Abstract ID : **84**

Centennial- to millennial-scale variations of atmospheric CO2 over Termination III and Marine Isotopic Stage 7

Content

Antarctic ice cores are a favoured climate archive to study carbon cycle changes from glacial/interglacial- to multi-centennial- timescales as they provide the only direct reconstructions of past atmospheric CO2 changes. In particular, understanding the interactions between climate and the carbon cycle during interglacials is key, as these past warm intervals provide a basis for comparison with the present interglacial and its future evolution.

Here we present a new atmospheric CO2 record from the EPICA Dome C ice core spanning Termination III (TIII) and Marine Isotope Stage 7 (MIS 7) (~260-190 ka). 203 ice samples were measured using a ball mill dry extraction system and gas chromatography at IGE. With a temporal resolution of about 300 years on average, our new record improves by a factor of three the existing CO2 record that had been measured on the Vostok ice core over this time interval.

We observe multi-centennial-scale atmospheric CO2 variations during MIS 7 and TIII. In particular, we identify abrupt atmospheric CO2 releases, also referred as Carbon Dioxide Jumps (CDJ), characterized by a CO2 increase rate higher than 1.5 ppm per century. With CDJ events already observed during MIS 9 and MIS 11, our results confirm that they most likely are a persistent feature of the carbon cycle during interglacials.

Finally, combining our CO2 data with a new record of δ15N of N2 from the EDC ice core, we quantify the evolution of the phase relationship between CO2 and the Antarctic temperature over MIS 7 and TIII. Our preliminary results suggest a variable phasing throughout the studied time interval, from an apparent near synchronicity (e.g. at the onset of TIII) to the existence of a CO2 lag of a few centuries (e.g. at the end of TIII).

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Track Classification: Glacial / interglacial dynamics, interglacials, and sea level