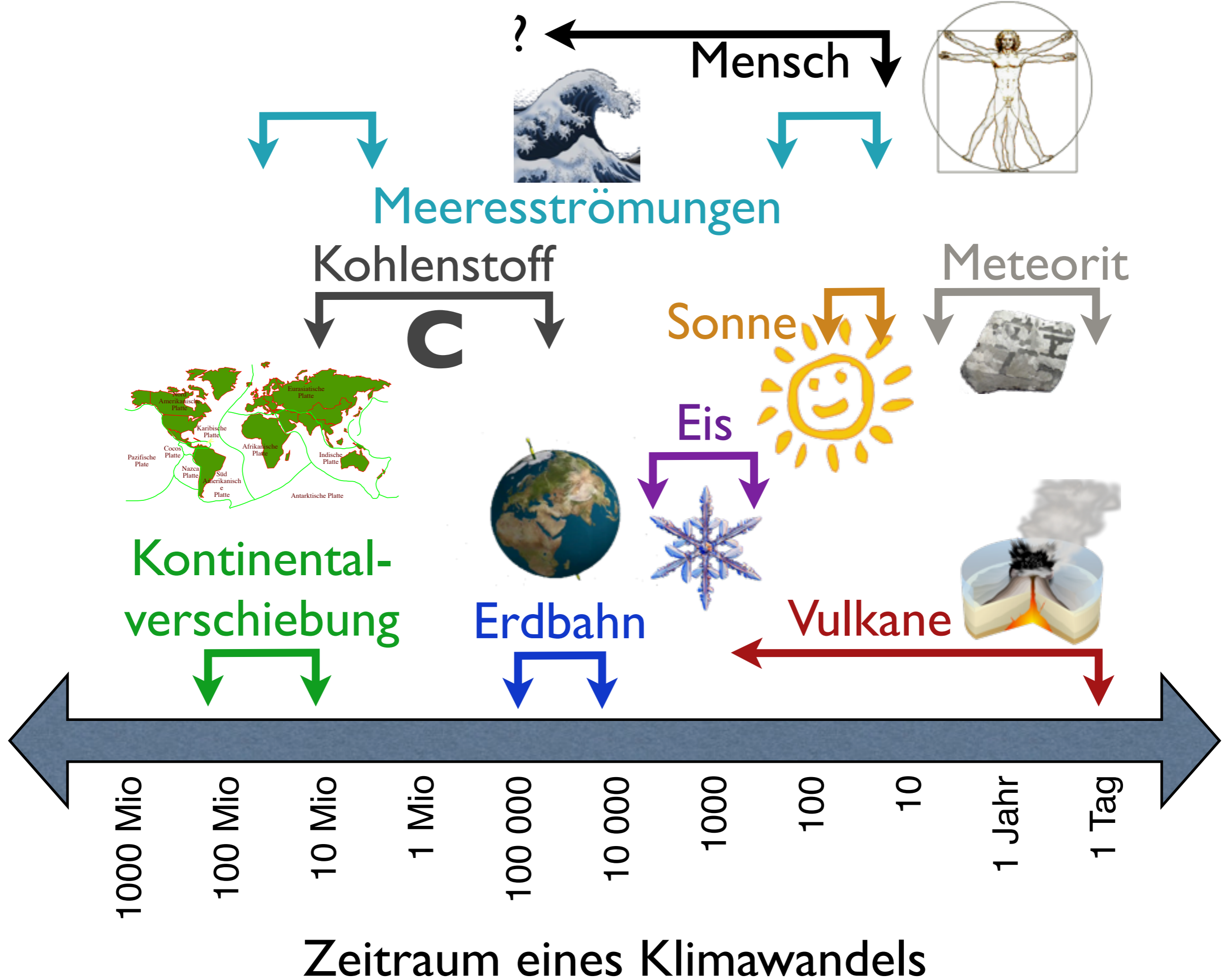


Klimahaus-Akademie 2014-05-08

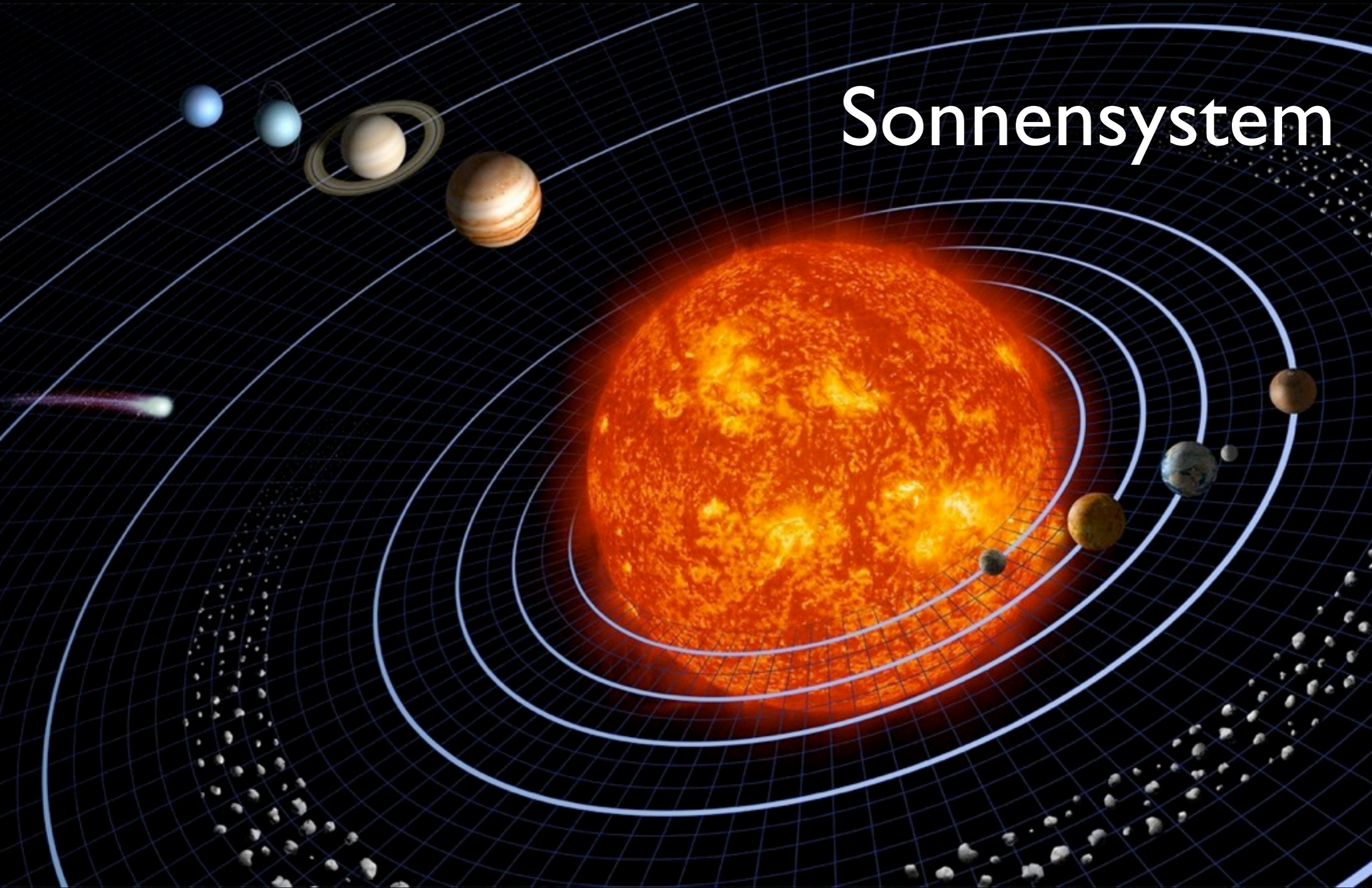
# Klimakapriolen der Erdgeschichte

Dr. Hannes Grobe

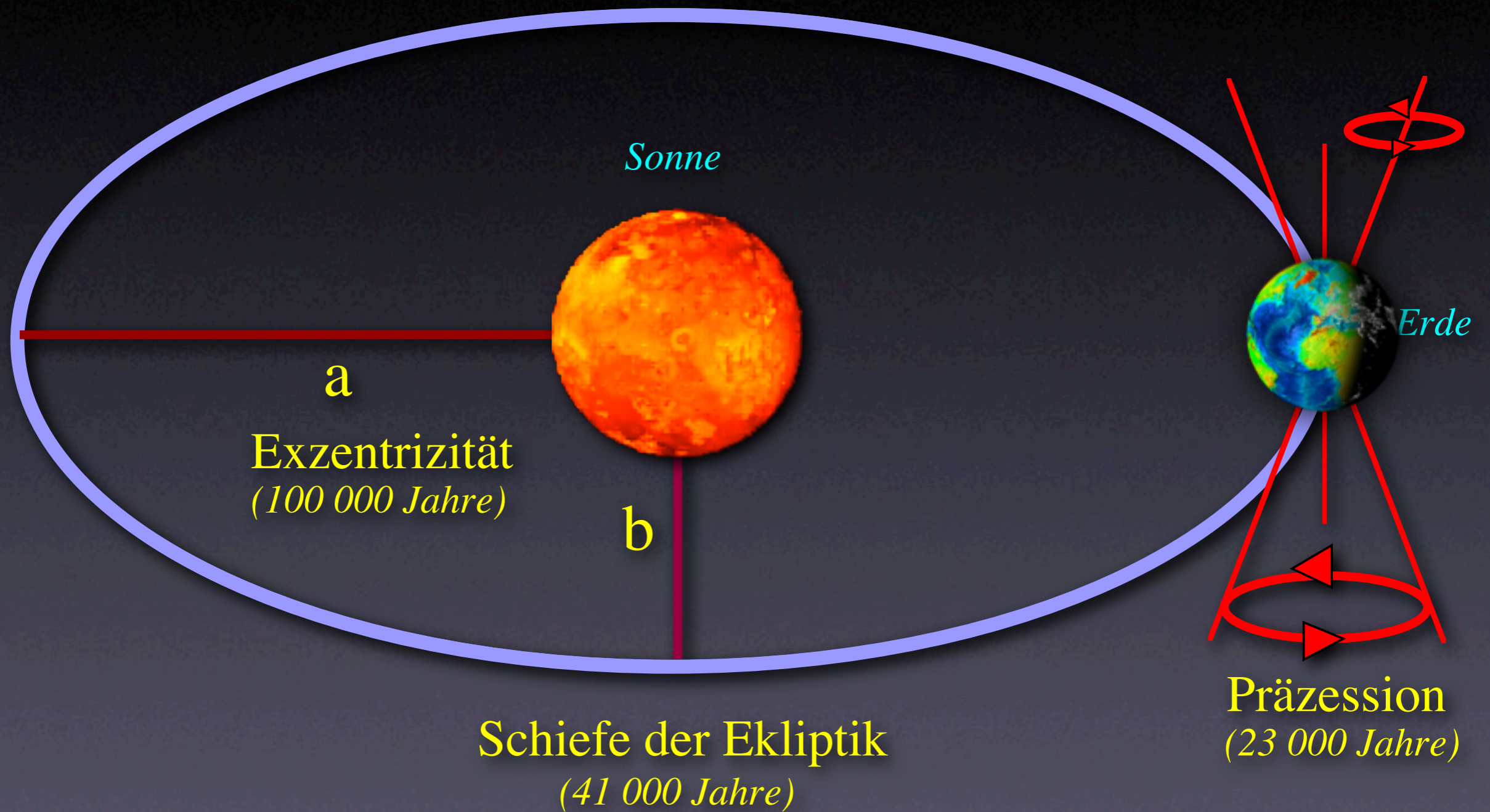
Alfred-Wegener-Institut



# Sonnensystem

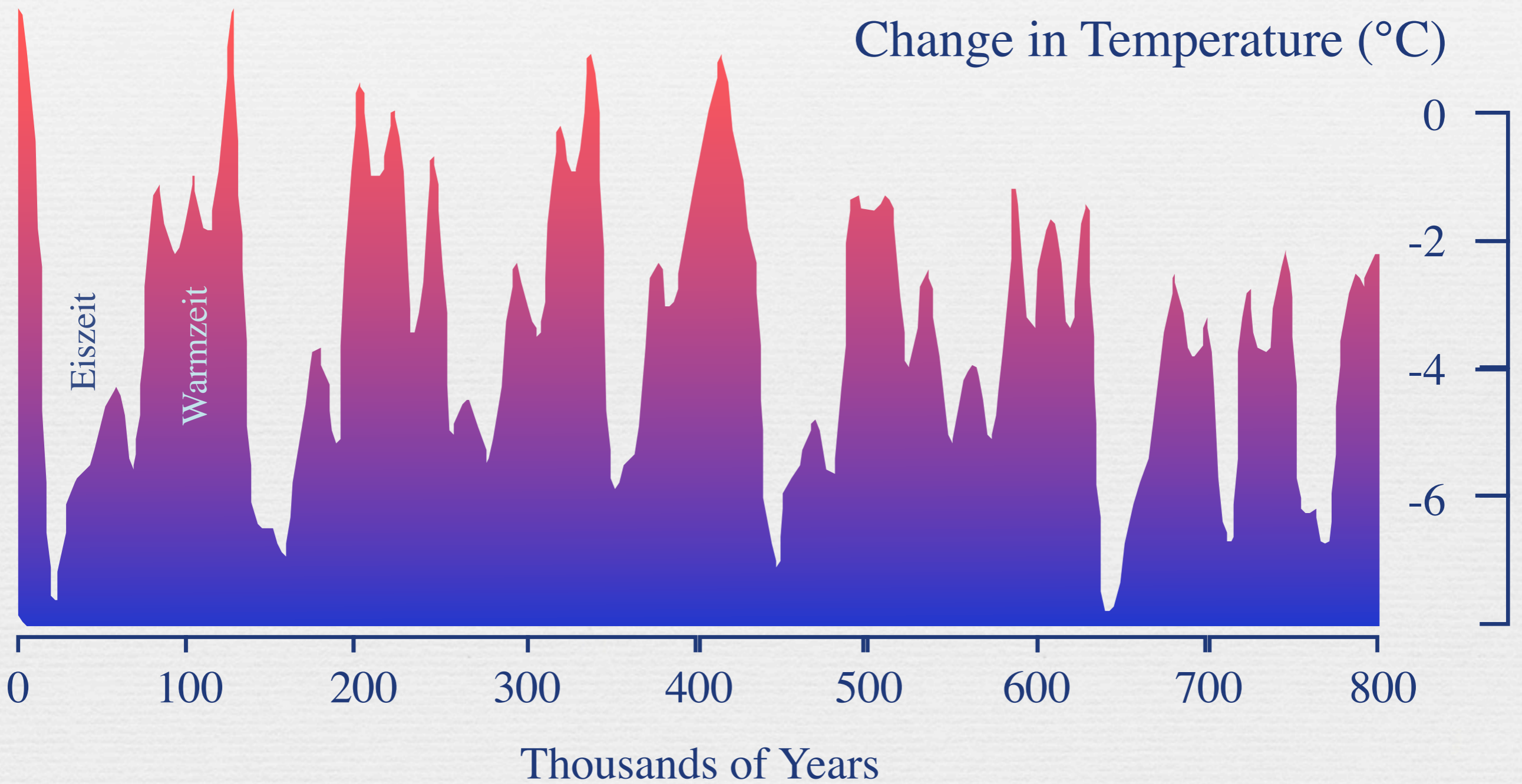


# Erdbahn-Parameter



# Quaternary

Change in Temperature (°C)



Eiszeit

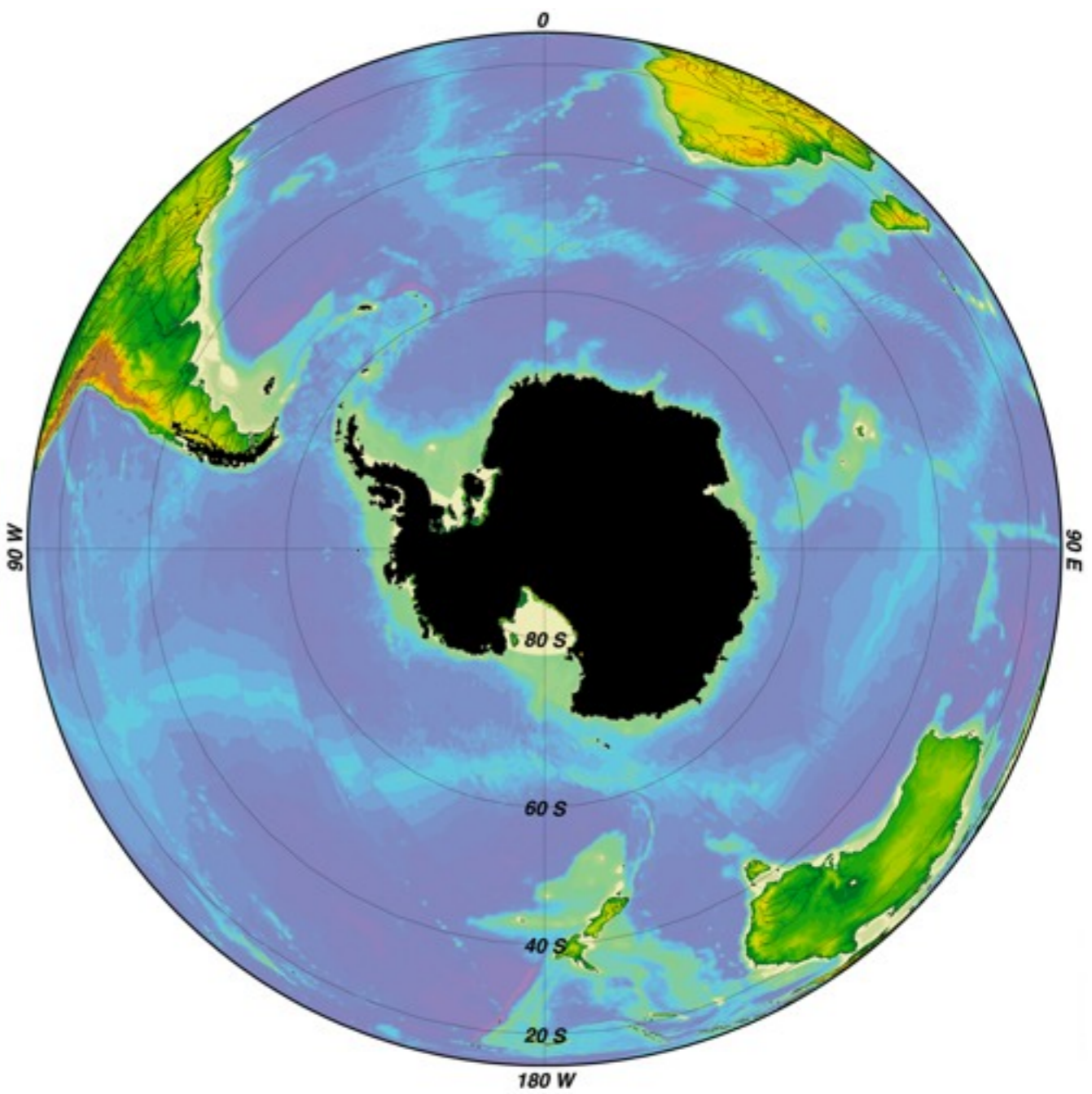
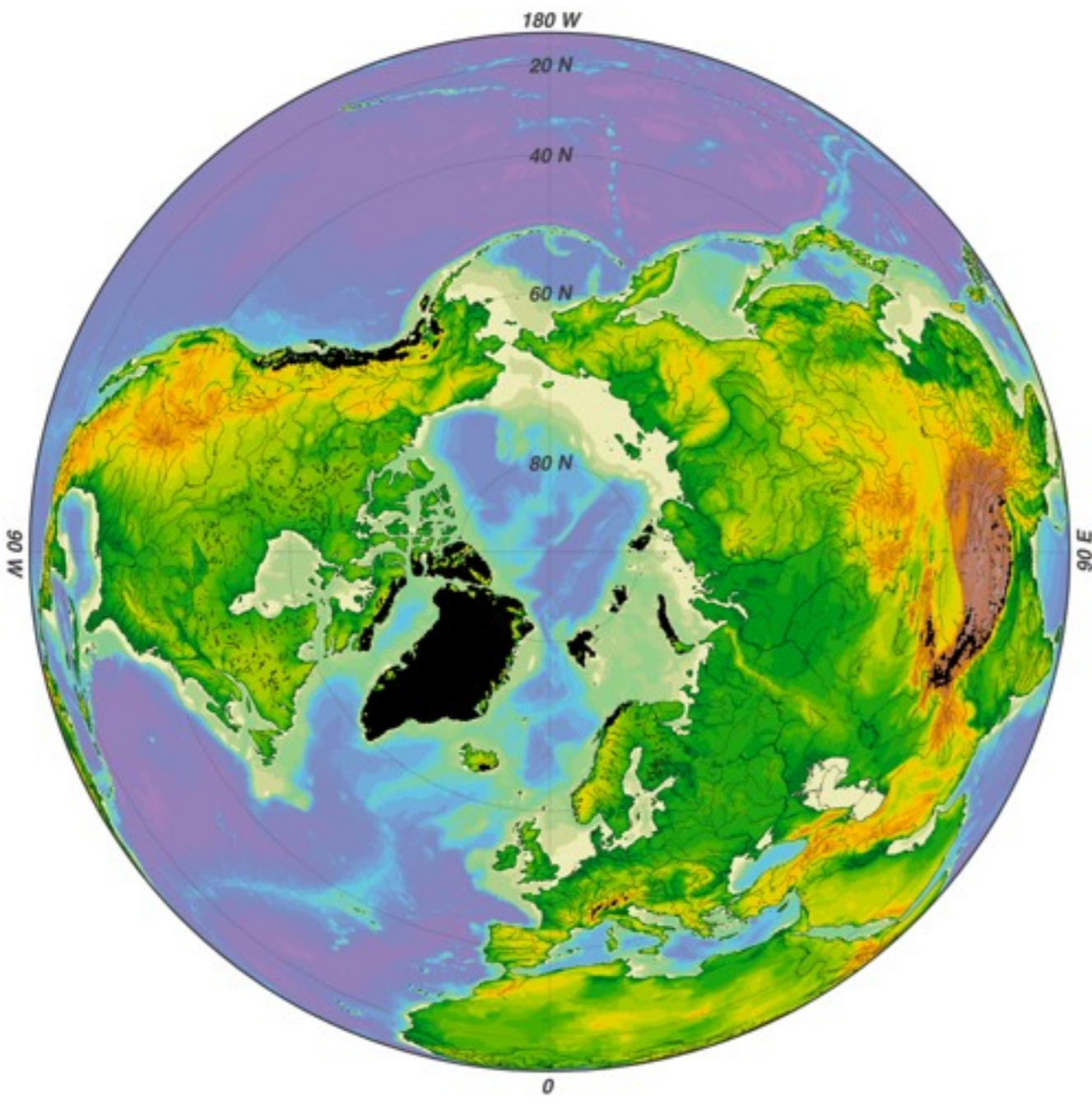
Warmzeit

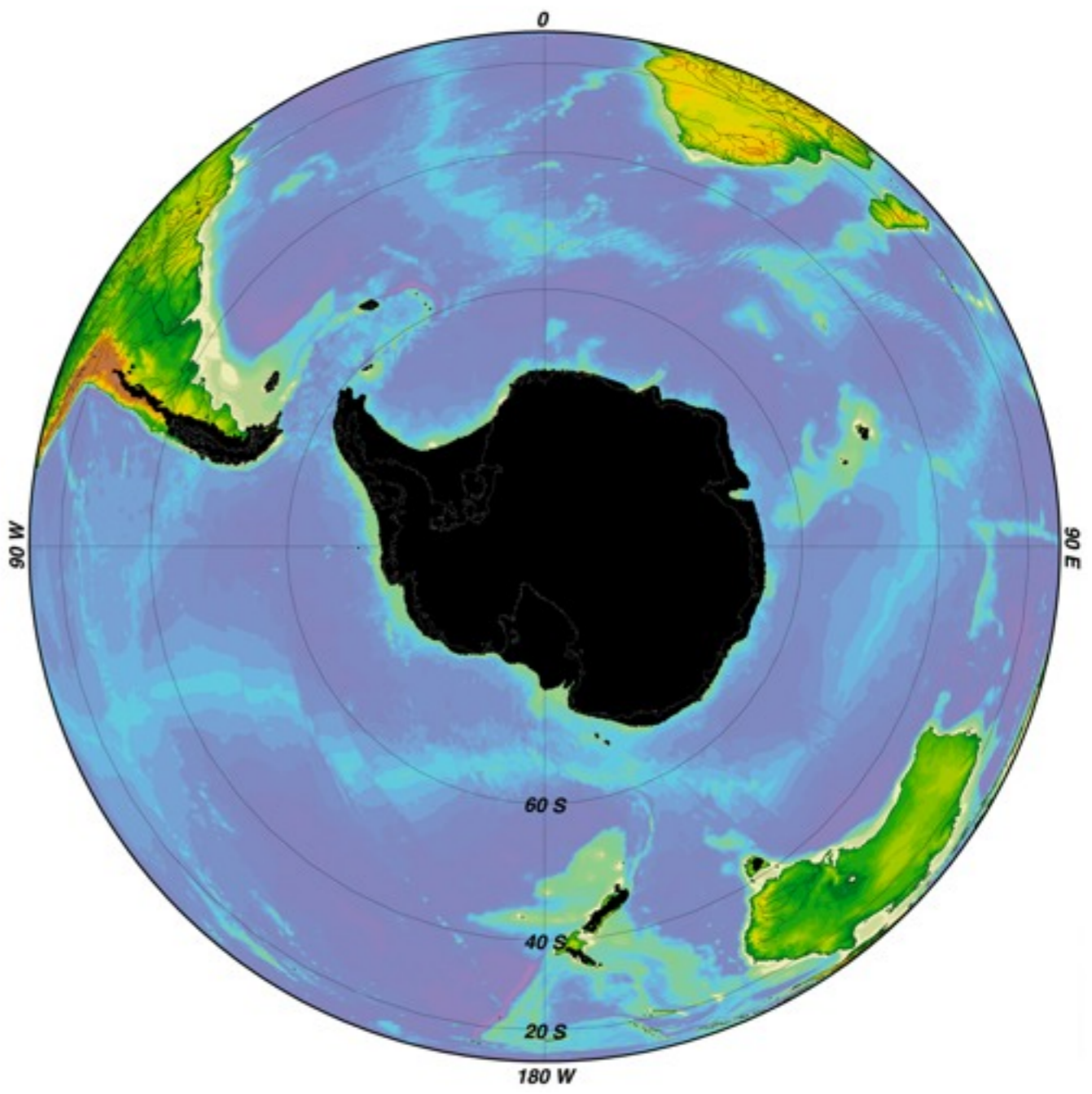
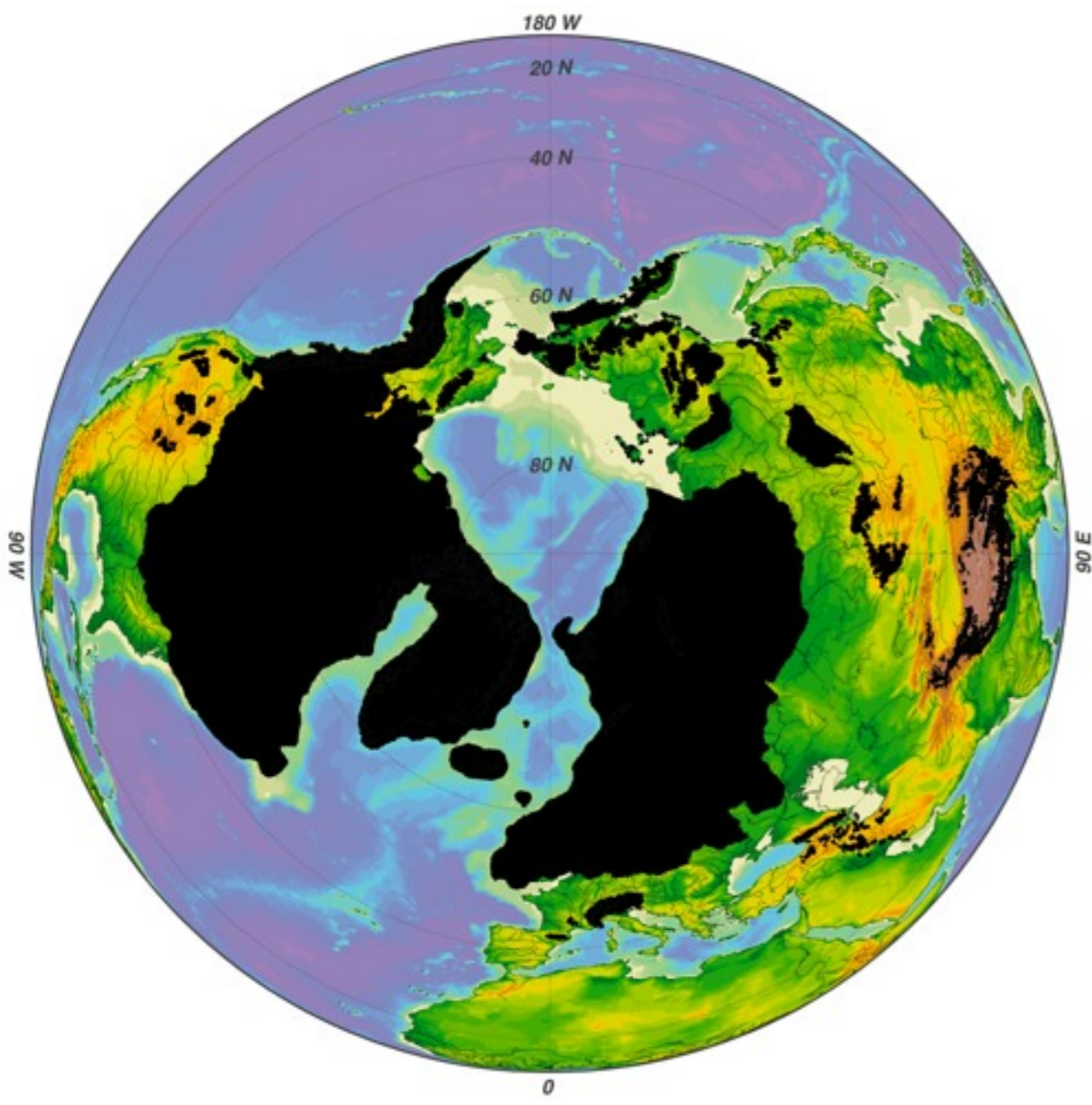
Thousands of Years



# NUNATAK

Eiszeitalter seit 1,8 Millionen Jahren











Der Steinbrecher John Brett 1858

Feuersteine

# Skandinavien



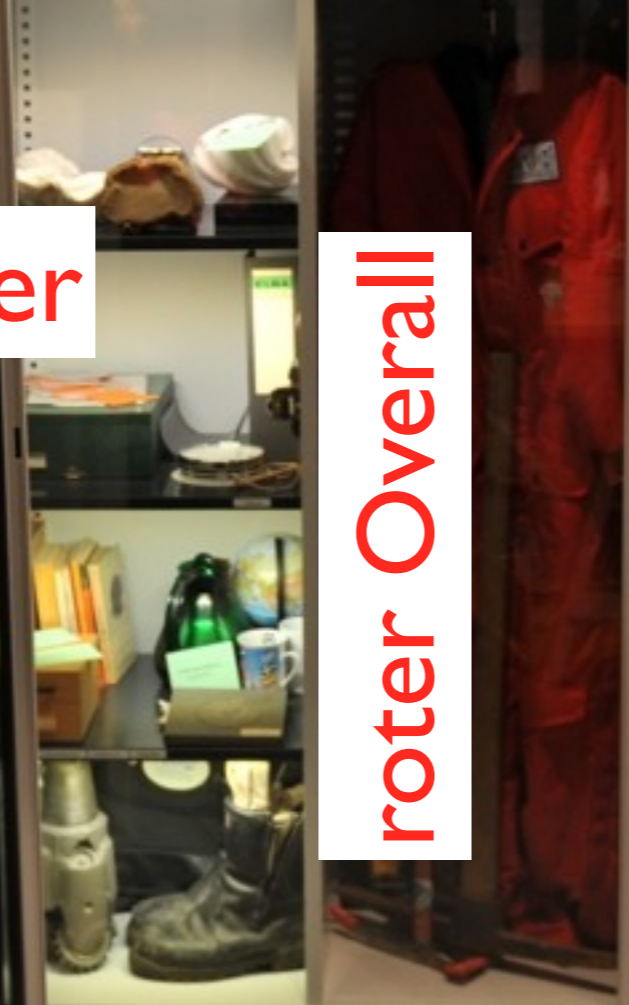
Findlinge + Feuersteine



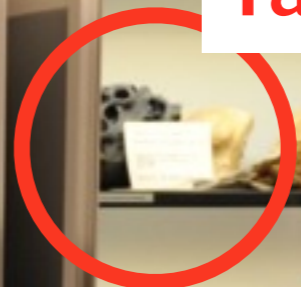
Windkanter

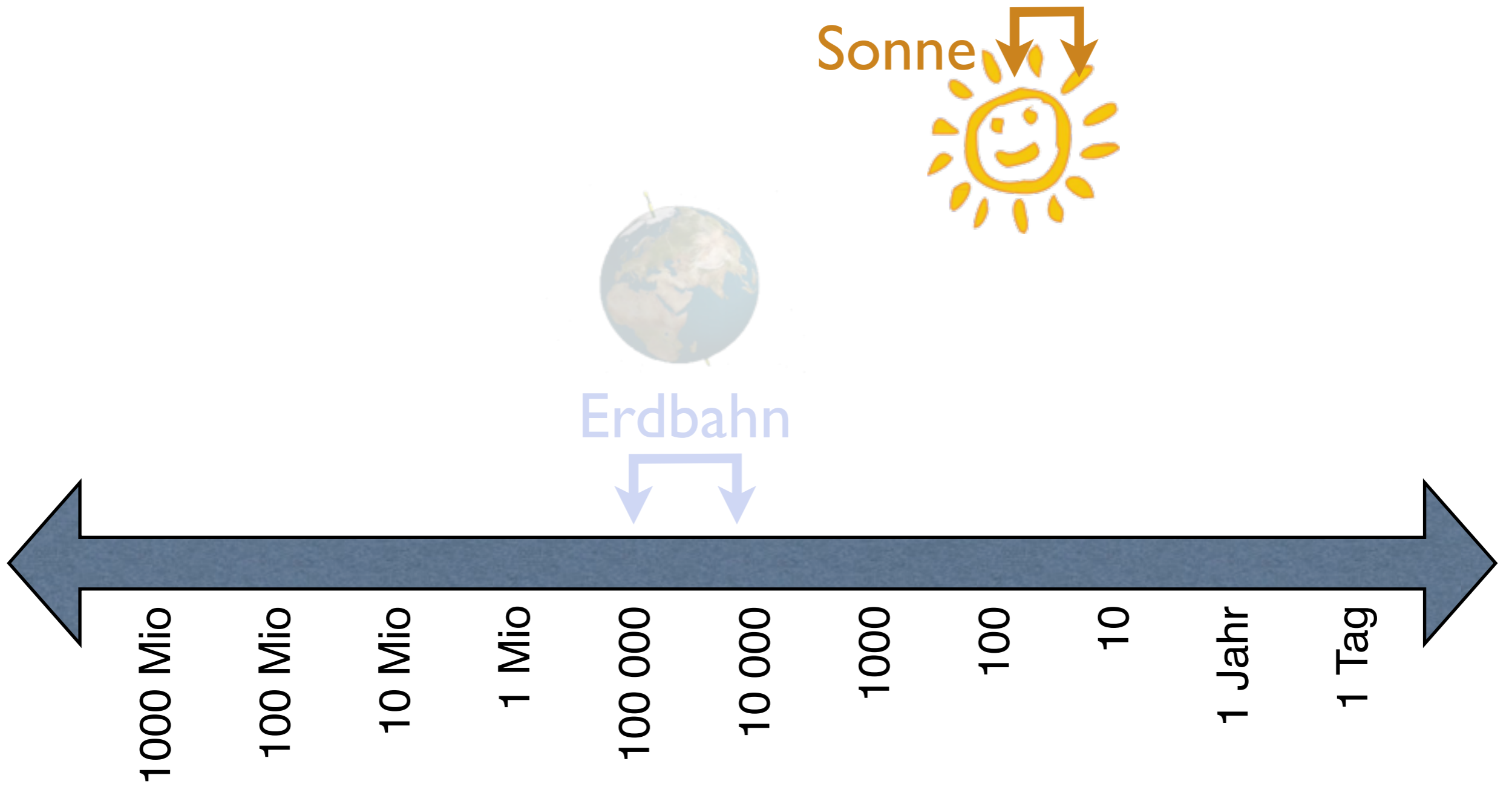


roter Overall



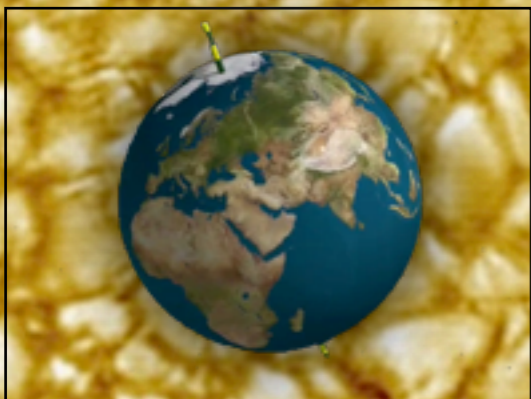
Tafoni



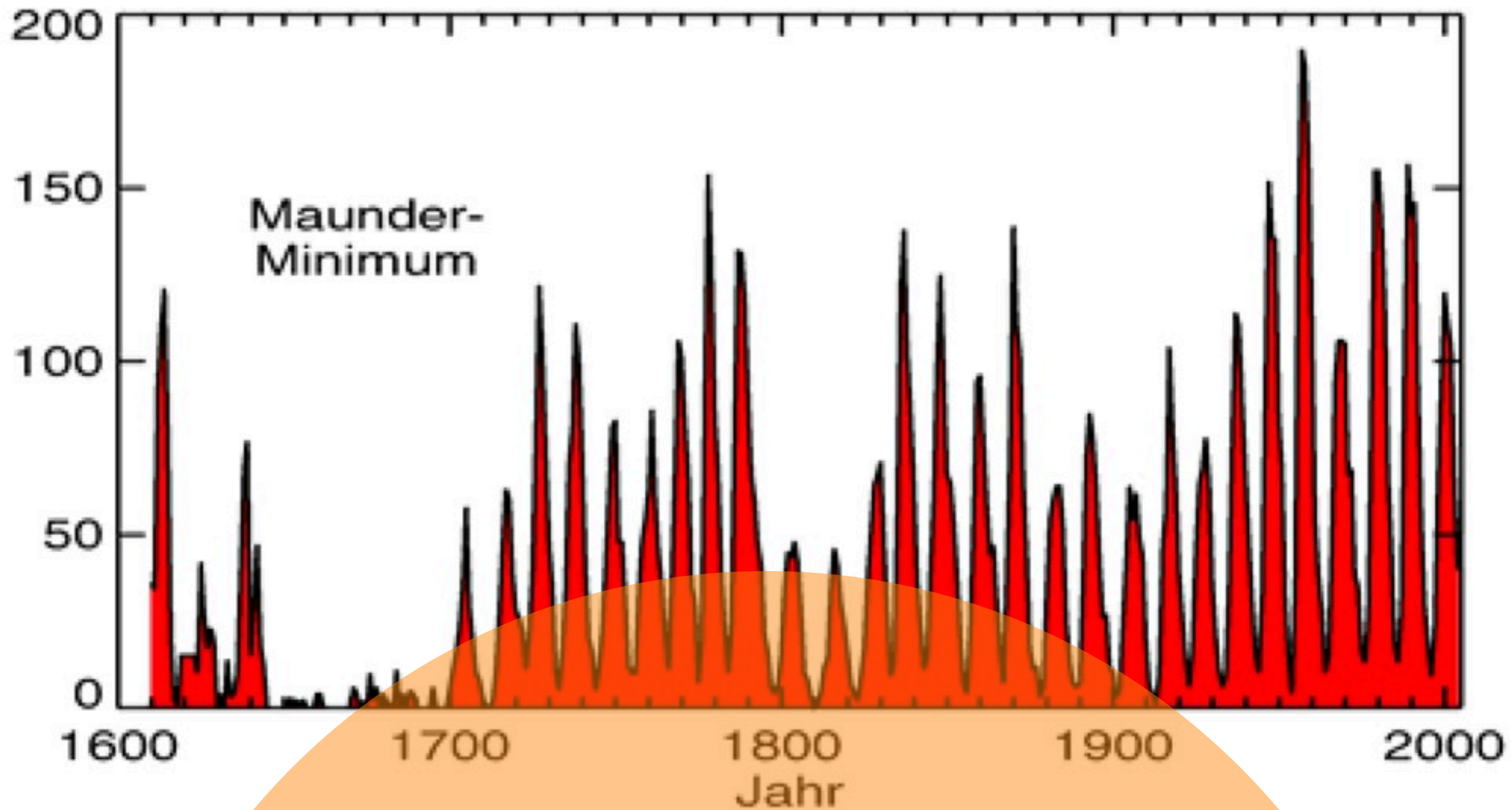


Zeitraum eines Klimawandels

Erde

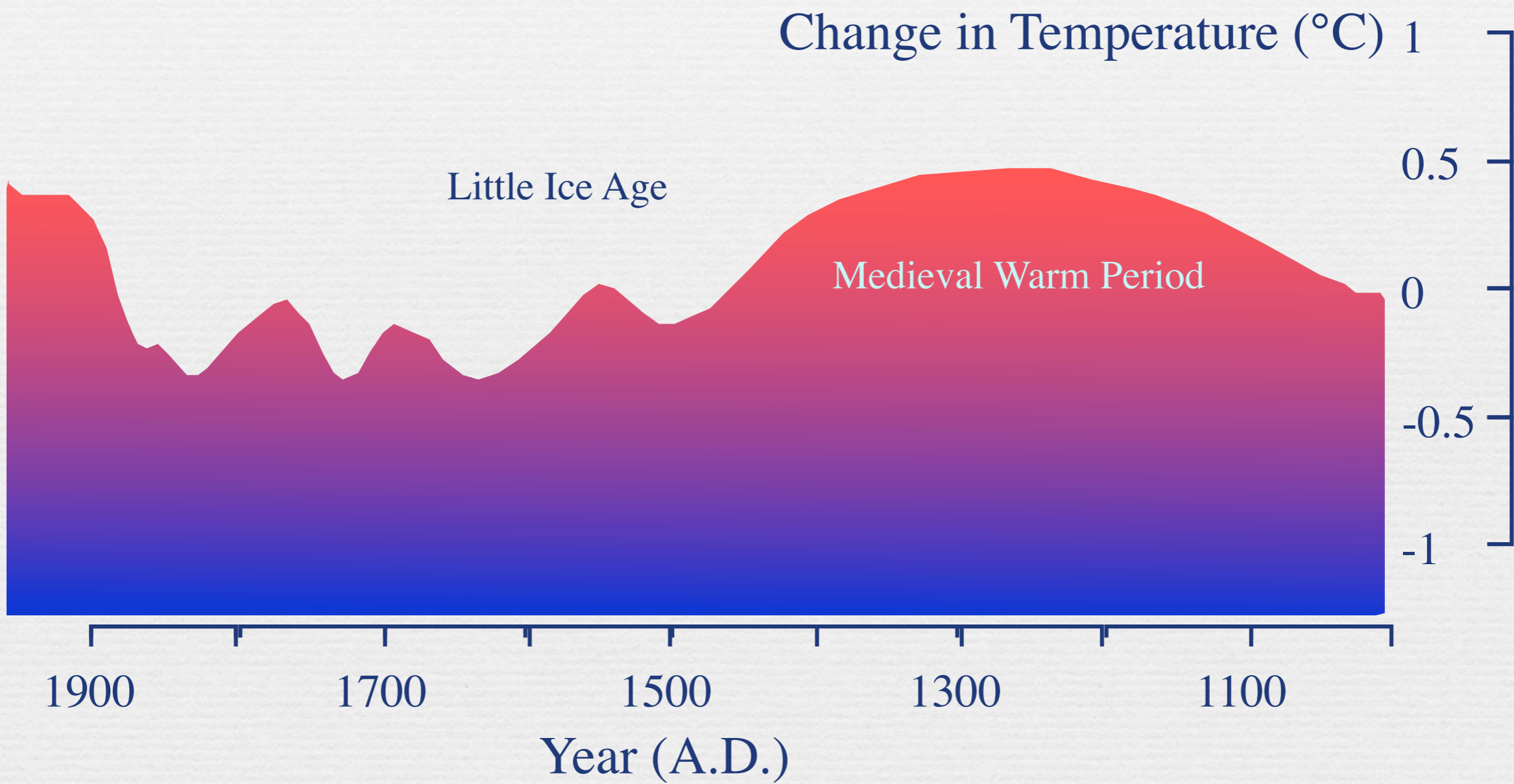


Sonnenfleckenrelativzahl



NASA

Sonnenflecken



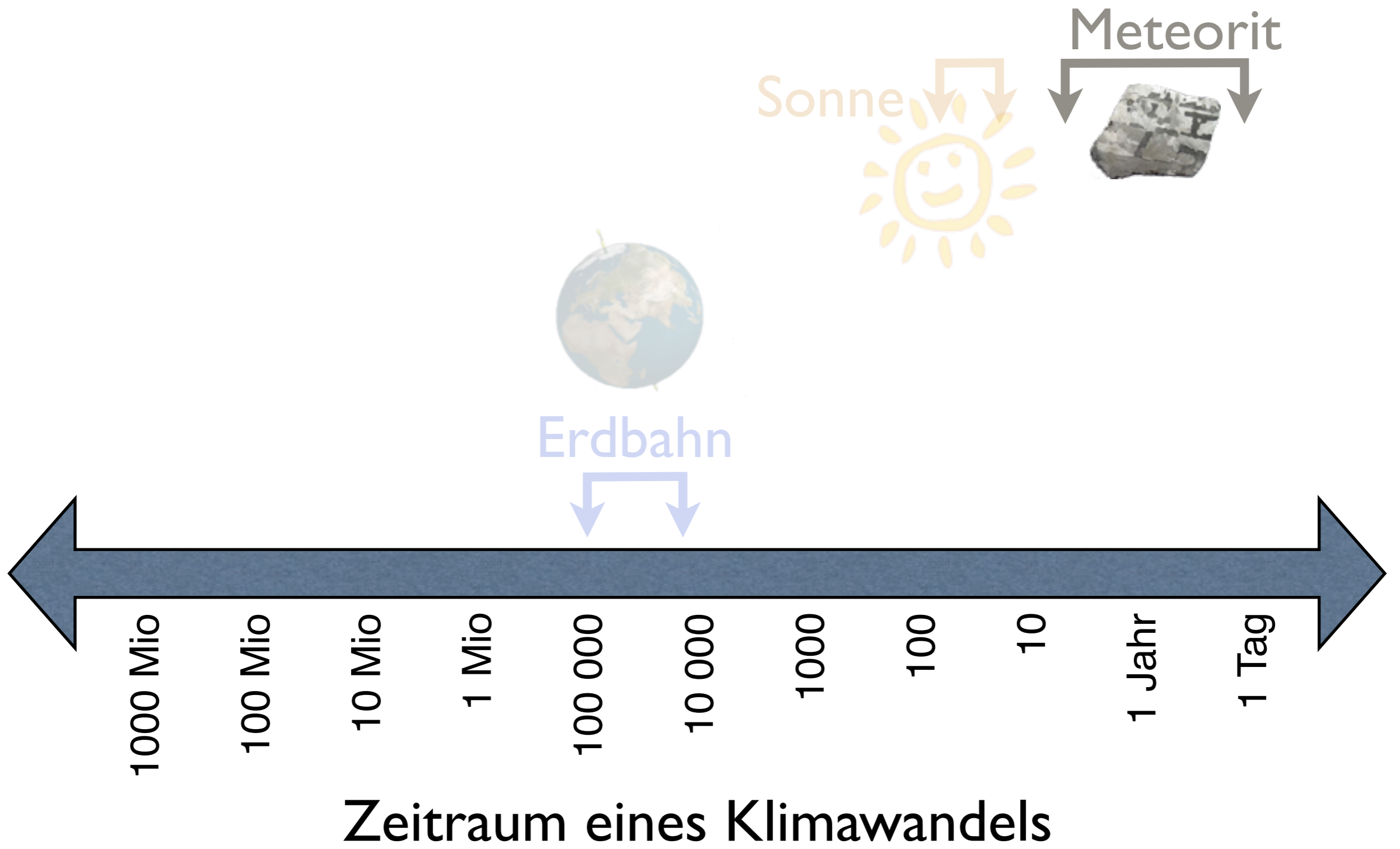


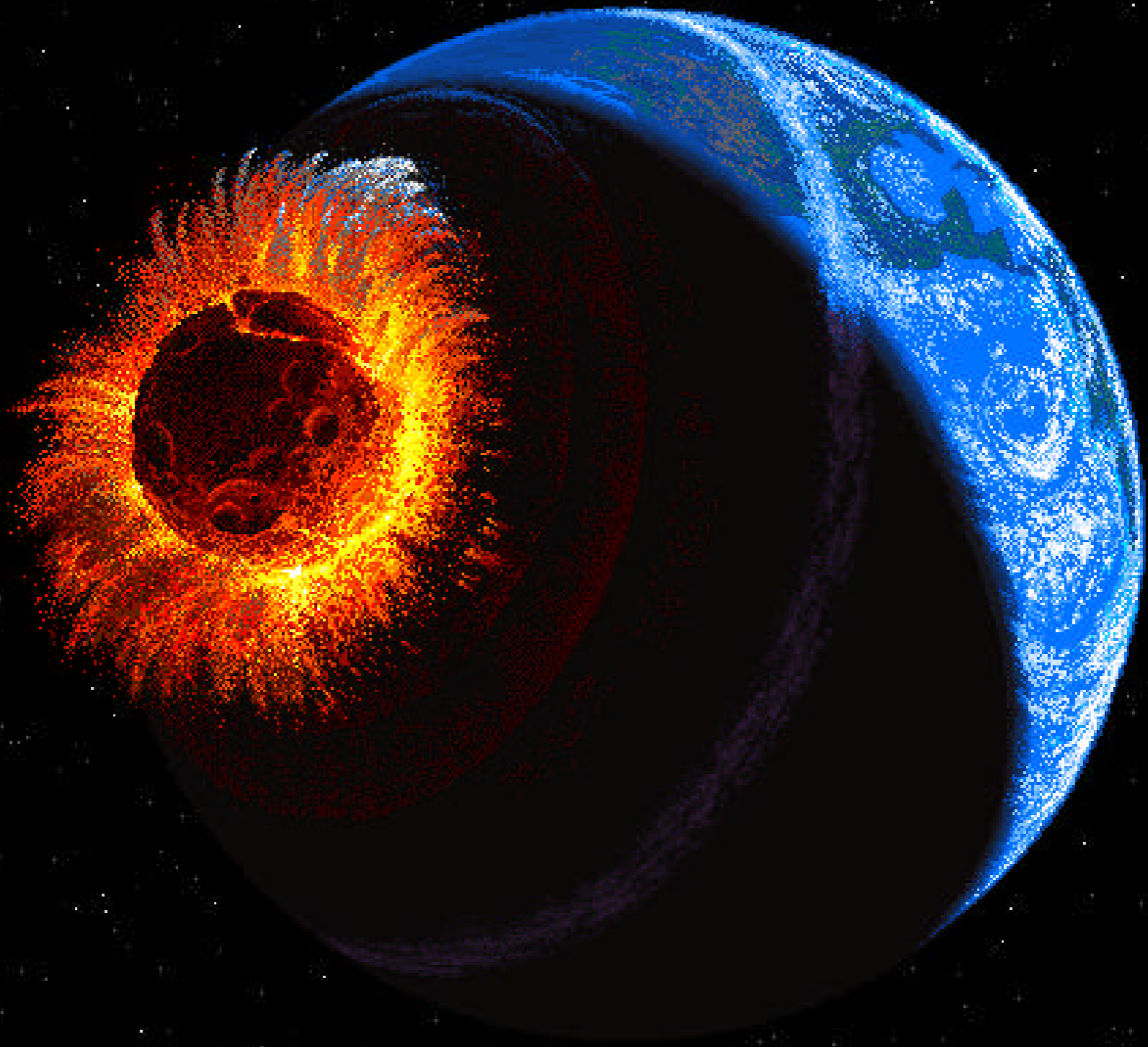


Hendrick Avercamp (1585-1634) *Winterlandschaft* (ca. 1608)

# Baumringe







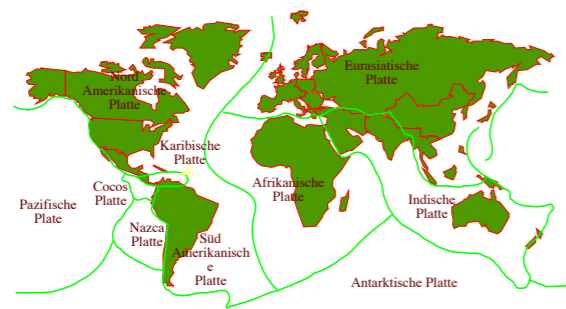
vor 65 Millionen Jahren

# Meteorit mit 12 km Ø

eq. 100 Mio Wasserstoffbomben

> **Impaktwinter**

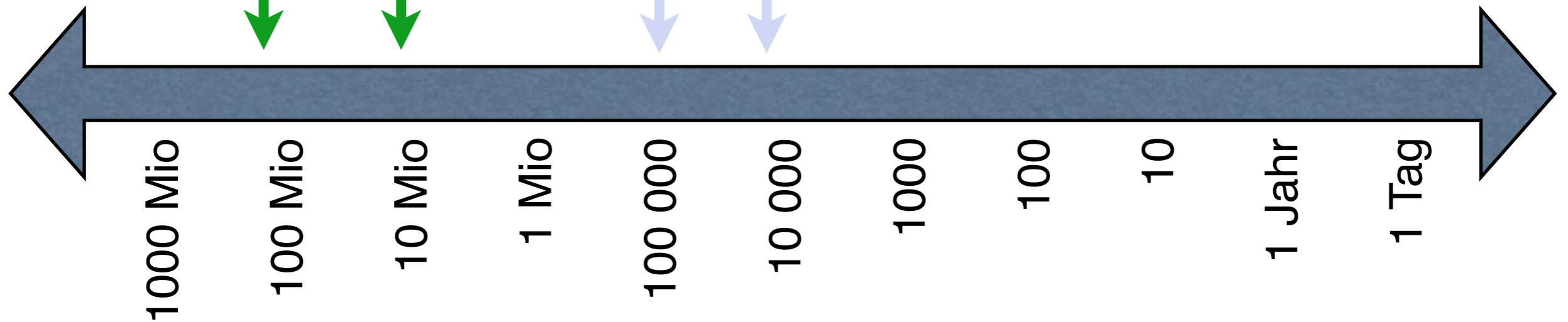
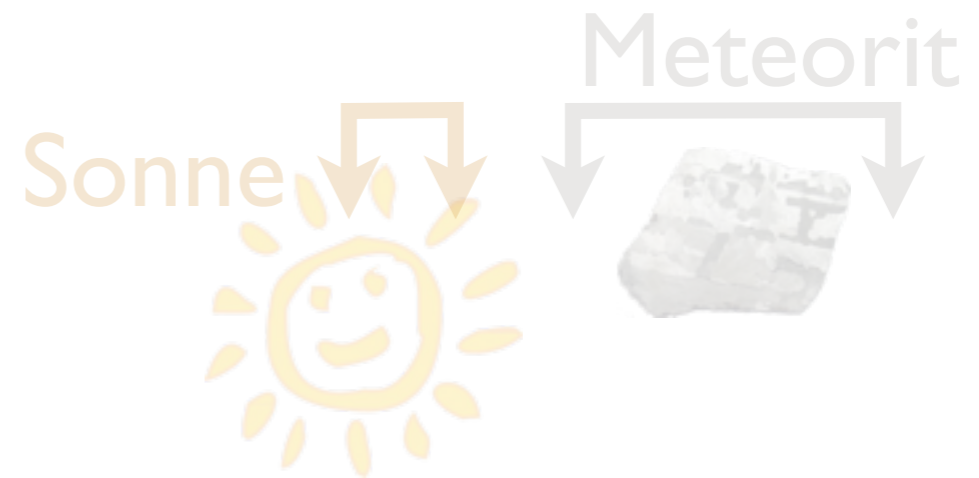




**Kontinental-  
verschiebung**

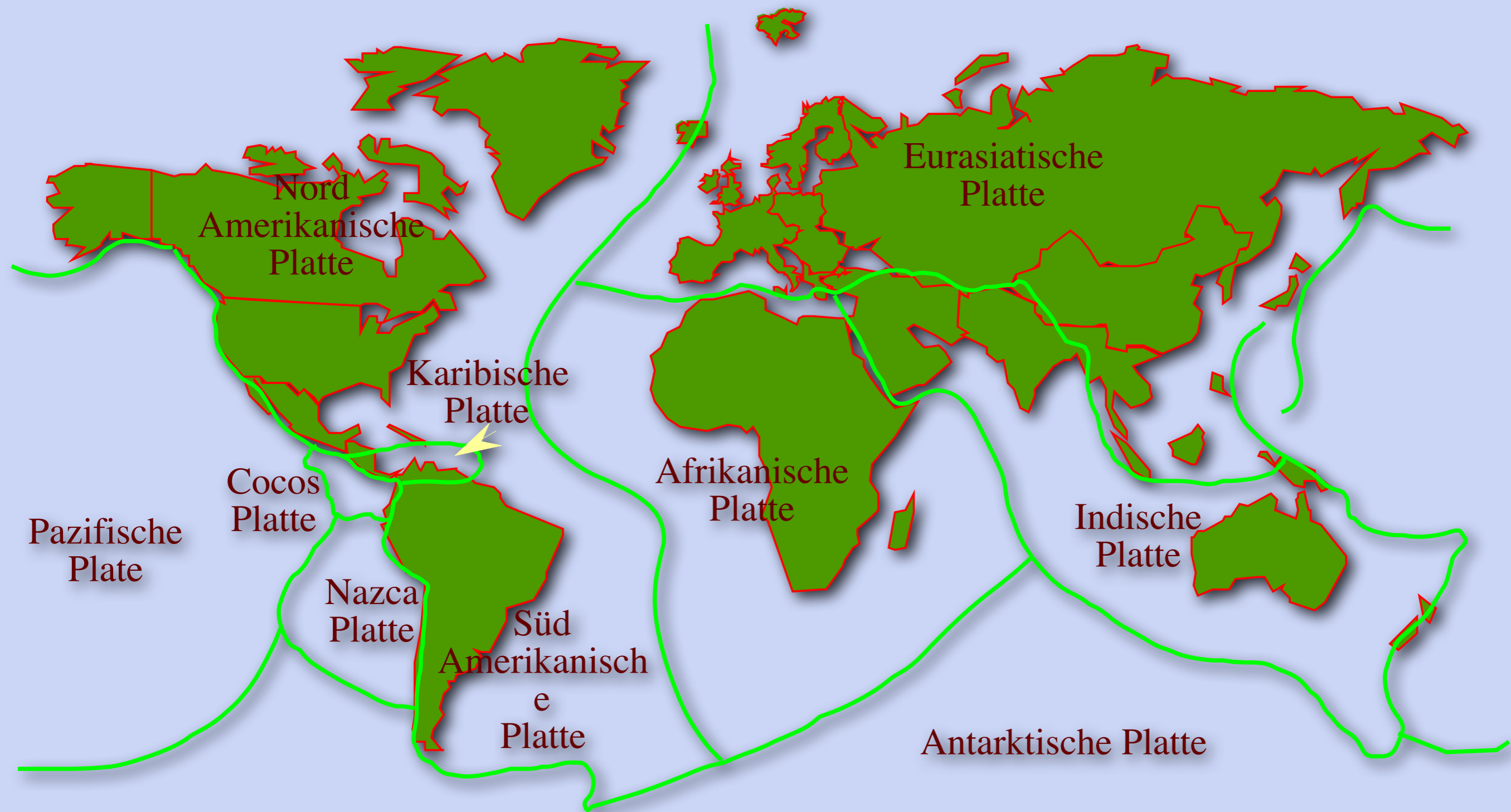


**Erdbahn**

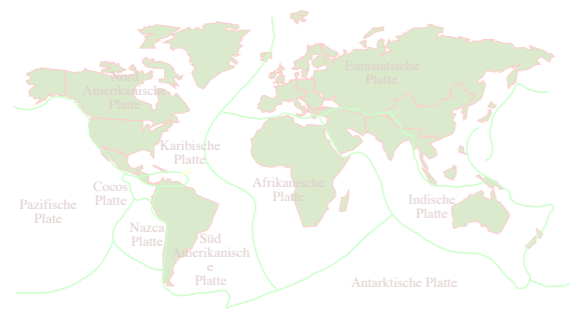


**Zeitraum eines Klimawandels**

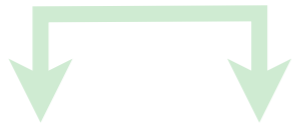








Kontinental-  
verschiebung



Erdbahn



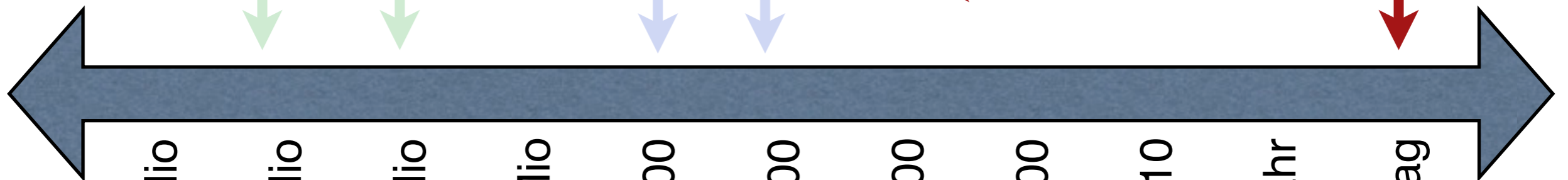
Sonne



Meteorit



Vulkane



1000 Mio

100 Mio

10 Mio

1 Mio

100 000

10 000

1000

100

10

1 Jahr

1 Tag

Zeitraum eines Klimawandels

An aerial photograph of the Mount Tambora volcano in Indonesia, showing a large, dark crater lake surrounded by rugged, brownish volcanic slopes. The surrounding landscape is a mix of green vegetation and brown volcanic ash.

# Tambora

Sunda-Inseln, Indonesien

10. April 1815

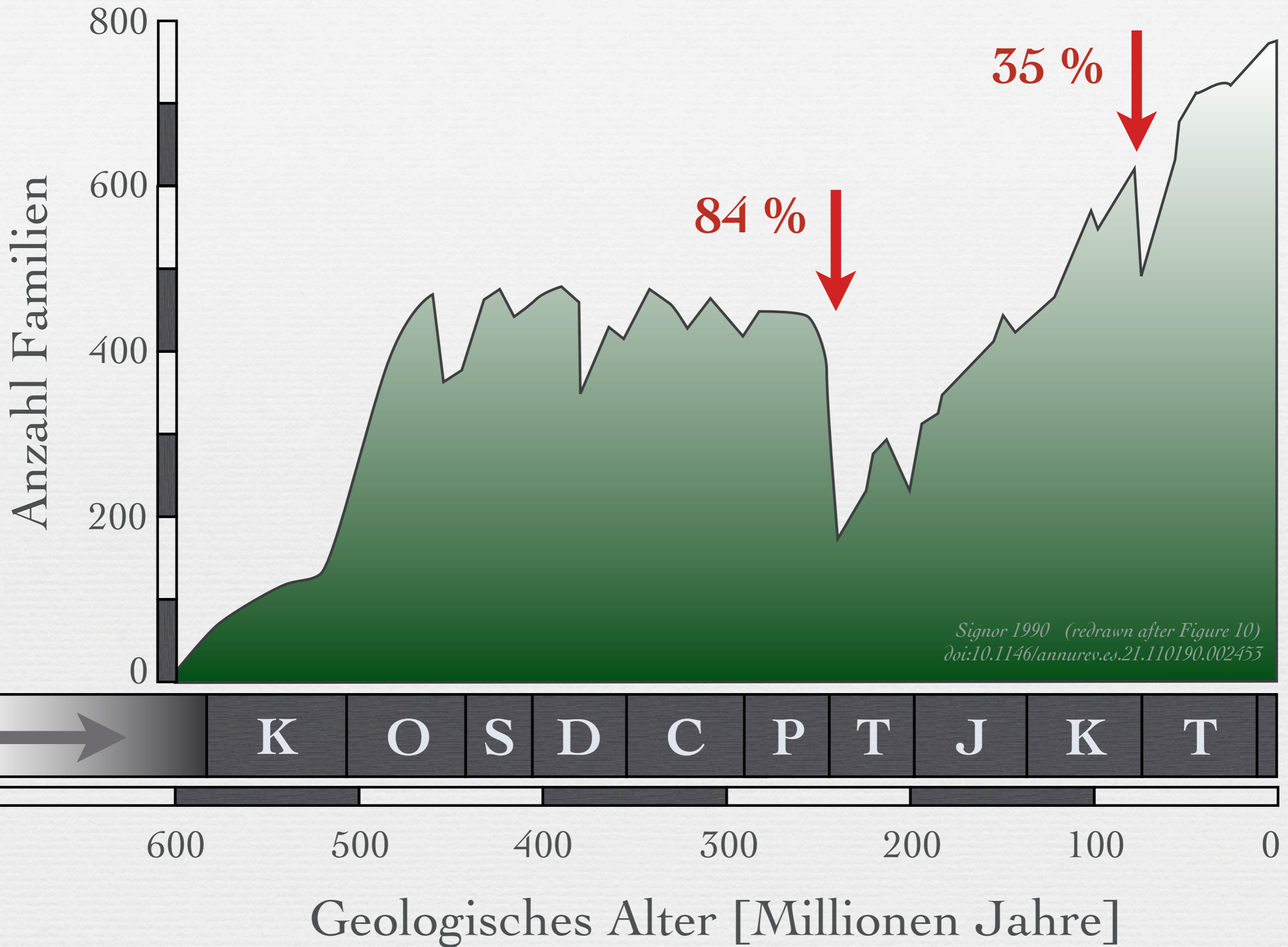
1816 > *Jahr ohne Sommer*



Joseph M.W. Turner (1838) *Flint Castle*

# Plateau-Basalt





Sedimentkern

Foraminiferen



Korallen

Handwritten labels on top of the coral display, including "Coral 3000-2" and various numbers.



Muscheln

Handwritten labels on top of the shell display, including "Muschel 1" and various numbers.



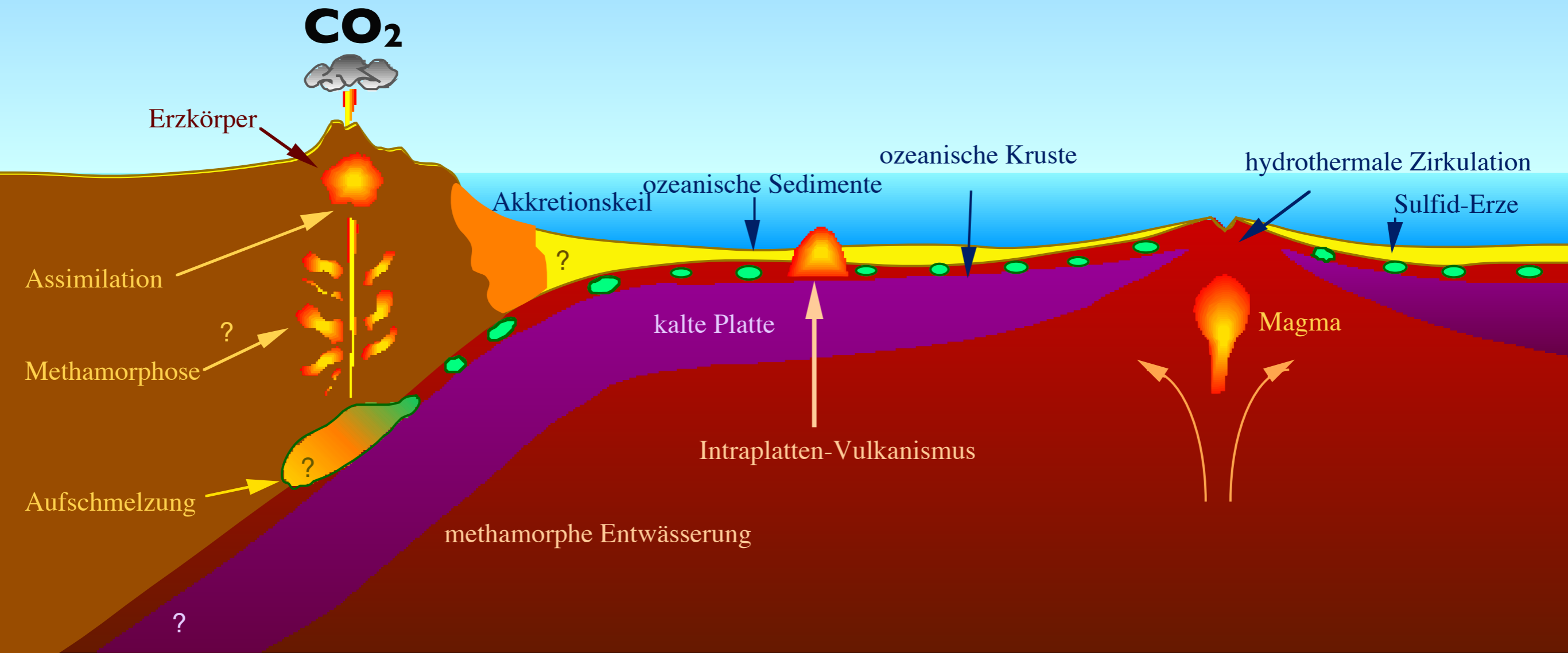
# *Kalkstein*





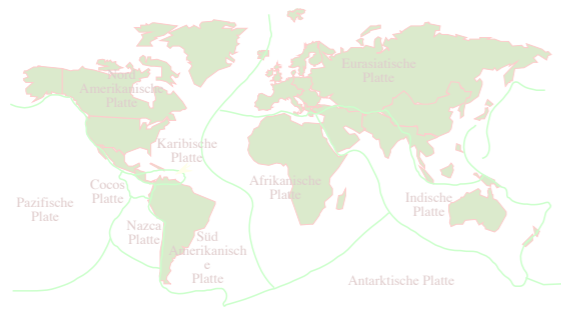
## Subduktionszone

## Mittelozeanischer Rücken

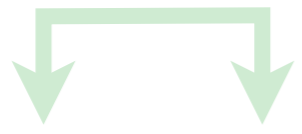




Meeresströmungen



Kontinentalverschiebung



Erdbahn



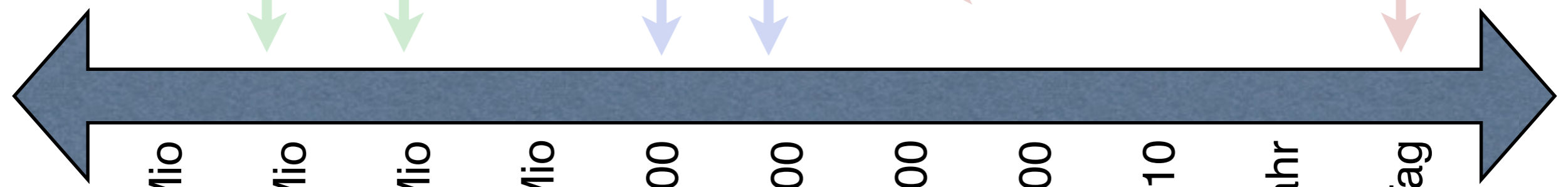
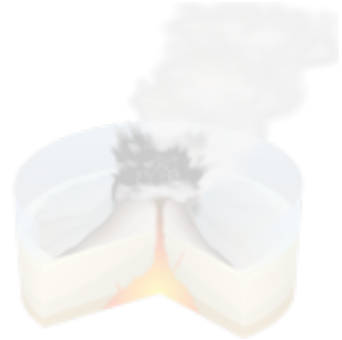
Sonne



Meteorit



Vulkane



1000 Mio

100 Mio

10 Mio

1 Mio

100 000

10 000

1000

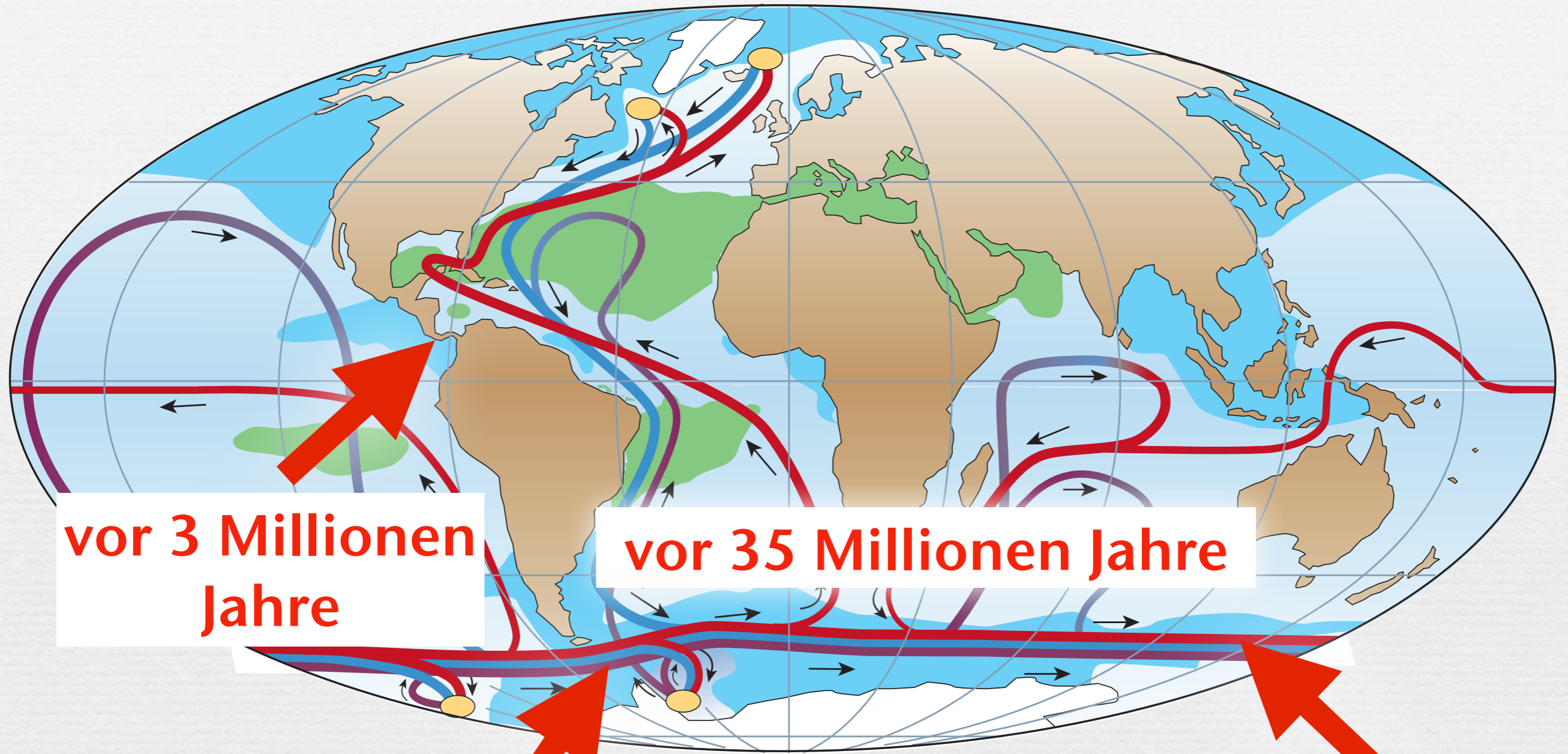
100

10

1 Jahr

1 Tag

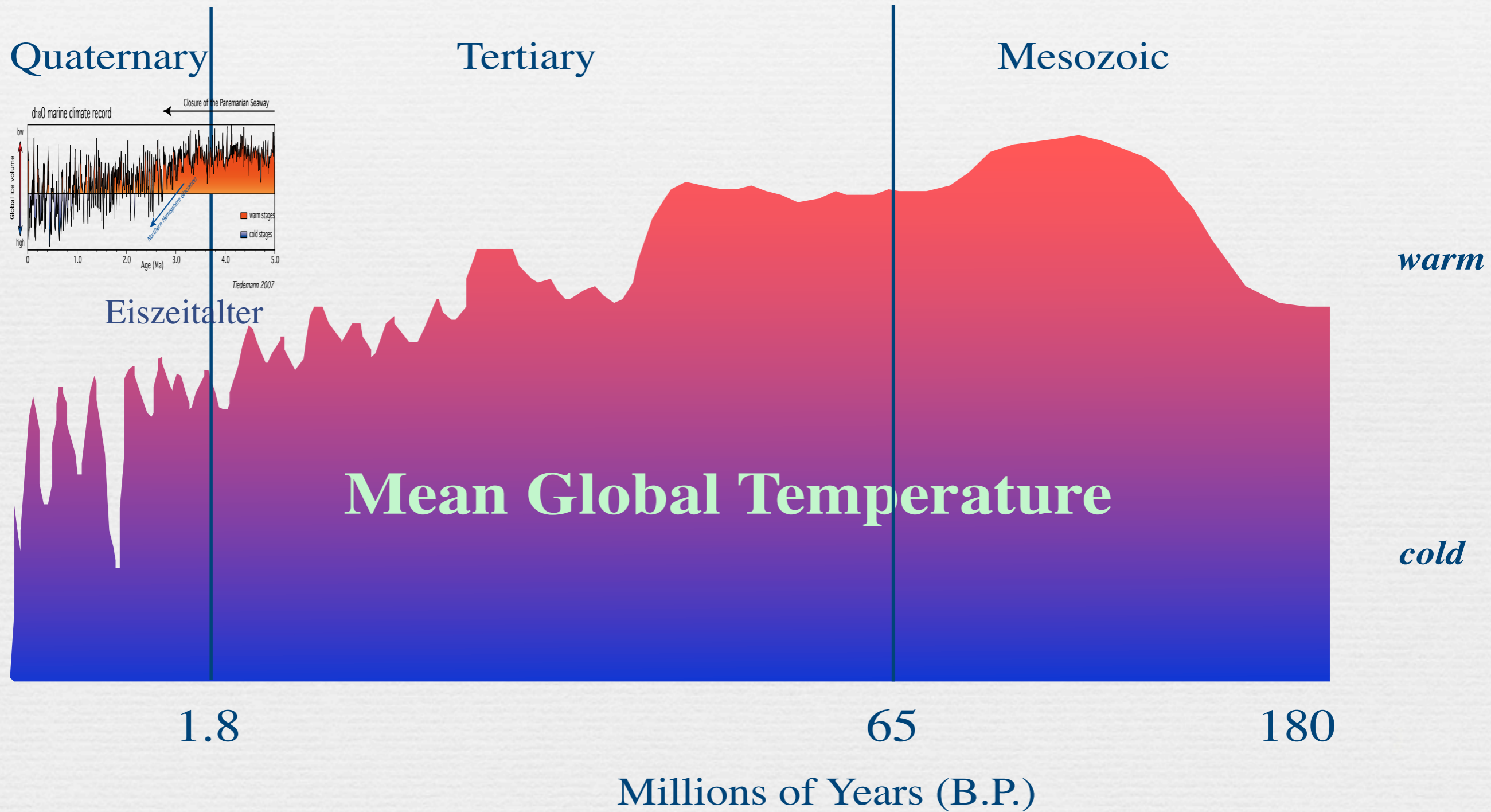
Zeitraum eines Klimawandels



**vor 3 Millionen Jahre**

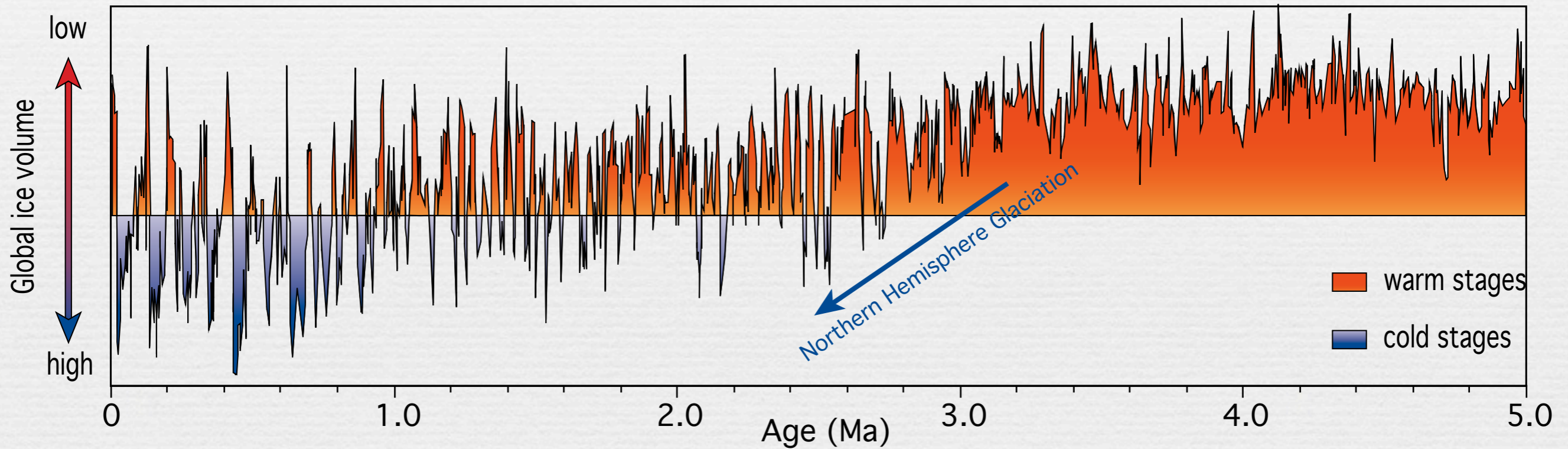
**vor 35 Millionen Jahre**

- Oberflächenströmung
- Bodenströmung
- Salinität > 36 ‰
- Tiefenströmung
- Tiefenwasserbildung
- Salinität < 34 ‰



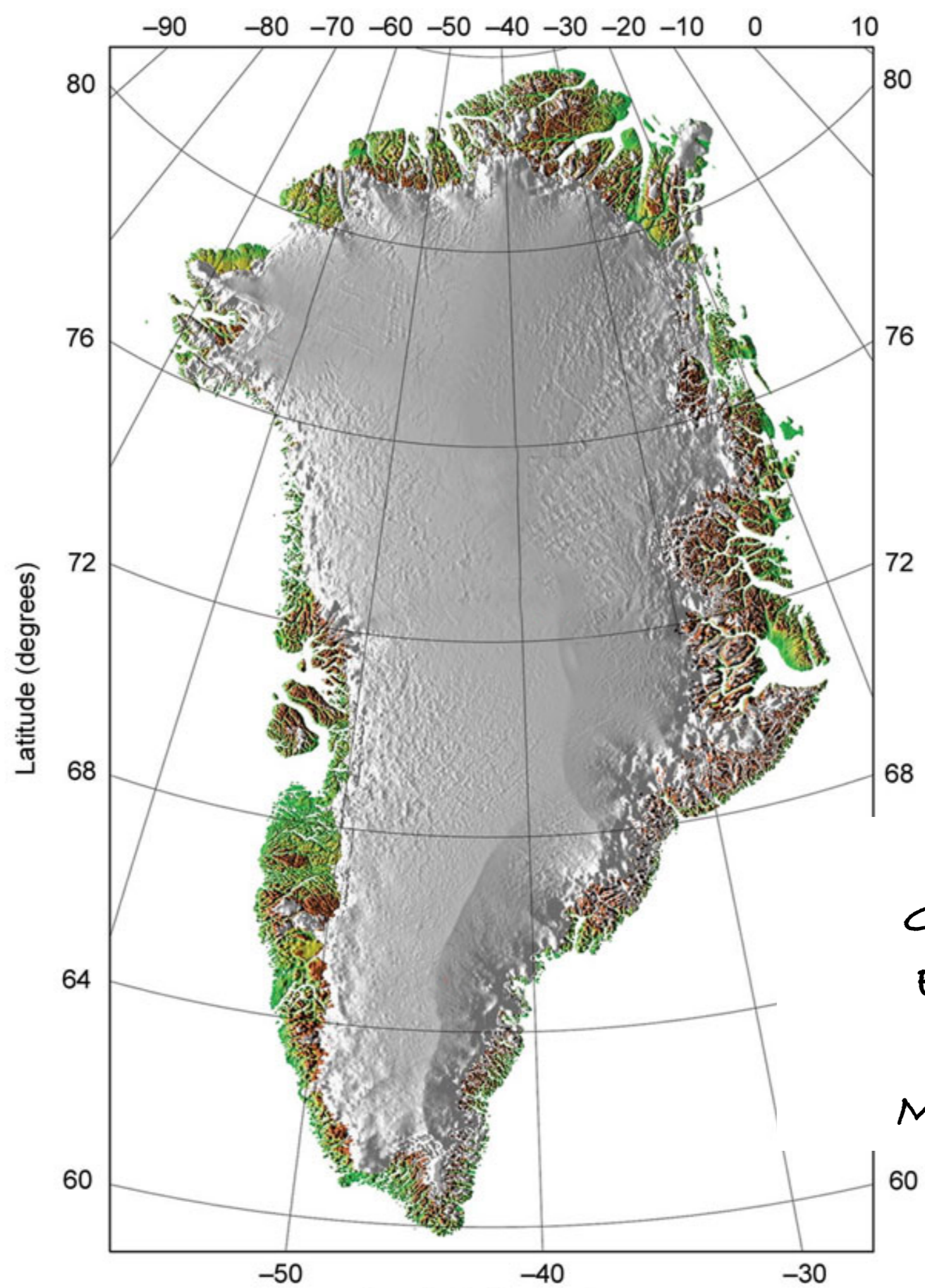
d<sub>18</sub>O marine climate record

Schließung der Straße von Panama



Richtungsänderung des Golfstroms

Tiedemann 2007



Aufbau des  
Grönländischen  
Eisschildes seit  
3  
Millionen Jahren



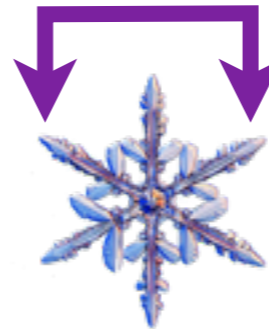
Meeresströmungen

Meteorit

Sonne



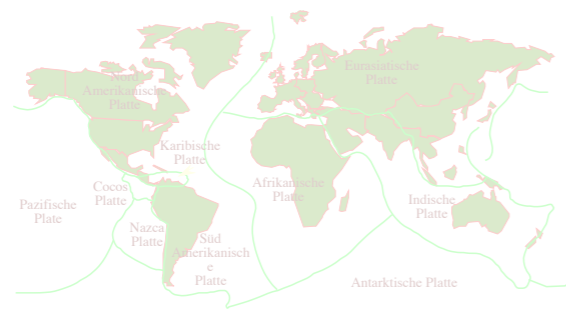
Eis



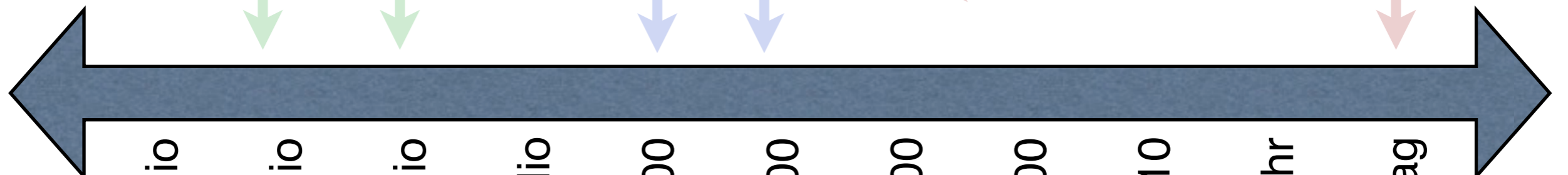
Erdbahn



Vulkane



Kontinentalverschiebung



1000 Mio

100 Mio

10 Mio

1 Mio

100 000

10 000

1000

100

10

1 Jahr

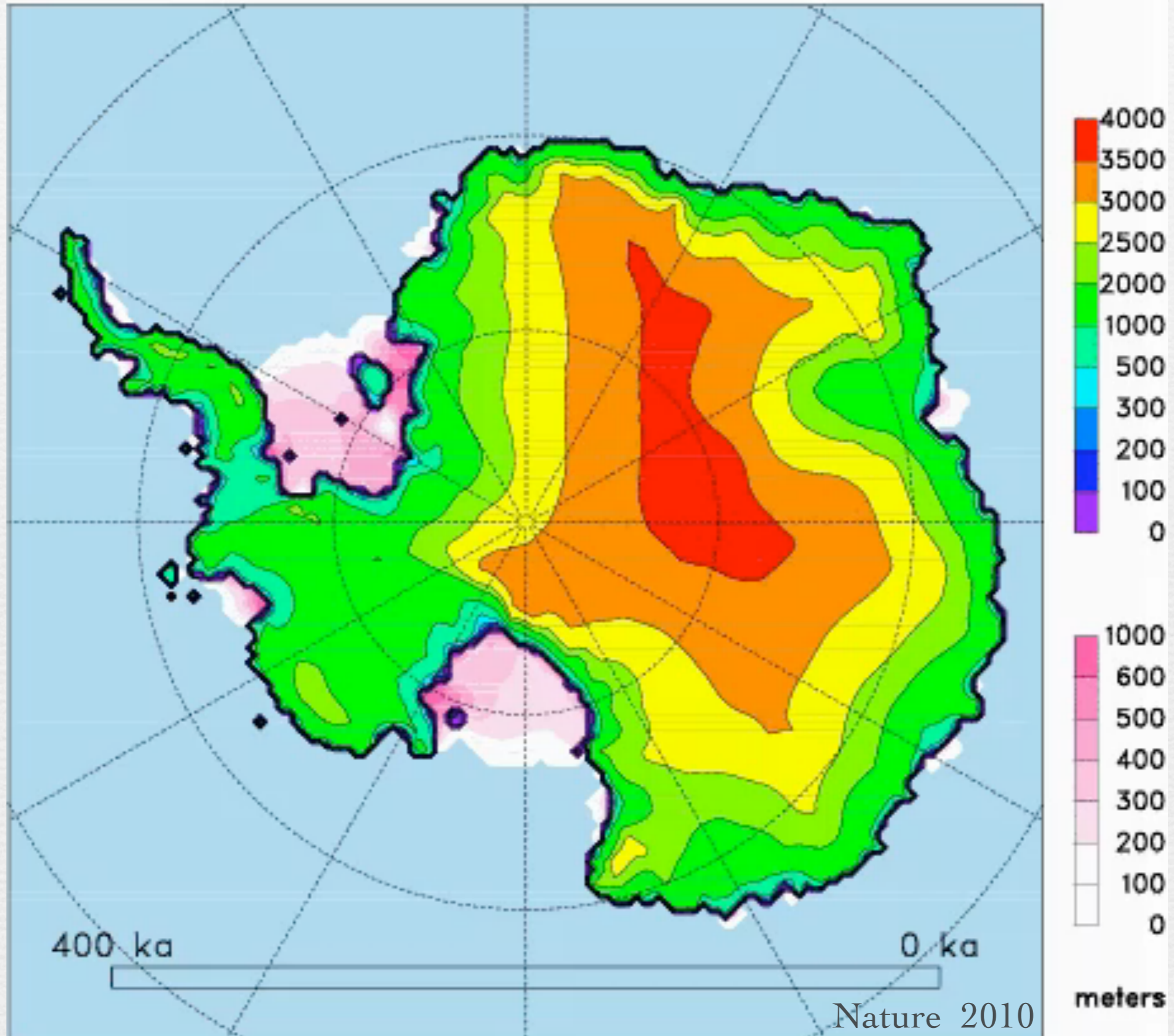
1 Tag

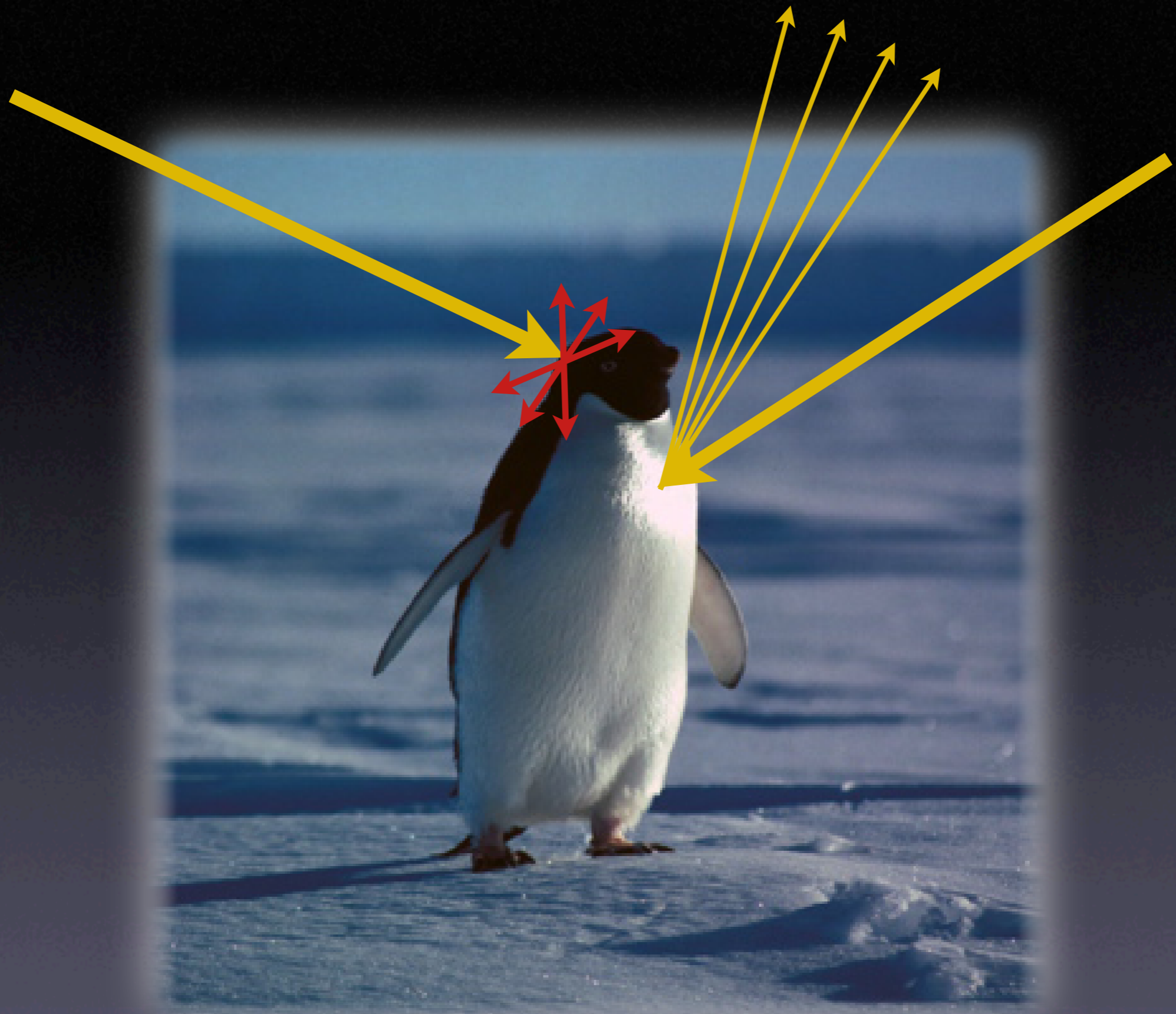
Zeitraum eines Klimawandels





year= -400000





Albedo

AWI GLAZ 5010

A workstation featuring a computer monitor displaying a software interface, mounted on a metal frame. Below the monitor is a control panel with several buttons and a small display. The entire unit is labeled 'AWI GLAZ 5010'.

LSC VIAL

AWI 3959

A laboratory bench with a wooden top and metal shelving. On the bench, there is a large piece of equipment with a blue light, a pair of black gloves, and a long white plastic bag. The shelves below contain boxes of 'LSC VIAL' (Packard TruLume), a white bucket with a red lid, a blue tool holder, and other supplies. A black stool is positioned in front of the bench. The floor is a metal grating. A label 'AWI 3959' is visible on the bottom shelf.

AWI

Polen Eiserns als Klimarekord  
Spurensuche bei -40 °C

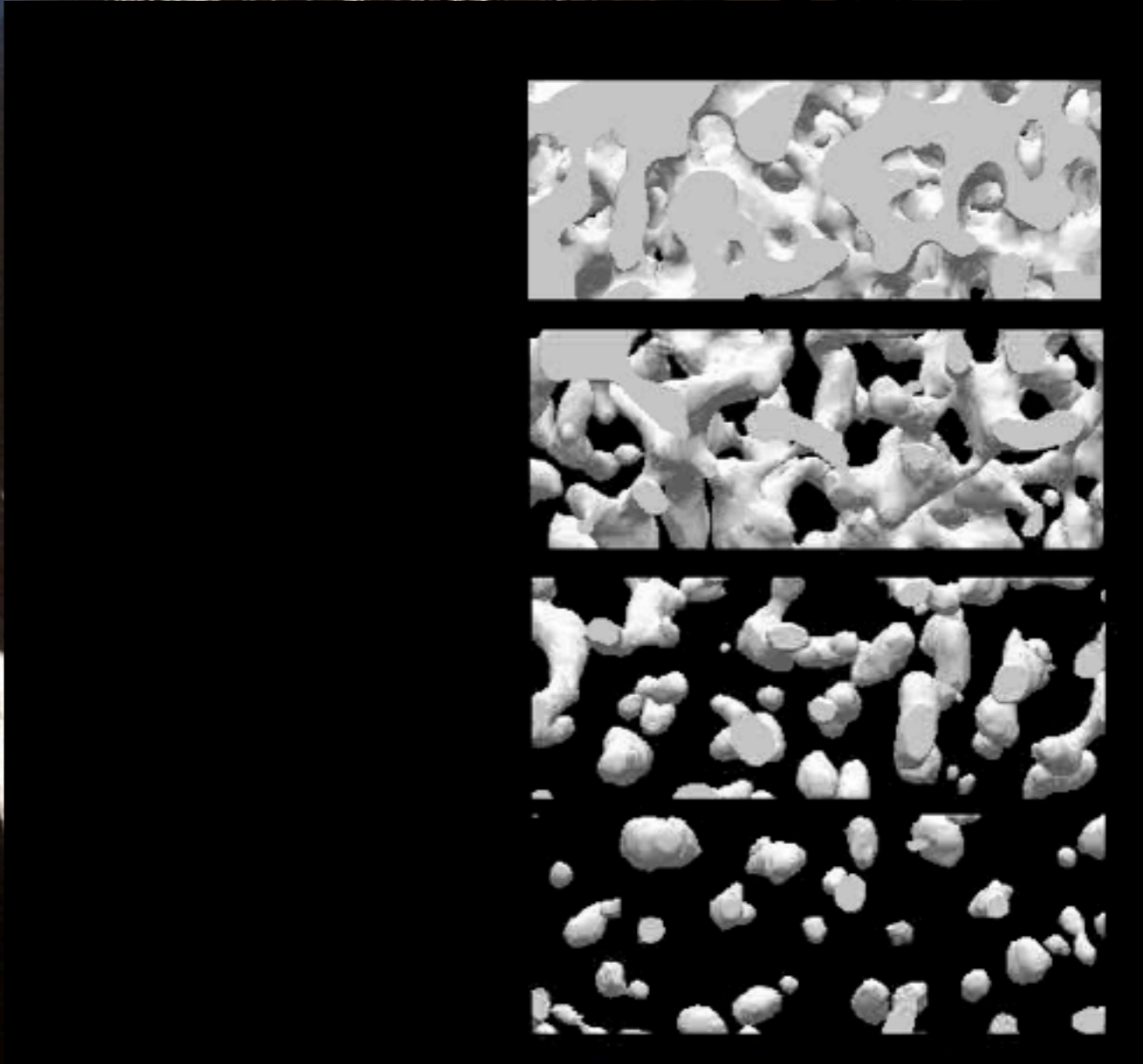
An informational poster with the title 'Polen Eiserns als Klimarekord' and subtitle 'Spurensuche bei -40 °C'. It features the AWI logo, a map of Antarctica, and several small photographs and diagrams illustrating ice core research.

AWI

Kühnstation, Antarktis  
Eine Eisentafelung in die Vergangenheit

An informational poster with the title 'Kühnstation, Antarktis' and subtitle 'Eine Eisentafelung in die Vergangenheit'. It features the AWI logo, a large graph showing temperature and CO2 levels over time, and several small photographs of the ice core drilling site.







Meeresströmungen

Kohlenstoff

C

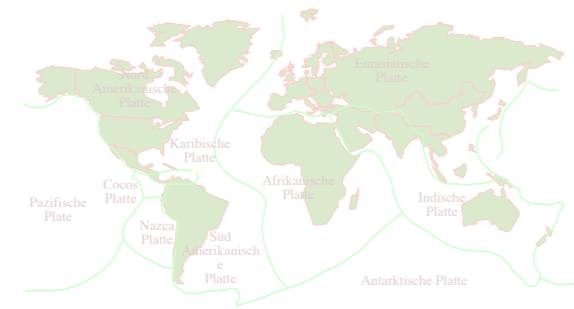
Meteorit

Sonne

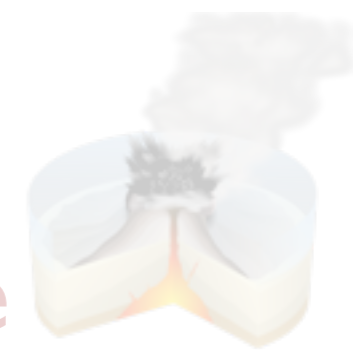
Eis

Erdbahn

Vulkane



Kontinentalverschiebung



1000 Mio

100 Mio

10 Mio

1 Mio

100 000

10 000

1000

100

10

1 Jahr

1 Tag

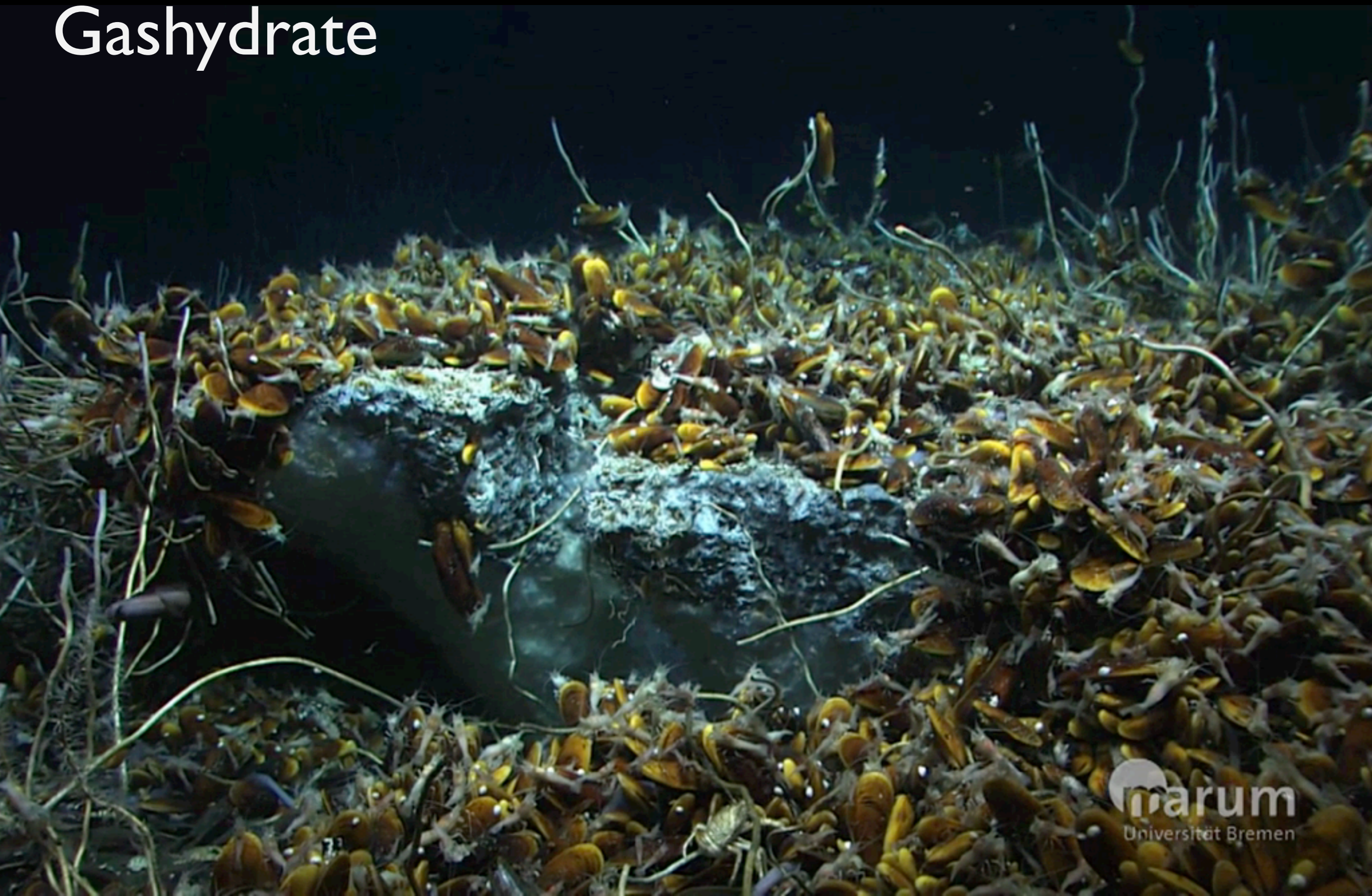
Zeitraum eines Klimawandels

# Permafrost



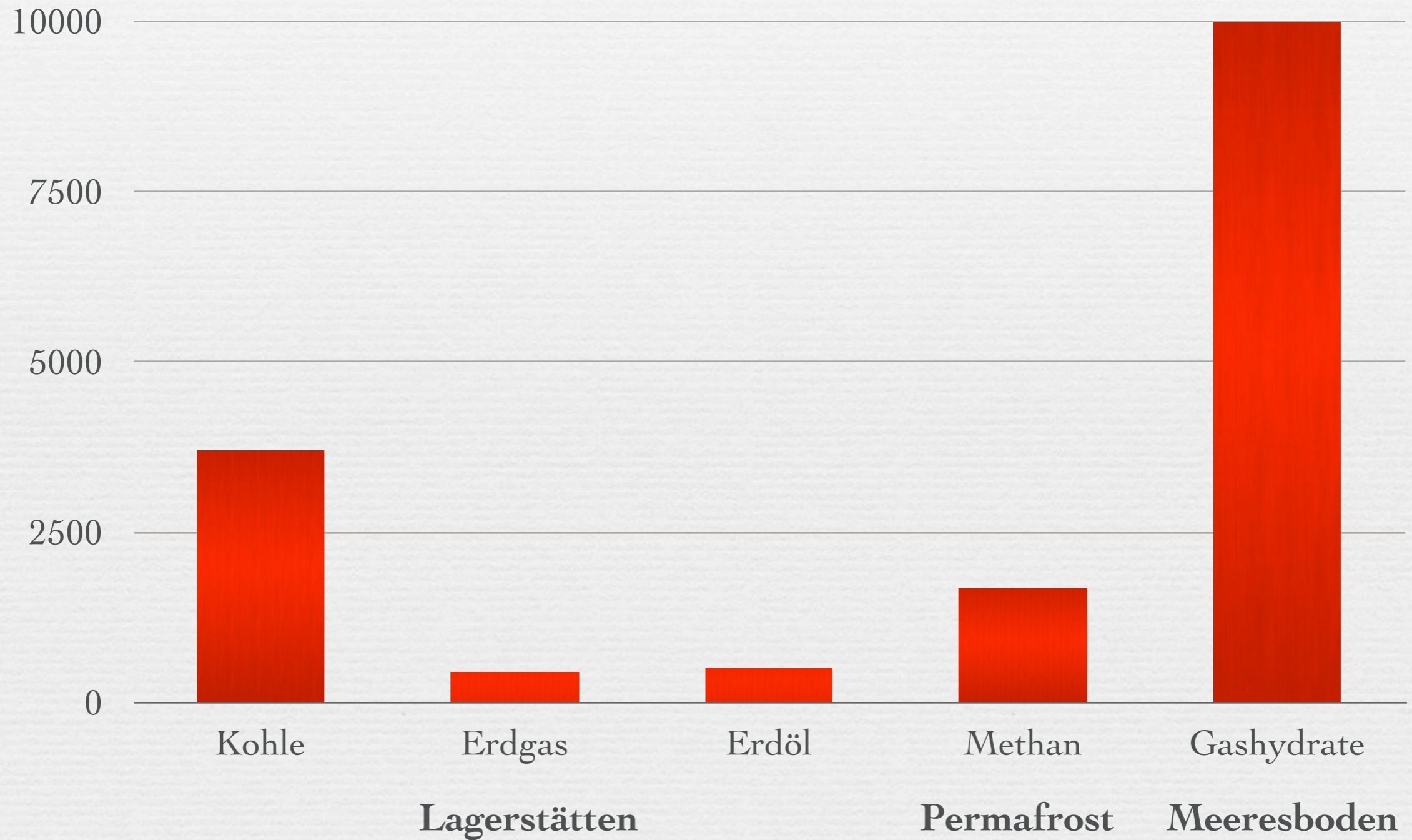


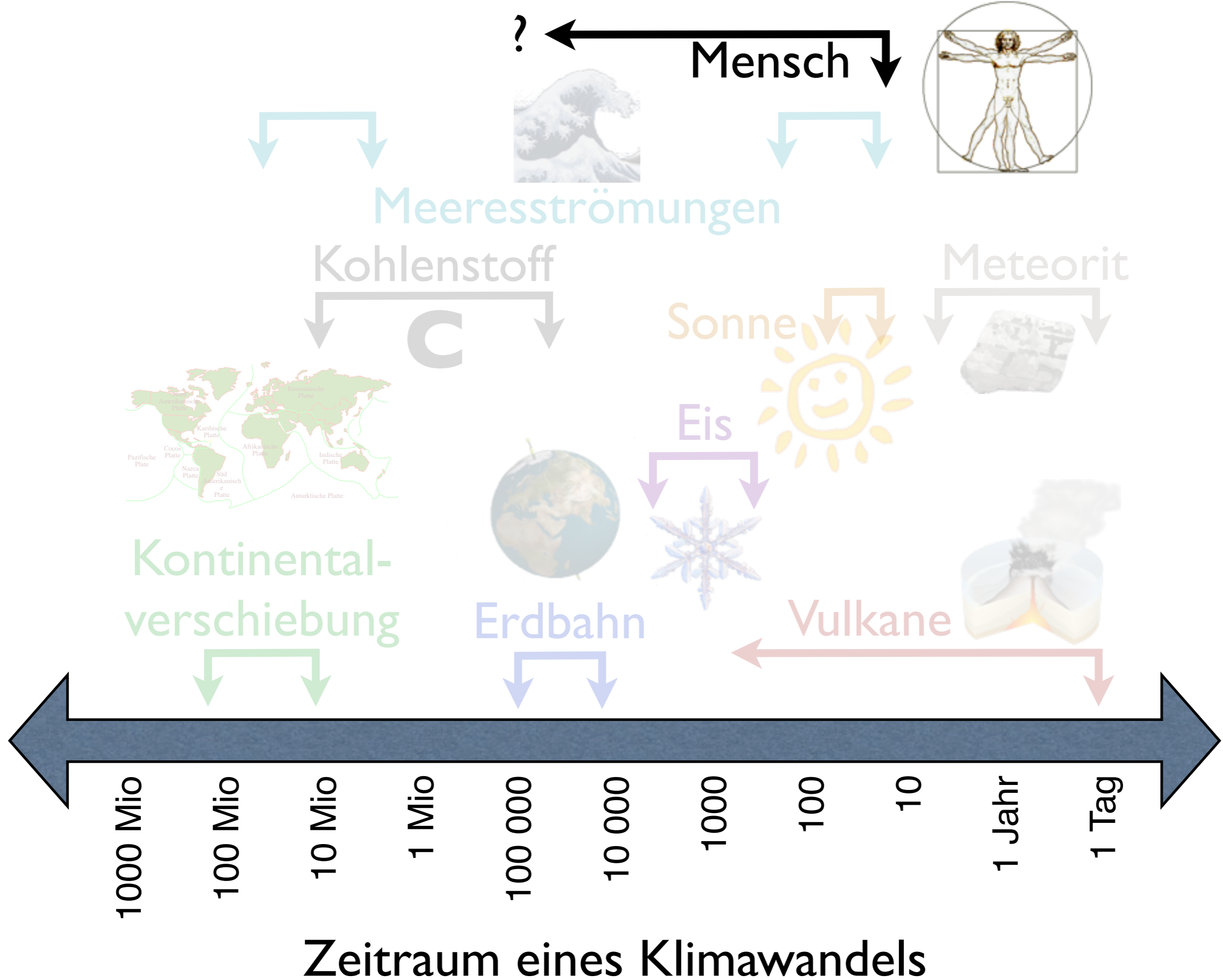
# Gashydrate





# Kohlenstoff -Reservoir [GT]



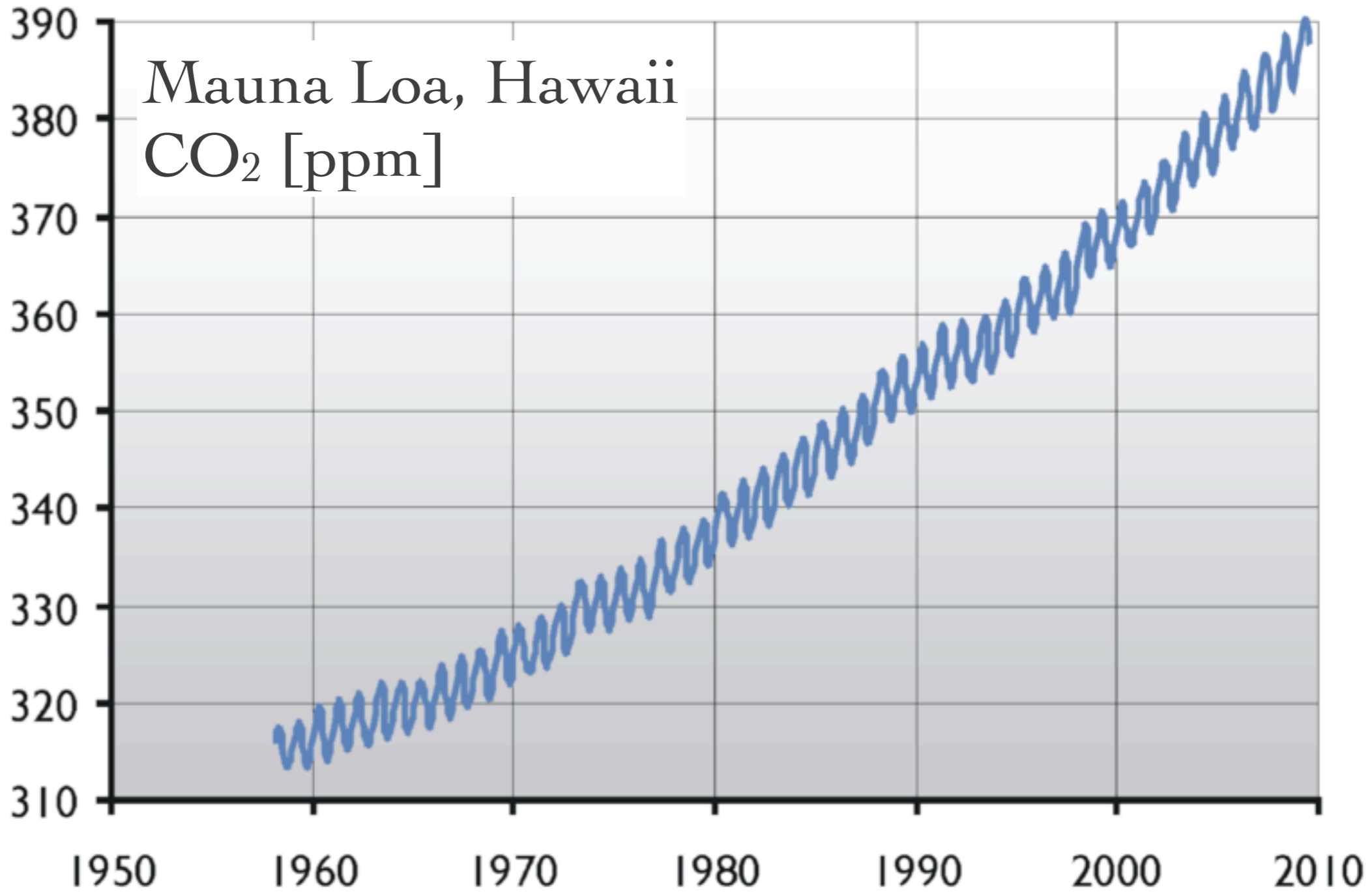


# Carbon Dioxide Concentration

Direct Measurements —  
Ice Core Measurements •••

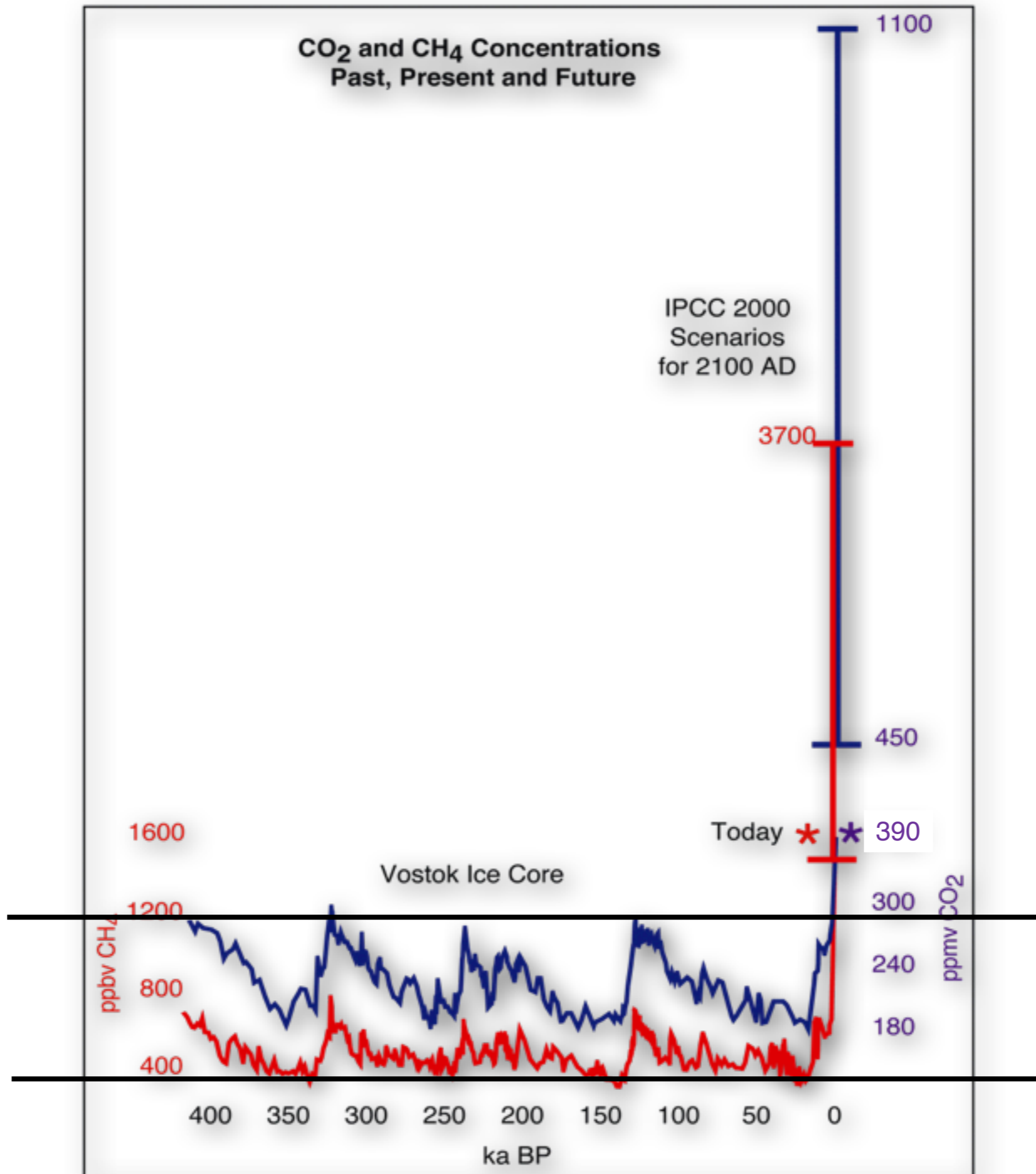
380  
360  
340  
320  
ppm by volume

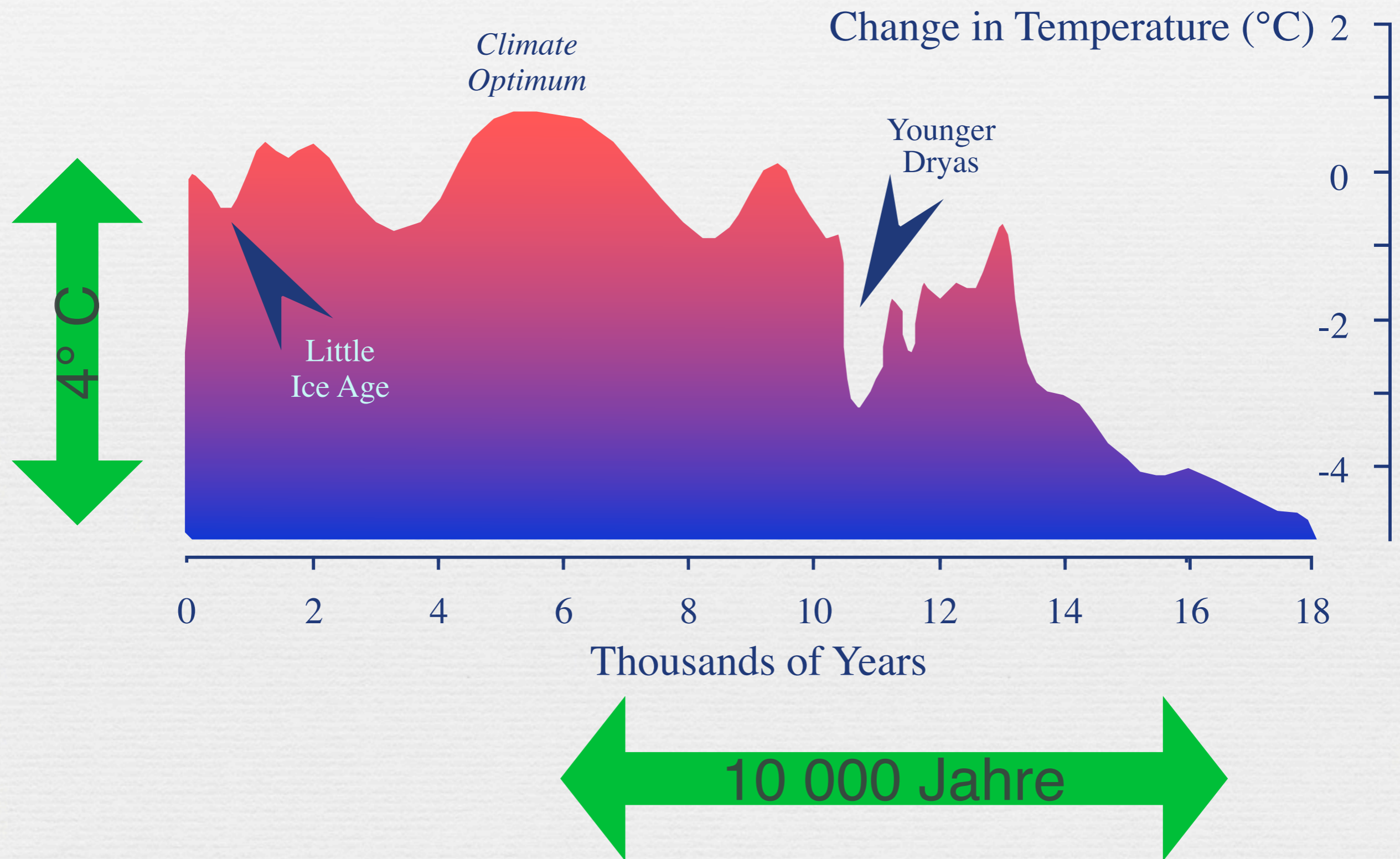
Mauna Loa, Hawaii  
CO<sub>2</sub> [ppm]



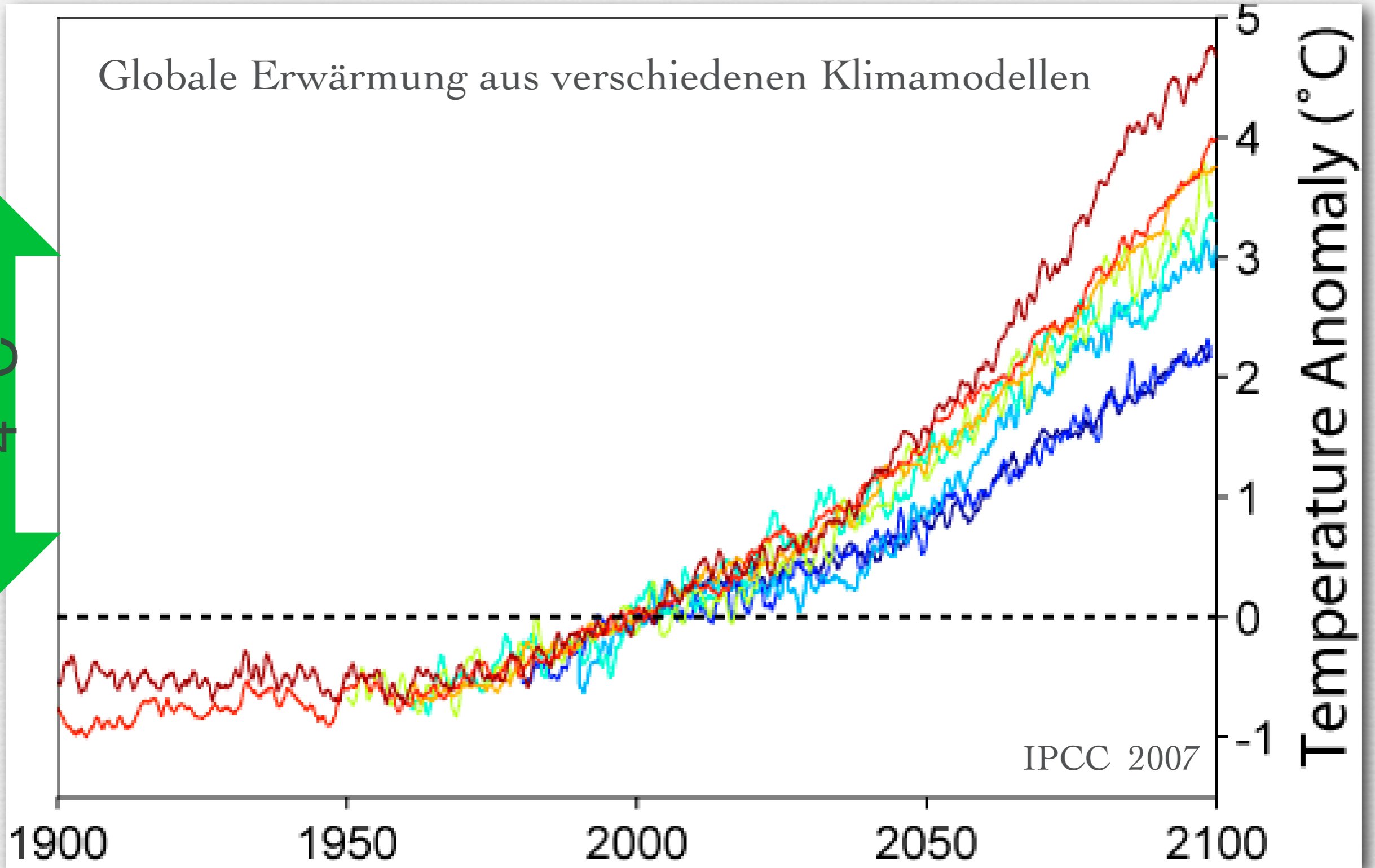
1750

# CO<sub>2</sub> and CH<sub>4</sub> Concentrations Past, Present and Future





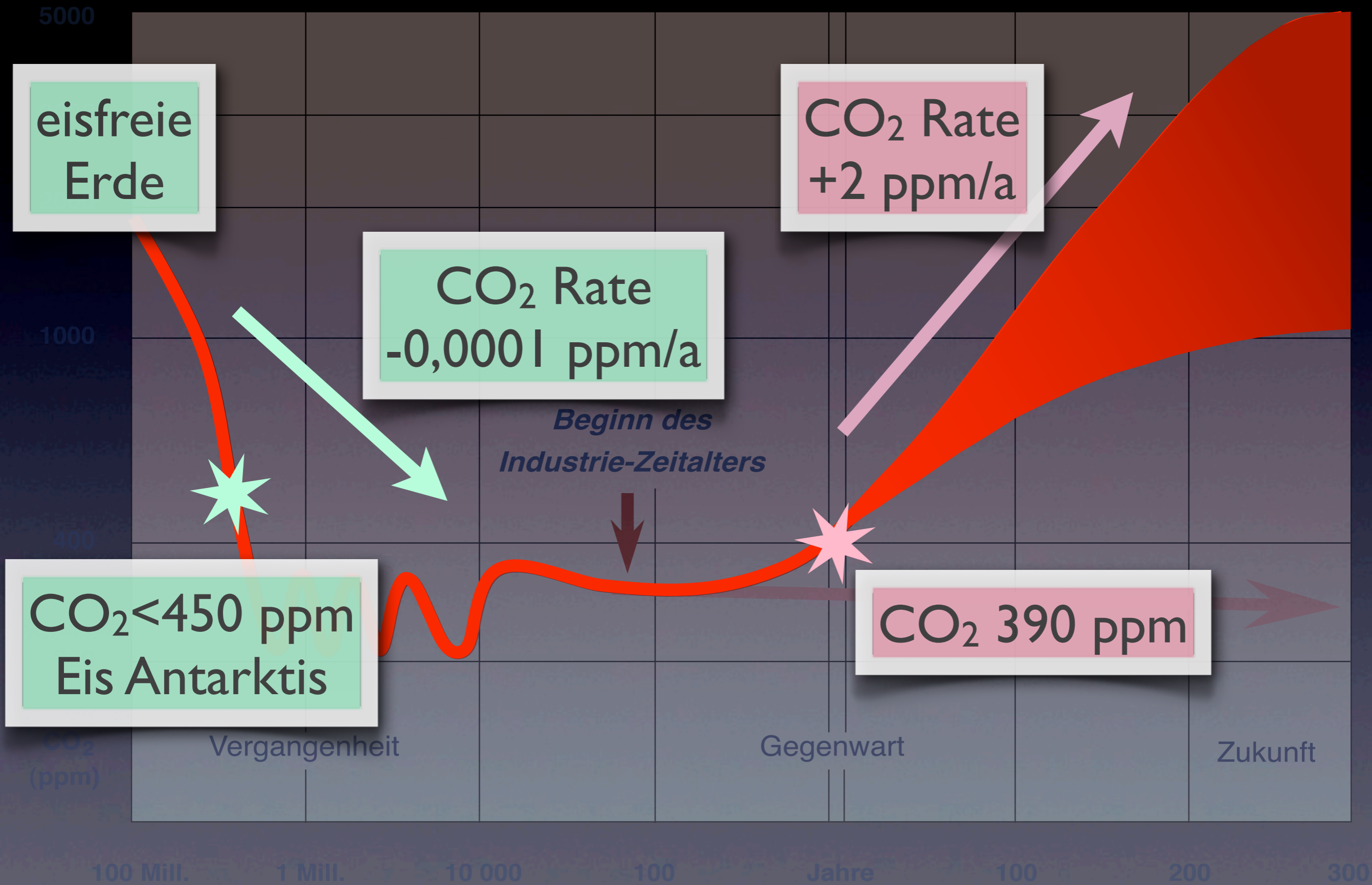
# Globale Erwärmung aus verschiedenen Klimamodellen



4° C

100 Jahre

# Entwicklung des CO<sub>2</sub>-Gehaltes in der Atmosphäre



# Konzeptstudie

**Klimastadt  
Bremerhaven**

Analysen, Perspektiven, Empfehlungen -



# Forschung & Bildung





AWI

HOCHWILDEHAUS 13169 km

BREMERHAVEN 14025 KM

KOLDEWEY 16656 km

HALLEY 798KM

DAVIS 3086 KM

# Energiewende



Klimahaus  
Bremerhaven 8° Ost

