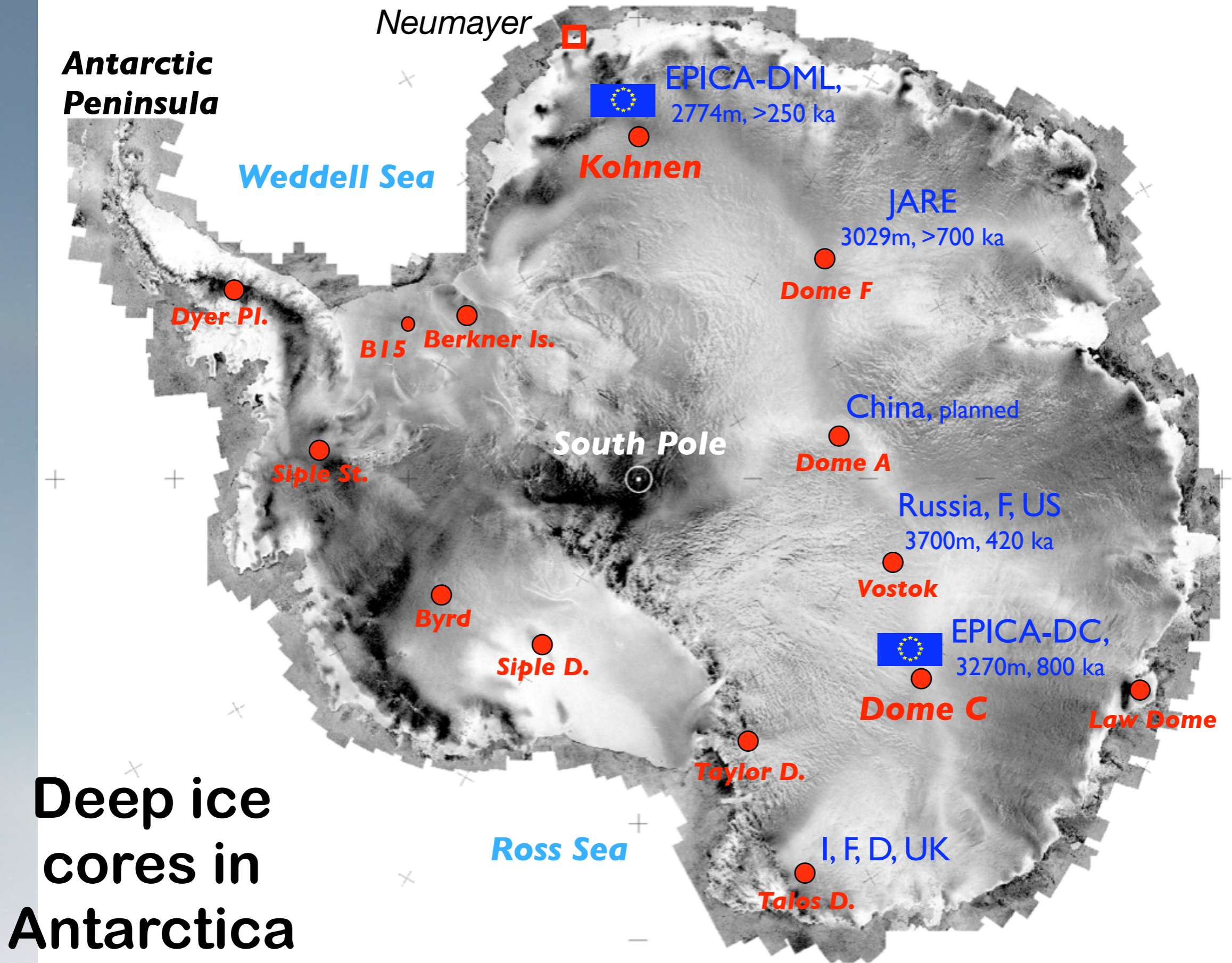


Two EPICA ice cores revealing 800,000 years of climate history: An overview.

Hans Oerter & EPICA team

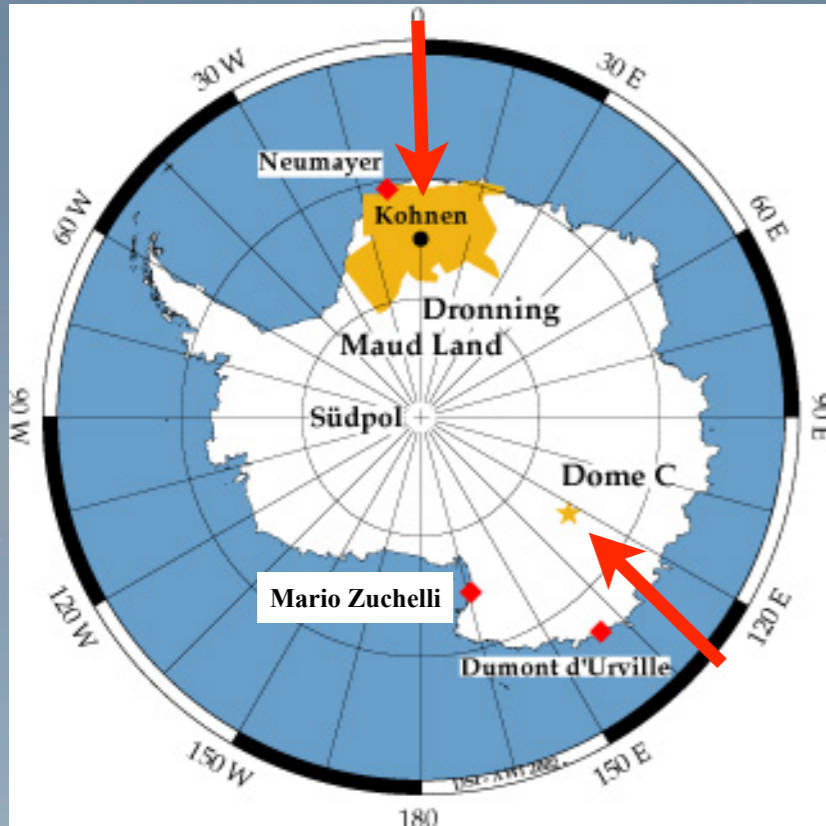
Alfred-Wegener-Institut für Polar- und Meeresforschung in der
Helmholtz-Gemeinschaft, Bremerhaven



Deep ice cores in Antarctica

layout: w. rack, h. oerter, AWI

European Project for Ice Coring in Antarctica (EPICA)



Dome C:

21. Dec. 2004

3272m

ca. 800 ka
(~2x Vostok)

DML:

17. Jan. 2006

2774 m

> 250 ka

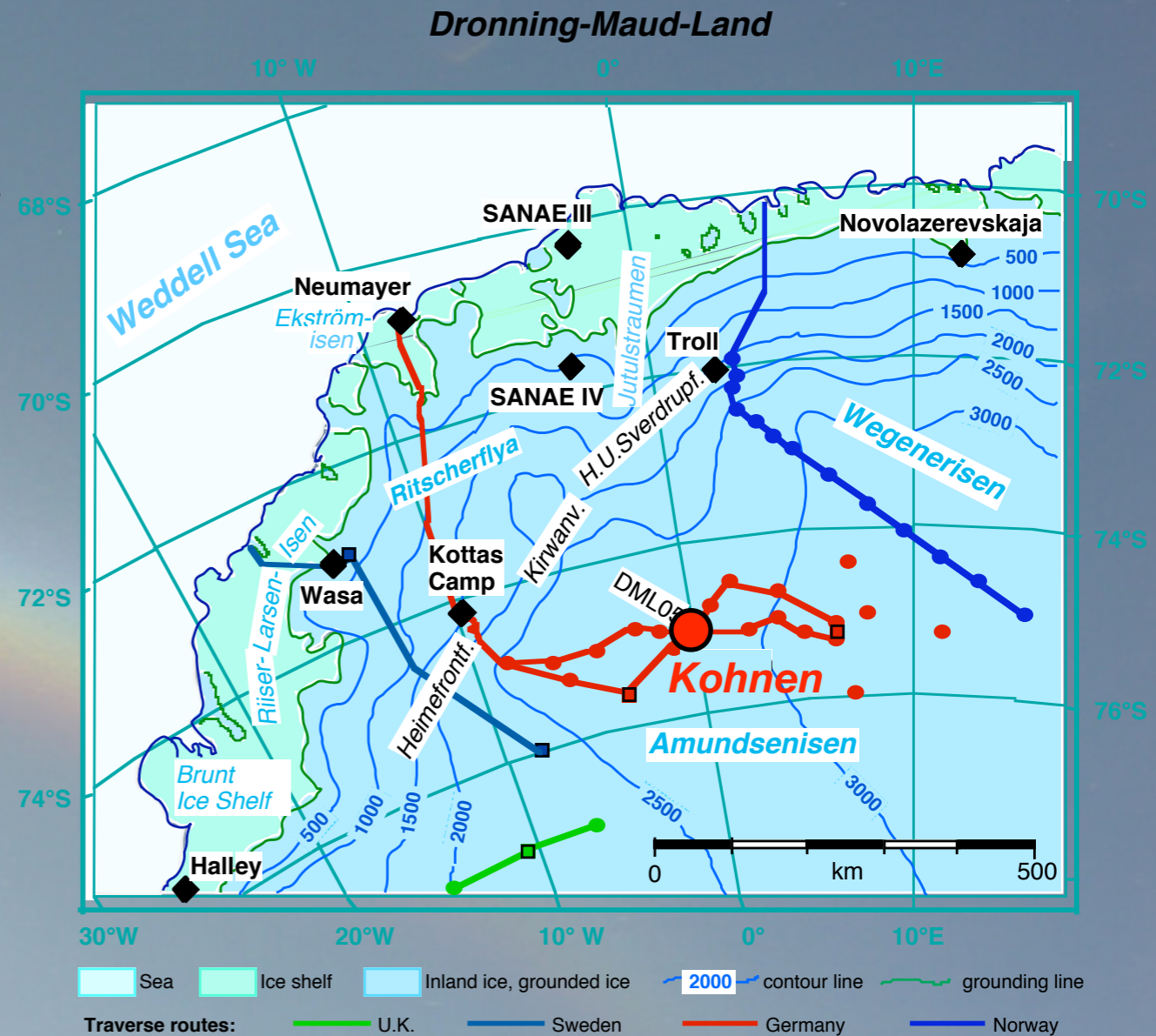
EPICA comprises two ice cores:

Dome C

(75 ° 06.10' S, 123° 23.71'E, 3233 m;
ice 3250 ±25m, -54.5 °C, 25 kg m⁻² a⁻¹)

Dronning Maud Land (DML, Kohnen)

(75 ° 0.10' S, 0° 4.07' E, 2892 m;
ice 2782 ±10m, -44.6 °C, 64 kg m⁻² a⁻¹)



10 European nations working together:

Belgium, Denmark, France, Germany, Italy, The Netherlands, Norway, Sweden, Switzerland, United Kingdom



Funding by the European Commission and by national contributions. For Germany AWI & DFG

23. Internationale Polartagung der Deutschen Gesellschaft für Polarforschung, Münster, 10.-14. März 2008



Schematic Cross Section Through an Ice Sheet

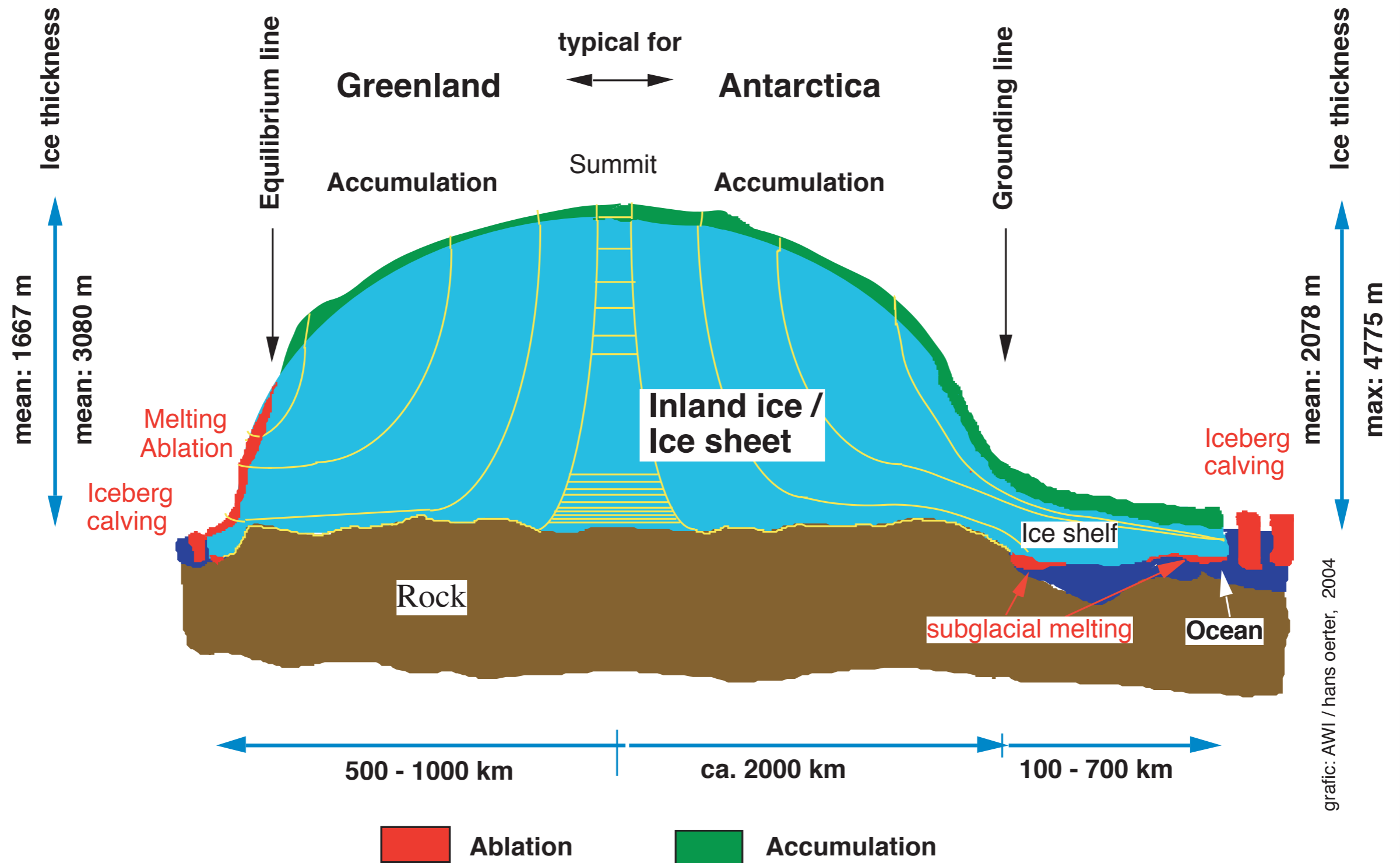
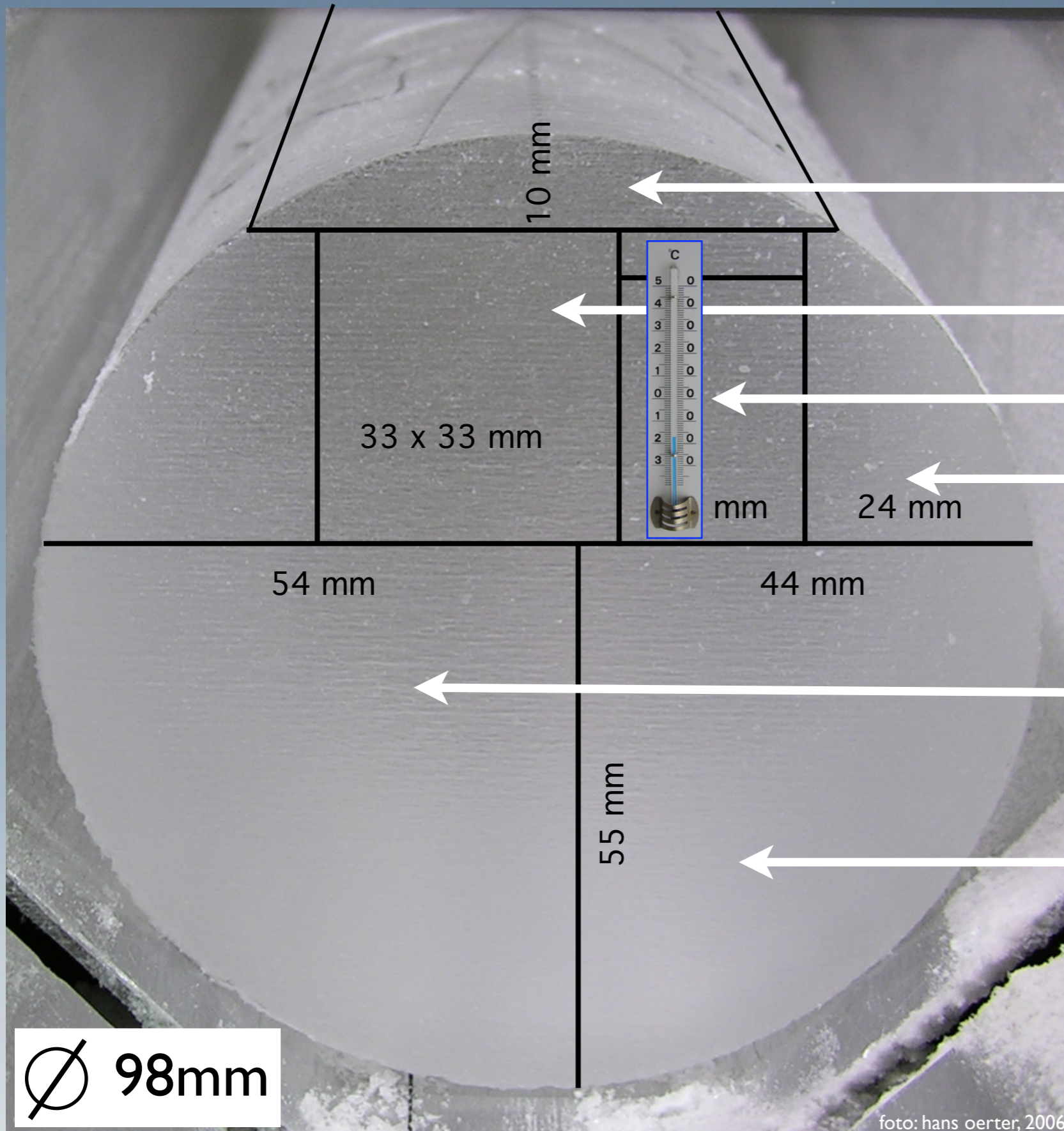




foto: hans oerter, 2006

The drill trench



Thin sections

CFA

$\delta^{18}\text{O}$, $\delta^2\text{H}$

^{10}Be

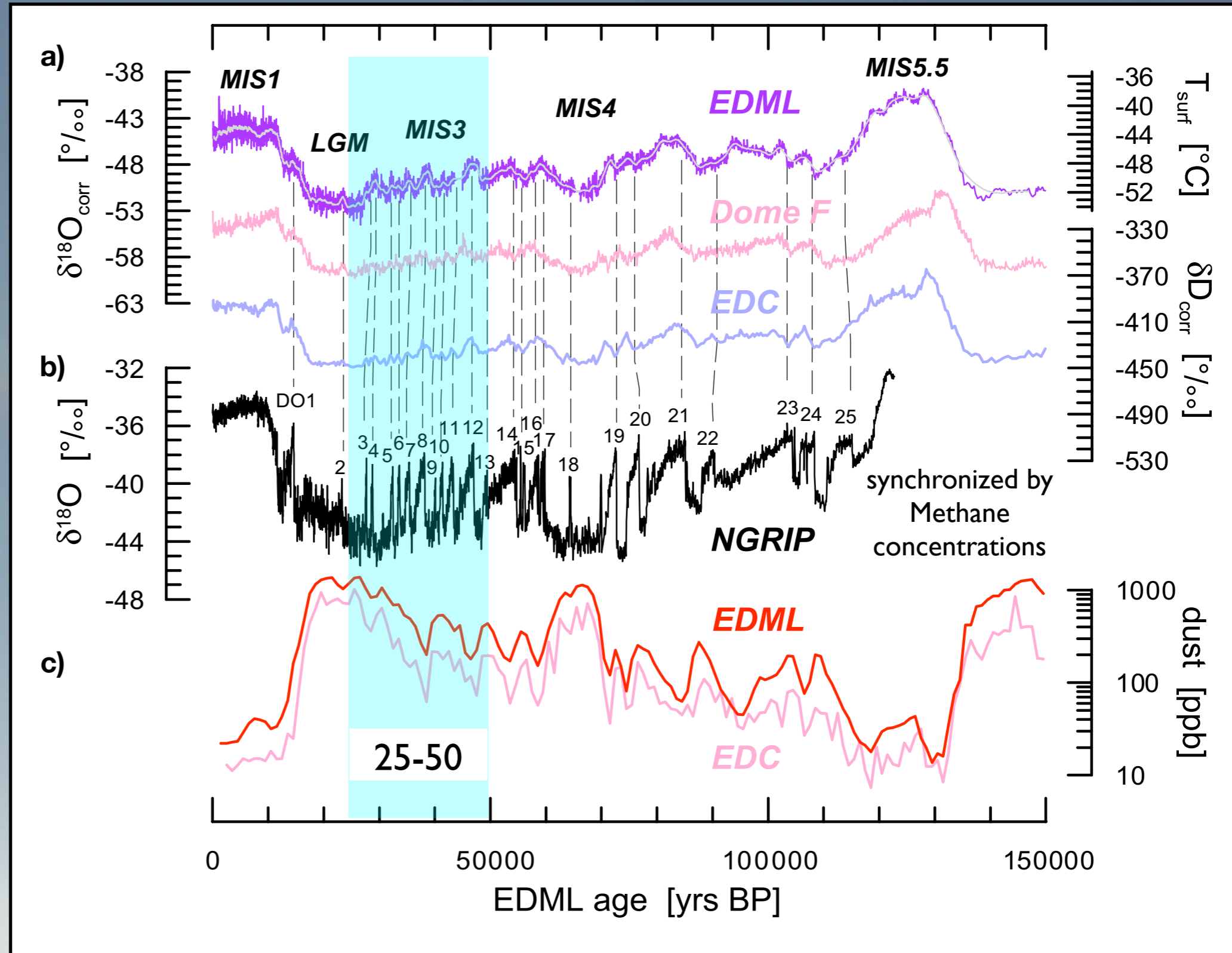
Archive

Gases, dust

CO_2 , CH_4 , N_2O
& isotopes

Cutting scheme for EPICA ice cores

Antarctic stable isotope records show synchronous millennial variations during the last glacial, whereas rapid variations are encountered in Greenland. **a)** EDML $\delta^{18}\text{O}$ record (purple, 0.5-m resolution; grey, 15-m running mean) after sea level and upstream correction over the past 150 kyr. The record shows features similar to those of the EDC (blue) and the Dome F (pink) isotope records but with more fine structure during MIS3 and MIS4. We note that EDML and EDC are plotted on the new common EDC3 timescale while Dome F is plotted on its individual timescale. The temperature axis on the right side indicates approximate surface temperatures at EDML as derived from the spatial $\delta^{18}\text{O}$ /temperature gradient. **b)** $\delta^{18}\text{O}$ record of the NGRIP ice core (grey). **c)** Mineral dust records of the EDML (red) and EDC (pink) ice cores at 1,000-yr resolution; these dust records were used for synchronization of the cores.



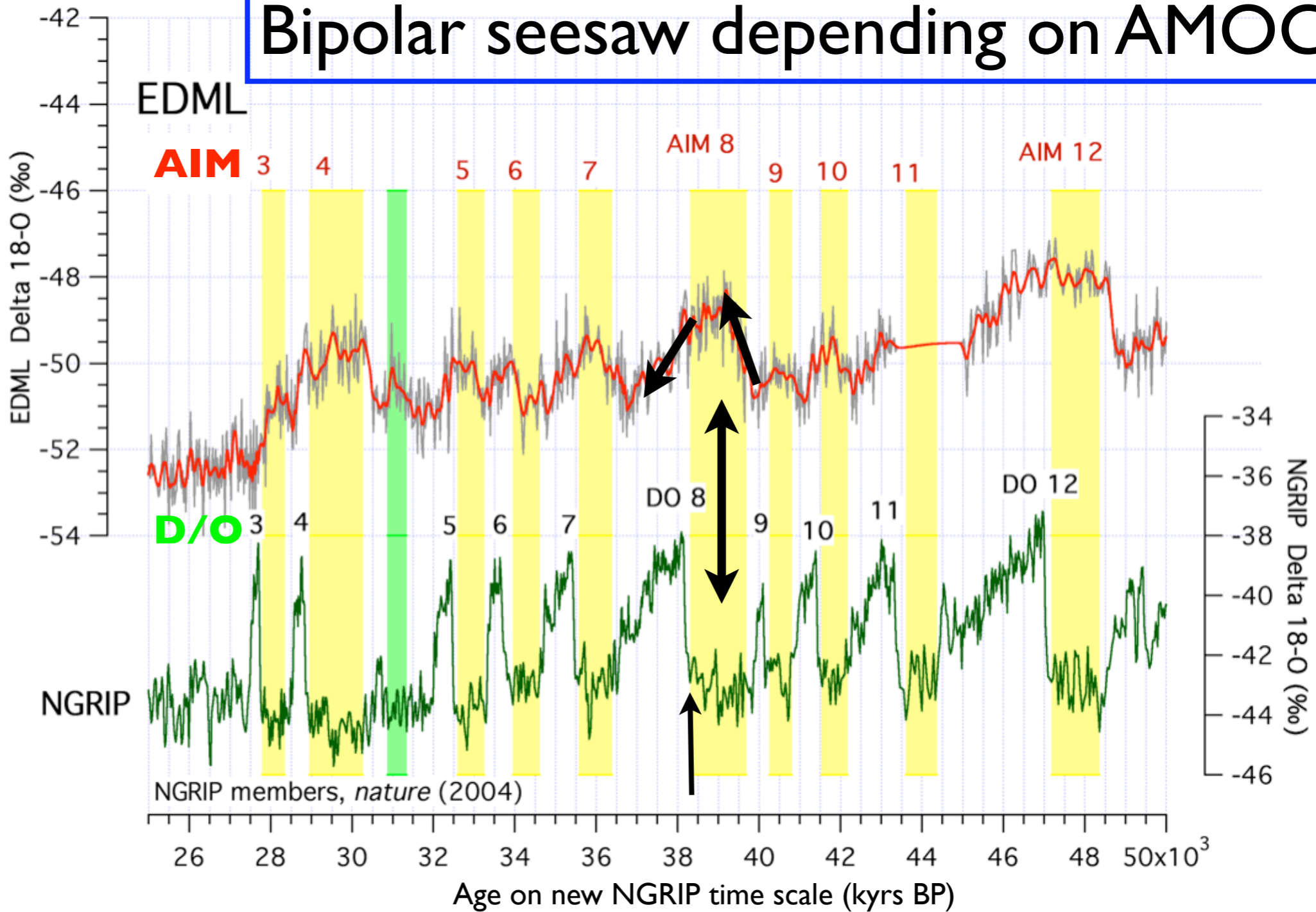
EPICA Community Members: *nature* 444, 9 November 2006. doi:10.038/nature06301

The EPICA EDML-ice core

Bipolar seesaw depending on AMOC

Each Antarctic Isotope Maximum (AIM) in the EDML-ice core corresponds to a D/O event in Greenland (NGRIP)

Warming in Antarctica starts in a cold phase (Stadial) of the North, Cooling in a warm phase (Interstadial)



Source: EPICA community members: *Nature*, Vol. 444, November 9, 2006

AMOC: Atlantic Meridional Overturning Circulation

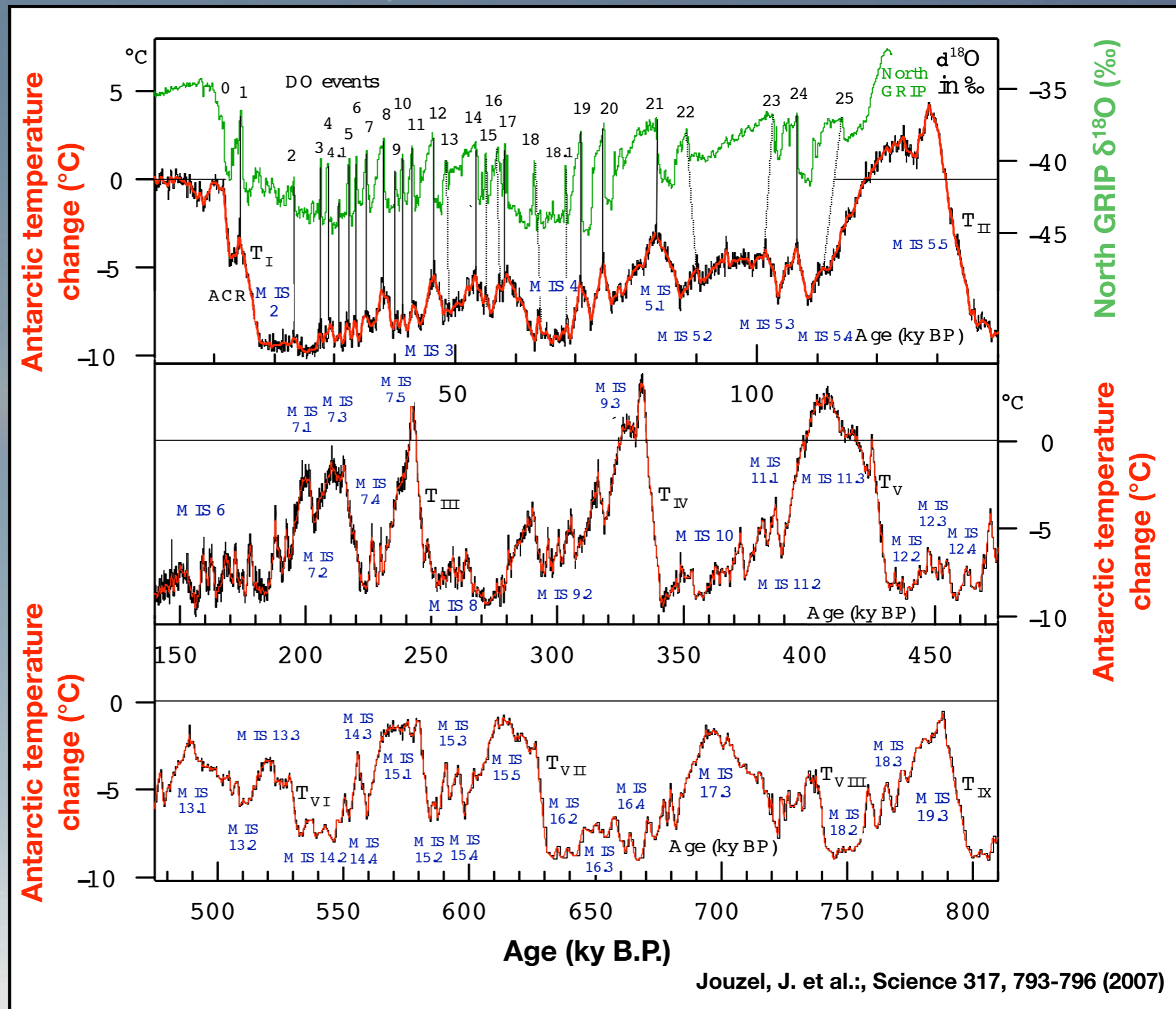
Comparison Antarctica (EDML) - Greenland (NGRIP)

AIMs appear also in earlier glacials

Strength of interglacials depending on whether obliquity and precession peak in phase or not

Back to 140 ky B.P., 100-year mean values are shown, whereas for earlier periods (middle and lower traces), DTs is calculated from 0.55-m raw data; a smooth curve using a 700-year binomial filter is superimposed on this detailed record.

In the upper trace (which is plotted on a more highly resolved time axis), the correspondence is shown between the DO events as recorded in the North Greenland Ice Core Project isotopic record and AIM events recorded in the EDC temperature record during the last glacial period and the last deglaciation. We have indicated the successive MIS, and the transitions are labeled from TI to TIX.

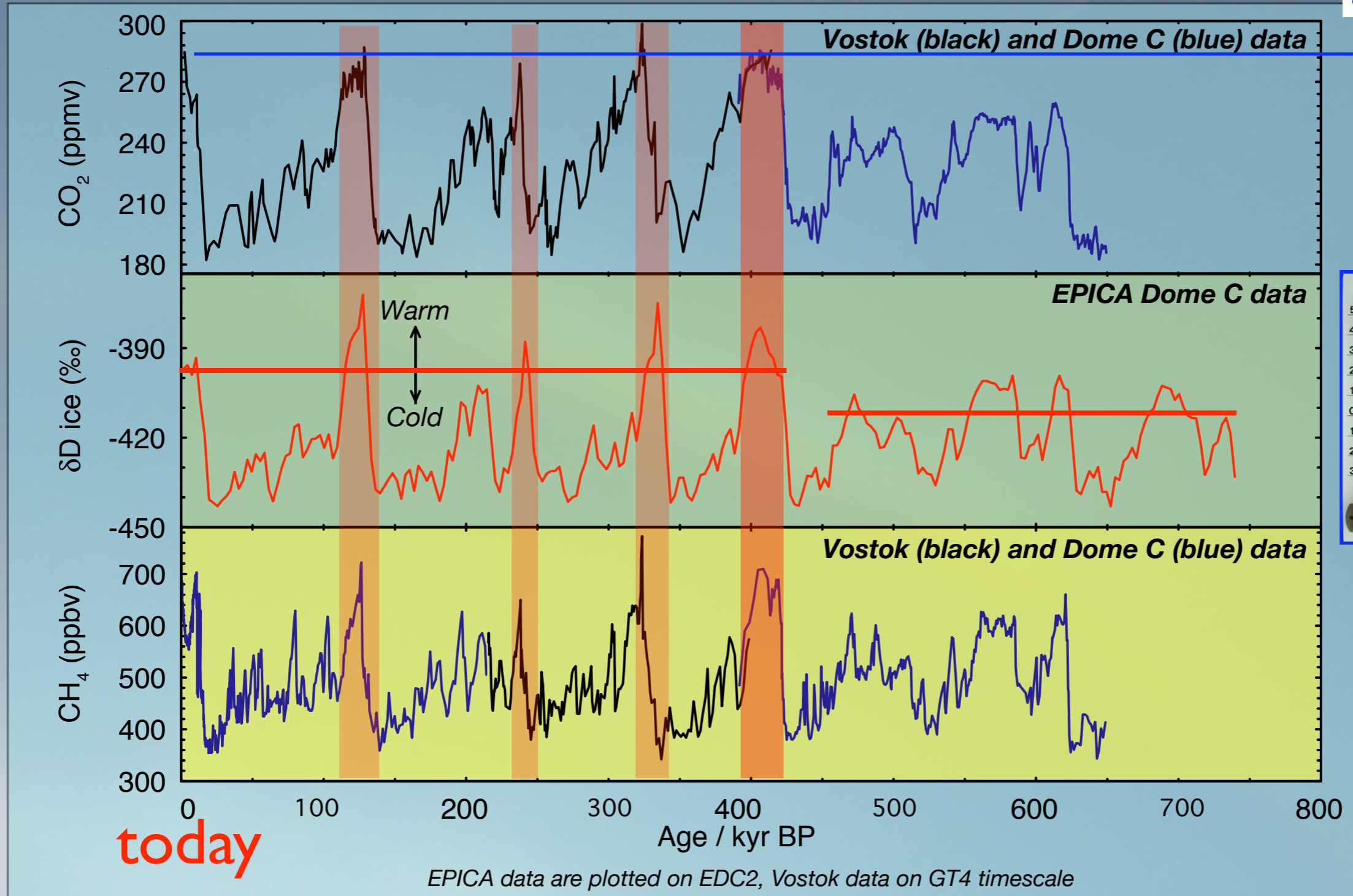


Dome C temperature anomaly over 810 ky

Antarctic ice core records: Vostok and EPICA CO₂, CH₄ and δD

at present 375

vor 1850 AD



GLOBAL
I G B P
CHANGE

Petit et al., 1999 (Vostok), Siegenthaler et al., 2005 (Dome C - CO₂),
Spahni et al., 2005 (Dome C - CH₄), EPICA community members, 2004 (δD)

PAIGES
PAST GLOBAL CHANGES

- EPICA has produced the definitive ice-core records of climate and environmental change from Antarctica.
- EPICA extended the ice-core records back to 800,000 years BP.
- Greenhouse gases (CO₂, CH₄, N₂O) are now at their highest concentrations of the past 650,000 years.
- CO₂ and Antarctic climate have been tightly coupled over the entire period (providing great constraints on the role of the Southern Ocean).
- Each of the rapid Dansgaard-Oeschger events, has an Antarctic counterpart (AIM), strongly supporting the idea that the mechanism was reorganisation of ocean heat transport.



foto: hans oerter, 2008

Summary