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$\delta^{13}C_{atm}$ and [CO_2] measurements in Antarctic ice cores, 160 kyrBP - present

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Measurements from Antarctic ice cores allow us to reconstruct atmospheric concentrations of climatically important gases including CO_2 over the past 800 kyr. Such measurements show that [CO_2] has varied in parallel with Antarctic temperatures on glacial-interglacial timescales. Knowledge of the variations of the stable carbon isotope of CO_2, $\delta^{13}C_{atm}$, can help us better understand the processes involved in these fluctuations. Here, we present a first complete $\delta^{13}C_{atm}$record extending from 160 kyrBP to the present accompanied by $\delta^{15}N_2$ measurements during Marine Isotope Stage 3 (MIS 3, 57 - 29 kyrBP).

The present record, measured primarily on ice from the EPICA Dome C and Talos Dome ice cores, has an average resolution of 500 yr, focused mainly on the Last Glacial Maximum and termination (180 yr; Schmitt *et al*., 2012), MIS 3 (660 yr), and Termination II through MIS 5.4 (590 yr; Schneider *et* al., 2013). Throughout the record, $\delta^{13}C_{atm}$ varies between approximately -6.8 and -6.4‰Ḟollowing a period of relatively constant δ13C_{atm} at the end of MIS 6 (around -6.8‰), the boundaries of MIS 5 correspond roughly with the beginning and end of a gradual enrichment in this isotope. In comparison, the more recent record depicts three more abrupt excursions to lighter values around 63 - 59, 46, and 17 kyrBP, in each case followed by a slower return (0.4‰ over the course of 5 - 15 kyr) to more enriched isotopic values. These coincide with Heinrich events 6, 5, and 1, respectively.

No direct correlation is observed between the concentration and carbon isotope of CO_2 over the last 160 kyr. The data indicate rather that numerous processes, such as uptake and release of atmospheric CO_2 by the ocean and land biosphere, perhaps influenced by regions of growing permafrost during MIS 3 and 4, acting on a variety of timescales must be considered in explaining the evolution of $\delta^{13}C_{atm}$ on glacial-interglacial timescales.

References:

Schmitt, J. *et al*. Science 336, 711-714 (2012)

Schneider, R. *et al*. Clim. Past, 9, 2507-2523 (2013)