EPICA ice core Dronning Maud Land: Results from stable isotope measurements back to the LGM

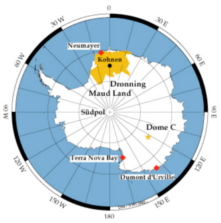
Hans Oerter, Hanno Meyer, Anja Lambrecht, Sepp Kipfstuhl, Frank Wilhelms

Alfred-Wegener-Institute for Polar and Marine Research, Bremerhaven & Potsdam, Germany

Wolfgang Graf, Willibald Stichler, GSF-Institute for Hydrology, Neuherberg, Germany

hoerter@awi-bremerhaven.de

European Project for Ice Coring in Antarctica (EPICA)

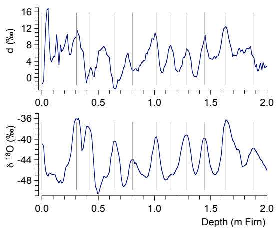


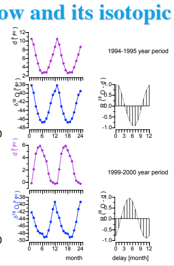
Introduction

The European Project for Ice Coring in Antarctica (EPICA) focuses on the drilling of two deep ice cores, the first at Dome C in the Indian/Pacific sector, and the second in Dronning Maud Land in the Atlantic sector of Antarctica. We focus on Dronning Maud Land and the isotope record from the EDML (EPICA Dronning Maud Land) ice core drilled there. The drilling of EDML started in the 2001/2002 season at Kohnen station (75°00'S, 0°04'E, 2882 m a.s.l.) and reached in the 2002/03 season a depth of 1564 m recovering approx. 55,000 year old ice.

The near surface snow and its isotopic composition

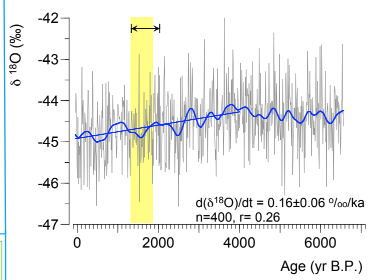
$\delta^{18}O$ und deuterium excess profiles, plotted against the depth, at the position of the snow pit SS0203, close to the EDML drilling site. The vertical lines indicate the annual layering and mark the austral summer (Dec/Jan).





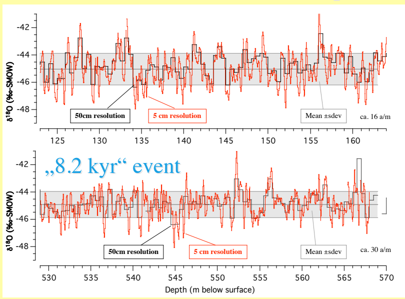
Cross-correlations between the ^{18}O content and the d values in the snow cover at SS0203, sampled 18.12.2002. To perform the correlation, the profile data were converted to monthly resolved time series using ^{18}O stratigraphy for dating and assuming equal accumulation rates throughout the year

Times series of ^{18}O contents (10-year, 300-years means)



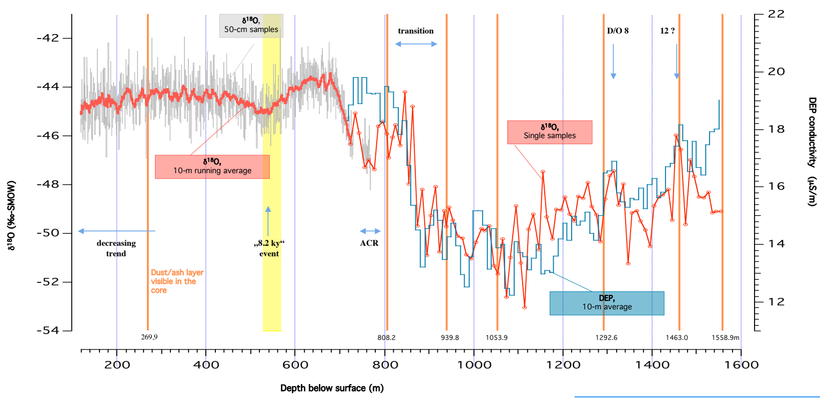
Times series of ^{18}O contents (10-year means) deduced from the ice cores B32 and EDML, which were drilled at slightly different positions and supplement each other. The smoothed curve (thick line) has been calculated using Gaussian low-pass filter over 300 years. Generally, the stable isotope profiles (^{18}O, ^{2}H) are characterized by Holocene stable climate and show only low variability. But, in the last 4000 years (based on a preliminary time scale) the $\delta^{18}O$ values decrease continuously and the deuterium excess values d increase in the same time by about 0.5 ‰. Both trends could indicate climate cooling in this part of Antarctica. The depth section of the EDML core (123-173m) for which higher resolution measurements are available is marked by arrows and a yellow bar.

EDML ice core: $\delta^{18}O$ 5cm samples

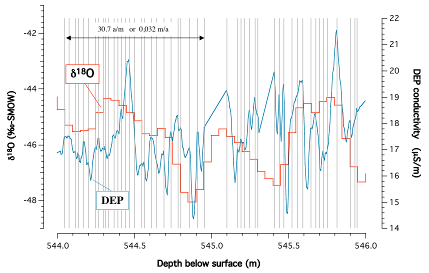


$\delta^{18}O$ profiles for two core sections (123-164m and 529-569m) where 5cm samples were available. In the upper profile the annual layer thickness corresponds to ca. 6.2cm, in the lower profile to ca. 3.3cm. The lower profiles originates from the time around the socalled "8.2 kyr" event. An exact dating of the EDML is still missing.

EDML ice core: $\delta^{18}O$ and DEP

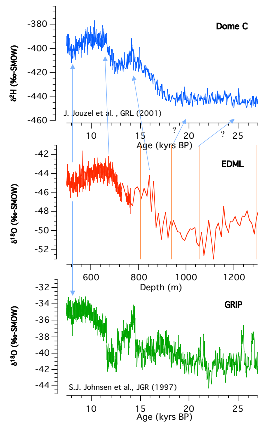


$\delta^{18}O$ and DEP high resolution



$\delta^{18}O$ and DEP profiles in the centre of the "8.2 kyr" event. The DEP profile (depth resolution 5mm) still shows variations which indicate annual layers (grey lines). The variations of the $\delta^{18}O$ values are in the order of a decade.

Profile of $\delta^{18}O$ values along the EDML core down to the depth of 1564 m: Shown are values measured at 50cm samples (single values grey, 10-m running mean thick red line) and at 4cm samples with a spacing of 10 m (red circles connected by lines). The blue lines are 10-m averages of DEP measurements, showing good correlation with the isotope values. The dating of the core is still under discussion. The isotope profile available so far shows a decreasing trend from around 270 m to the surface (cf. Figure above), a clear cooling event is indicated around the depth of 545 m ("8.2 kyr" event; cf. Figures left) as well as the Antarctic Cold Reversal (ACR). It looks whether the transition zone is steeper than known from the Dome C, Dome F or Vostok cores (Watanabe et al., 2003) (cf. Figure right). The dust/ash layers which can be seen in the EDML core are indicated by lines. There is indication from air-borne radar survey (Steinhage et al., 2003) that the layers at 939.8m and 1053.9m correspond to visible tephra layers in the Dome F core at a depth of 505.8m and 573.9m (Fuji et al., 1999). According to Watanabe et al. (2003) those layers in the Dome F core correspond to appr. 19.5 kyr and 24.5 kyr.



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