Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06938, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06938
EGU General Assembly 2008

Constraints on the causes of CO2 rise during deglaciations: atmospheric stable carbon isotope ratio of CO2 from Antarctic ice cores

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The analysis of air bubbles trapped in polar ice permits the reconstruction of the evolution of major greenhouse gases over various timescales. This study leans on the past behaviour of the most important human-induced greenhouse gas, carbon dioxide (CO2). The past origin of CO2 is better comprehended when studying concomitantly the evolution of its stable carbon isotope composition, as it is affected by various fractionation processes in and between carbon reservoirs.

The LGGE dry extraction method of gases occluded in ice was used in combination with a new instrumental setup to investigate the CO2 mixing ratio and its stable carbon isotope composition (delta13CO2) in air from the last deglaciation at the EPICA Dome Concordia site (Antarctica). The resolution of our results (250 years in average) allows us to divide Termination I (TI) into four sub-periods, each representing different climatic features at the Earth' surface (Heinrich I, Bølling/Ållerød, Antarctic Cold Reversal, Younger Dryas). We observe that CO2 and delta13CO2 are not correlated. Delta13CO2 shows positive and negative excursions associated with changes in the growth rate of atmospheric CO2. This illustrates the dynamic character of the carbon cycle and its coupling to climate change during the deglaciation. The use of two carbon cycle box models highlight oceanic mechanisms as the major contributors to the

CO_2 evolution during these periods of TI, and the terrestrial biosphere for the warm Bølling/Ållerød event.

We will also present pioneering delta13CO2 data obtained in the course of the penultimate deglaciation (TII); this is expected to bring some more light in the carbon cycle question during glacial-interglacial transitions although the existing challenge on ice physics (clathrate ice for TII vs bubbly ice for TI) should not be neglected.