GLOBAL CHANGE: A NATURALIST'S VIEW—AN UPDATE

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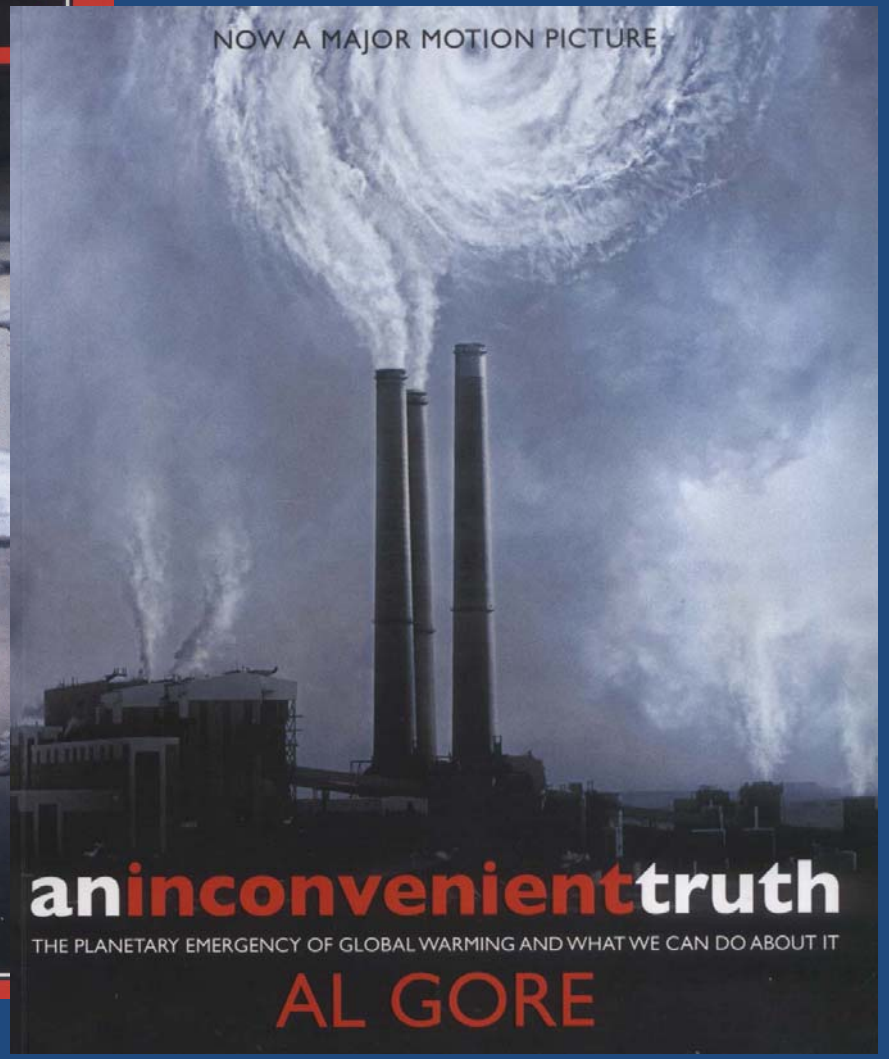
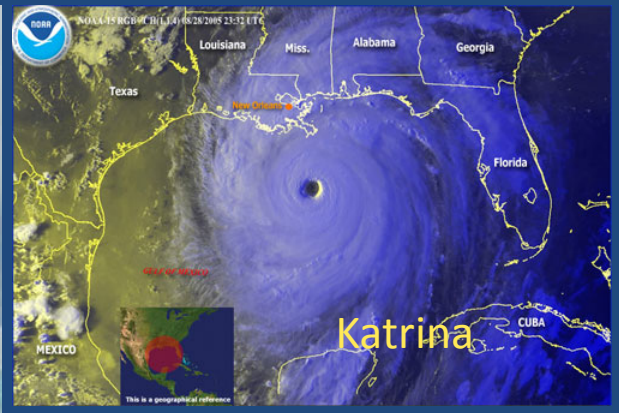
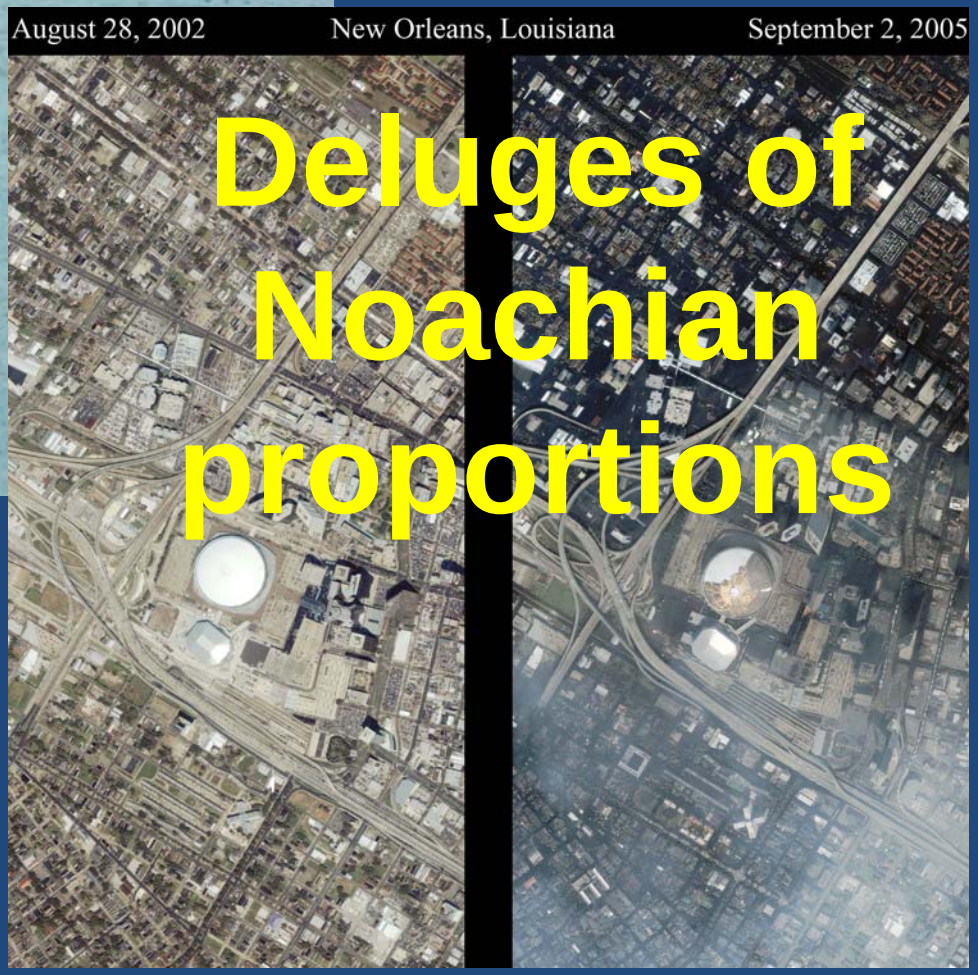
Worry has enveloped mankind!



(Well, at least some of us)

Rapidly melting polar ice caps





Deluges of Noachian proportions

Some believe that the climate change we see today is one with no past analogue

BUT IS IT TRUE?

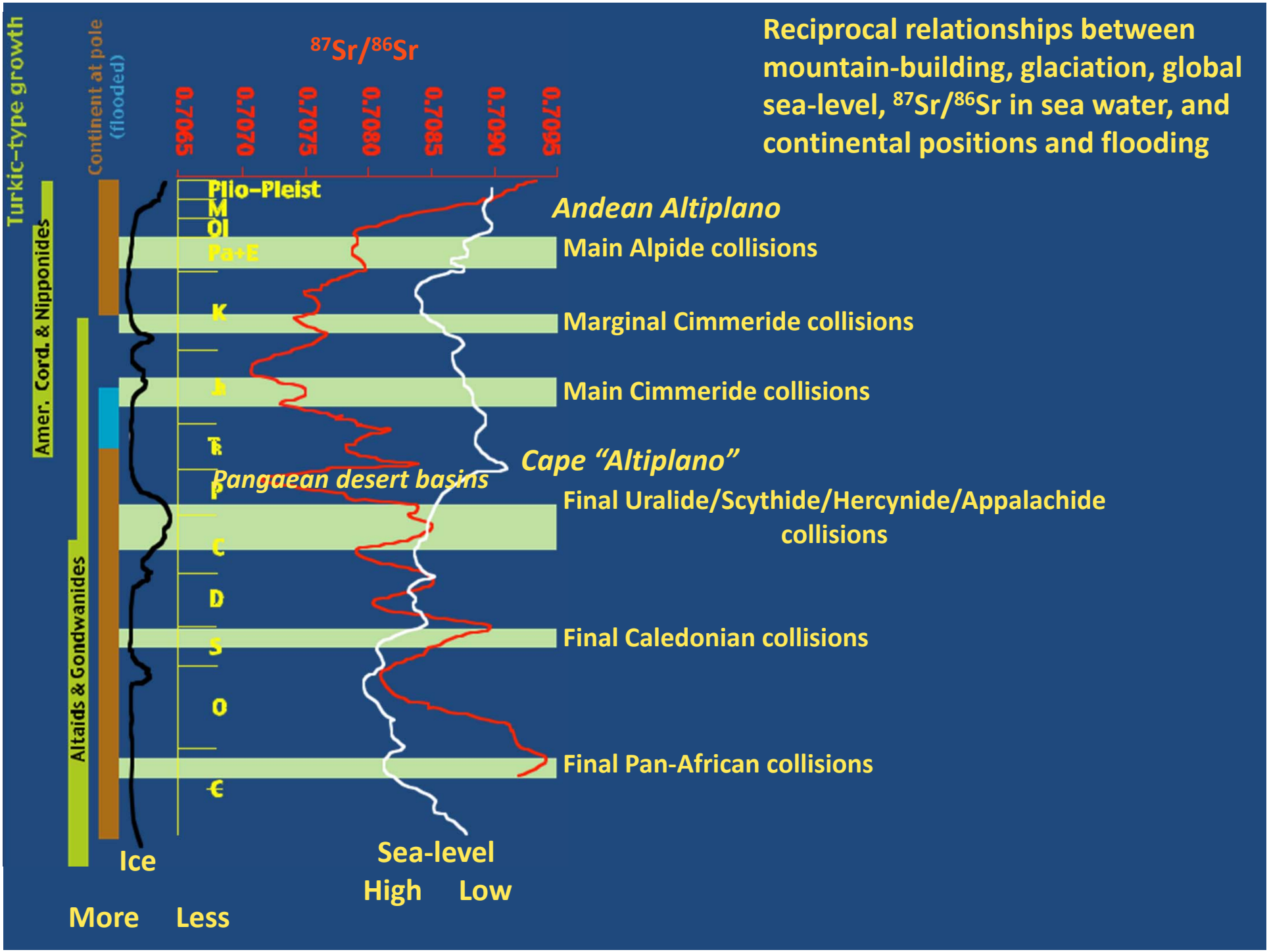
IS THE PUBLIC AWARE OF THE FACT THAT GLOBAL ENVIRONMENT HAS CONTINUOUSLY CHANGED SINCE THE ORIGIN OF OUR PLANET MORE THAN 4.5 BILLION YEARS AGO?

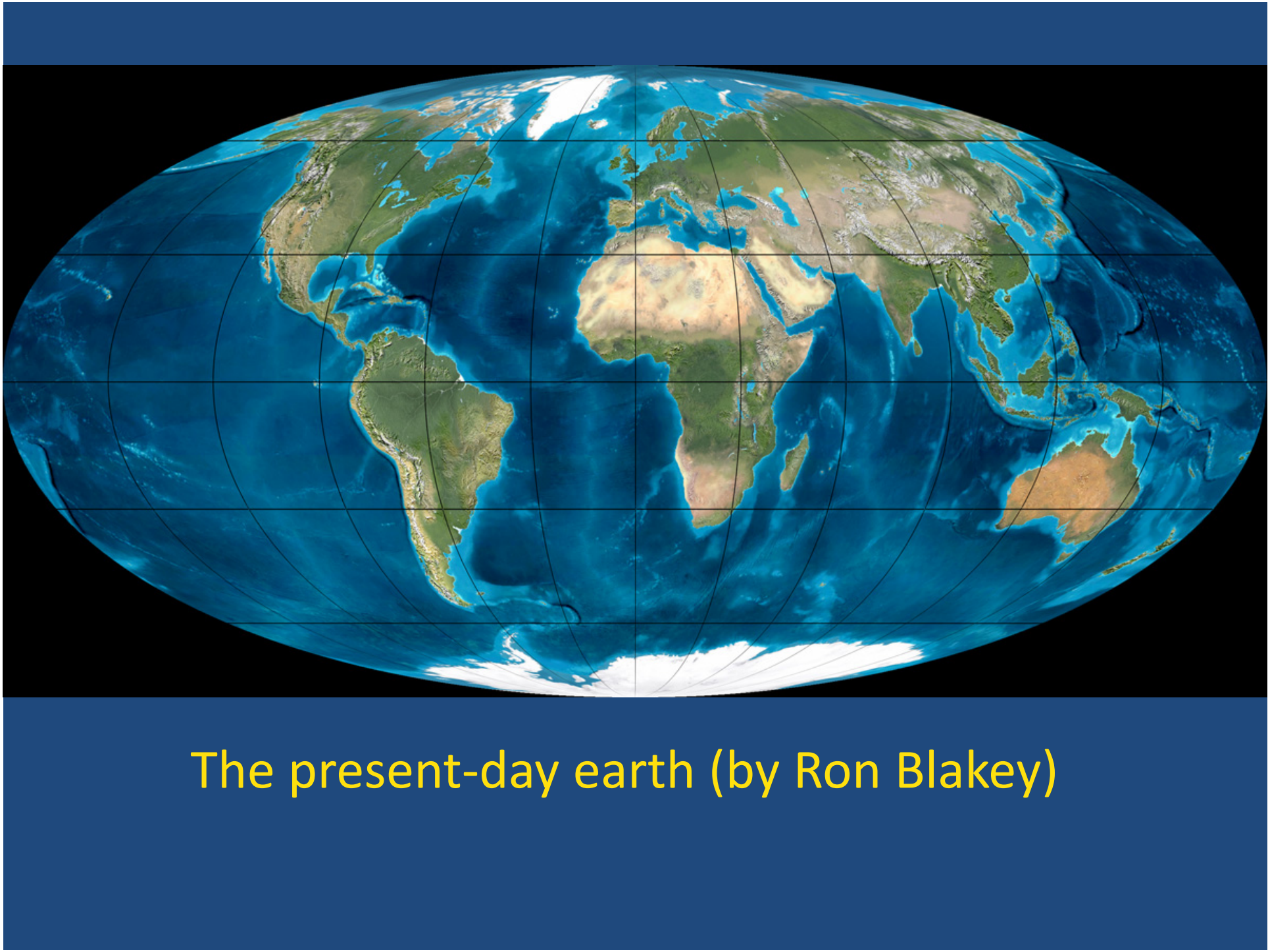
PEOPLE REALISE THAT DINOSAURS ARE NO LONGER AROUND, BUT WE STILL SEE IDIOTIC MOVIES SHOWING MEN AND DINOSAURS LIVING TOGETHER!

MOVIES ARE MADE SHOWING THAT THE EARTH CAN FREEZE IN A FEW HOURS OR THAT IT IS POSSIBLE TO TRAVEL TO THE CORE OF THE EARTH!

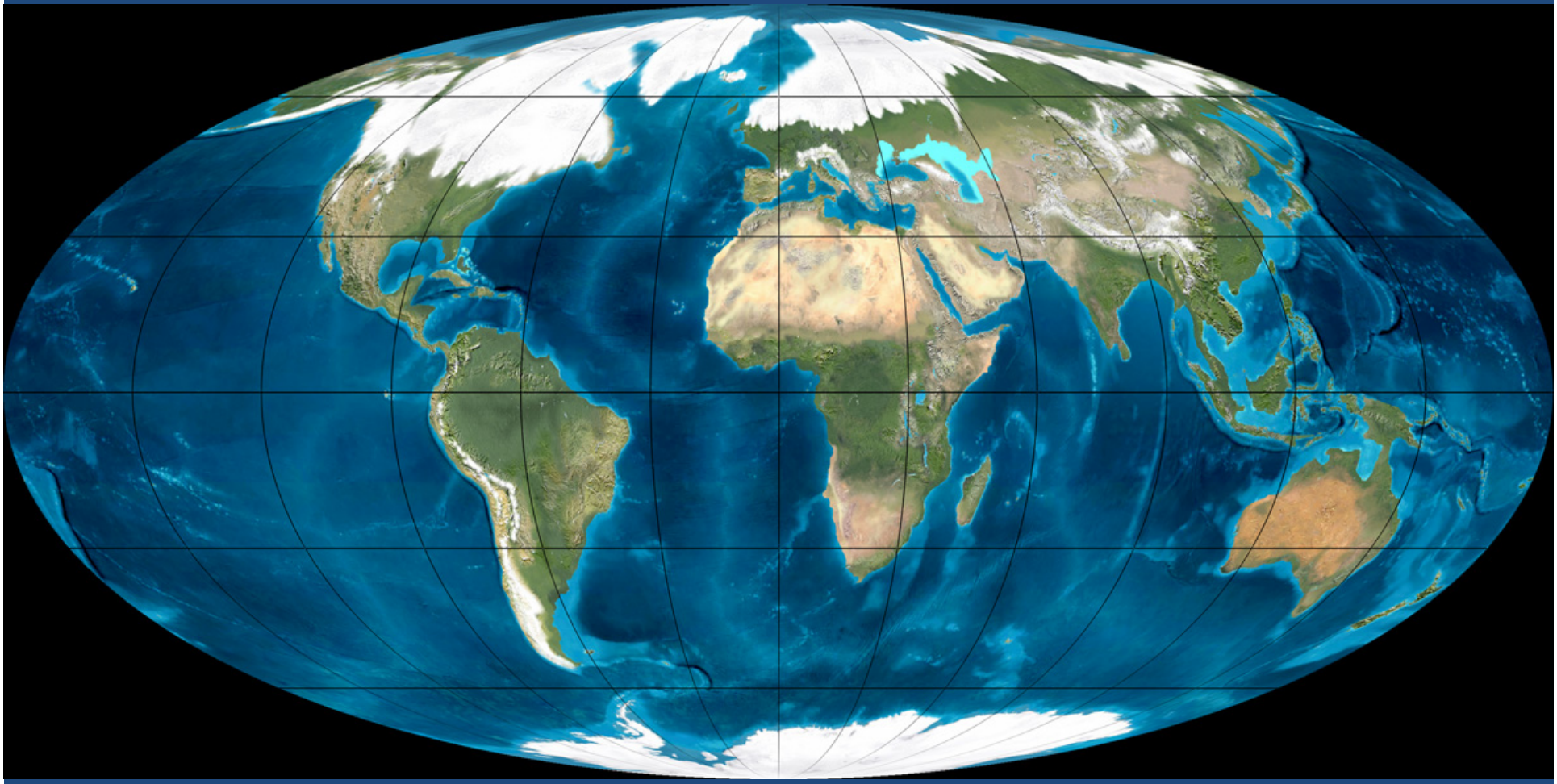
OTHER MOVIES SHOW THAT SUBDUCTION ZONE VOLCANOES CAN GO BERSERK IN A MATTER OF WEEKS AND ERUPT IN CONCERT AND THAT THIS CAN BE STOPPED BY A FEW EXPLOSIONS!

THE PUBLIC IS FRIGHTENINGLY IGNORANT ABOUT THE PLANET ON WHICH IT LIVES, YET VOTES ABOUT POLICIES THAT GOVERN OUR RELATIONSHIPS WITH THE PLANET. THIS CAN HAVE SUICIDAL CONSEQUENCES FOR THE ENTIRE HUMANKIND OR EVEN THE ENTIRE BIOSPHERE.

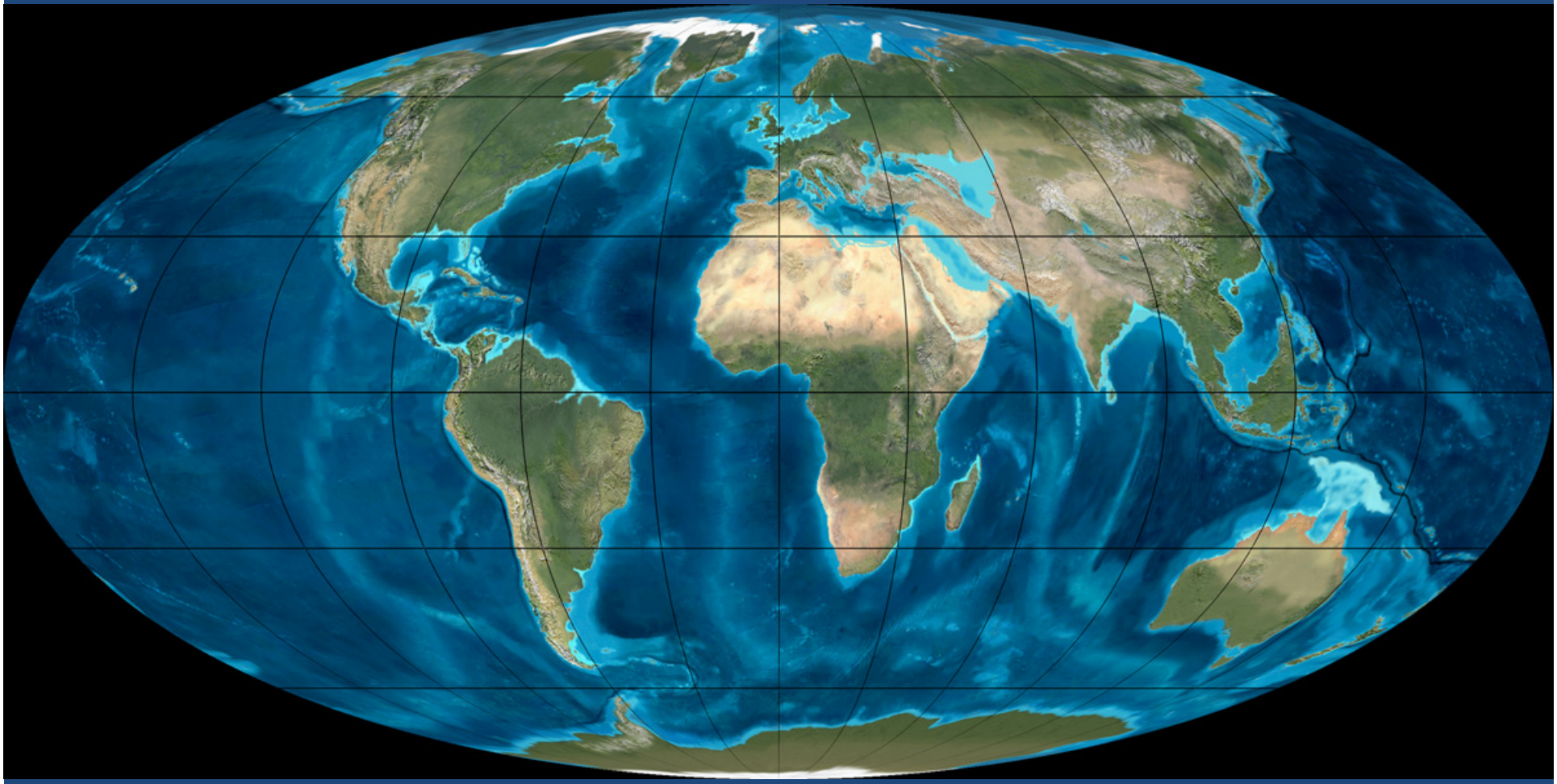

Reciprocal relationships between mountain-building, glaciation, global sea-level, $^{87}Sr/^{86}Sr$ in sea water, and continental positions and flooding
$^{87}Sr/^{86}Sr$
0.7065
0.7070
0.7075
0.7080
0.7085
0.7090
0.7095
Turkic-type growth
Continent at pole (flooded)
Amer. Cord. & Nipponides
Altaids & Gondwanides
Plio-Pleist
M
Ol
Pa+E
K
J
Tr
P
C
D
S
O
Є
Andean Altiplano
Main Alpide collisions
Marginal Cimmeride collisions
Main Cimmeride collisions
Cape "Altiplano"
Pangaean desert basins
Final Uralide/Scythide/Hercynide/Appalachide collisions
Final Caledonian collisions
Final Pan-African collisions
Ice
More
Less
Sea-level
High
Low



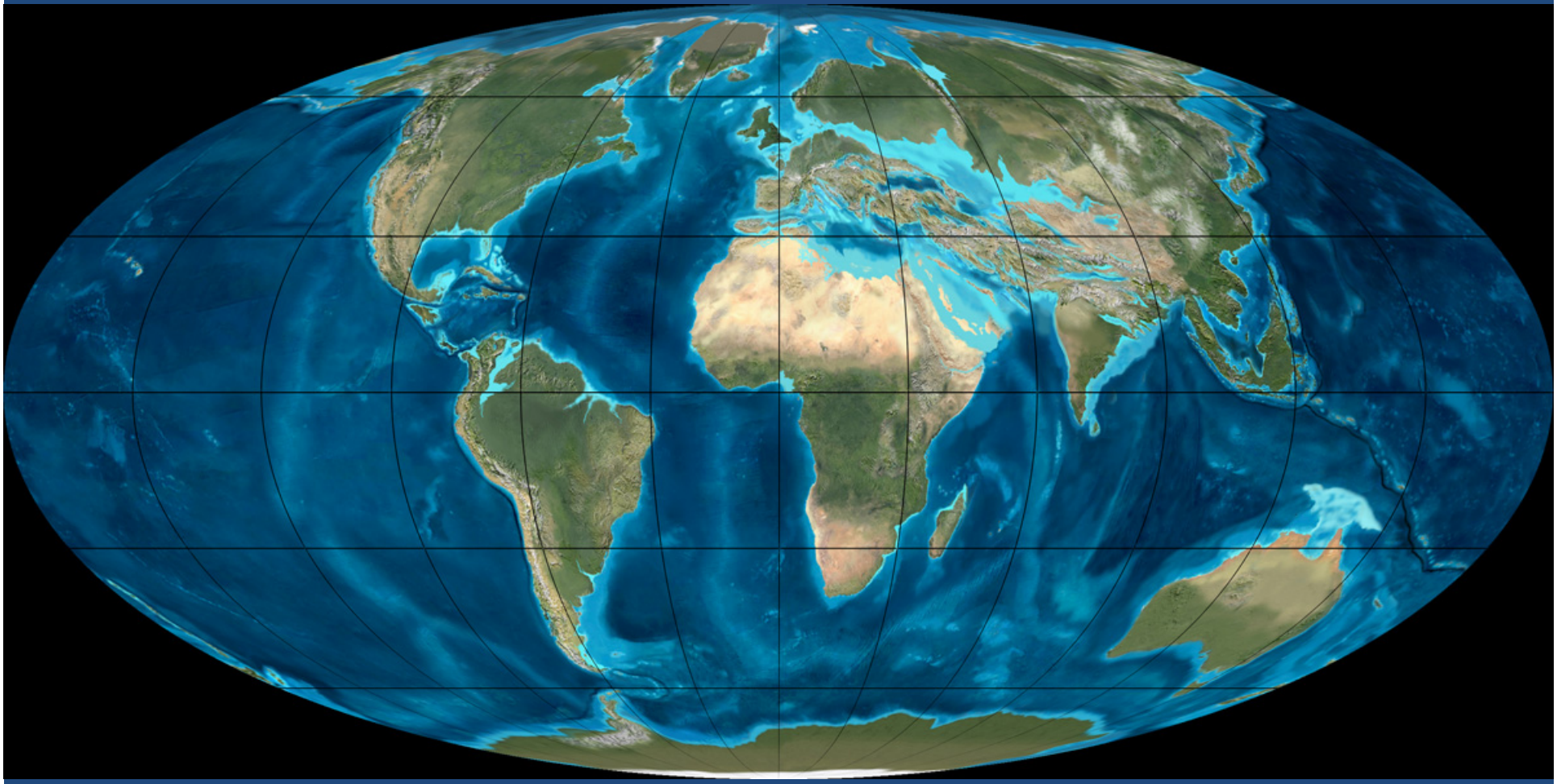
The present-day earth (by Ron Blakey)



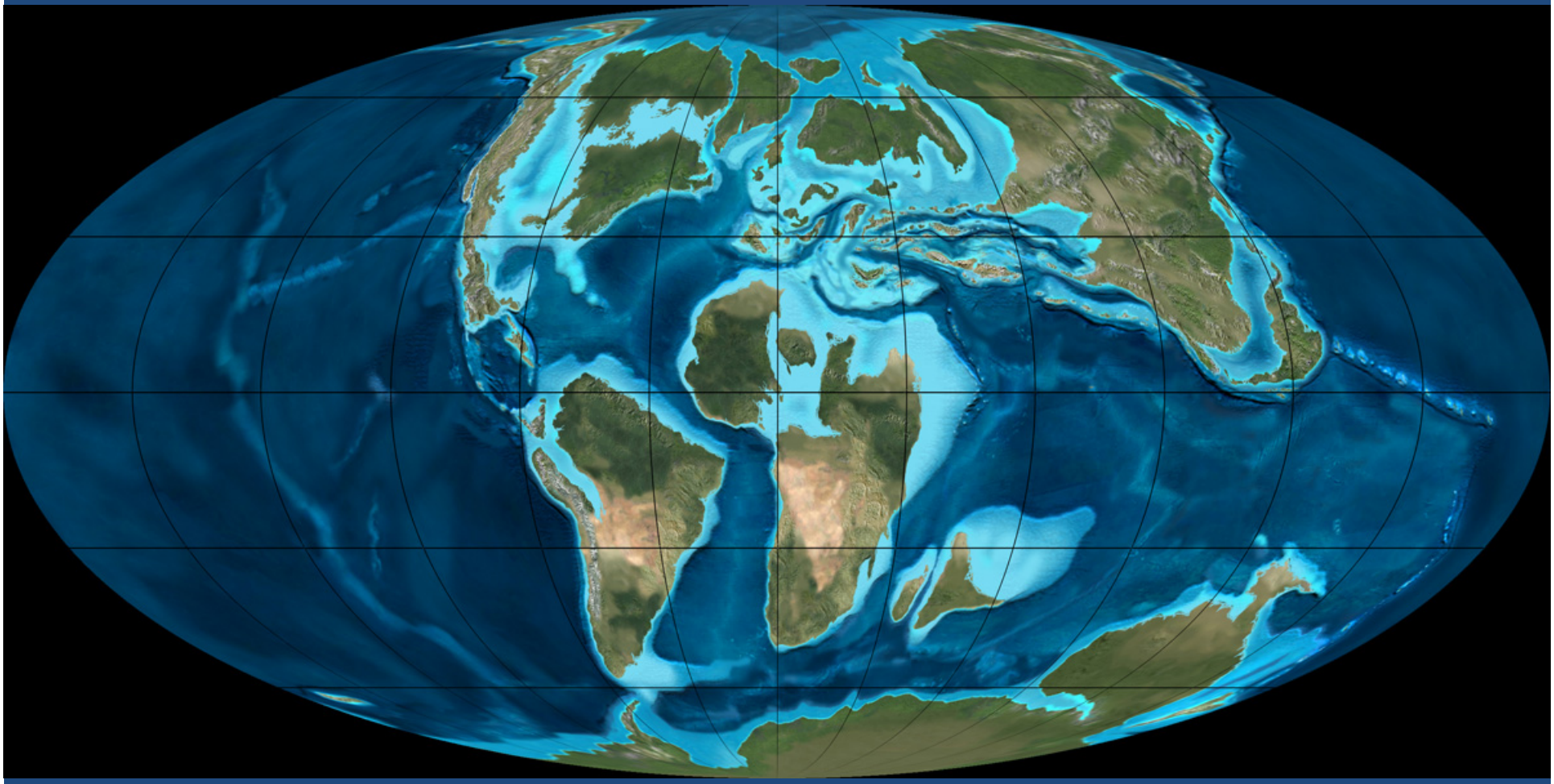
The earth 50,000 years ago (by Ron Blakey)



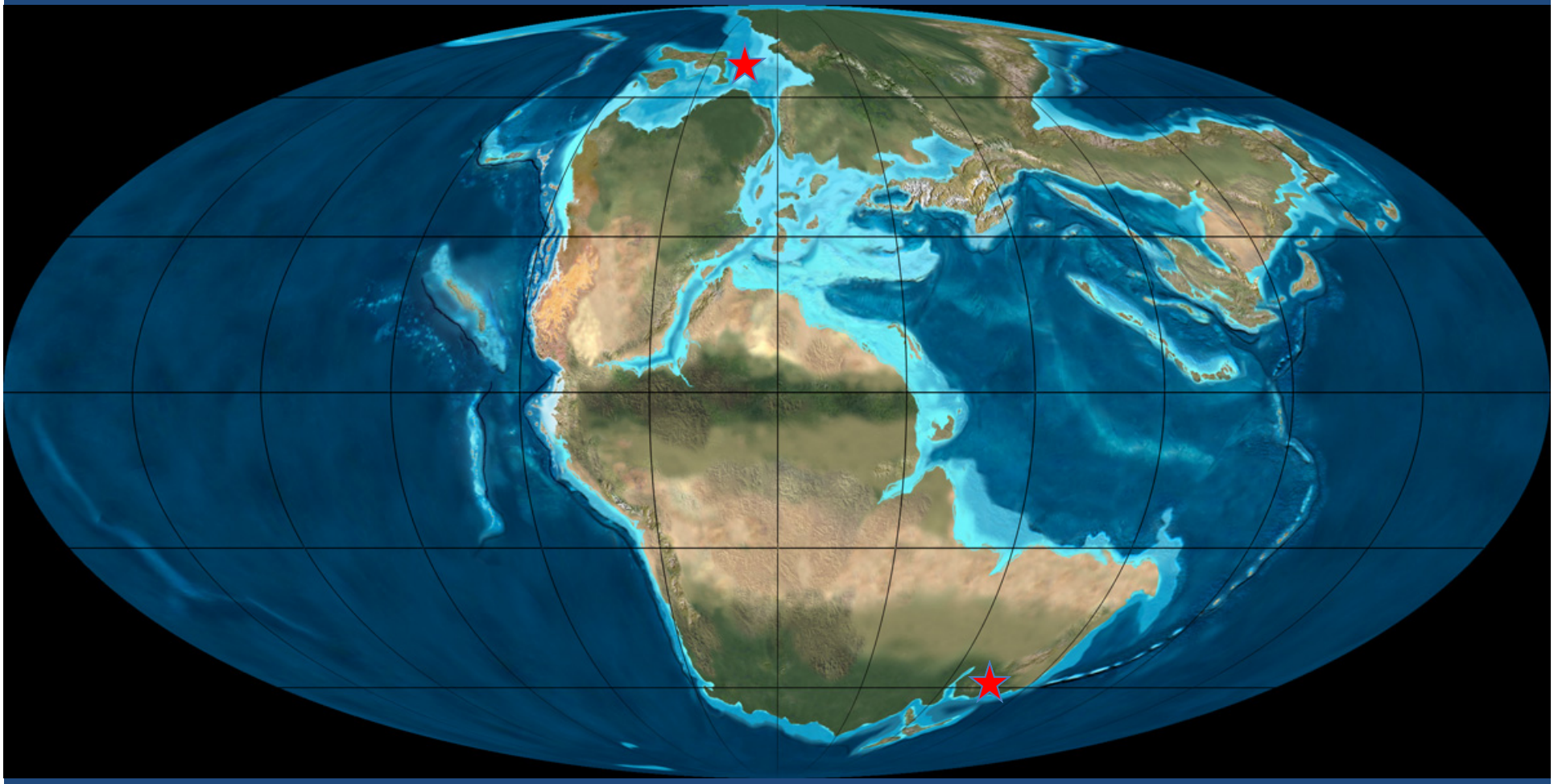
The earth 20 million years ago (by Ron Blakey)



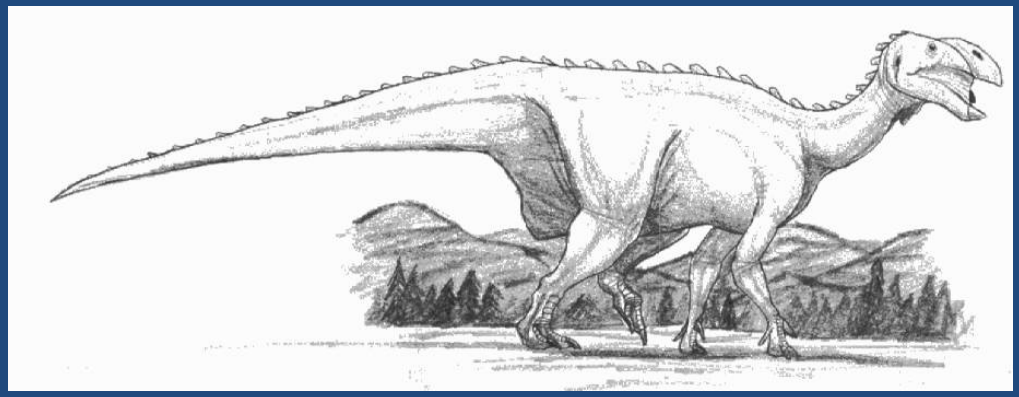
The earth 35 million years ago (by Ron Blakey)



The earth 90 million years ago (by Ron Blakey)

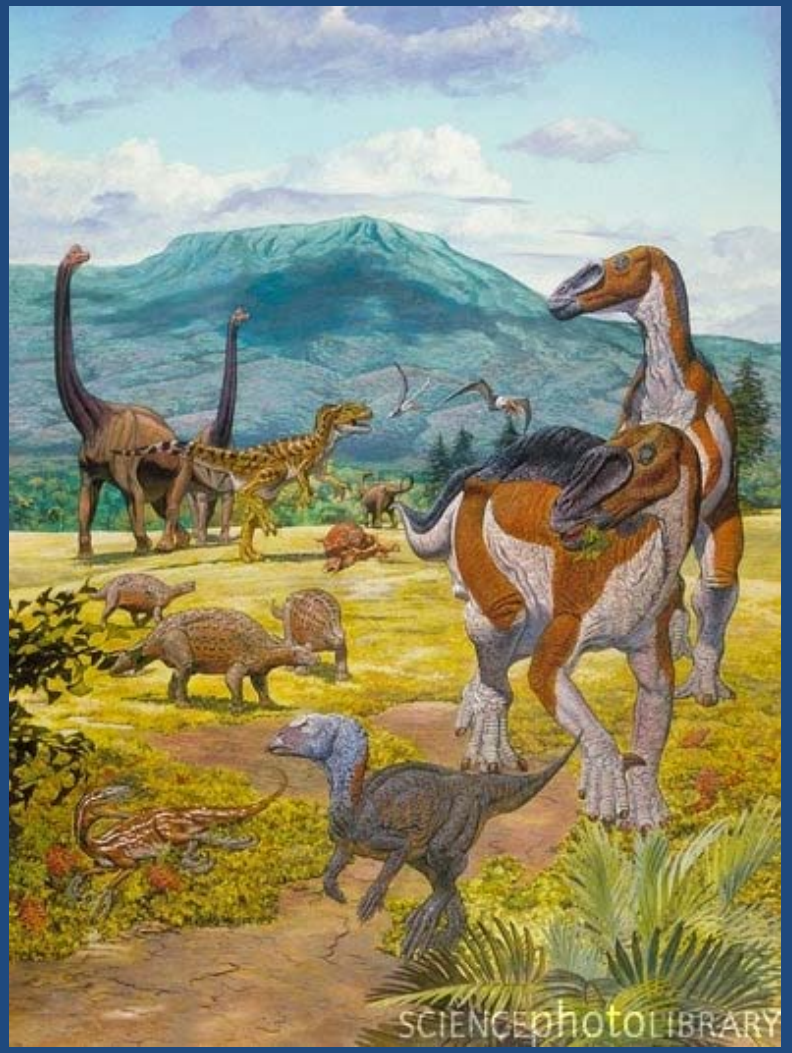


The earth 200 million years ago (by Ron Blakey)

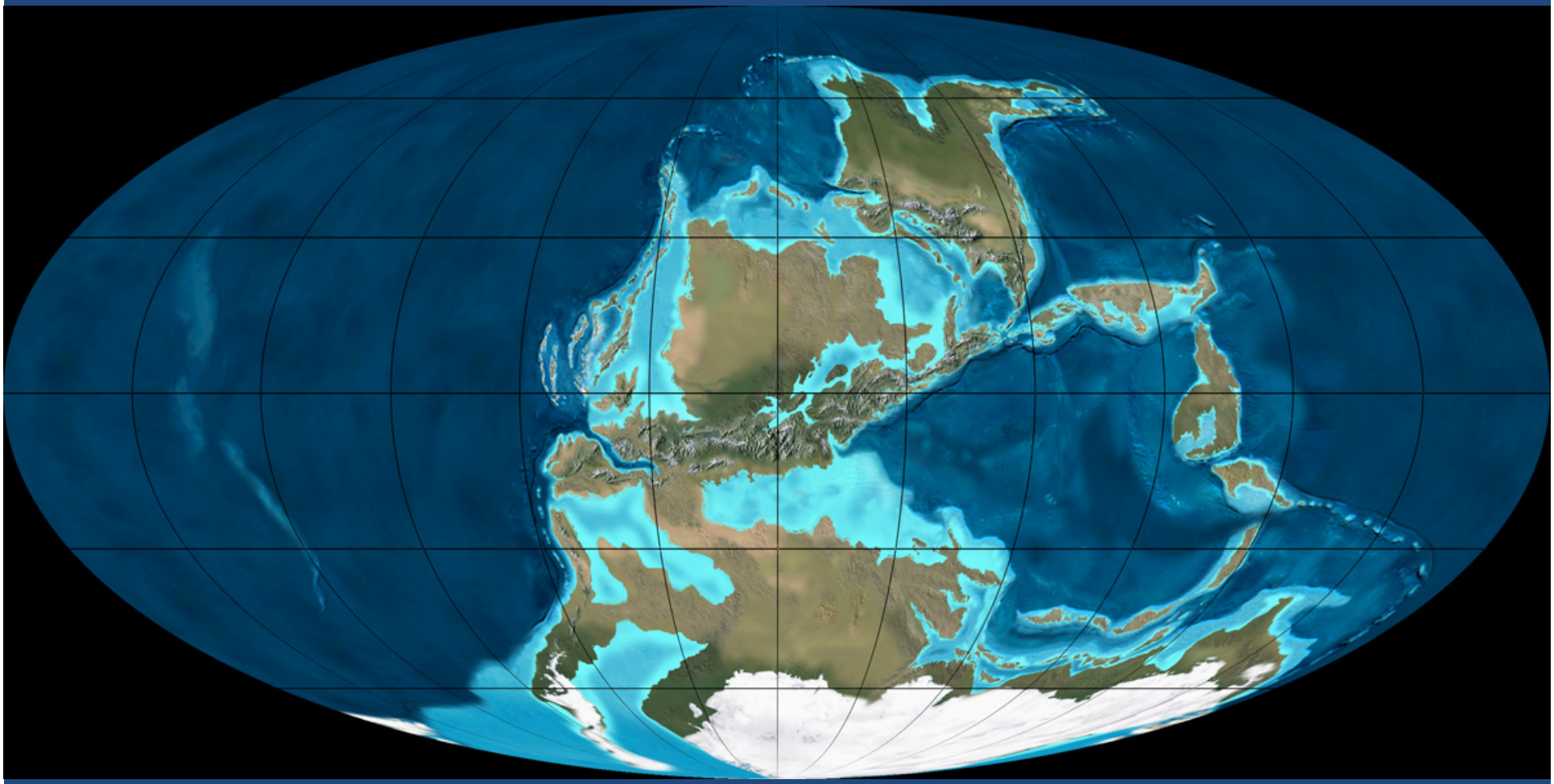


A dinosaur from Spitzbergen (*Iguanodon ?bernissartensis*)

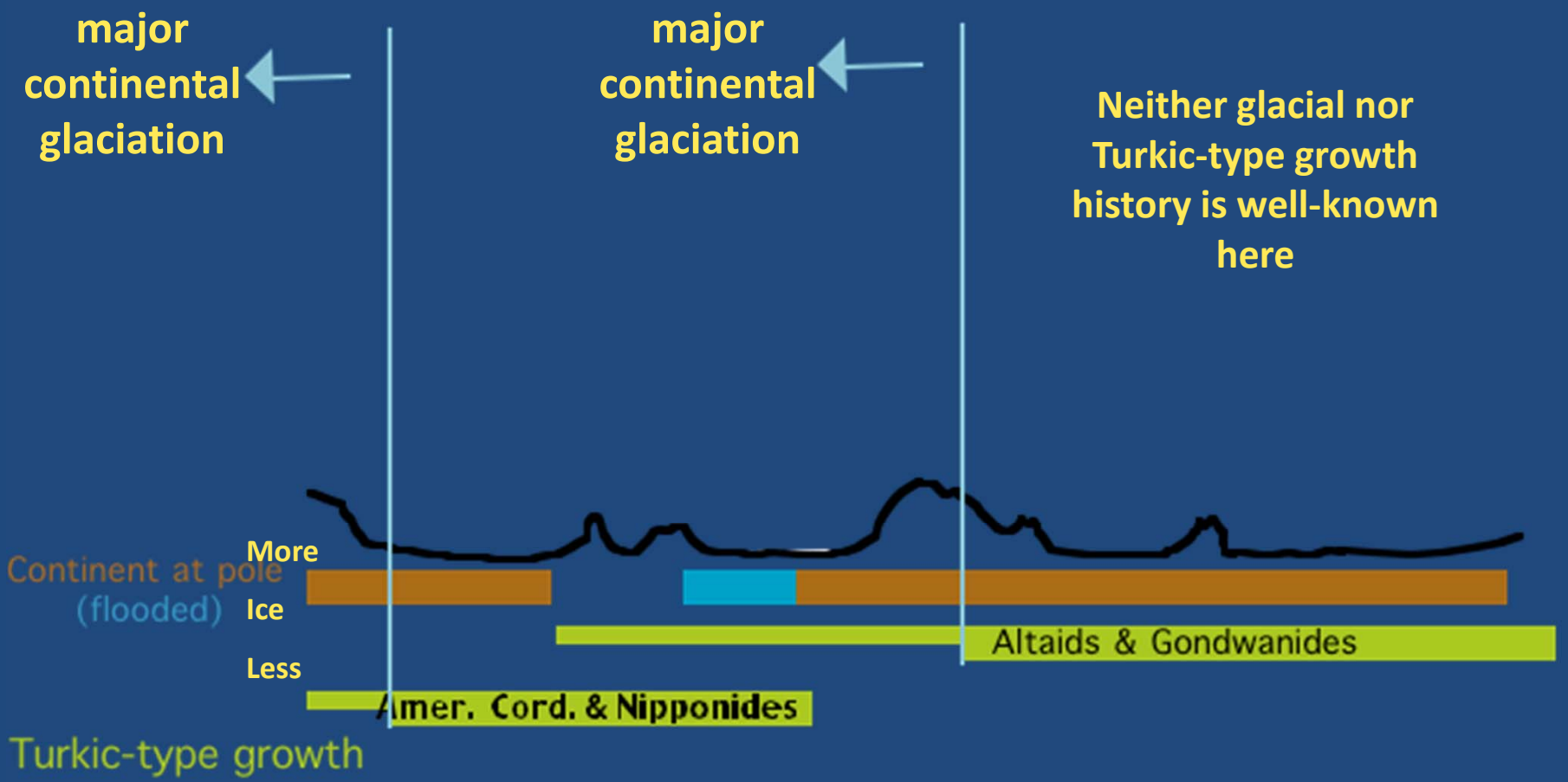
Certainly these dinosaurs did not live in perennially cold regions!



Australian dinosaurs



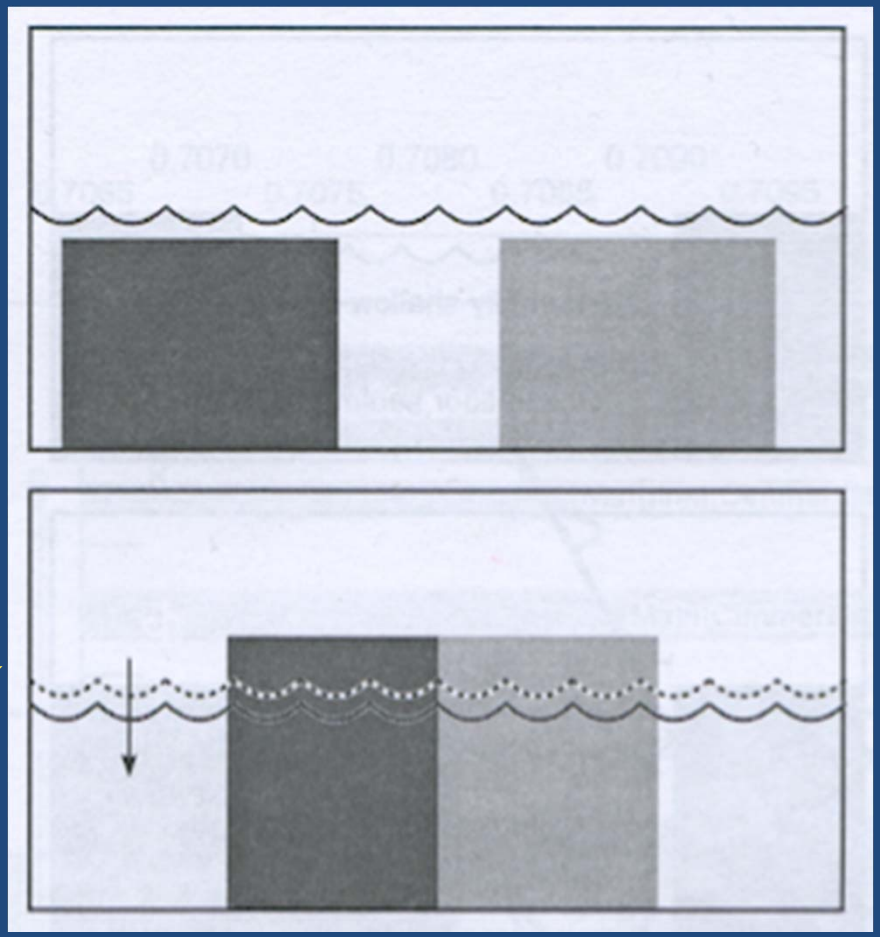
The earth 300 million years ago (by Ron Blakely)



Largest glaciations in the history of the earth correlate with termination of major Turkic-type growth on the planet.

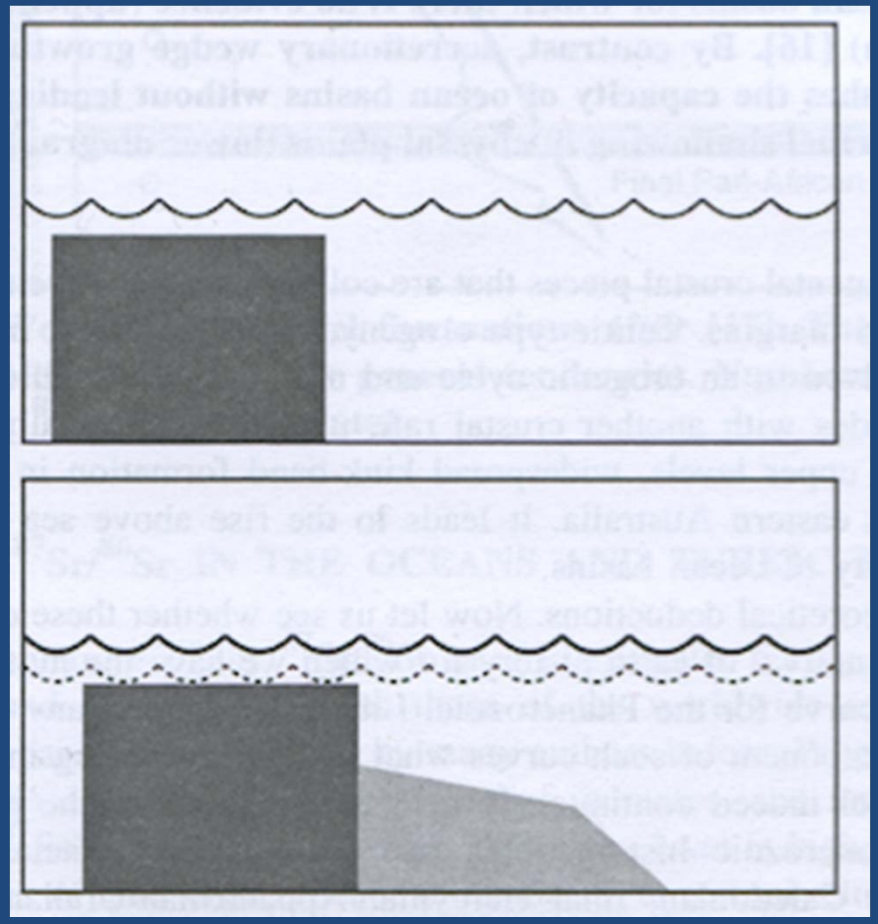
WHY SHOLD THIS BE SO?

What are the relationships between mountain-building events and global sea-level ?



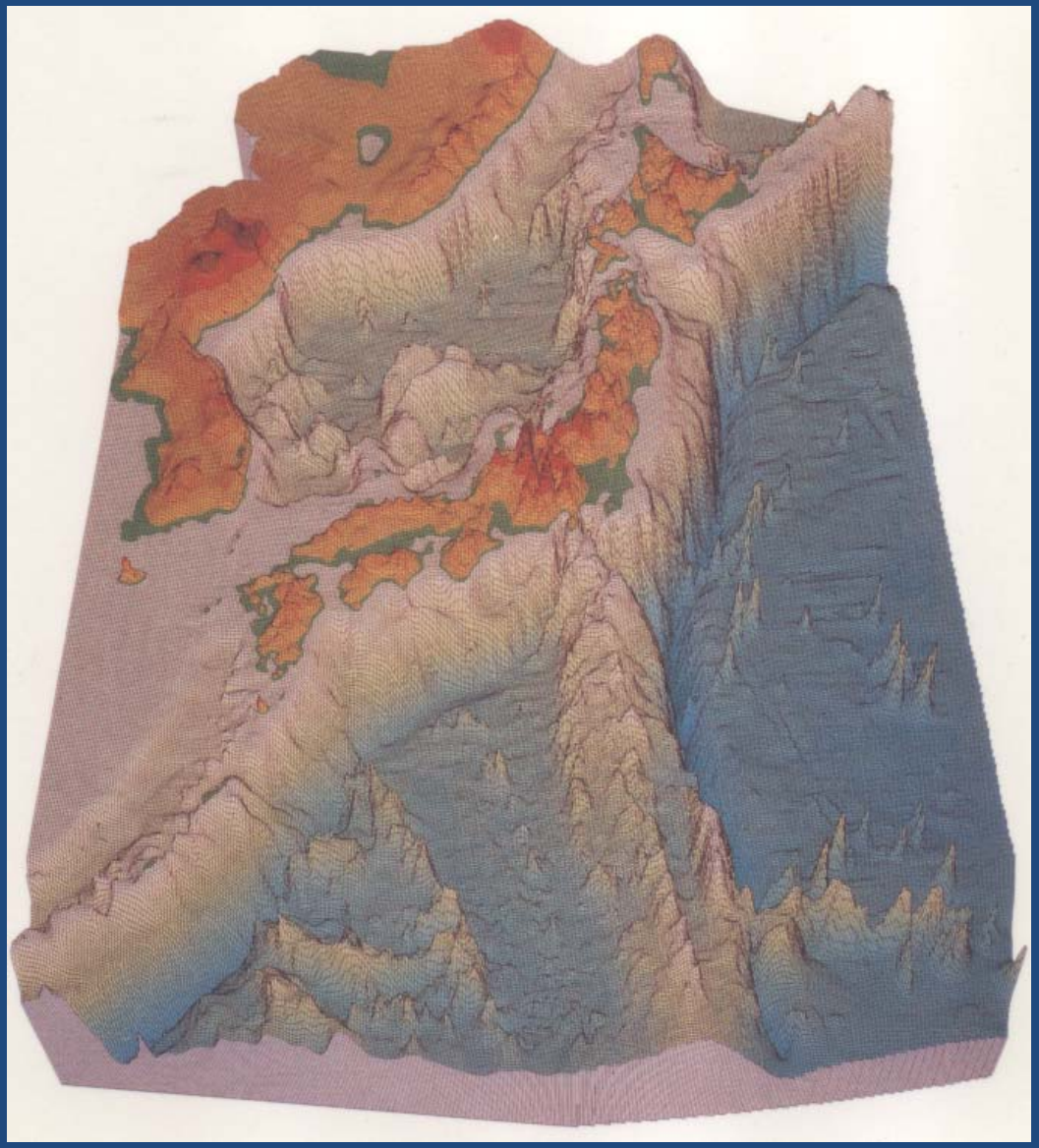
Drop in world-wide sea-level because of diminished submerged continental volume

Effect of “hard” collisions on world-wide sea-level: GLOBAL REGRESSION

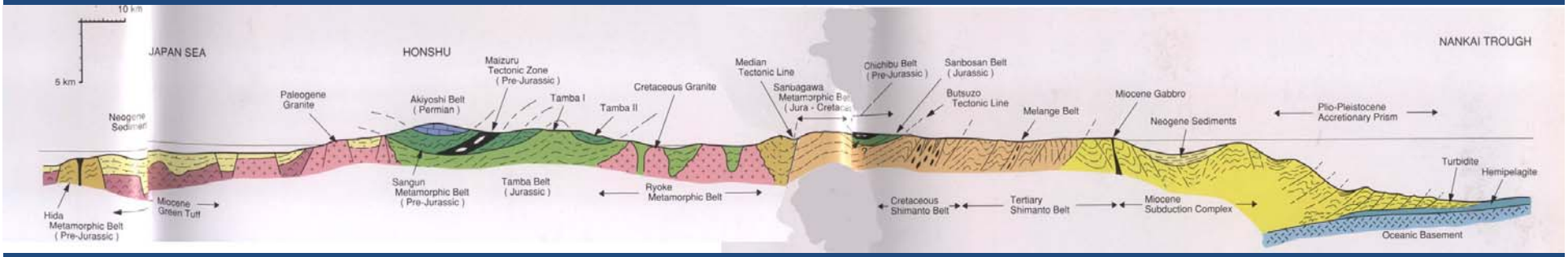


Rise in world-wide sea-level because of enlarged submerged continental volume

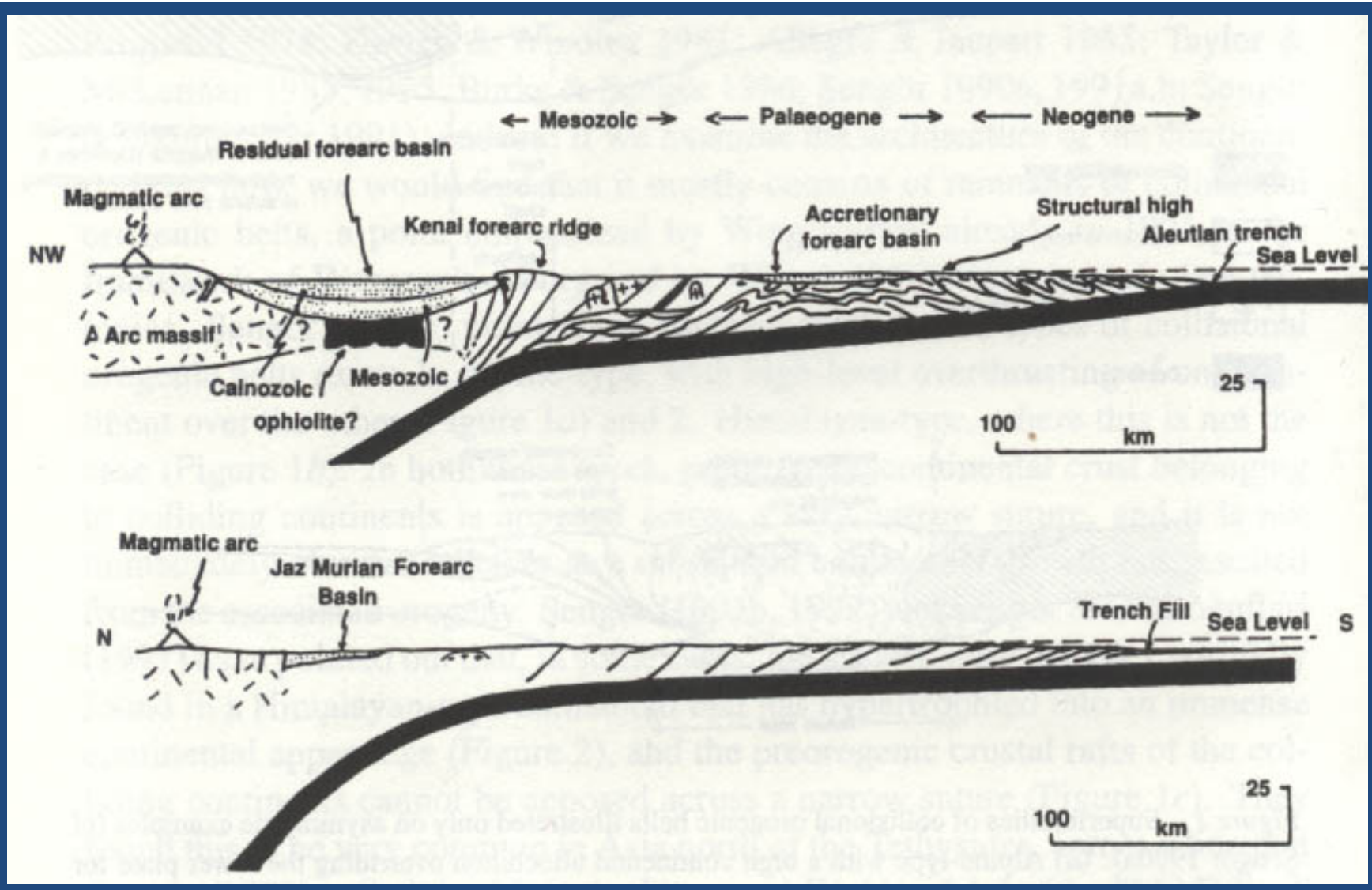
Effect of the growth of “Turkic-type orogens on world-wide sea-level: GLOBAL TRANSGRESSION



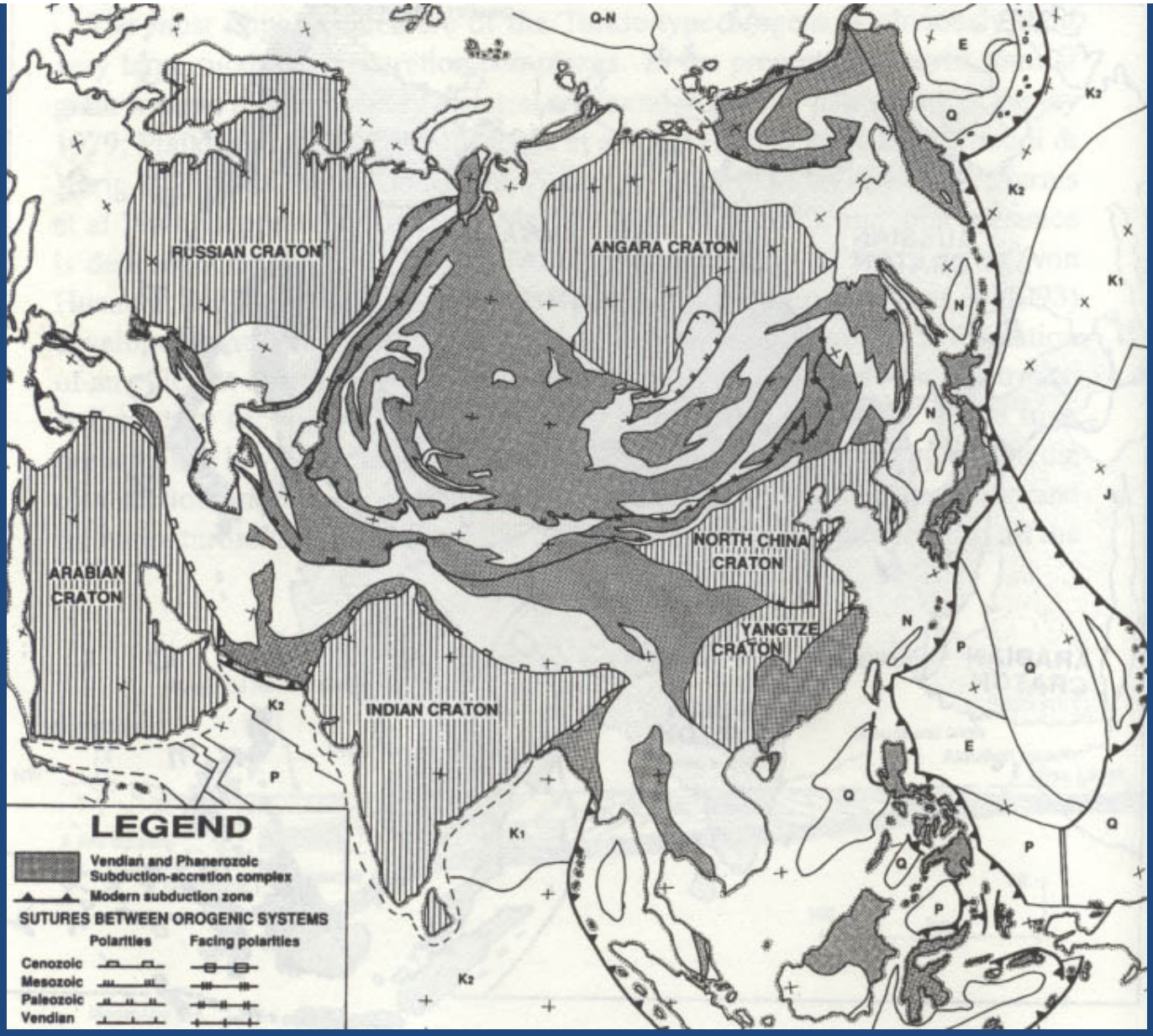
Topography and bathymetry around Japan



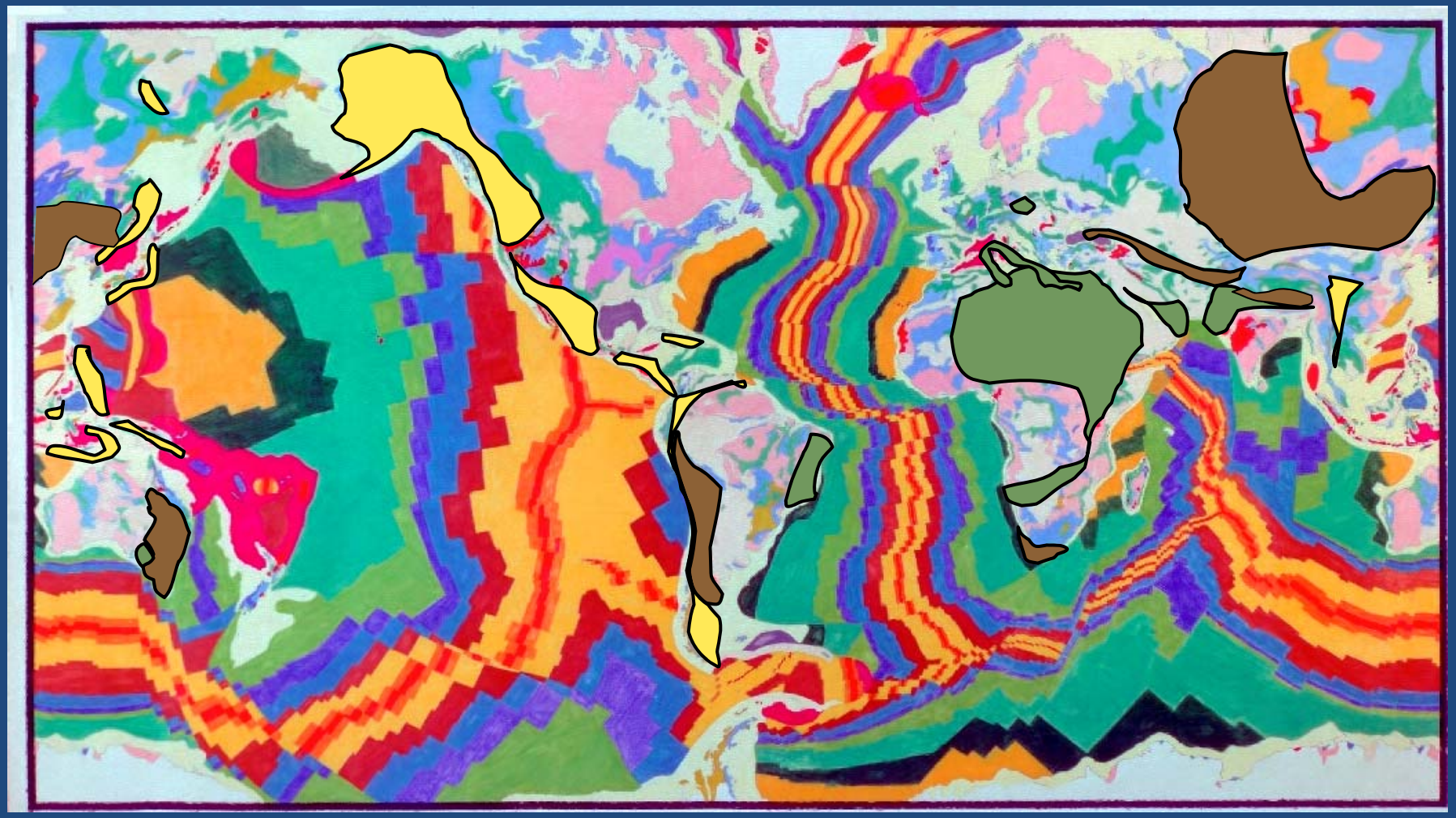
Structure section across southern Honshu and Shikoku



Two of the largest accretionary wedges in the world today: Alaska (above) and Iranian Makran (below). The wedge in the Pakistani Makran (not shown here) is almost twice as wide as the one in the Iranian Makran



Areas made up of Phanerozoic subduction-accretion complexes in Asia

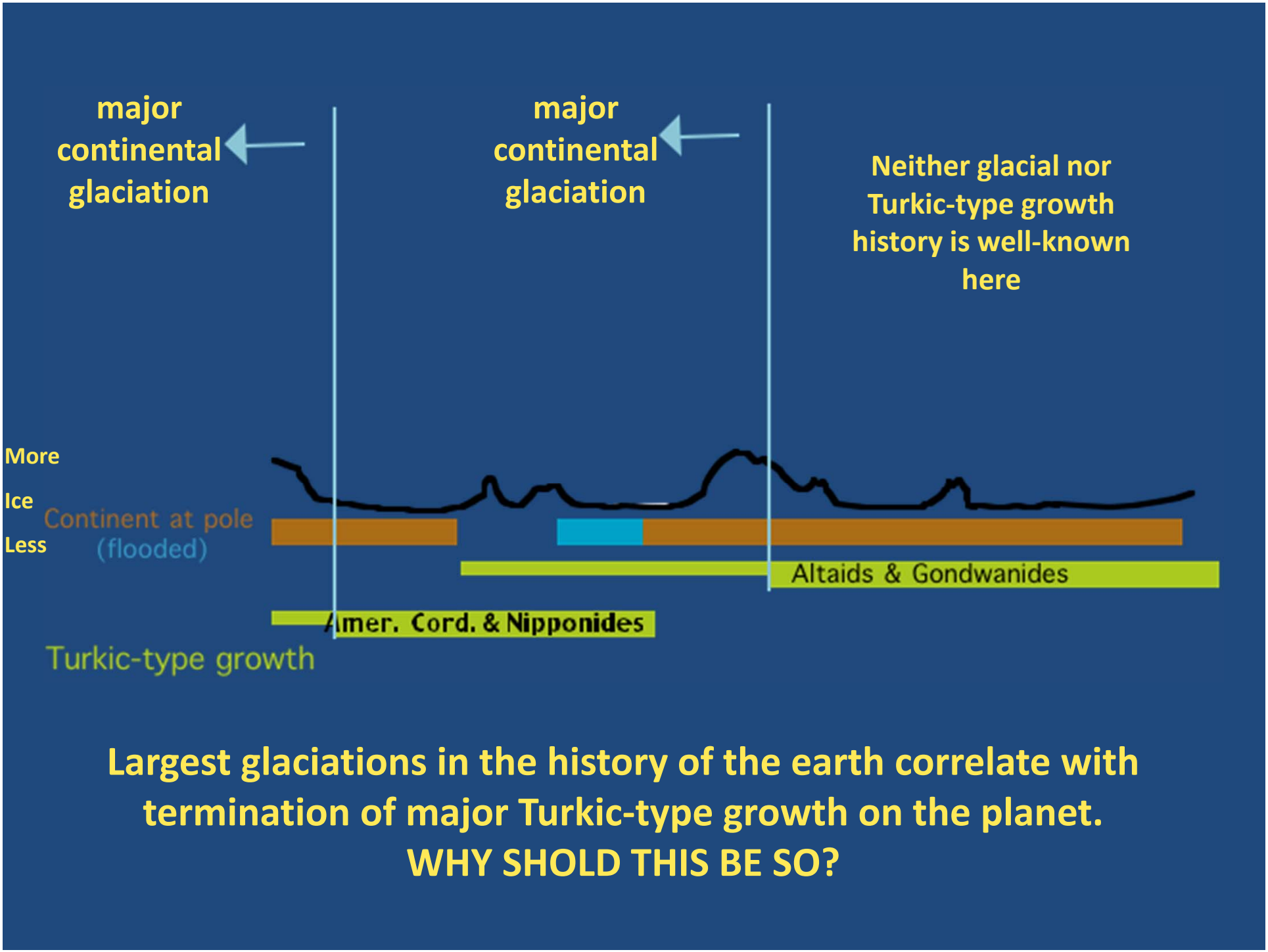


The Turkic-type orogens of the later Neoproterozoic and the Phanerozoic

Pan-Africanides (900-550 Ma)

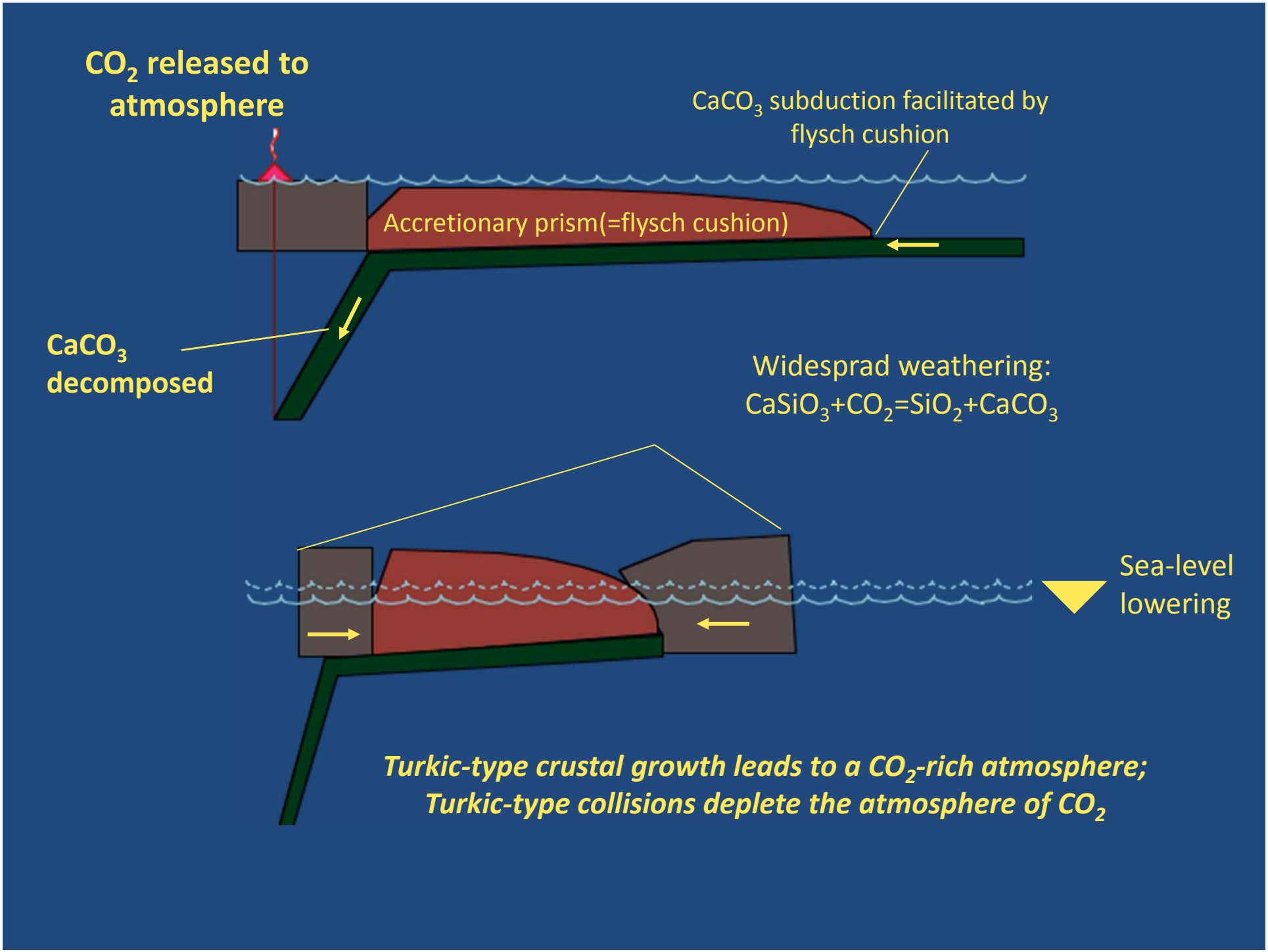
Altaides and Gondwanides (580-320 Ma) with some Kuen-Lun & Scythide additions

Cordillerides and Nipponides (250-2 Ma) with some Cimmeride additions

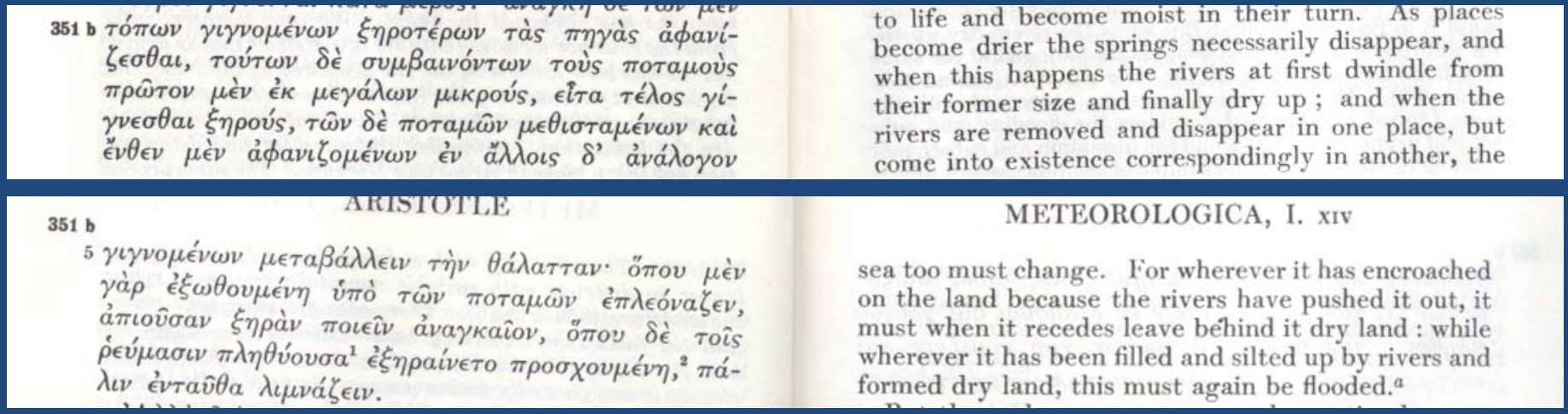


Largest glaciations in the history of the earth correlate with termination of major Turkic-type growth on the planet.

WHY SHOLD THIS BE SO?


CO_2 released to atmosphere
$CaCO_3$ subduction facilitated by flysch cushion
Accretionary prism(=flysch cushion)
$CaCO_3$ decomposed
Widesprad weathering:
$CaSiO_3+CO_2=SiO_2+CaCO_3$
Sea-level lowering
Turkic-type crustal growth leads to a CO_2-rich atmosphere;
Turkic-type collisions deplete the atmosphere of CO_2

ΑΡΙΣΤΟΤΕΛΟΥΣ
ΜΕΤΕΩΡΟΛΟΓΙΚΩΝ



351 b τόπων γιγνομένων ξηροτέρων τὰς πηγὰς ἀφανί-
ζεσθαι, τούτων δὲ συμβαινόντων τοὺς ποταμοὺς
πρῶτον μὲν ἐκ μεγάλων μικρούς, εἶτα τέλος γί-
γνεσθαι ξηρούς, τῶν δὲ ποταμῶν μεθισταμένων καὶ
ἔνθεν μὲν ἀφανιζομένων ἐν ἄλλοις δ' ἀνάλογον

to life and become moist in their turn. As places become drier the springs necessarily disappear, and when this happens the rivers at first dwindle from their former size and finally dry up ; and when the rivers are removed and disappear in one place, but come into existence correspondingly in another, the

ARISTOTLE

351 b

5 γιγνομένων μεταβάλλειν τὴν θάλατταν· ὅπου μὲν
γὰρ ἐξωθουμένη ὑπὸ τῶν ποταμῶν ἐπλεόναζεν,
ἀπιοῦσαν ξηρὰν ποιεῖν ἀναγκαῖον, ὅπου δὲ τοῖς
ῥεύμασιν πληθύουσα[1] ἐξηραίνετο προσχουμένη,[2] πά-
λιν ἐνταῦθα λιμνάζειν.

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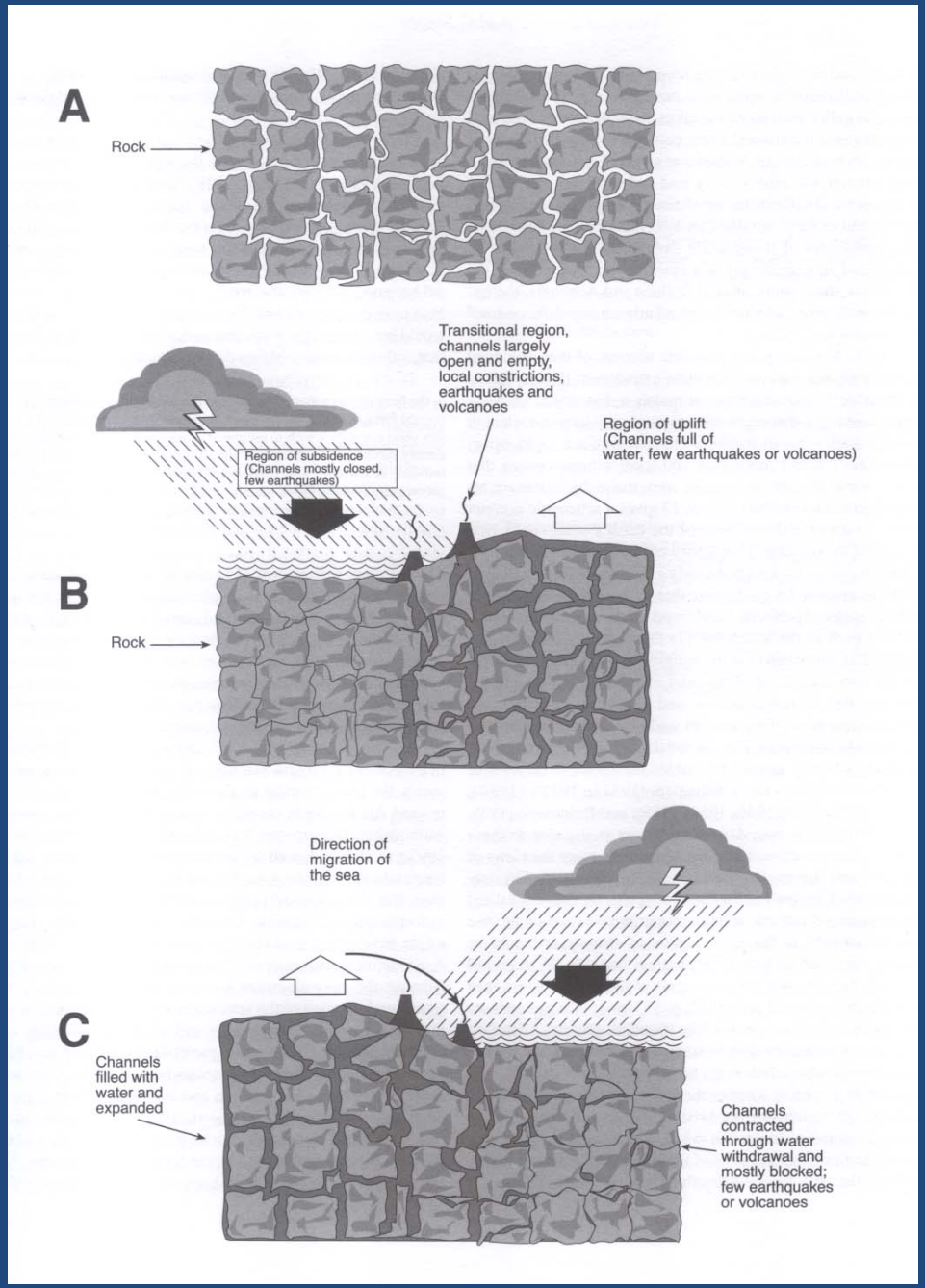
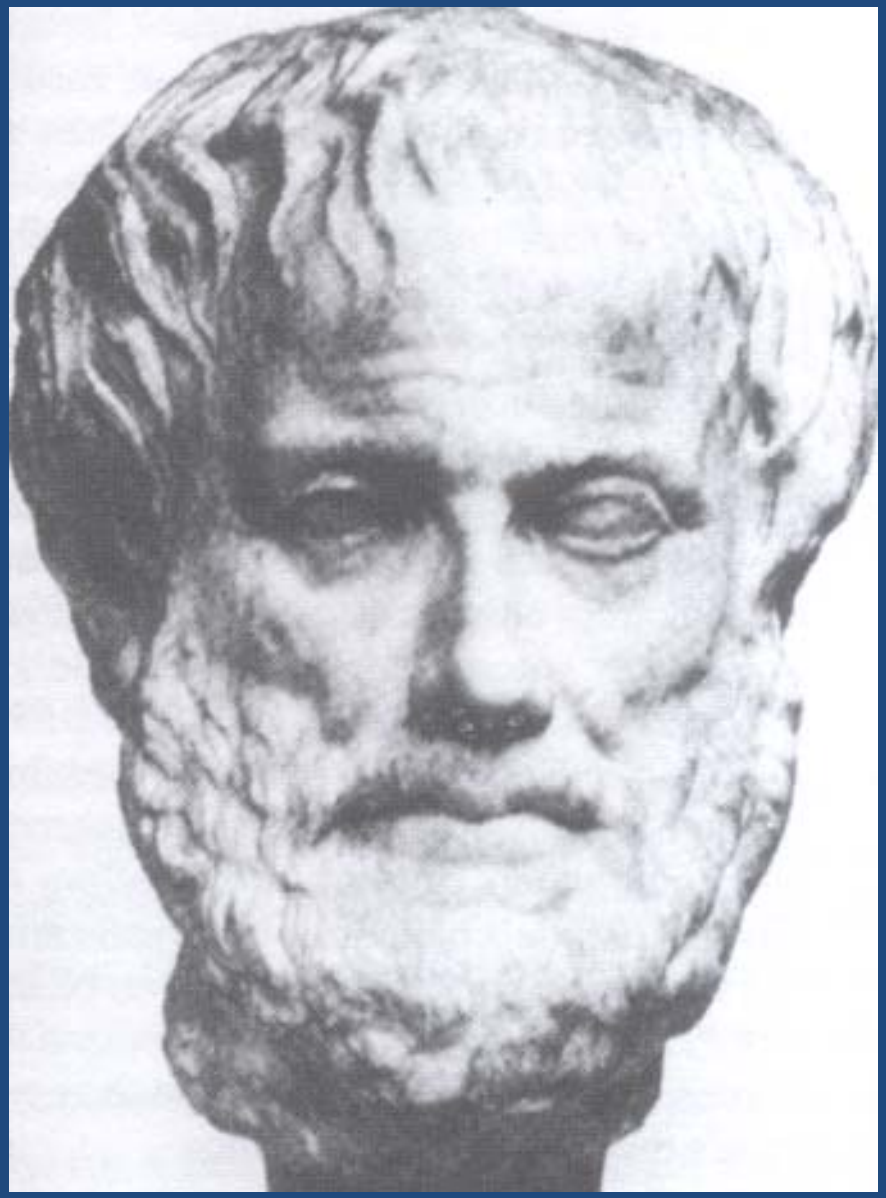
sea too must change. For wherever it has encroached on the land because the rivers have pushed it out, it must when it recedes leave behind it dry land : while wherever it has been filled and silted up by rivers and formed dry land, this must again be flooded.[a]

Aristotle knew enough to speculate about changing geographies through time, although his conception of the time required for such changes was entirely wrong. He thought in terms of thousans of years, instead of millions of years.

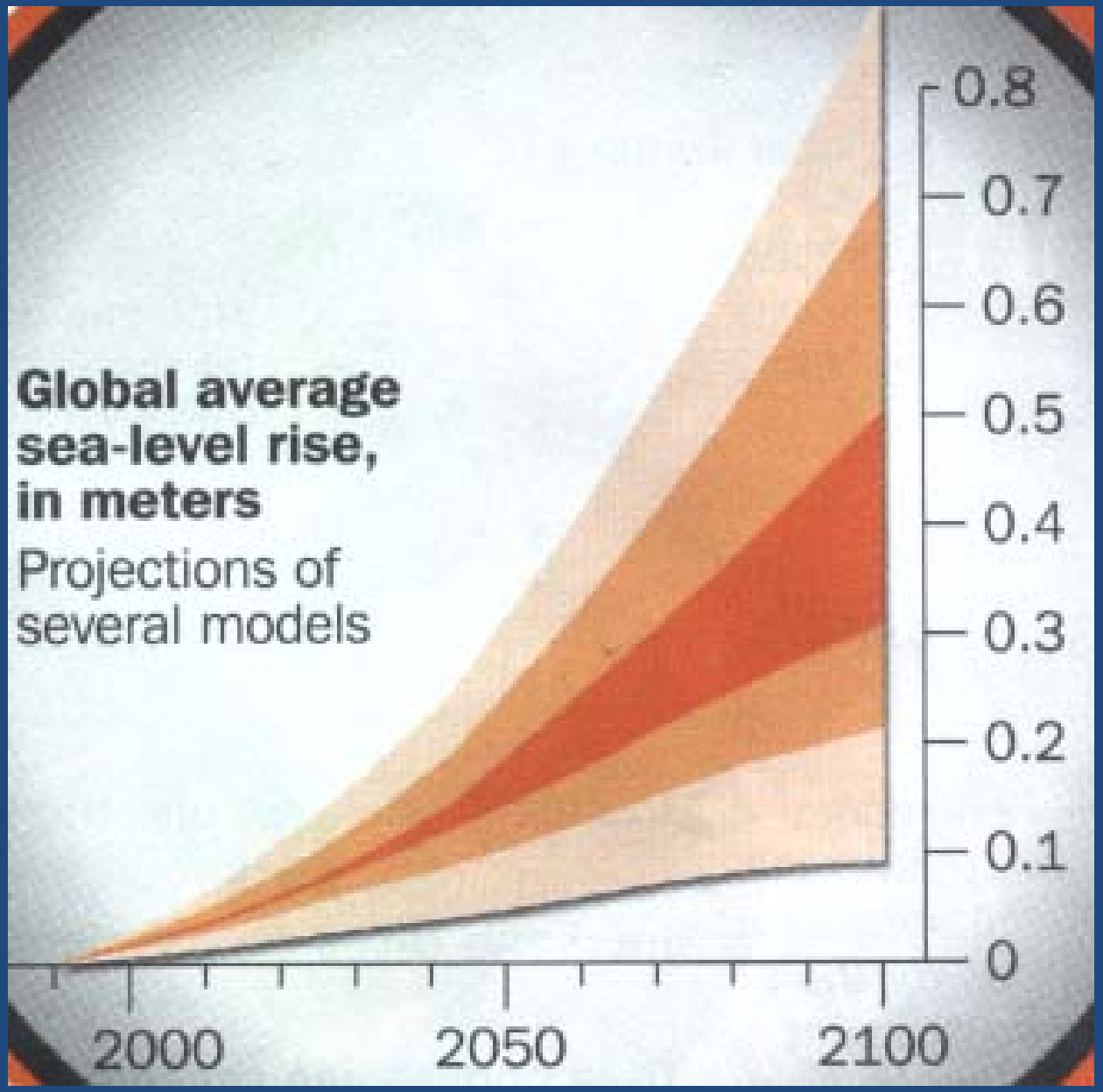

A
Rock
Transitional region, channels largely open and empty, local constrictions, earthquakes and volcanoes
Region of uplift (Channels full of water, few earthquakes or volcanoes)
Region of subsidence (Channels mostly closed, few earthquakes)
B
Rock
Direction of migration of the sea
C
Channels filled with water and expanded
Channels contracted through water withdrawal and mostly blocked; few earthquakes or volcanoes



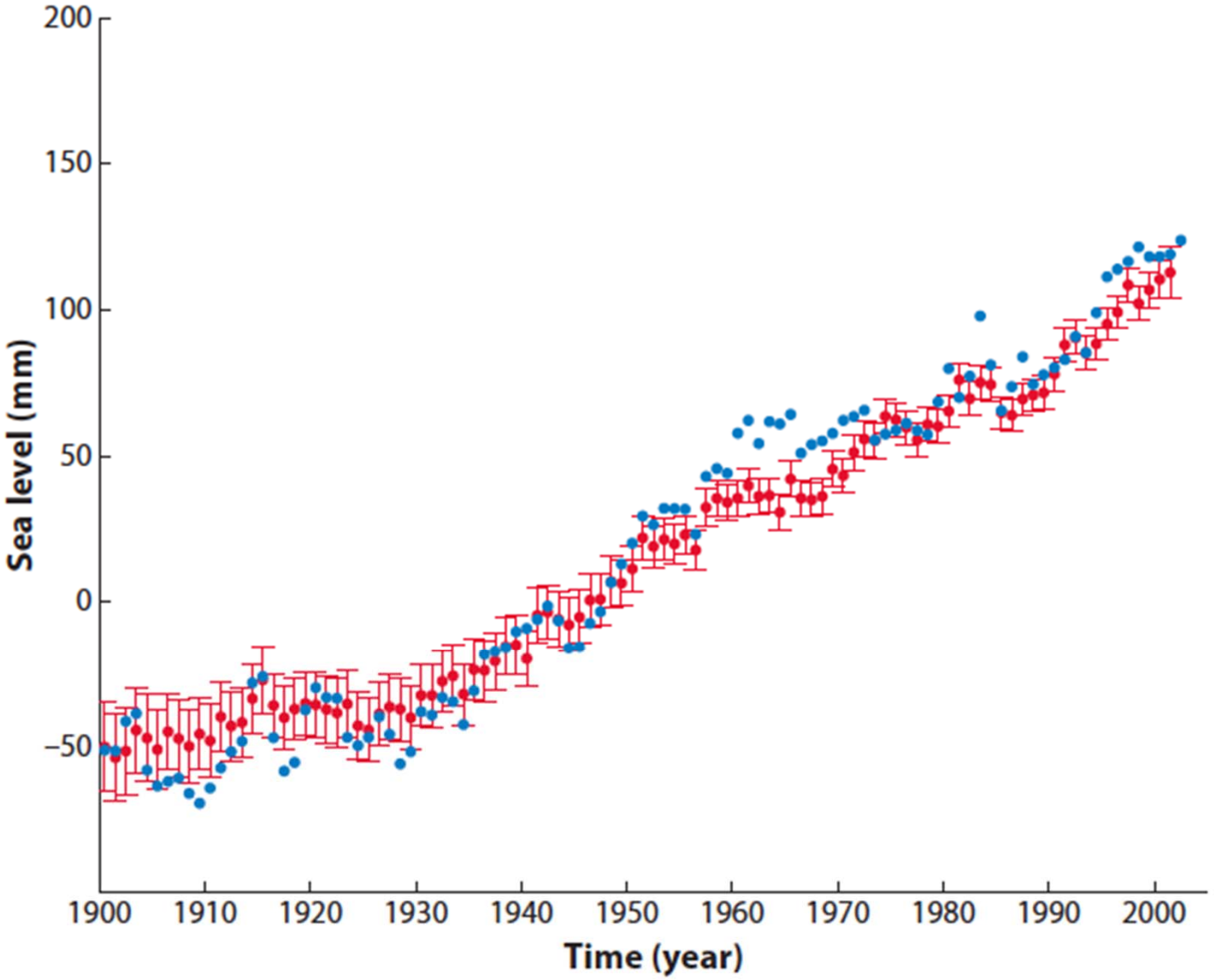
ARISTOTLE

Stagira (-384) — Near Chalkis (-322)

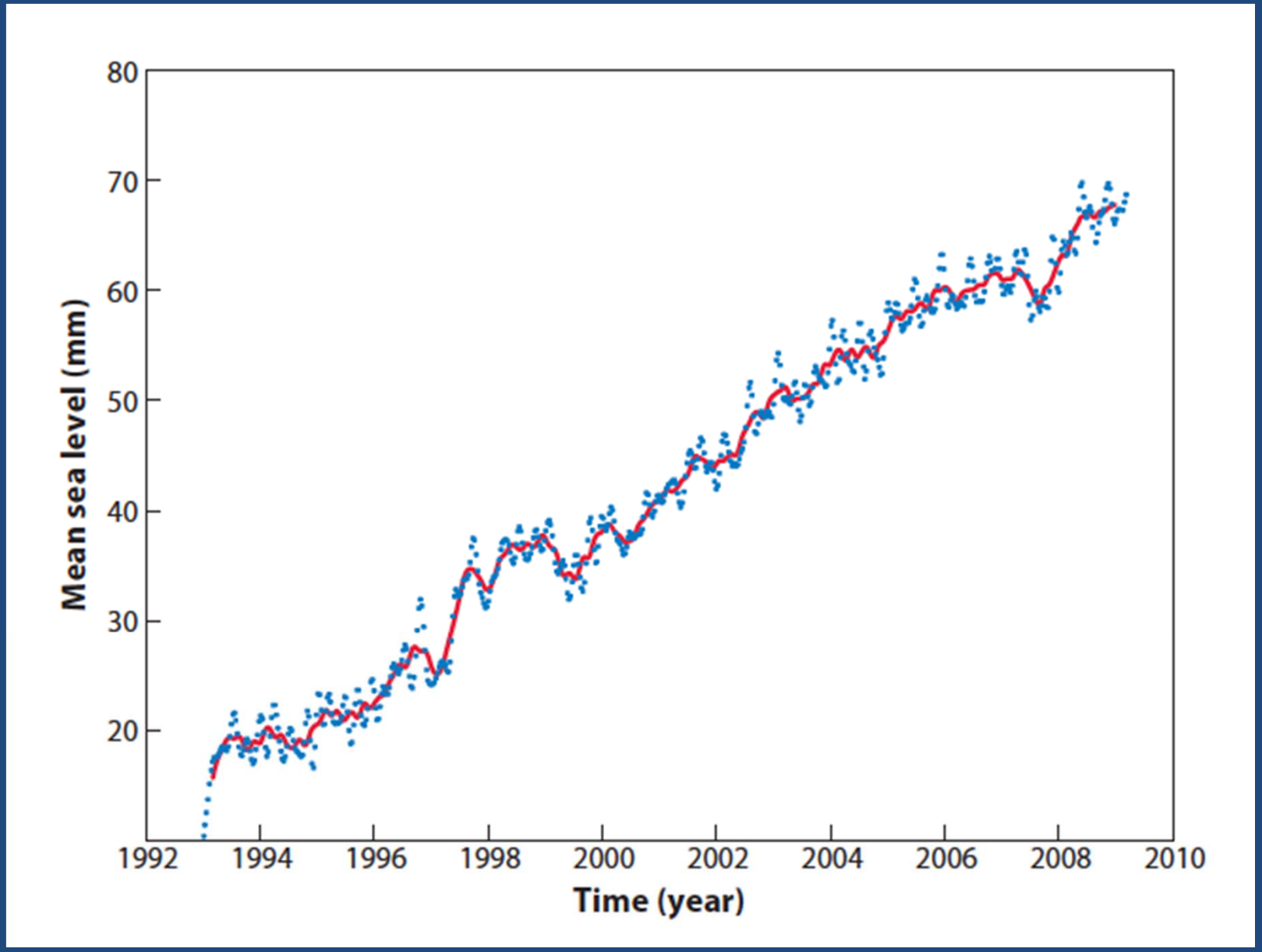
BUT, YOU HAVE INVITED ME HERE TO TELL YOU WHETHER THE MACEDONIAN MASTER WAS REALLY AS WRONG AS WE THINK HE WAS?



Time, 3rd April 2006 climate issue has summarised the existing models of expected sea-level change in the next century



Observed mean sea-level from tide gauges (from Cazenave and Llovel (2010)



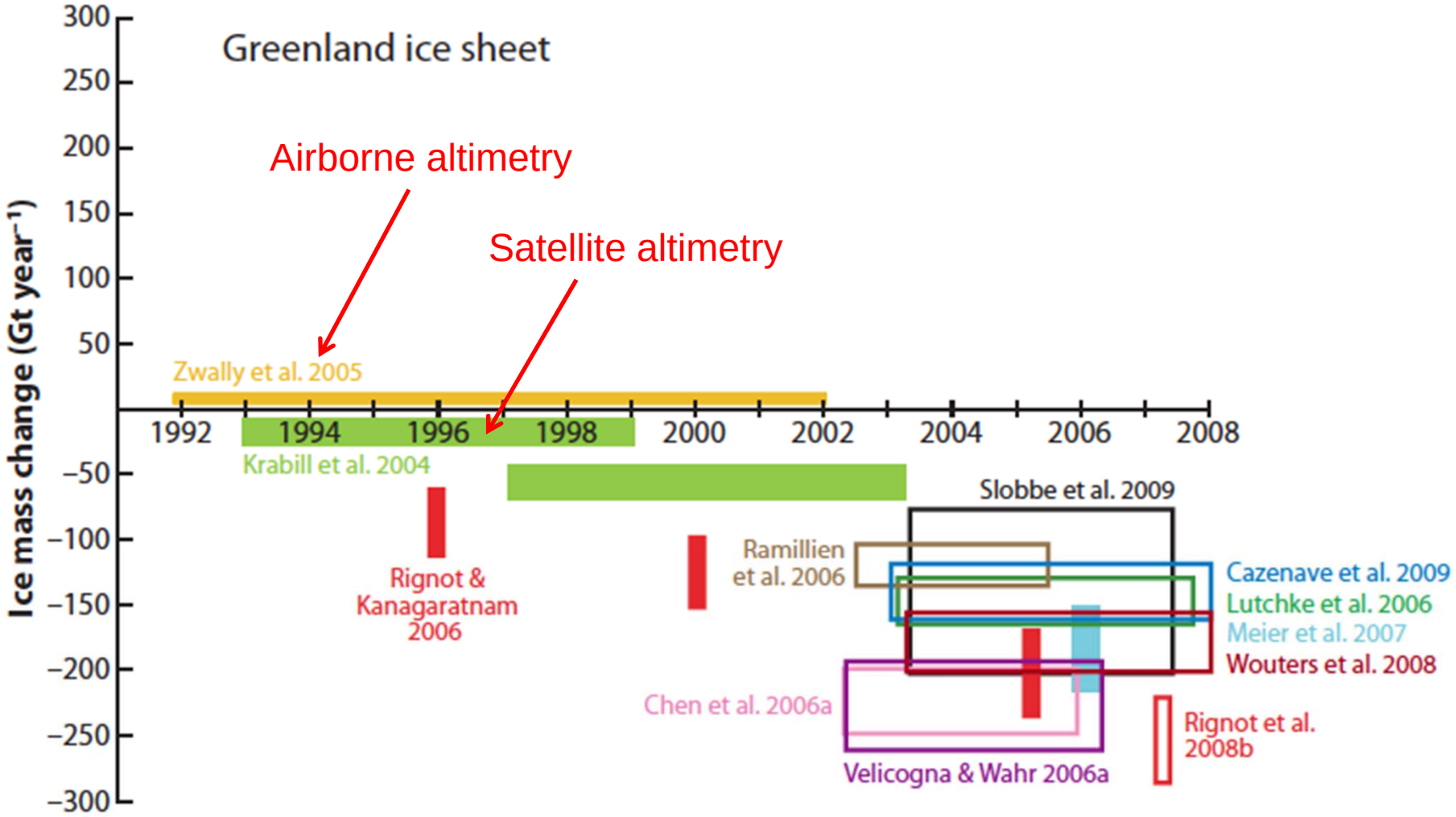
Global mean sea-level from satellite altimetry between January 1993 and december 2008 (from Cazenave and Llovel, 2010)

Between 1993-2007 sea level rise has averaged 2.85 ± 0.35 mm/a

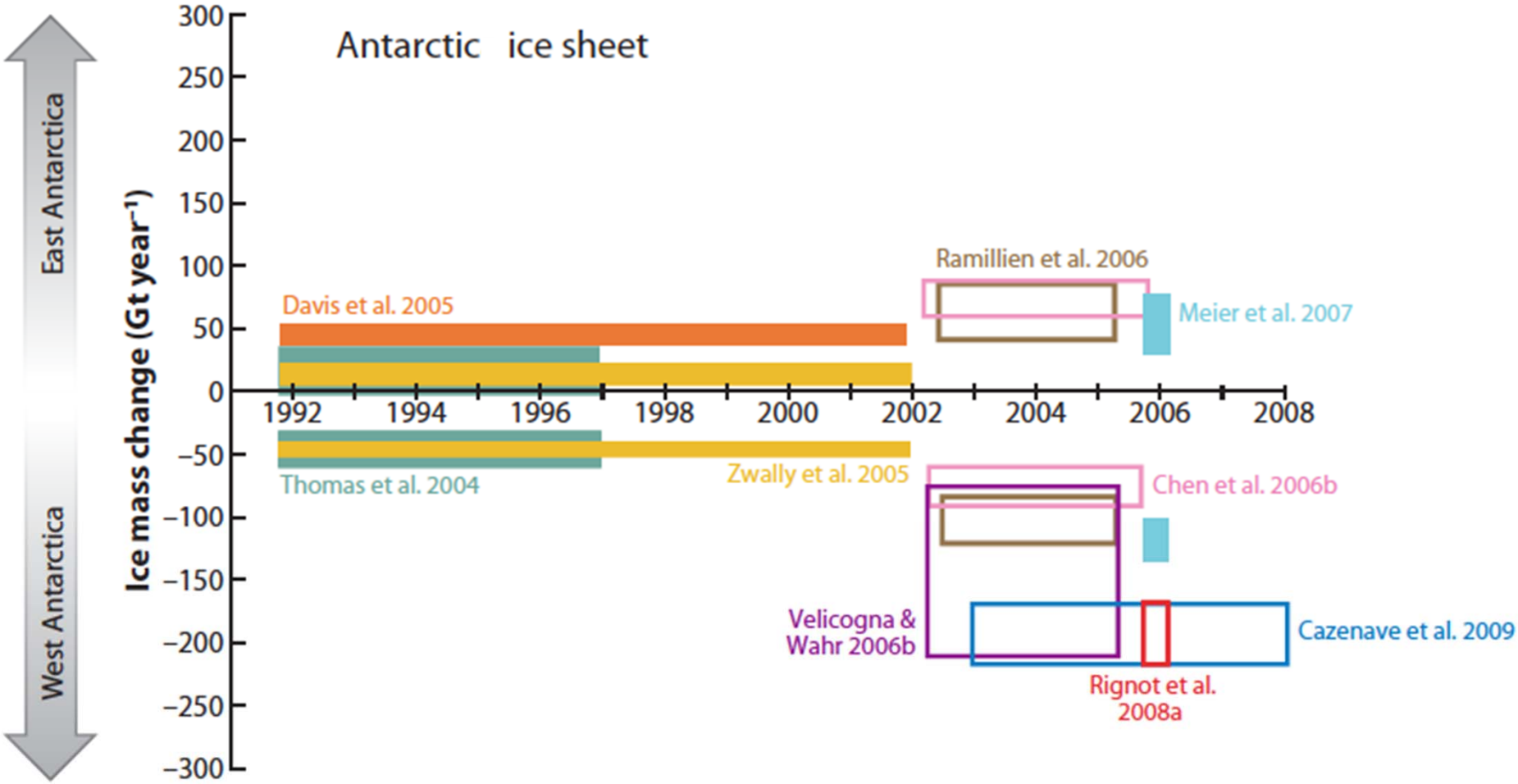
Of this sum,

30 % is a consequence of the thermal expansion of ocean water and the rest is due to glacier ice melt

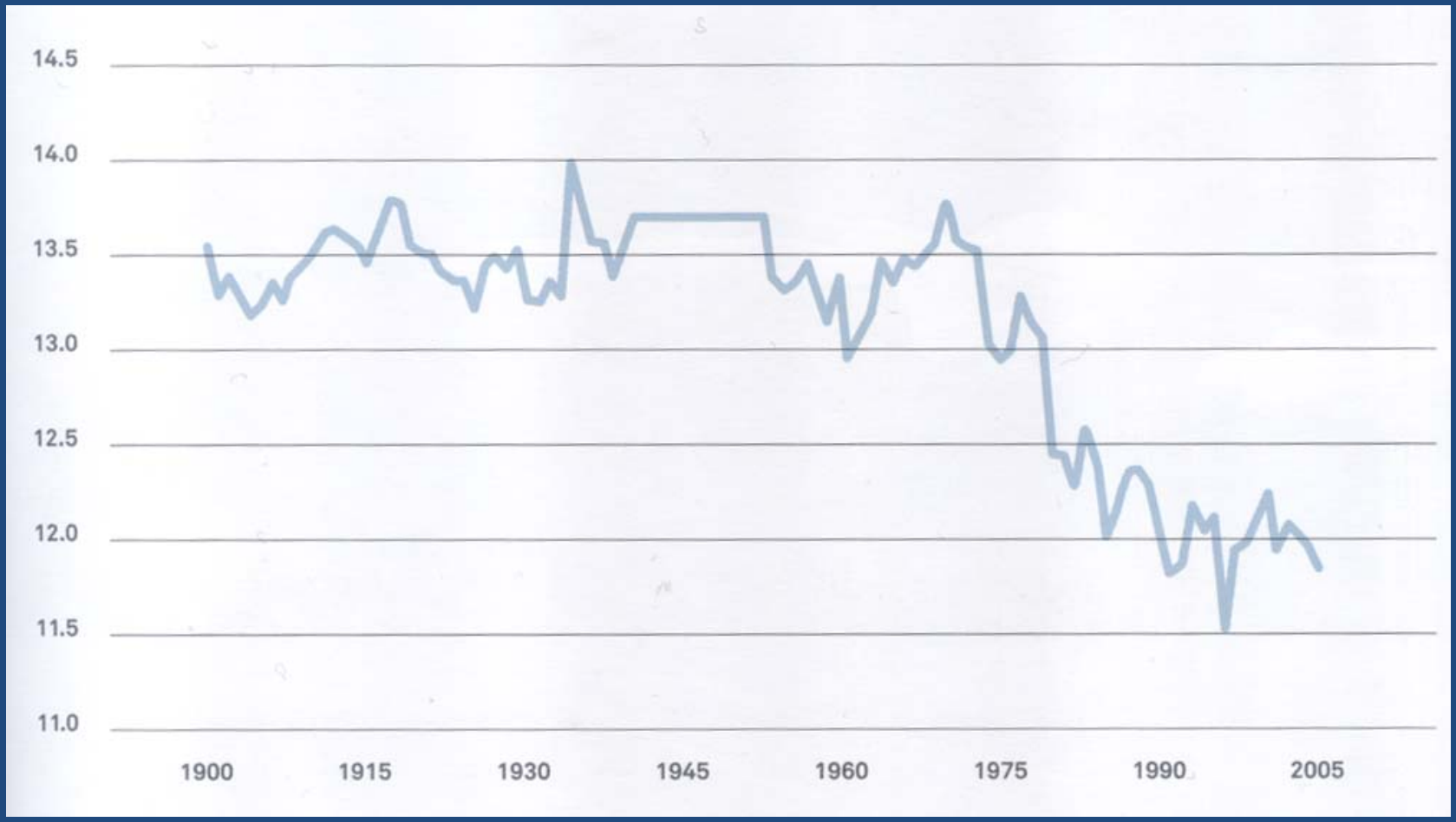
In recent years, however, the contribution of glacier melt to sea-level rise has increased to 80% !



The mass change of the Greenland ice sheet between 1992 and 2008. Notice the rapid acceleration of the ice loss both because of surface melting and basal lubrication of the ice tongues (from Czenave and Llovel, 2010)

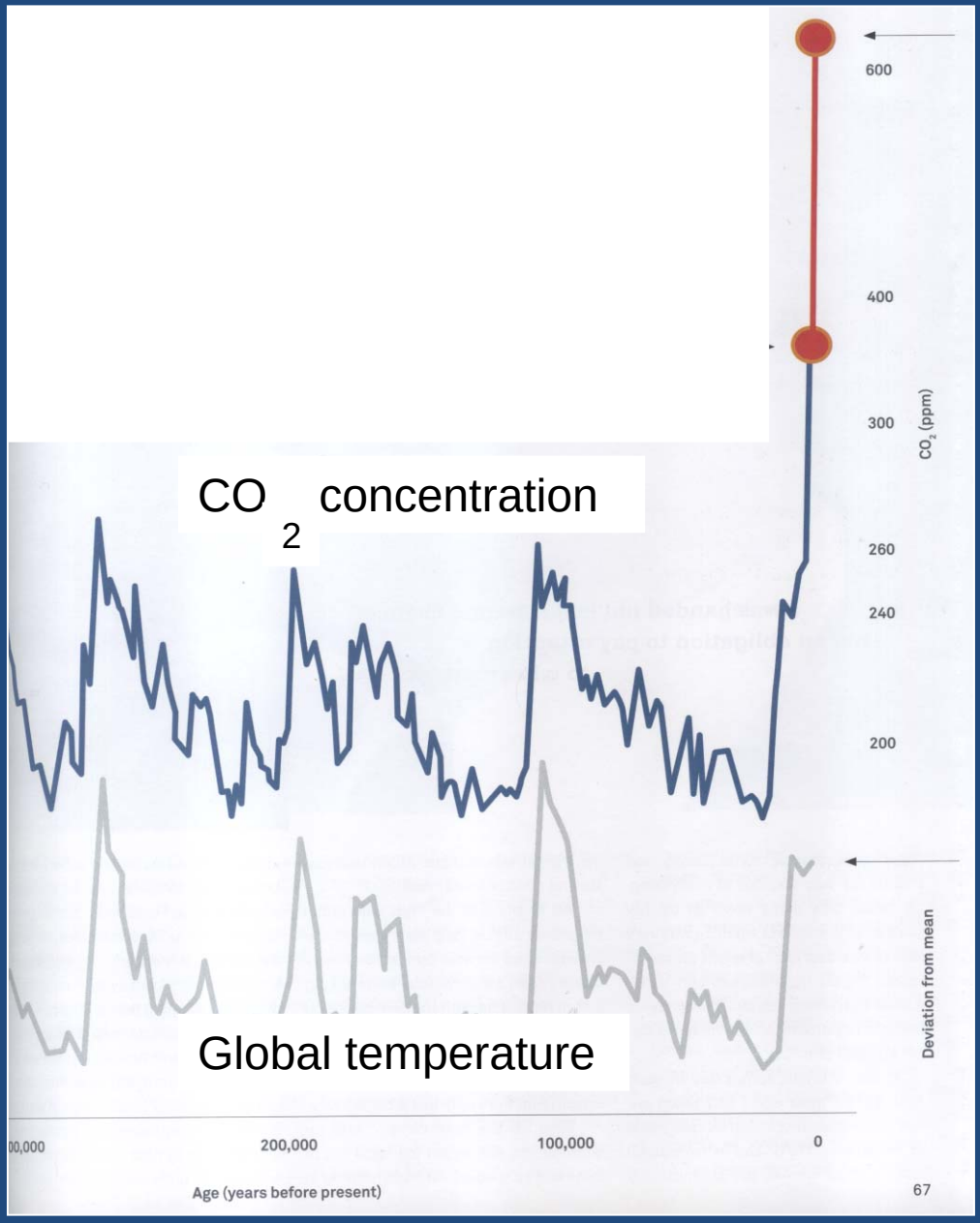


Ice mass loss in Antarctica (from Cazenave and Llovel, 2010)

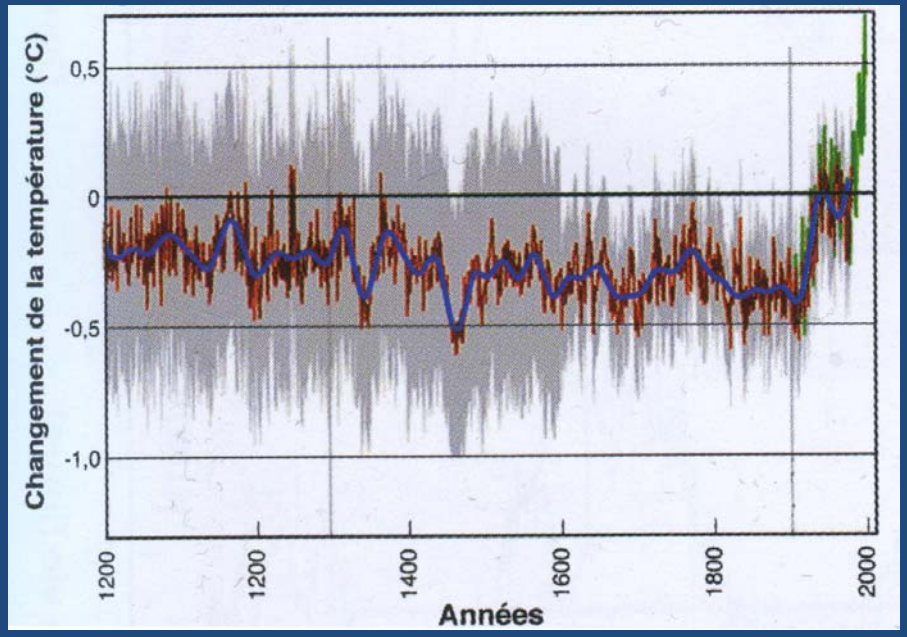


Change in area of sea-ice cover in the northern hemisphere (in millions of km^2)
(from Al Gore, who forced the US Navy to release its data)
(Gore, 2006)

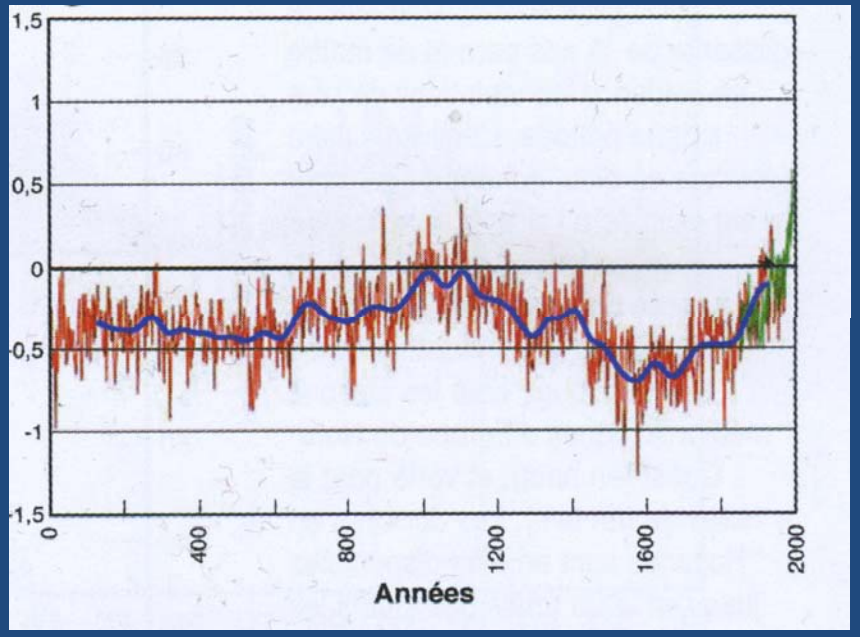
WHAT CAUSES THE OBSERVED ICE MELTING AND THE SEA-LEVEL RISE?



This is the comparison between global temperature rise and CO_2 concentration that Gore published in his 2006 book



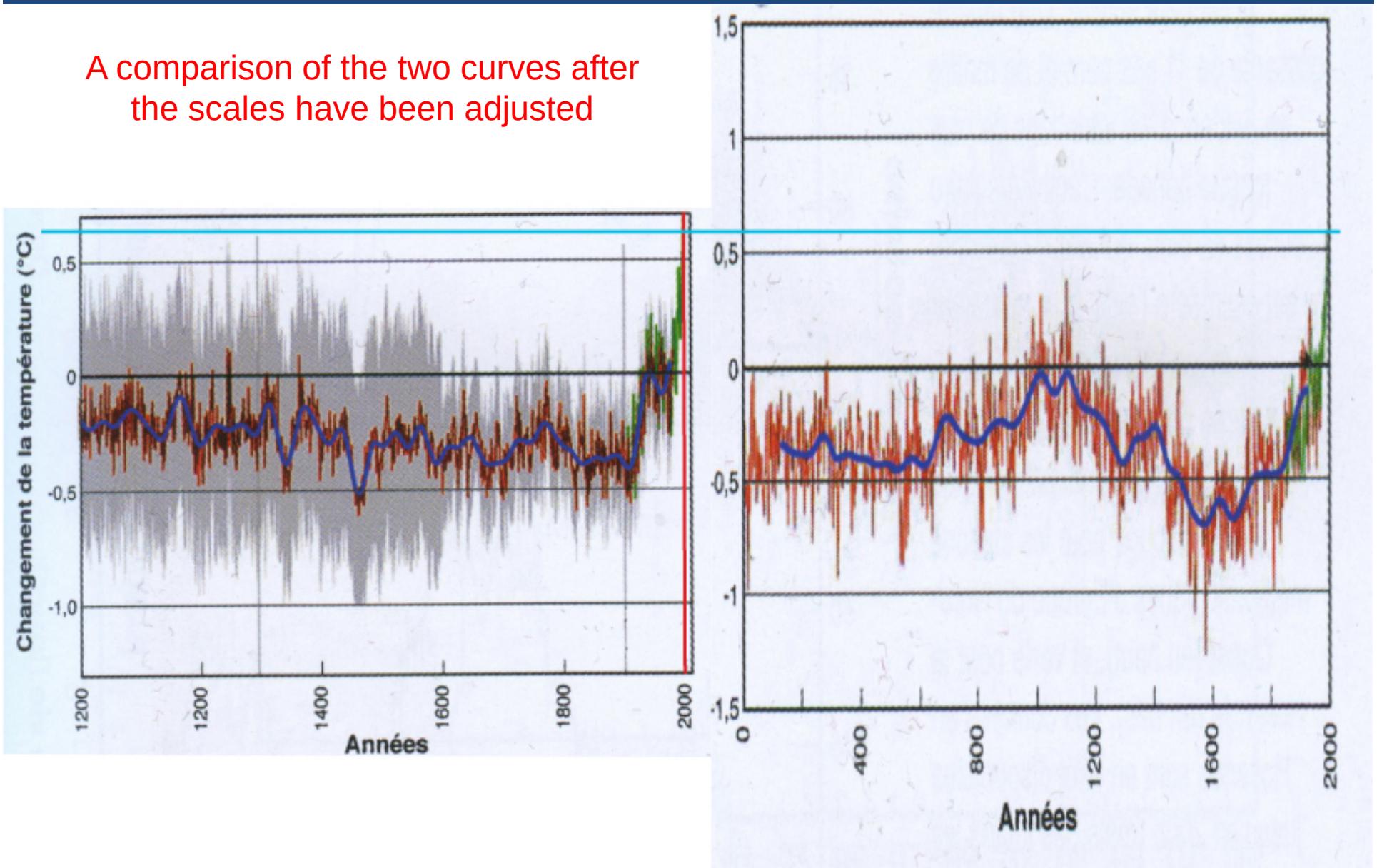
From Mann et al. (1999)
(This 'hockey-stick curve' was used by the 2001 UN Intergovernmental Panel on Climate Change)



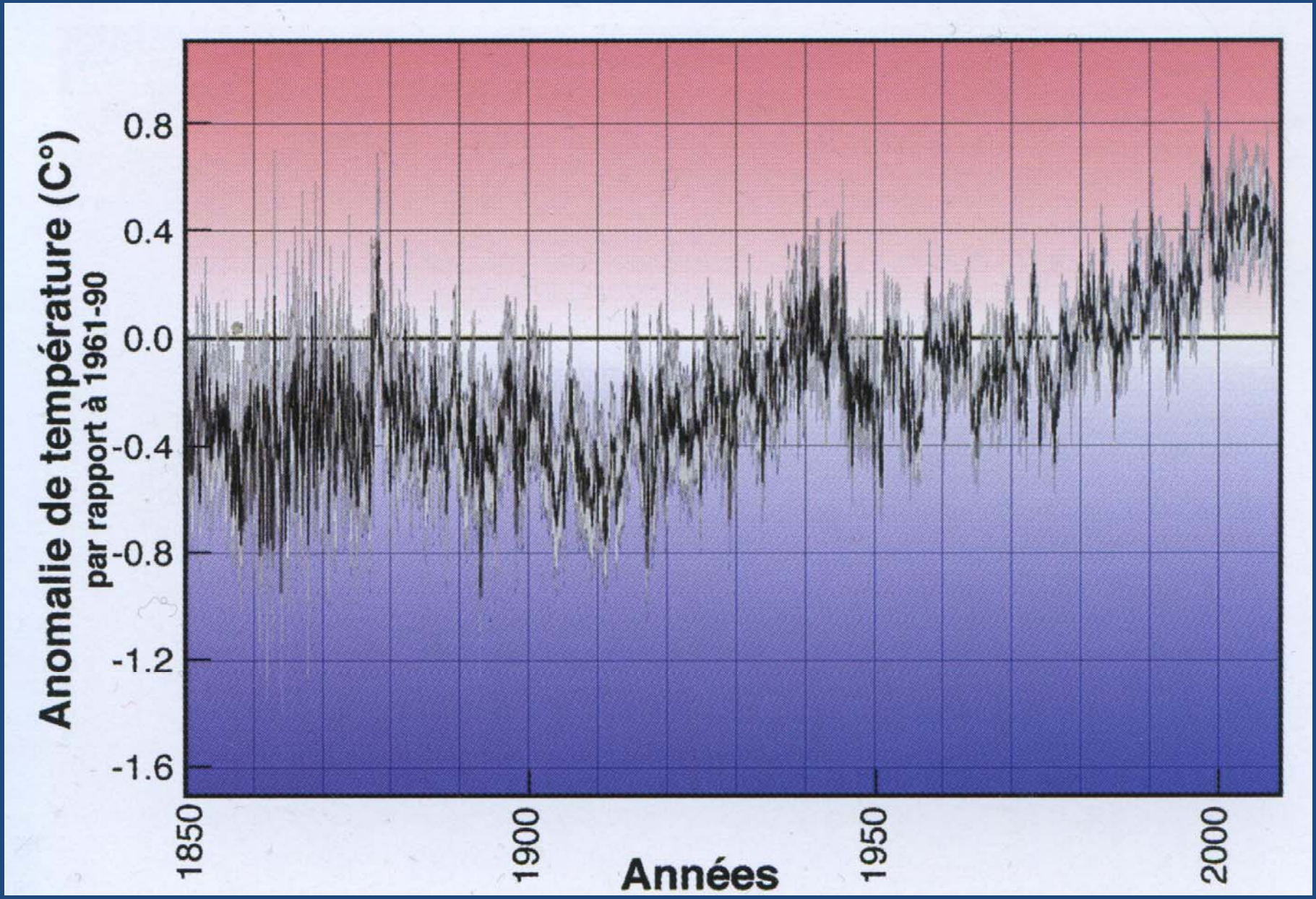
From Moberg et al. (2005)

A comparison between two global temperature change curves (from Courtillot, 2009)

A comparison of the two curves after the scales have been adjusted

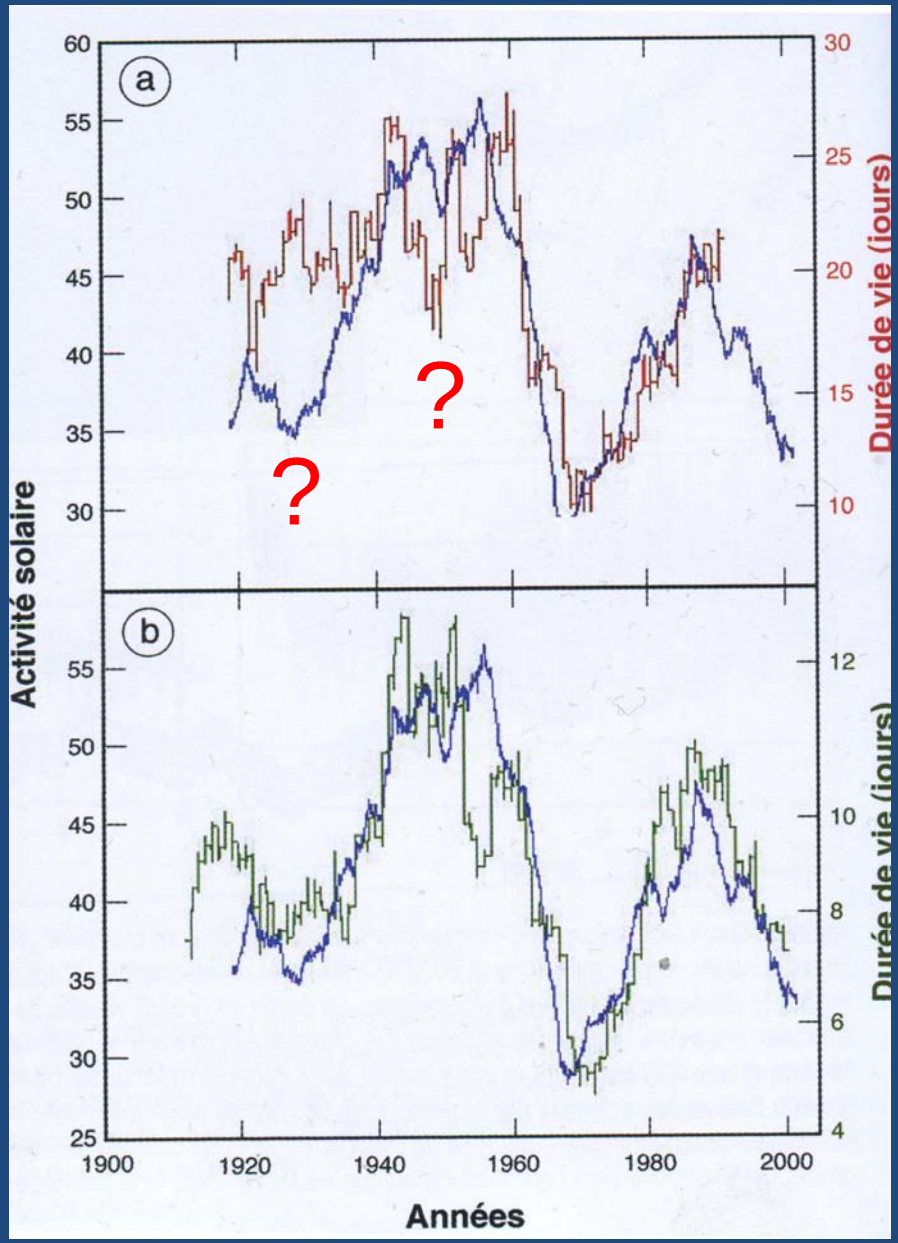


The two curves say the same thing: It is getting hotter !

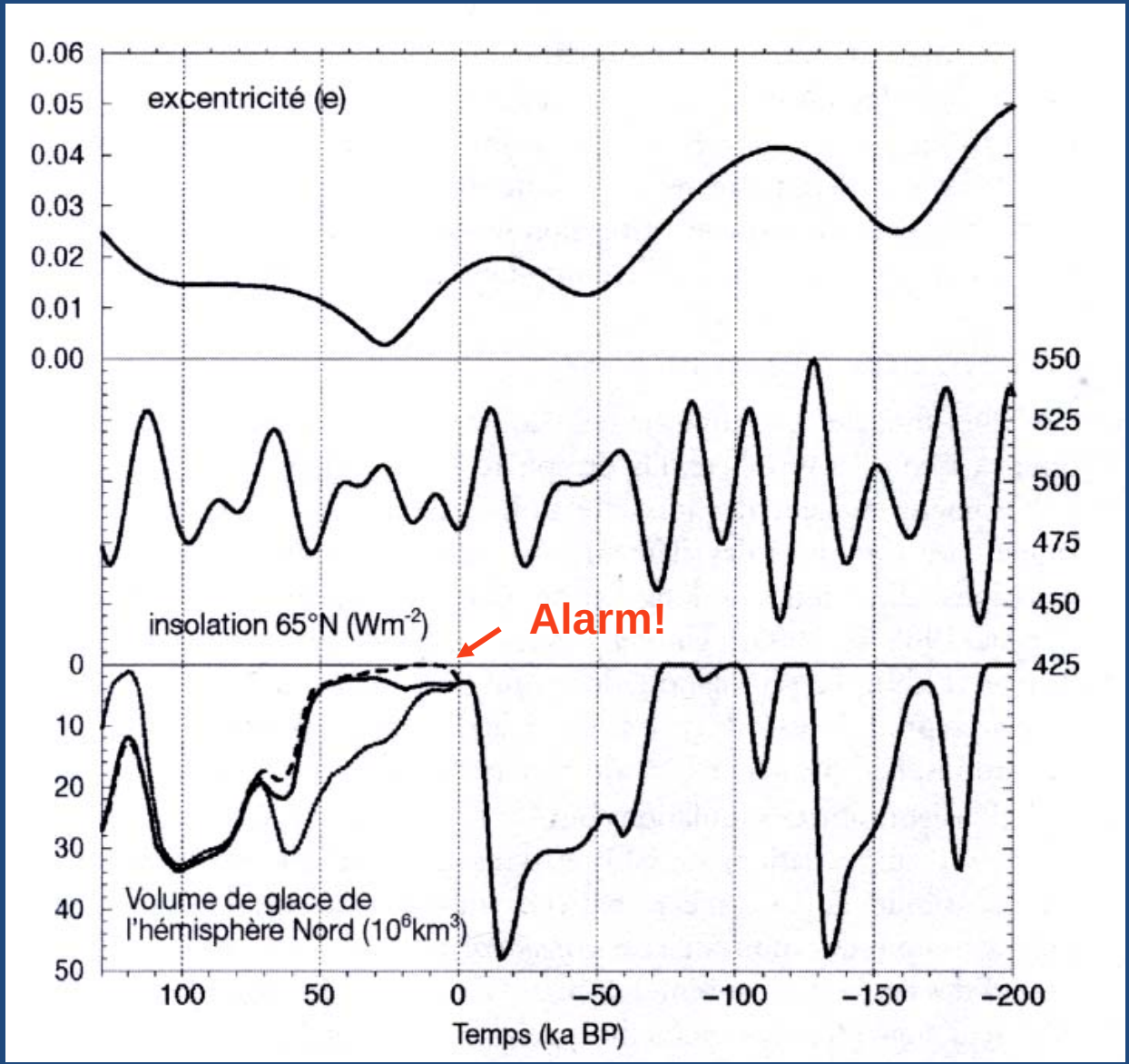


Courtillot's preferred temperature change curve updated to 2009 (Courtillot, 2009)

NOW THAT WE AGREE THAT IT IS GETTING HOTTER, THE QUESTION BECOMES ‘WHY?’



Comparison of solar activity with the duration of daily temperature trends on earth (from Courtillot, 2009) Match imperfect, but general trends agree



Change in excentricity of the earth's orbit

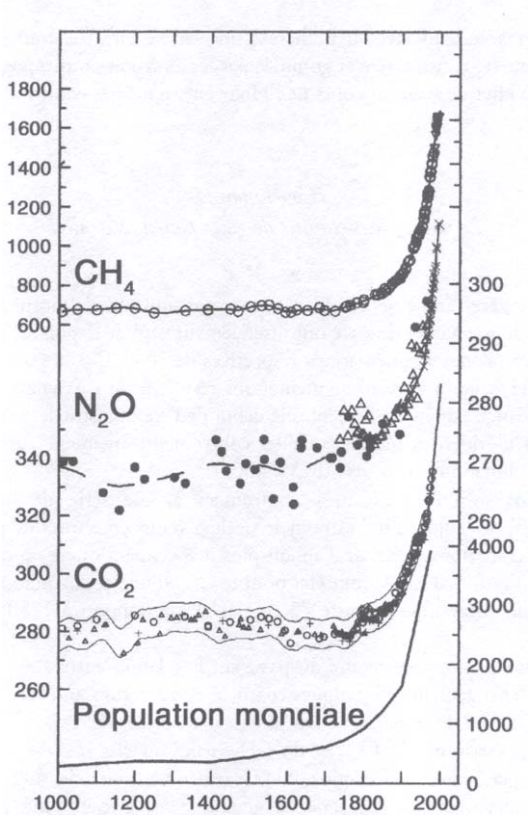
Solar energy arriving at the top of the atmosphere

Ice volume

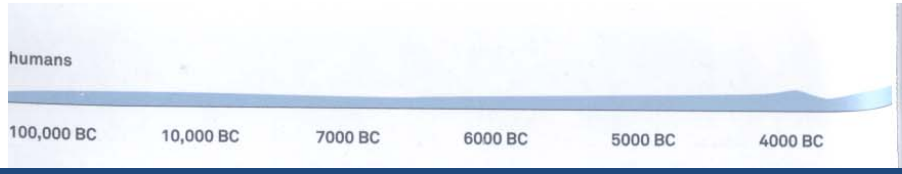
Change in ice volume from 200.000 years ago to 130.000 years ago and its comparison with excentricity and solar energy arrival at the earth's atmosphere (Berger and Loutre, 2006)

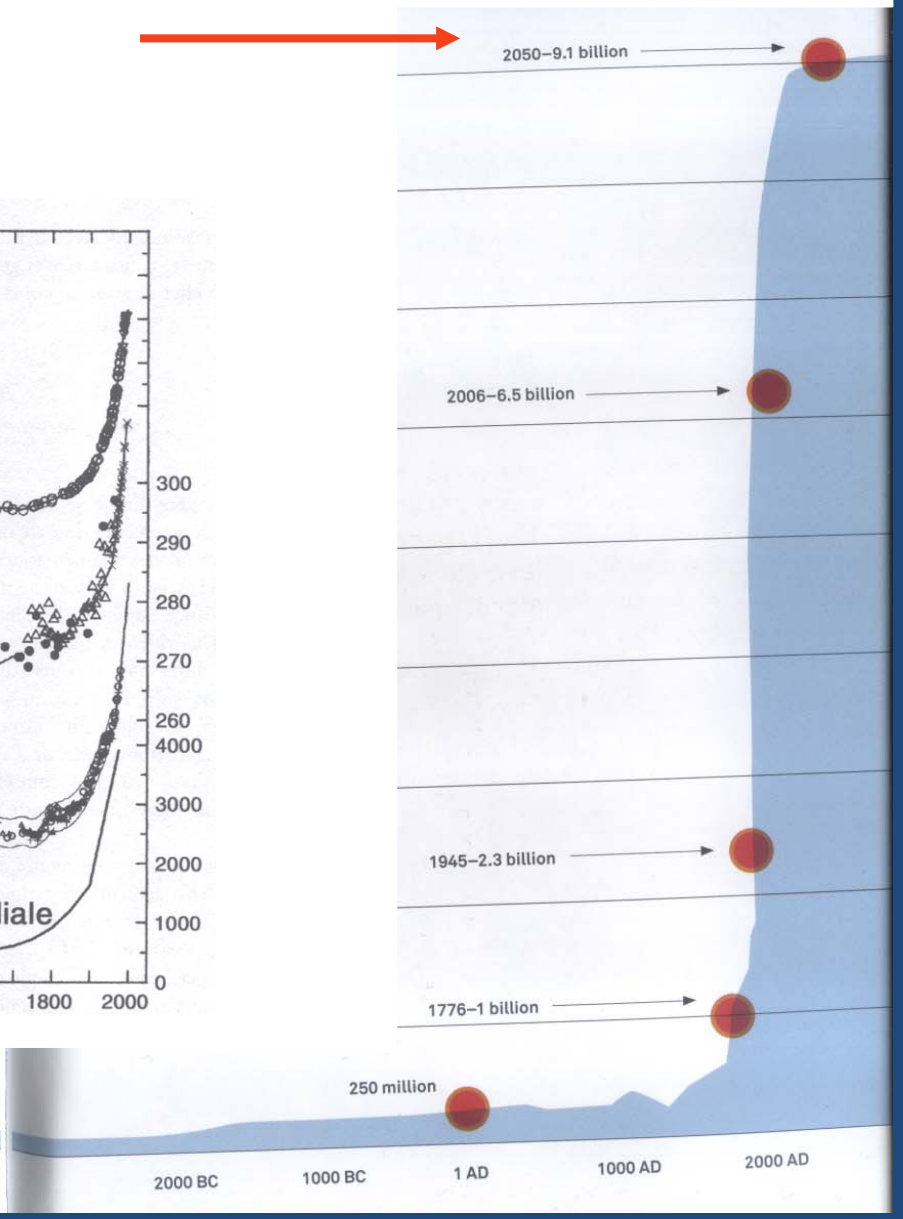
9,1 billion in 2050!

ALARM!

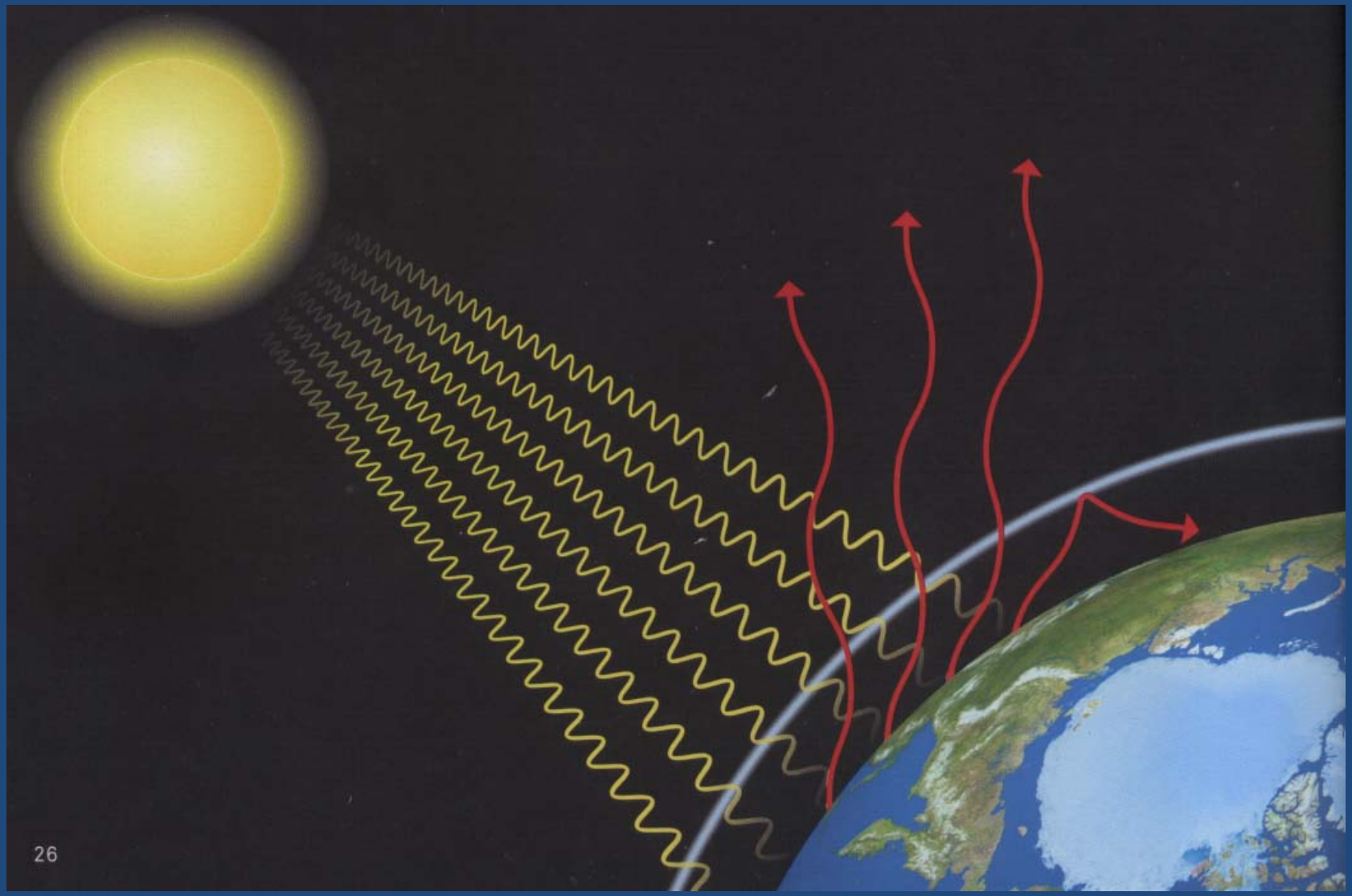


First humans

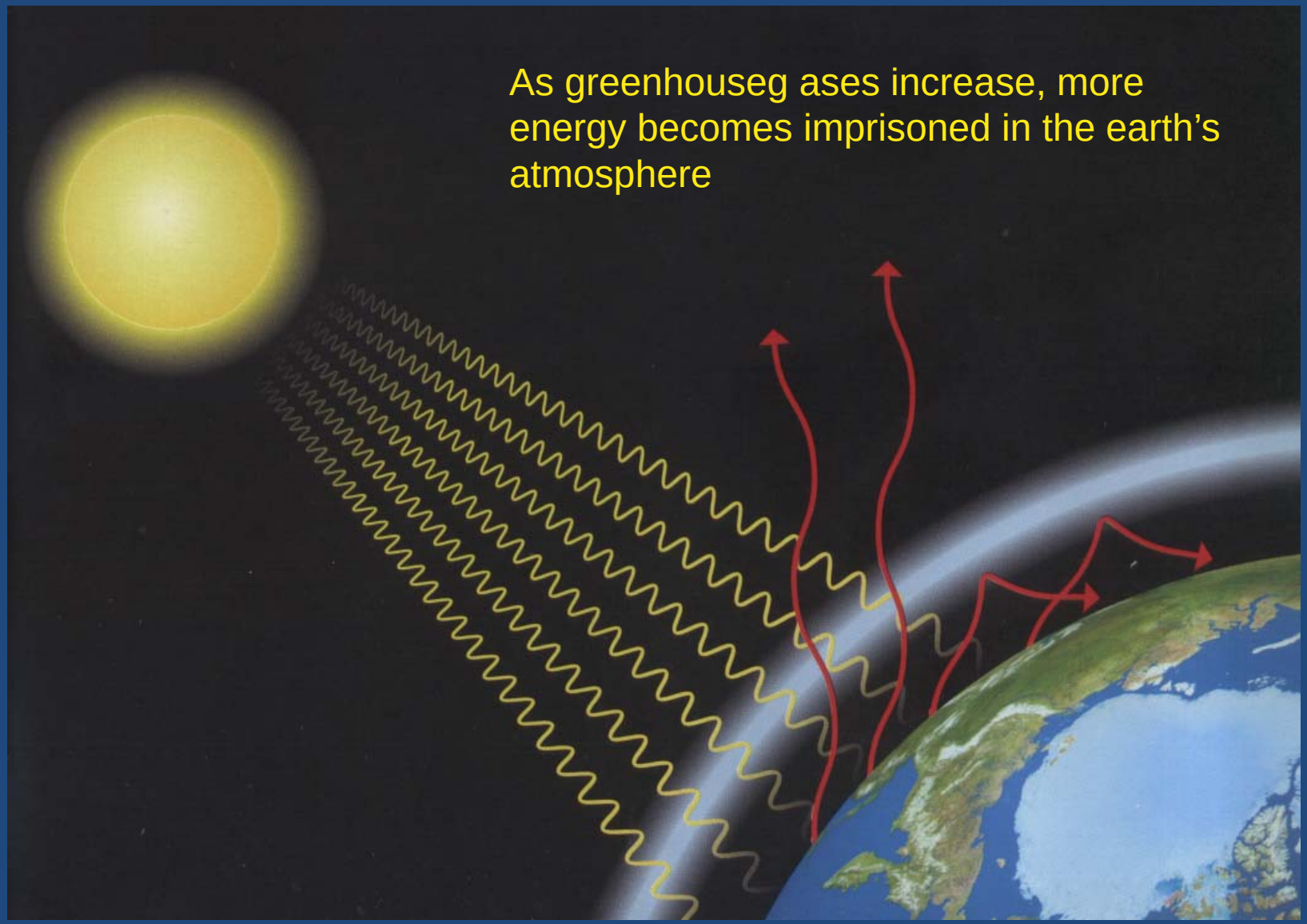




Population increase and its correlatior with the increase in green house gases

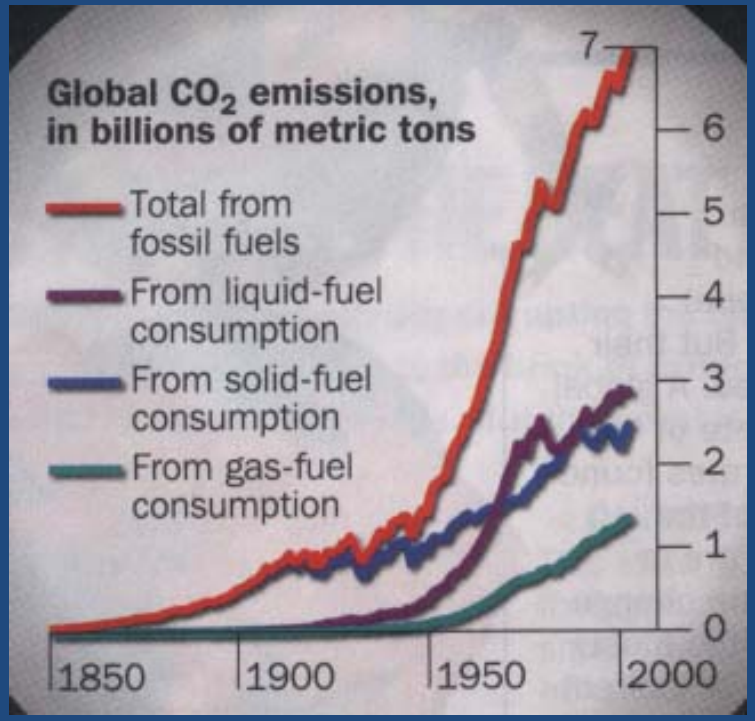


(Gore, 2006)

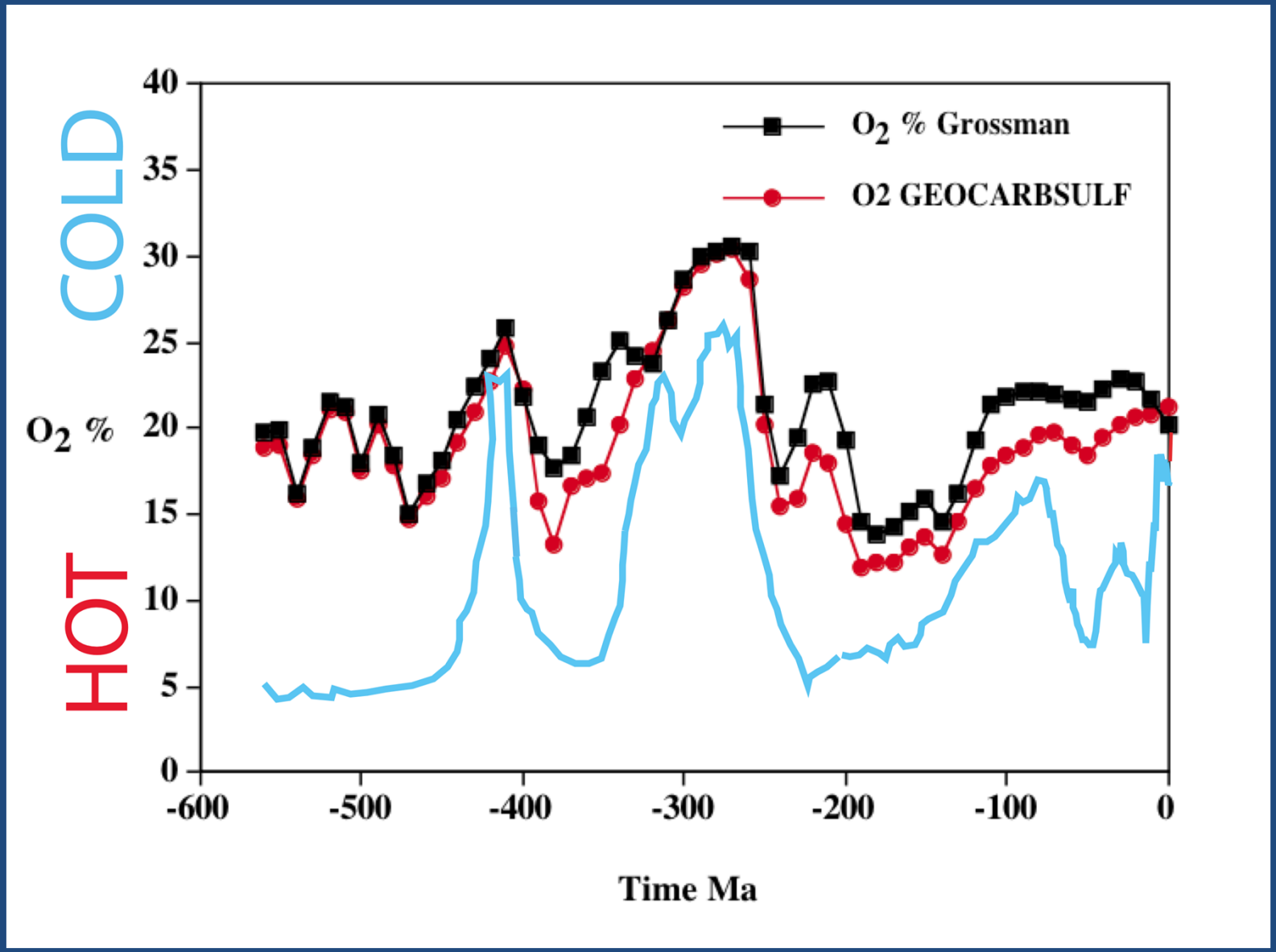

As greenhouseg ases increase, more energy becomes imprisoned in the earth’s atmosphere

(Gore, 2006)

IT SEEMS CLEAR THAT AS OUR POPULATION INCREASES WE GENERATE MORE AND MORE GREENHOUSE GASES, MOST NOTABLY CO_2, BECAUSE WE NEED MORE AND MORE ENERGY. ALL LIFE USES SUN'S ENERGY. WE USE IT MUCH FASTER BY EXPLOITING THE SOLAR ENERGY IMPRISONED IN FOSSIL FUELS THROUGHOUT HUNDREDS OF MILLIONS OF YEARS.



CO_2 generation in billions of tons from fossil fuels (from *Time*, 2006)



Percentage of O_2 in the atmosphere compared with averge global temperature (O_2 from Berner, temp. from Courtillot)

LETTER

doi:10.1038/nature20146

Greenland was nearly ice-free for extended periods during the Pleistocene

Joerg M. Schaefer[1,2], Robert C. Finkel[1,3], Greg Balco[4], Richard B. Alley[5], Marc W. Caffee[6], Jason P. Briner[7], Nicolas E. Young[1], Anthony J. Gow[8] & Roseanne Schwartz[1]

The Greenland Ice Sheet (GIS) contains the equivalent of 7.4 metres of global sea-level rise[1]. Its stability in our warming climate is therefore a pressing concern. However, the sparse proxy evidence of the palaeo-stability of the GIS means that its history is controversial (compare refs 2 and 3 to ref. 4). Here we show that Greenland was deglaciated for extended periods during the Pleistocene epoch (from 2.6 million years ago to 11,700 years ago), based on new measurements of cosmic-ray-produced beryllium and aluminium isotopes (^{10}Be and ^{26}Al) in a bedrock core from beneath an ice core near the GIS summit. Models indicate that when this bedrock site is ice-free, any remaining ice is concentrated in the eastern Greenland highlands and the GIS is reduced to less than ten per cent of its current volume. Our results narrow the spectrum of possible GIS histories: the longest period of stability of the present ice sheet that is consistent with the measurements is 1.1 million years, assuming that this was preceded by more than 280,000 years of ice-free conditions. Other scenarios, in which Greenland was ice-free during any or all Pleistocene interglacials, may be more realistic. Our observations are incompatible with most existing model simulations that present a continuously existing Pleistocene GIS. Future simulations of the GIS should take into account that Greenland was nearly ice-free for extended periods under Pleistocene climate forcing.

The possibility that future warming will cause destabilization of the GIS has motivated the use of geological records to estimate the climate sensitivity of the GIS. Terrestrial studies[2,3] have argued that the palaeo-environment of the Kap Kobenhavn Formation in north Greenland implied an ice-free Greenland, with temperatures nearly 6 °C above present persisting for about 20,000 years (20 kyr) from 1.8 million years (Myr) ago to 2.0 Myr ago. Marine sedimentary proxy data from sites off southwest Greenland[5,6] are interpreted to indicate a smaller GIS during both the Marine Isotope Stage (MIS) 5e (or Eemian; about 120 kyr ago) and MIS 11 (about 410 kyr ago) interglacial periods. Biomolecules in basal ice of the Dye-3 ice core in southern Greenland provide evidence for subarctic conditions (and thus a smaller GIS) sometime in the past million years or so[7] and a recent review[8] argues that the near-field and far-field data require major ice-sheet fluctuations, and allow (but do not require) near-total ice loss during the Pleistocene. On the other hand, data from the basal NEEM ice core[9] indicate minor ice-surface lowering during MIS 5e despite temperatures several degrees warmer than present. The geochemistry of Greenland Ice Sheet Project Two (GISP2) silty basal ice has been interpreted as being consistent with the scenario of continuous ice cover for the past 2.6 Myr (ref. 4) and trapped air enclosed in the silty ice layer of the nearby Greenland Ice Sheet Project (GISP) core indicate basal ice ages exceeding 1 Myr (ref. 10; Methods).

The GIS survived mid-Holocene temperatures somewhat warmer than those of the past millennium and many model simulations show a relatively stable GIS over the interglacials of the recent geologic past[11,12]. However, simulations also show that the warming required to remove most of the GIS is model-dependent and sensitive to external forcings and internal feedbacks, including insolation forcing, accumulation rate parameterization, and distribution and seasonality of temperature. Results imply temperature thresholds for ice-sheet stability between one[11] and a few degrees Celsius above present temperatures (see review in ref. 8; also refs 13 and 14). Because the GIS sensitivity probably changes with increasing forcing temperature, model timescales for ice-sheet removal depend on the amplitude of the forcing: a temperature threshold of 2 °C with a 5,000-year response time given 3 °C warming was inferred by ref. 13, but more extreme temperature forcing allows for GIS removal within a few thousand or even several hundred years[13]. Thus, current model results remain ambiguous but do show that both the magnitude and the duration of warmth are important to ice-sheet deglaciation.

Overall, existing geological data and model experiments have not resolved the question of whether the GIS disappeared or shrank substantially in warm interglacial periods. Much of this uncertainty reflects the fact that the geological data mostly comprise inference from remote proxy records, since direct evidence, if it exists, is buried beneath the present ice sheet. Here we attempt to overcome this obstacle via cosmogenic nuclide analysis of sub-GIS bedrock.

On 1 July 1993, after five years of drilling and recovery of a 3,040.3-m-long ice core and a 13.1-m-long core of sediment-rich basal ice, the GISP2 project penetrated 1.55 m of bedrock[15] (Figs 1 and 2). We describe measurements of cosmic-ray-produced in-situ ^{10}Be and ^{26}Al from this GISP2 bedrock core. ^{10}Be and ^{26}Al, with half-lives of 1.4 Myr (refs 16 and 17) and 0.7 Myr (ref. 18) respectively, are trace radionuclides produced in situ by nuclear interactions between cosmic-ray particles and rocks exposed at Earth's surface. The cosmic-ray flux decreases exponentially with an e-folding length ($1/e \approx 0.37$) of about 60 cm in rock or about 1.5 m in ice, so cosmogenic-nuclide production is negligible beneath ice sheets. The presence of any substantial *in situ* cosmogenic radionuclide concentration in subglacial bedrock indicates geologically recent near-surface exposure and thus ice-free conditions. Pioneering analysis in the 1990s, published as an abstract[19], indicated detectable ^{10}Be and ^{26}Al in the GISP2 bedrock core, but overall uncertainties remained large enough to prevent unambiguous conclusions about past GIS change. Here we describe comprehensive new ^{10}Be and ^{26}Al measurements, a detailed analysis of the data, and their implications for past GIS dynamics.

After separating and purifying quartz from segments of bedrock core (Methods), we combined aliquots into the largest number of depth

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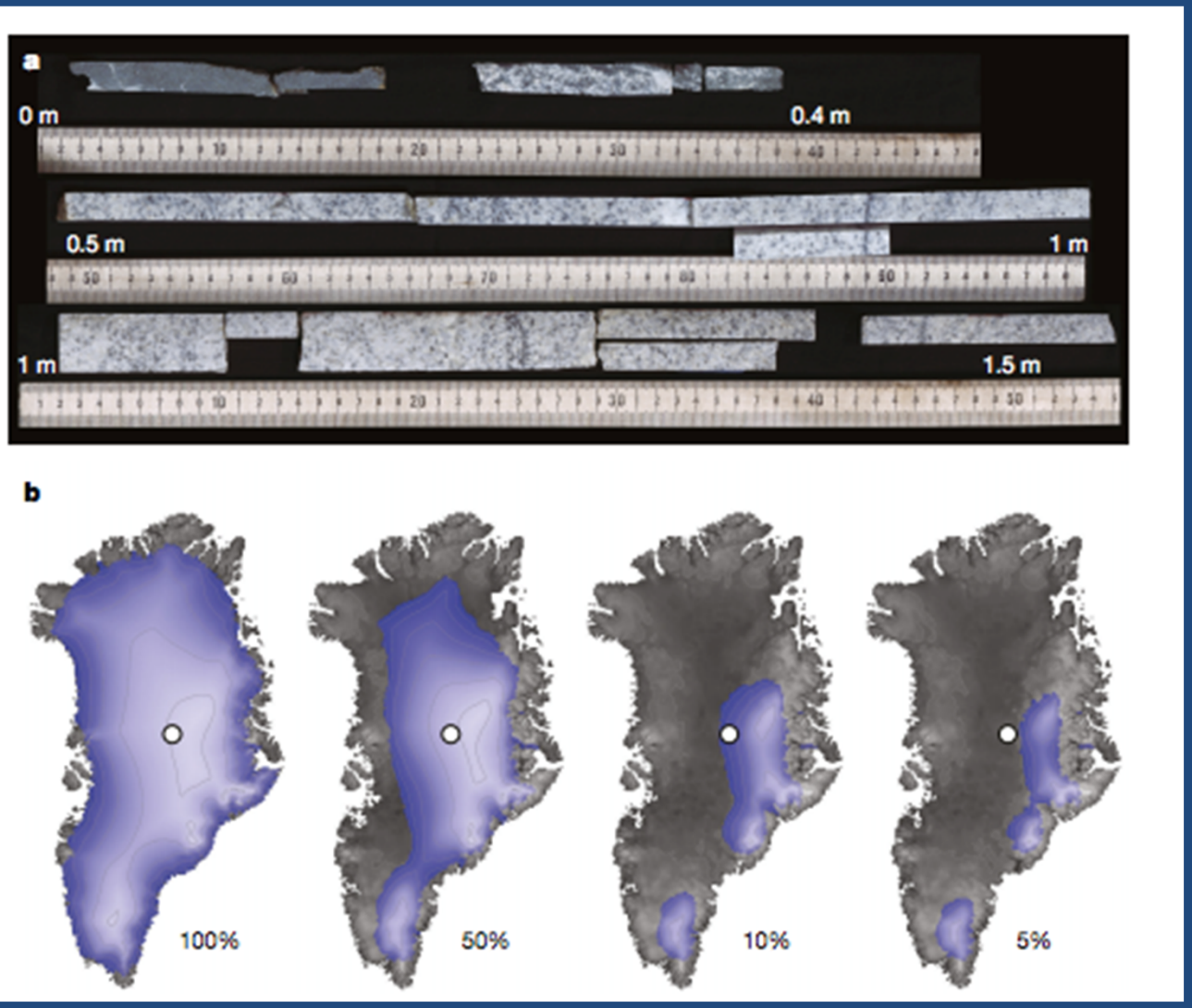
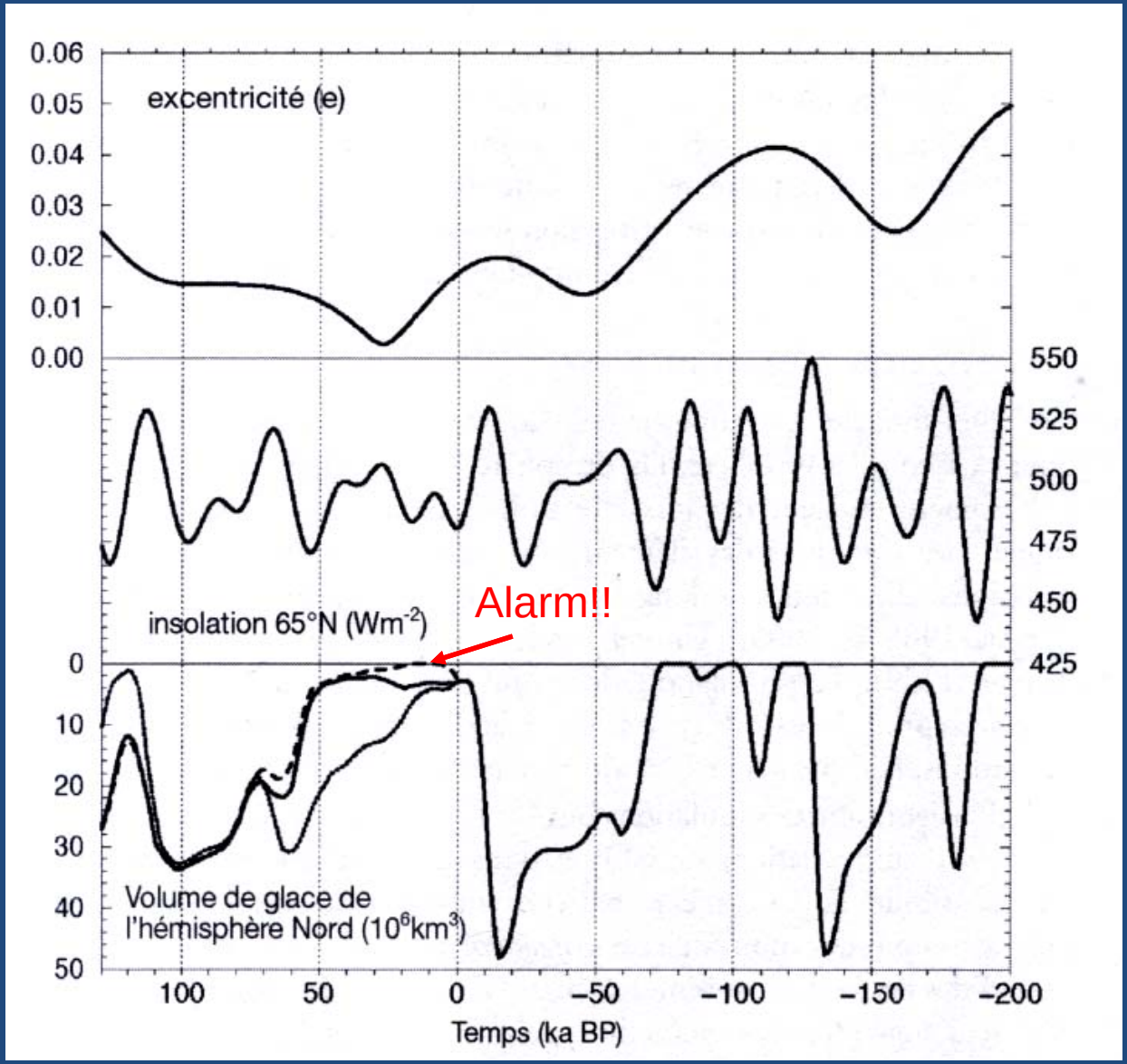
But there was no industrial gas output during the Pleistocene! (*Nature*, 2016)



Greenland ice sheet seems a lot more vulnerable to small fluctuations in the atmospheric temperature than we so far believed!



That is why the alarm point is so very important!

FOSSIL FUEL CONSUMPTION CONDEMNS OUR CIVILISATION TO A HOTTER EARTH WITH HIGH SEA-LEVELS.

NUCLEAR IS AN ALTERNATIVE, BUT THE RECENT EVENTS IN THE FUKUSHIMA-DAICHI NUCLEAR PLANTS HAVE MADE EVERYONE VERY WEARY OF NUCLEAR POWER PLANTS. STATISTICS ABOUT THEM ARE FLAWED, BECAUSE WE DO NOT HAVE ENOUGH DATAPOINTS.

A SAFER ALTERNATIVE ARE THE SO-CALLED RENEWABLE ENERGY RESOURCES. BUT THE PROBLEM HERE IS, HOW RENEWABLE ARE SUCH RESOURCES? UNLESS WE UNDERSTAND THE NATURE AND DIRECTION OF GLOBAL CLIMATE CHANGE WE CANNOT FORECAST THE RENEWABILITY OF THE SO-CALLED RENEWABLE ENERGY RESOURCES.

AS AN EXAMPLE, LET US LOOK AT THE FUTURE OF THE MEDITERRANEAN REGION WITHIN THE PRESENT CENTURY

The "Great Game" Enters the Mediterranean: Gas, Oil, War, and Geo-Politics
by Mahdi Darius Nazemroay

A decade-old title that justifies the choice of the Mediterranean as an example

The Mediterranean Region as commonly understood.

It accounts for 9% of the World's total energy demand. This will stay unchanged till 2030 (Observatoire Méditerrannéen de l'Énergie, 2009)

Kinds of energy:

Non-renewable (fossil fuels):
Geology

Renewable (solar radiation and atmospheric, hydrospheric and biospheric motions):

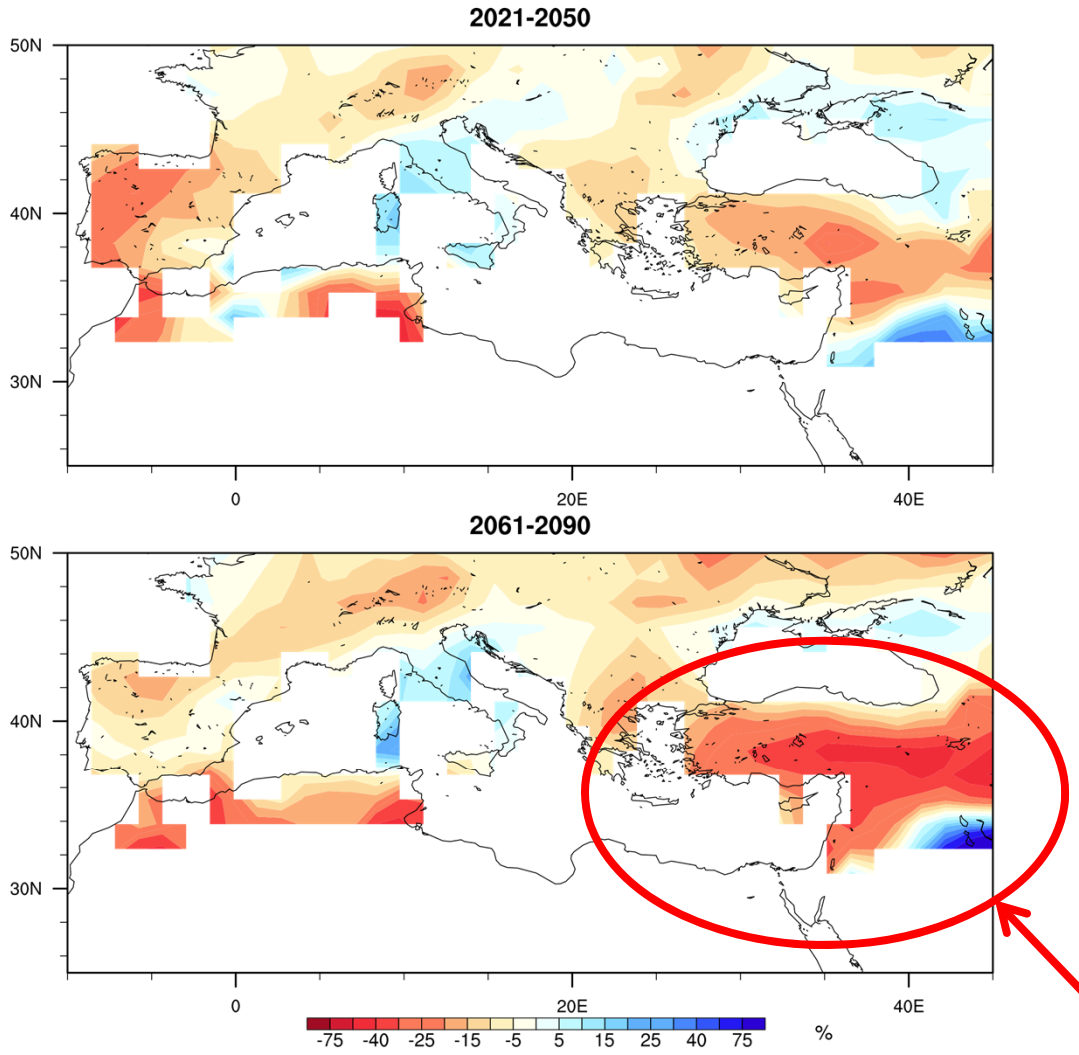
Climatology and Agriculture

According to the BP 2007 statistics published in 2008:

- The oil reserves are mostly located in the Middle East and to a lesser degree in Russia, Venezuela, Kazakhstan, Libya and Nigeria, which collectively account for 84% of the world reserves; ***42*** *years of reserves plus* ***21*** *years of resources*

- The gas reserves are mostly located in the Middle East and Russia, which collectively account for 66% of the world reserves; ***61*** *years of reserves plus* ***69*** *years of resources*

- The coal reserves are mostly located in the USA, Russia, China, India, Australia and South Africa which collectively account for 82% of the world reserves; *Will last us for another* ***5 to 6 millenia****!*

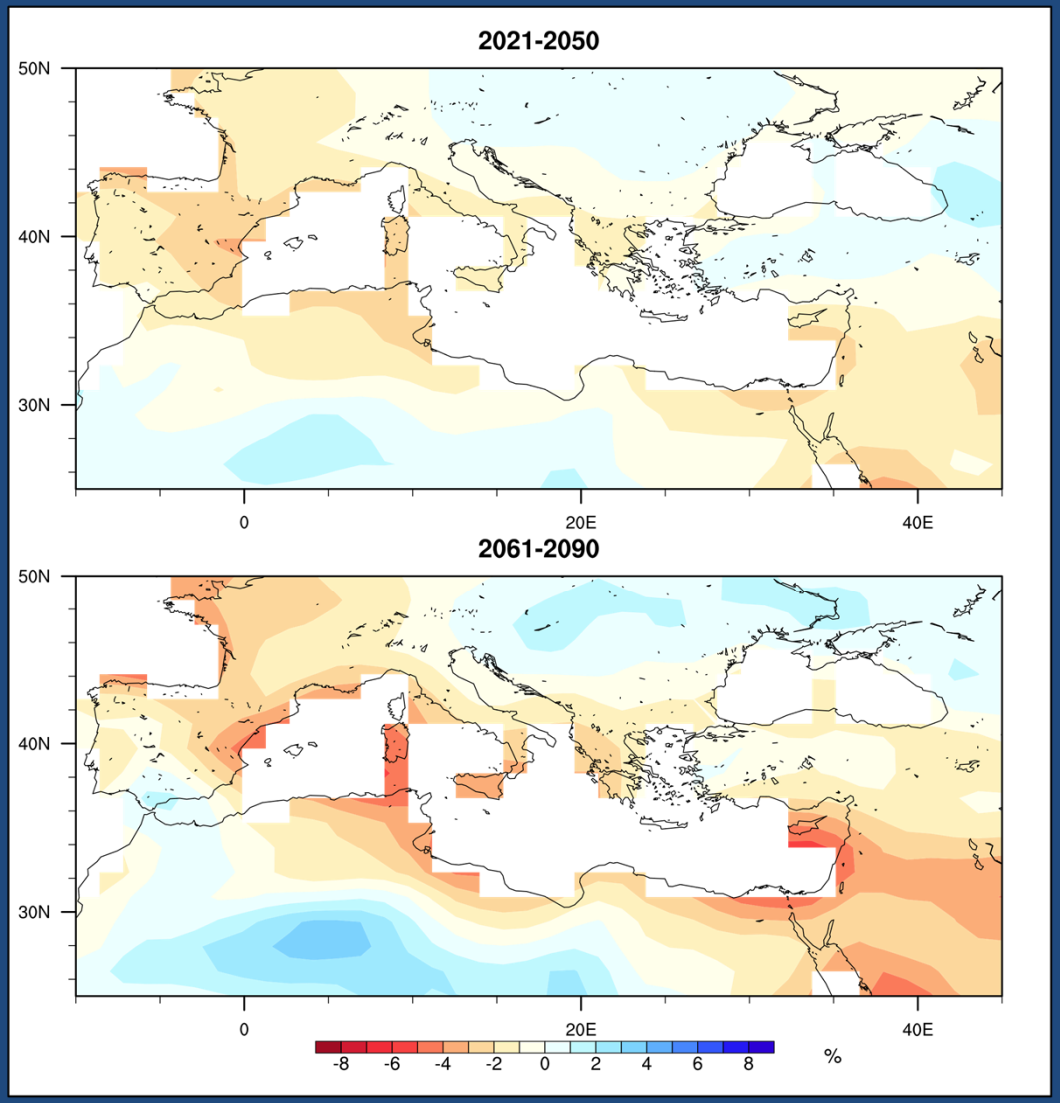


Relative change in hydro power potential with reference to [1961-1990] period, using downwelling solar flux density field from the CCSM A2 simulations as a proxy for two episodes in the future:

2021-2050

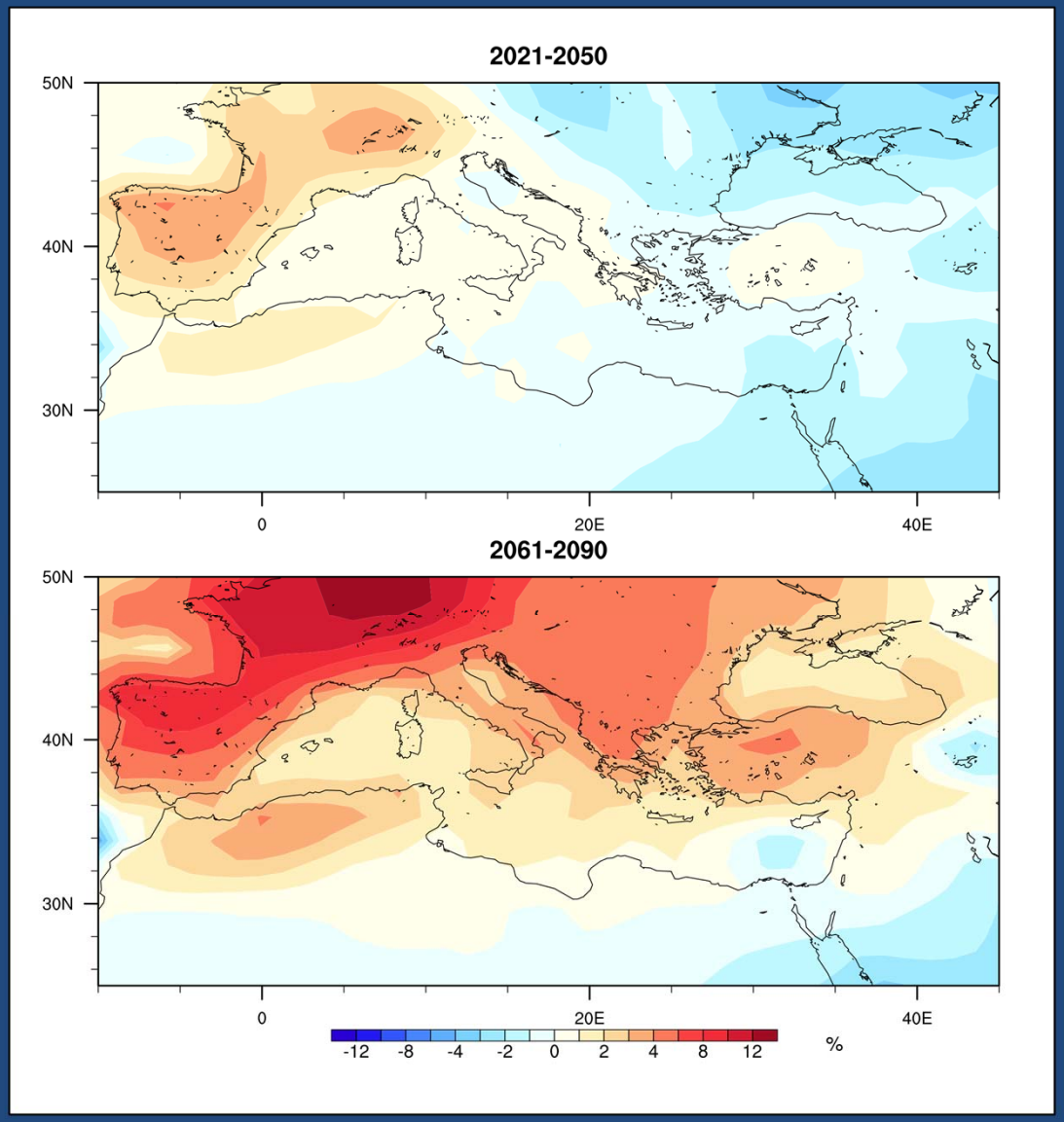
2061-2090

Region of main trouble! Turkey!



Relative change in wind power potential with reference to [1961-1990] period, using 2m field from the CCSM A2 simulations as a proxy.

The Mediterranean will get less windy. So a ***net loss of wind power***.



Relative change in solar power potential with reference to [1961-1990] period, using downwelling solar flux density field form the CCSM A2 simulations as a proxy. Notice that in the Mediterranean the potential for solar energy increases everywhere.

From the viewpoint of solar energy, it is good that the earth is getting hotter.

Conclusions for the energy potential of the Mediterranean countries:

Non-renewable:

Oil: 70 BBBO+?45 BBBO

Natural gas: 99 BBBOE + ?30 BBBOE

Coal: 74.5 BBBOE

Nuclear: 7.720 BBBOE (for the next 20 a with the existing reactors)

So-called renewable:

Water: 261 MBBO/a (with decreasing potential)

Wind: 250 MBBO/a (with decreasing potential)

Sun: 198 x 10^{12} BBBOE/a (with increasing potential)

IT NOW SEMS THAT SOLAR ENERGY IS A SOLUTION TO OUR ENERGY PROBLEM IN THE FUTURE. *ALL LIFE USES SOLAR ENERGY*.

WE HAVE OVERSHOT OUR QUOTA OF IT BY USING FOSSIL FUELS, *I.E.*, STORED SOLAR ENERGY, BECAUSE WE ARE EXHAUSTING ITS SAVINGS IN FOSSIL FUELS. THE SAVINGS WILL EVENTUALLY RUN OUT AND THEIR SWIFT EXHAUSTION WILL OVERHEAT US.

BECAUSE WE REQUIRE MORE SOLAR ENERGY TO SURVIVE THAN AN ORDINARY PRIMATE ANIMAL (*E.G.*, CHIMPANZEES) , WE HAVE TO FIND EXTRAORDINARY MEANS OF HARNESSING A LOT OF IT.

WE ARE LUCKY THAT A LOT OF IT IS AVAILABLE AND WE KNOW HOW TO HARNESS IT. ALL WE HAVE TO DO IS TO INVEST IN IT MORE TO EXPEDITE ITS EFFICIENT AND WIDESPREAD EMPLOYMENT

MAIN SOLUTION TO OUR PROBLEM:

EDUCATION IN NATURAL SCIENCES

OF OUR CHILDREN, OF THEIR PARENTS AND, MOST IMPORTANT OF ALL, OF OUR POLITICIANS

POLITICIANS RUNNING THE WORLD NOW ARE FRIGHTFULLY IGNORANT IN NATURAL SCIENCES. THAT MUST CHANGE IF OUR PLANET IS TO SURVIVE AS A PLACE SUITABLE FOR HUMAN HABITATION

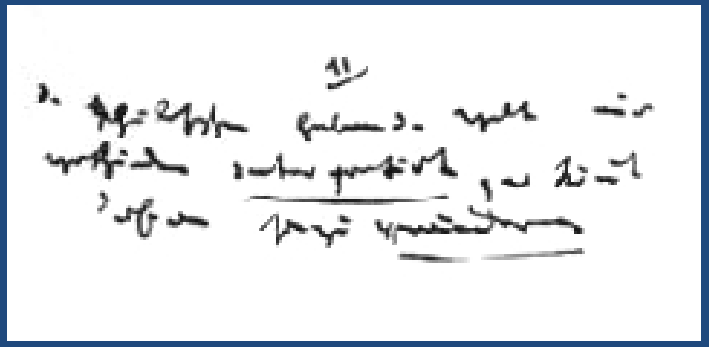
IMPORTANT MESSAGE:

THERE SHOULD BE NO RIGHT TO REMAIN IGNORANT ABOUT THE PLANET ON WHICH WE LIVE

RELIGION, ENABLING PEOPLE TO HAVE IRRATIONAL HOPES AND IMAGINARY FRIENDS, CONSTITUTES THE BIGGEST STUMBLING BLOCK IN FRONT OF A SAFE CONDUCT OF OUR RELATIONSHIPS WITH NATURE.

AN EXAMPLE OF AN IDIOTIC STATEMENT RAISED TO THE STATUS OF RELIGIOUS DOGMA:

‘Philosophers have long interpreted Nature in various ways; what is in fact needed is to change it’



Karl MARX, *Theses on Feuerbach*