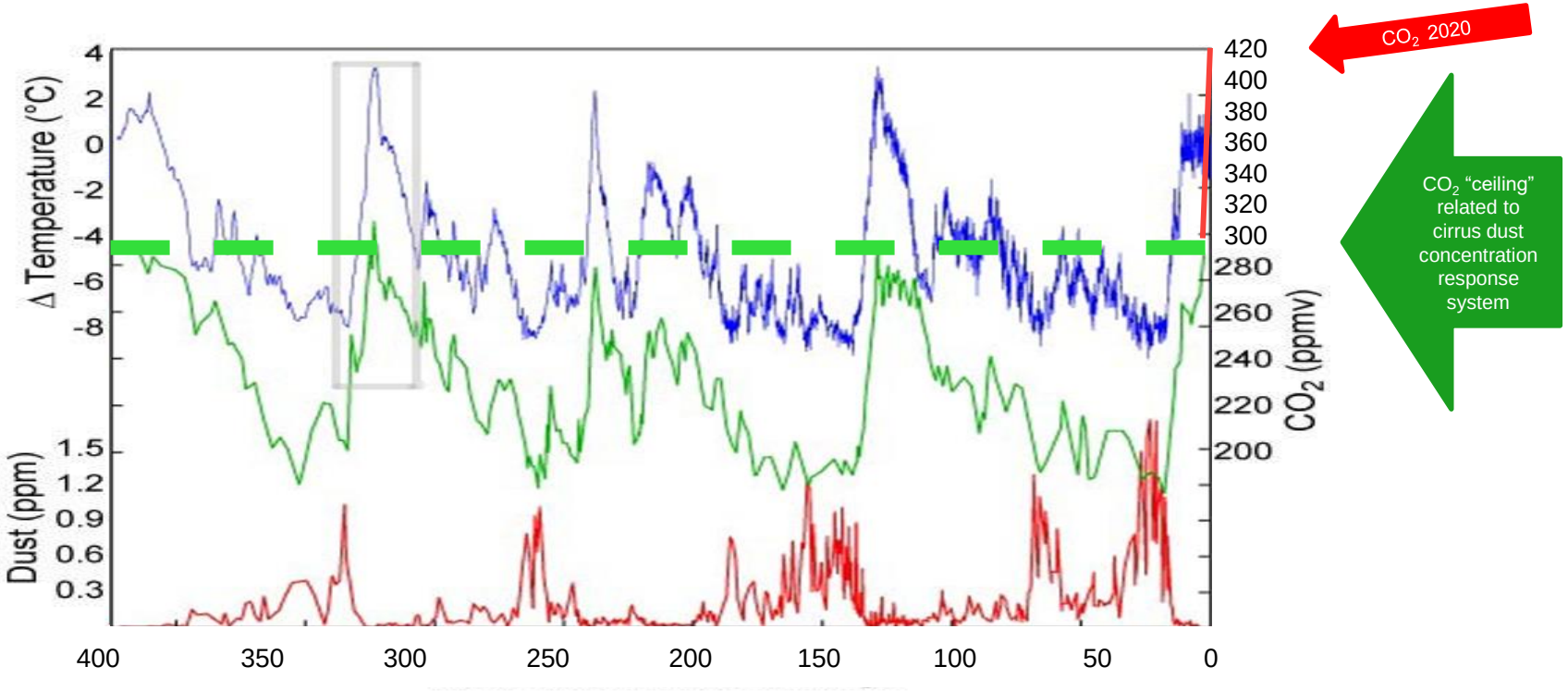


Fig. 5. a) Dust flux and dark cloud density, which are estimated through Eqs. (1)–(3), are shown. Whereas the horizontal axis represents geological age (Snoeckx et al., 1995), the vertical axis is the density of the dark cloud in the case of the velocity of the solar system relative to the dark cloud is 10 km s^{-1} and 20 km s^{-1}, and optical depth of the dust particles in the stratosphere. b) The survival rate of a genus of dinosaur (Sloan et al., 1986). The blue area delineates 73–65 Ma, a period of time when there is recorded enhanced climate cooling hypothesized to be the result of the dark cloud encountering the terrestrial environment, with the dinosaurs gradually becoming extinct.

When applying the Midas Model for System Earth, apparently over the last 400 000 years, the natural CO_2 "ceiling'' formed at 300 ppm. At present CO_2 is at 420 ppm, how is it possible that we are going through the ceiling to our natural CO_2 concentration? Is it conceivable that we are producing more aerosols, or other types of crystallization cores, or are we producing too much CO_2 or perhaps, both at the same time?

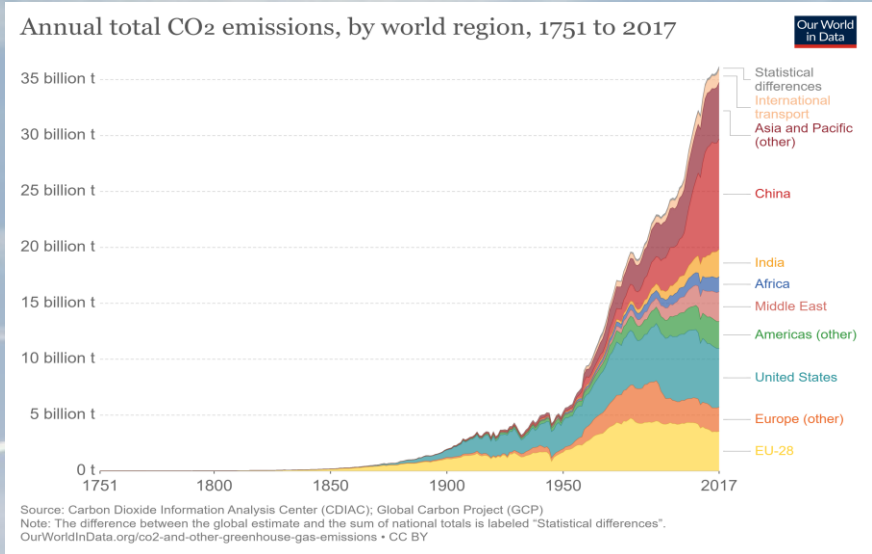


Petit, J.R., J. Jouzel, D. Raynaud, N.I. Barkov, J.-M. Barnola, I. Basile, M. Benders, J. Chappellaz, M. Davis, G. Delayque, M. Delmotte, V.M. Kotlyakov, M. Legrand, V.Y. Lipenkov, C. Lorius, L. Pépin, C. Ritz, E. Saltzman, and M. Stievenard. 1999. Climate and atmospheric history of the past 420,000 years from the Vostok ice core, Antarctica. *Nature* 399: 429-436.

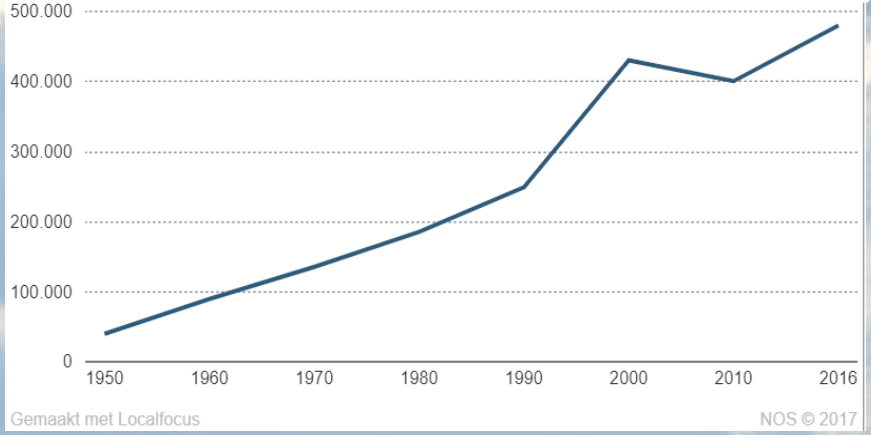
The view that we are presently tempering with the Earth's response system stands to reason because

(1) Infra red light (heat) is, as proven in the papers cited below, indeed caught in the troposphere.

It was demonstrated that contrails enhance greenhouse effect (Kärcher B., 2018. Formation and radiative forcing of contrail cirrus. Nature communications 9:1824) **while we know that cirrus optical depth relates to organic carbon concentration in cirrus clouds** (Martinsson B. G., Friberg J., Sandvik O. S. , Hermann M., van Velthoven P. F. J. and Zahn A., 2019. Formation and composition of the UTLS aerosol. Climate and Atmospheric Science 2:40) **and we know that planes produce transport soot** (Penner, J. E., Zhou, C., Garnier, A., & Mitchell, D. L. (2018). Anthropogenic aerosol indirect effects in cirrus clouds. Journal of Geophysical Research: Atmospheres, 123, 11,652–11,677. https://doi.org/10.1029/2018JD029204)



Flight number from Amsterdam presented here as a proxy for soot particle density and hence optical depth of the cirrus clouds in the lowermost stratosphere.



(2) And it requires no argumentation (see diagram on the left) that we are indeed emitting green house gasses at rates challenging any natural process that ever took place on Earth before, I even expect that, together with the Bovidae, we are far more efficient than the dinosaurs!

THE KING MIDAS MODEL

About anthropogenic tempering with Earth's natural response system

First, I would like to tell you what paleobotany has figured out about the carbon cycle until now (1)

Second, I would like to show you what the Naturalis study of Early Permian from SE Asia has added to it (2)

Third, I would like to show you that the paradigms applied SE Asia are only partly applicable to the Vostok ice core where dust appears to play an important role (3)

So, fourth let's see together what there is to know about dust, or saying it scientifically, aerosols (4)

Fifth, I explain the Vostok core data by introducing dynamic flows between the litho-, phyto-, hydro- and atmosphere of System Earth (5)

Sixth, I'll show you that System Earth holds unexpected surprises as experienced earlier by the dinosaurs (6)

Seventh, I'd like to stress the importance to falsify or validate this model for which I hope to interest you (7)

And last, as an epilogue, I will touch upon the reason why this model is named after poor King Midas (9)

Identifying organisms in environmental air samples

With a focus on allergenic pollen, using and developing an existing bio-informatics pipeline

Student name:	Jasper Boom
Date:	30-11-2018
Version number:	1.0
Educational institution:	Hogeschool Leiden
Course of study:	Bio-Informatica
Internship:	05-02-2018 → 19-12-2018
Internship institution:	Naturalis Biodiversity Center
Workplace supervisors:	Dr. Arjen Speksnijder Dr. Michael Stech
Graduation teacher:	Jan Oliehoek

Considering the stakes at hand, it may well be worthwhile to model the influence of the optical depth of cirrus clouds on ocean degassing (acidification) and the composition of the atmosphere. At the same time it seem relevant to conduct an analysis of the composition and origin of the **organic carbon** in the LowerMost Stratosphere for which there presently are automated methods in bio-informatics. Numerous chemical studies are conducted but DNA (and pyrolysis) will give the clearest directions on the source of the crystallisation cores, excluding interpretation as much as possible.

In fact, as it appears that numerous bacteria and fungi survive at 12 km of altitude, a whole discipline considering the vital processes in the LowerMost Stratosphere is necessary in order to understand organic molecule reduction or oxidation, instead of considering these airmasses as pure gasses.

EPILOGUE

Finally, while thanking you for having read this presentation, I'd like to add a few words in favor of the unfortunate King Midas, who had chosen that everything he'd touch be turned into gold as a reward for having found Dionysus dear friend and tutor Silenus. As from his food to his daughter, everything did turn into gold and he had to humbly beg Dionysus for forgiveness.

As scientists dealing with a climate crisis, we can relate to King Midas, chased by the Red Queen inciting us to withhold the knowledge that can save the miraculous cradle that harbors us and instead materialize this knowledge as income for publishing companies, but also as witnesses remaining silent.

Let us hope that it is not too late and that further ocean degassing can still be stopped (and inversed), that the lowermost stratosphere can be cleaned, that the excess carbon dioxide can be put back to its sinks, and finally by changing our culture to one with immaterial priorities, instead of the tempting material culture we grew accustomed to.

N.B. Here you can see that King Midas also had the ears of a donkey, that had been his punishment for preferring the lower material culture to the higher immaterial culture

6-5-2020, Isabel Van Waveren