

## More efficient CO<sub>2</sub> sequestration in the North Atlantic Ocean during the last glacial

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During ice ages, the global ocean sequestered a large quantity of carbon from the atmosphere and land biosphere. Current explanations focus on the mechanisms that helped to limit the outgassing of CO<sub>2</sub> from the deep ocean to the atmosphere via the Southern Ocean. Field measurements and modeling studies suggest that the North Atlantic Ocean has been an important sink of CO<sub>2</sub> during preindustrial and modern times, but the role of the North Atlantic in sequestering atmospheric CO<sub>2</sub> in the past largely remains unconstrained. Here, we use a suite of geochemical proxies to reconstruct nutrient and carbonate ion concentrations of both surface and deep waters in the North Atlantic during the last ~25 kyr. We determine that carbon sequestration through North Atlantic air-sea exchange was more efficient during the Last Glacial Maximum than during the Holocene. This indicates that North Atlantic CO<sub>2</sub> uptake variations played a critical role in glacial-interglacial atmospheric CO<sub>2</sub> changes. Therefore, we infer that, in addition to changes in the Southern Ocean, processes in the North Atlantic Ocean enhanced the uptake of CO<sub>2</sub> and synergistically contributed to the low atmospheric CO<sub>2</sub> during ice ages.