

Oxygen depletion in the upper waters of the Southern Ocean during glacial periods

31 March 2016



Sieving sediment from the seabed for animals

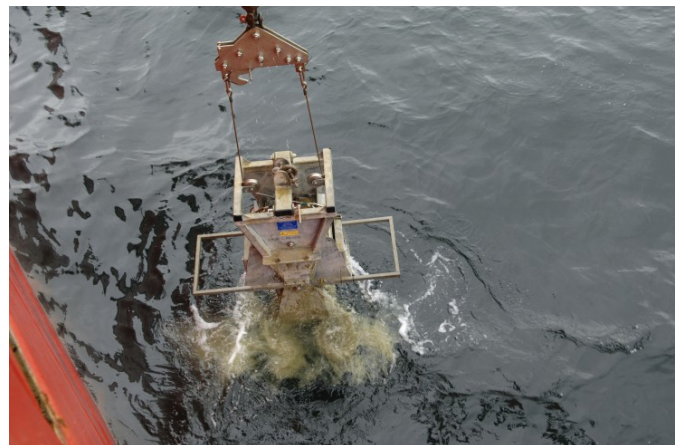
Research published this week by an international team of scientists, including the British Antarctic Survey, provides new insights into how carbon dioxide changed in the oceans surrounding Antarctica during glacial periods.

Although scientists have generally agreed that atmospheric [carbon dioxide](#) was drawn down and locked up in the deep ocean during ice ages, quantitative measures of how much was stored have previously been hard to come by.

Reporting in the journal *Nature Communications* the team describe a study of the carbonate shells of tiny ocean-dwelling organisms, foraminifera, preserved in sediments covering an underwater mountain beneath the Amundsen Sea close to Antarctica. The researchers conclude that the amount of atmospheric CO₂ released from the Southern Ocean during warm periods was reduced during ice ages.

Foraminifera dwelling in the ocean build their shells using elements from the seawater so the chemical composition of ancient foraminifera shells can be

used to estimate the composition of ocean waters in the past. The new study demonstrates that the ratio of iodine to calcium in the shells is an indicator of oceanic oxygen levels. Data from the Amundsen Sea show that during ice ages surface waters of the Southern Ocean had low levels of oxygen. Because these waters are directly connected to deep waters derived from surrounding ocean basins and upwelling around Antarctica the researchers conclude that the oxygen levels in these deep waters must have been reduced during glacial times. Low [oxygen levels](#) in seawater are associated with high carbon dioxide concentrations. Therefore, the new findings imply that the release of CO₂ into the atmosphere within the Southern Ocean was reduced during ice ages and that more CO₂ was trapped in the deep ocean, potentially explaining the lowering of atmospheric CO₂ during these times.



Recovery of a box corer used to sample soft surface sediments like mud and sand.

Co-author Claus-Dieter Hillenbrand of the British Antarctic Survey says, "Physical, chemical and biological changes in the World Ocean in general, and in the Southern Ocean in particular, played a

crucial role in controlling [atmospheric carbon dioxide](#), and the transition from glacial to interglacial conditions. Our findings are an important step forward in explaining natural climate changes and predicting for how present-day warming might influence future change in the marine environment."

More information: Zunli Lu et al. Oxygen depletion recorded in upper waters of the glacial Southern Ocean, *Nature Communications* (2016).
[DOI: 10.1038/NCOMMS11146](https://doi.org/10.1038/NCOMMS11146)

Provided by British Antarctic Survey

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