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Highly resolved measurements of d13C on CO2 extracted from an EPICA Dome C ice core during the Holocene

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In contrast to the detailed documentation of the evolution of atmospheric carbon dioxide (CO2) knowledge about its underlying quantitative processes is scarce. The atmosphere is linked to the ocean and the biosphere by exchange of carbon. Oceanic and biospheric CO2 have distinctive carbon isotope ratios, accordingly, its precise measurement in ice cores allows constraining the individual contribution of different carbon reservoirs to atmospheric CO2.

We present a highly resolved d13C record for the Holocene (400 yrs BP - 12,000 yrs BP), obtained from an EPICA Dome C ice core. The measurements were performed with two different extraction methods: The cracker method, where the air trapped in a sample of ice (5 to 6 g) is released applying a stainless steel needle cracking device, and the sublimation method, where the ice (30 g) is sublimated. The agreement between these two methods is very good. Mean reproducibility for d13C is now estimated at 0.07 per mil for either method. The results allow a detailed investigation of effects associated with atmospheric CO2 variations during the Holocene. Ruddiman's hypothesis of an anthropogenic influence as early as 8 kyr BP can clearly be ruled out. Applying the double deconvolution method on our combined d13C and CO2 record leads to further information about sources and sinks during the Holocene.