Deep-sea coral records of deep ocean carbon storage and release during the last deglaciation

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The storage and release of carbon from the deep waters surrounding Antarctica is thought to be a key driver of atmospheric CO_2 and global climate on glacial-interglacial timescales[1]. However, direct evidence for the release of carbon in the Southern Ocean and its redistribution remains elusive. The boron isotope-pH proxy measured in uranium-thorium dated deep-sea corals provides a means to track the release of carbon from deep waters to the surface and its subsequent transport via intermediate waters during the last deglaciation. Reconstructions of the changing pH of the Southern Ocean using this technique show that deep Southern Ocean pH increased as it released its stored carbon during the last deglaciation. Corresponding decreases in pH in upper ocean corals at the same times track the recommunication of this carbon back to the upper ocean and the atmosphere. These low-pH pulses are particularly pronounced during rapid (centennial-scale) increases in atmospheric CO_2 at the end of Heinrich Stadial 1 and the Younger Dryas. Yet, supporting evidence for these low pH, carbon-rich, intermediate water events at other sites has yet to be established.

Here we present boron isotope measurements in deep-sea corals recovered from Equatorial Atlantic sites within the Antarctic Intermediate aater flow path. These records span the last 20 kyr and provide further evidence for episodic release of carbon from the Southern Ocean and transport of low pH waters to the intermediate Atlantic during the last deglaciation. Such carbon outgassing likely resulted from the retreat of the sea ice that had supressed gaseous exchange [2, 3] and demonstrates the key role of the Southern Ocean in rapid changes in the carbon cycle and climate.

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