The stable isotopes' record of the EPICA-EDML ice core in comparison with the Dome C and NGRIP ice cores

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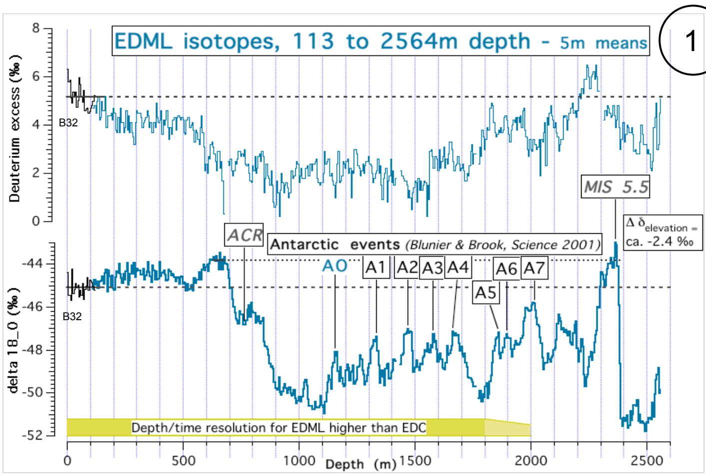


The new data set from the EDML ice core

The new data set for isotopes from the EDML ice cores comprises $\delta^{18}O$, δ^2H,, and the deuterium excess $d = \delta^2H - 8\,\delta^{18}O$. The sample resolution was 0.5 m.

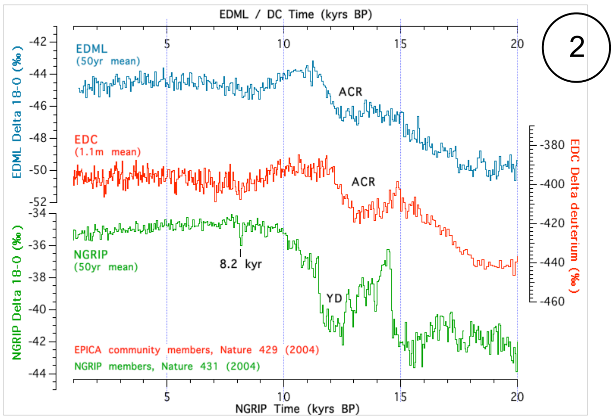
The dating of the core is not definite yet. The age shown in the Figures 2 and 3 is mainly derived from a comparison of dust profiles of the EDML and EDC cores by wiggle matching (Ruth & Fischer, pers. Comm.). A synchronisation with EDC and NGRIP by means of CH_4 concentrations is still under way.

As shown by numerical modelling (Huybrechts & Rybak, pers. comm.) the MIS 5.5 ice layers have been deposited approximately 150 km upstream of the drilling site. Therefore we have to account for a $\delta^{18}O$ bias of up to 2.4 ‰ due to surface slope and elevation change during MIS 5.5 in the deposition area. The $\delta^{18}O$ values during MIS 5.5 were up to 3.2 ‰ higher than the values during the Holocene.

Down to a depth of roughly 2000 m (72 % ice thickness), corresponding to an ice age of 80 kyr, the depth/time resolution in the EDML core is higher than in the EDC core due to the higher accumulation rate. Further down the EDML core looses this advantage due the smaller ice thickness at the EDML location.

During the last glacial period the record displays very clearly the seven Antarctic events A1 - A7 introduced by Blunier & Brook (2001). In addition, there is evidence for an event A0.

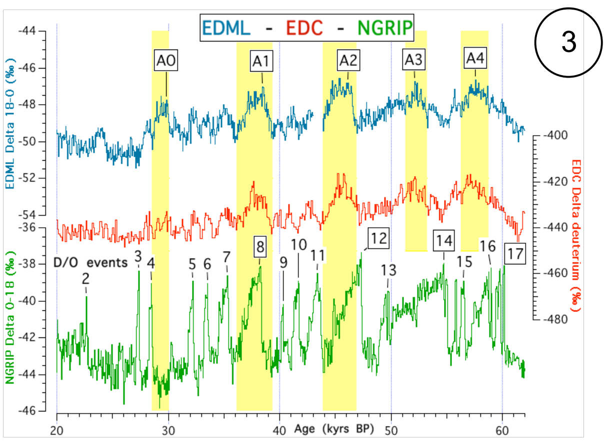
The deuterium excess d along with the ^2H content contains information on the sea surface temperature in the source region of the atmospheric moisture and information on the condensation temperature. Assessment of the temperature changes is feasible with Rayleigh type models. Qualitatively speaking, e.g. the A7 event could be caused by changes in the condensation temperature only. The increase of δ^2H and the decrease of the deuterium excess (the anti-correlation) is typical for changes of the condensation temperature Petit et al. (1991). On the other hand, the positive correlation between ^2H content and d values of the Holocene and Pleistocene values is typical for changes in both in the source region and in the precipitation area.



The EDML ice core in comparison with EDC and NGRIP for the period 1 to 20 kyr

In the Holocene part the record shows a relatively stable isotope content, as it is known from the EDC and other Antarctic ice cores as well. However, since 4 kyr BP a trend to decreasing ^{18}O values and increasing excess values can be observed, which is not obvious in the EDC core. The 8.2 kyr event, a feature of the Greenland ice cores and other archives is missing.

The record from EDML shows a less pronounced Antarctic cold reversal (ACR) compared to EDC.



The EDML ice core in comparison with EDC and NGRIP for the period 20 to 60 kyr

During the last glacial, Figure 3 shows the period 20 to 60 kyr BP, the EDML record and EDC record show in general a homogenous behaviour of climatic changes in Antarctica. The Antarctic events are displayed in both cores, but the shape is slightly different. An A0 event appears in the EDML record which is not evident in the EDC core. The so far defined Antarctic events find their counterparts in the Dansgaard-Oeschger (D/O) events in Greenland (figures in boxes). But it is most likely that also the ^{18}O wiggles in between are correlated with D/O events. However, to derive the exact phasing of these events is not possible at present. A better synchronisation would be needed for this purpose. So far only A1 gives an indication for the „bipolar seesaw mechanism" with a sudden temperature increase in the North coinciding with a temperature maximum in the South (Stocker & Johnsen, 2003) .

References:

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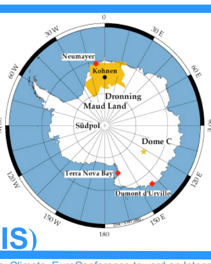
European Project for Ice Coring in Antarctica

(EPICA-MIS)



The geographical setting of the drilling sites in DML and on Dome C

Area:	**Dronning Maud Land (DML)**
Station:	Kohnen Station
Co-ordinates:	75°00'06"S; 00°04'04" E
Altitude:	2,892 m (WGS84)
Mean annual surface temperature:	-44.6°C (10 m depth temperature)
Mean annual accumulation rate:	64.0 ±0.5 kg·m^{-2}·a^{-1} (for last 1000 and last 4000 years)
Measured ice thickness:	2,782 ±10 m
Notation of ice core:	**EDML**

Area:	**Dome C**
Station:	Concordia Station
Co-ordinates:	75°06'04"S; 123°20'52"E
Altitude:	3,233 m (WGS84)
Mean annual surface temperature:	-54.5°C (10 m depth temperature)
Mean annual accumulation rate:	25.0 kg·m^{-2}·a^{-1} (used for present time scale); using Tambora: 25.6 kg·m^{-2}·a^{-1}; last 1000 years: 25.4 kg·m^{-2}·a^{-1}
Measured ice thickness:	3,309±22 m
Notation of ice cores:	**EDC96 and EDC99**

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