Quantitative PCO_2 reconstructions across the mid-Pleistocene transition based on boron isotopes in planktic foraminifers

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A major change in global climate occurred ~850 kyr ago, when the periodicity of glacial cycles changed from 41 kyr to 100 kyr. Because the 100-kyr periodicity of eccentricity is by far the weakest solar insolation forcing, the dominance of this periodicity in the late Pleistocene climatic cycles remains an enigma. Some researchers have suggested this 'mid-Pleistocene transition' may be due to global cooling, possibly caused by a long-term decrease in atmospheric CO_2 concentrations. Direct evidence for such a decrease, however, has not yet been demonstrated.

Available ice core records are restricted to the late Pleistocene glacial cycles. Because carbon dioxide is well mixed in the atmosphere, and because CO_2 is exchanged between the surface ocean and the atmosphere, knowledge of past sea surface carbonate chemistry can place constraints on past atmospheric pCO_2. A promising candidate for reconstructing marine carbonate chemistry exists in the form of the boron isotope proxy for past seawater pH. In a recent study of ODP site 668B in the eastern equatorial Atlantic we have demonstrated that the pCO_2 variations recorded in the Vostok ice core can be quantitatively replicated with the boron isotopic composition of the surface dwelling foraminifer *Globigerinoides sacculifer*. We are now in the process of extending the marine record to 1.8 Ma BP. Initial results dating back to 1.3 Ma suggest the pre-transition glacial/interglacial surface seawater pH amplitude was smaller compared to the late Pleistocene. Further, the average G/I pH before and after the transition are similar and our data thus do not support the hypothesis that a longterm pCO_2 decrease was the primary driver of the transition.