

HIGH RESOLUTION $\delta^{13}\text{C}$ MEASUREMENTS FROM THE EPICA DOME C ICE CORE

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Measurements of the isotopic composition of carbon dioxide were performed on EPICA Dome C ice on 76 different depth levels covering the last 40'000 years. The time resolution is in the order of 500 years for the last 18'000 years. For each depth level at least two determinations were obtained. The $\delta^{13}\text{C}$ signals show different trends during the last 18000 years that are anti-parallel to the CO_2 concentration evolution as measured on the same ice core. However millennial scale deviations from these trends are observed for at least three time periods. The robustness and significance of these deviations are investigated by Monte Carlo simulations performed with different subsets of the measurements. The decreases of carbon isotopes could be connected with observed step-like increases of the CO_2 concentration. Furthermore, a similar evolution as for stable carbon isotopes is visible for detrended radiocarbon. We will discuss potential mechanisms responsible for the trends as well as for the millennial scale deviations in carbon-13, including changes in the thermohaline circulation as well as potential influences of a changing ^{17}O - ^{18}O relationship.

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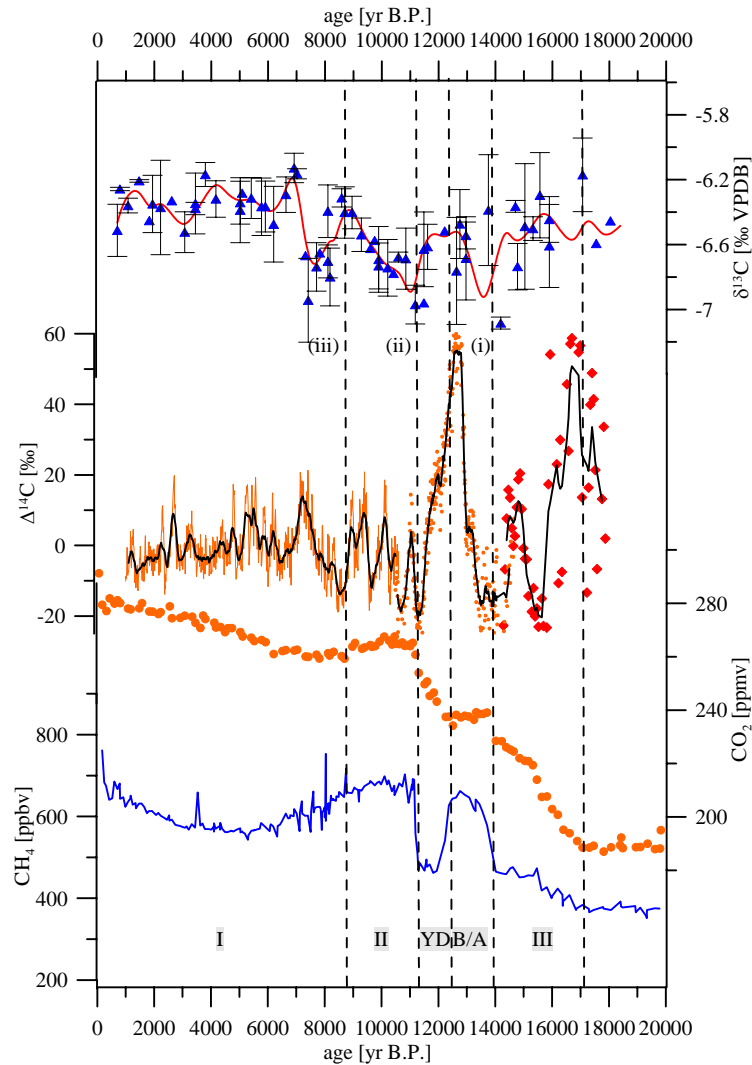


Fig. 1: (a) $\delta^{13}\text{C}$ measured on the EDC ice core (triangles, mean of mostly two samples; error bars are 1σ of the mean), the line through the data represents the mean of a Monte Carlo simulation of 100 normal distributed, error weighted splines with a cut-frequency of 1.2 ky. (i), (ii) and (iii) mark the three major negative excursions in the record. The dashed fits in the $\delta^{13}\text{C}$, $\Delta^{14}\text{C}$ and in the CO_2 records help to visualize the long term trends. (b) Composite $\Delta^{14}\text{C}$ record: Detrended $\Delta^{14}\text{C}$ variations (gray line) calculated by subtracting a 3 ky running mean from the IntCal98 data [4], detrended planctonic foraminifera $\Delta^{14}\text{C}$ data (diamonds, small) from the Cariaco Basin [5] and low resolution detrended $\Delta^{14}\text{C}$ data from the Cariaco Basin [3] (large diamonds). All $\Delta^{14}\text{C}$ data are not production rate corrected. The bold dark line through the whole data set shows a 200 yr running mean. (c) CO_2 concentration (dots) measured on the EDC ice core [2,1]. (d) EDC methane record [6,2]. Younger Dryas (YD) and the Bølling-Allerød (B/A) periods are shaded. The $\delta^{13}\text{C}$, CO_2 and methane data are presented on the GRIP SS09 time scale, whereas the $\Delta^{14}\text{C}$ data are referred to the GISP2 time scale.