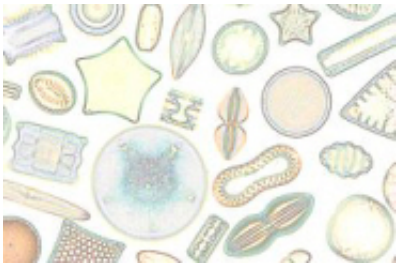
Fundamental marine ecosystem change during rapid climate change events

January 24 2014



Diatoms. Credit: Rovag [CC-BY-3.0]

(Phys.org) —Marine ecosystems – especially in nutrient-starved areas of the ocean – are very sensitive to abrupt climate change, according to new research from the University of Bristol.

The research, which involved scientists from the University of Bristol'sEarth Science department, Cardiff University, Woods Hole Oceanographic Institute and Columbia University, is published today in *Nature Communications*. The scientists have used evidence from deep-sea fossils to show that there were fundamental changes in the marine ecosystem during rapid climate change events, which ultimately changed how carbon was buried in the ocean.

The team studied algae known as diatoms, and some kinds of protists and sponges, which make their skeletons out of biogenic opal, a glass-like material made out of silicon. Using the chemistry of biogenic opal,

the authors show that the physical and chemical structure of the North Atlantic Ocean was very different during Heinrich Stadial One, a rapid climate event approximately 16,000-19,000 years ago. During this event, the concentration of silicon in the ocean changed significantly and allowed for the growth of large diatoms. The expansion of large diatoms allowed more carbon to sink into the abyss and become locked into the sedimentary record.

Dr. Kate Hendry, a Royal Society Research Fellow and member of the Cabot Institute at the University of Bristol, said: "We know from climate records that there were abrupt changes in climate as the Earth warmed up after the last ice age between fifteen and twenty thousand years ago. These changes in climate had massive influence on the oceans, rapidly changing the physical circulation and essential nutrient supplies, which significantly impacted marine life.

"The implications of this work are that marine ecosystems - especially in nutrient-starved areas of the oceans such as the North Atlantic gyre - are very sensitive to shifts in ocean circulation that are brought about by climate change, and that these ecological changes can have a big impact in carbon burial."

Although evidence exists for increased diatom burial in the North Atlantic during deglaciation, this study provides the first quantitative evidence for changes in silica cycling during this millennial-scale climate change event. This new study also shows that changes in ocean chemistry and restructuring of the marine ecosystem helped to remove carbon from the ocean during a period where global atmospheric carbon dioxide was gradually increasing.

This research was funded by a number of research bodies, including the National Environment Research Council (NERC) and the Royal Society.

Further information: Paper "Silicon isotopes indicate enhanced carbon export efficiency in the North Atlantic during deglaciation" by Katharine Hendry, Laura Robinson, Jerry McManus and James Hays, is available in Nature Communications.

More information: "Silicon isotopes indicate enhanced carbon export efficiency in the North Atlantic during deglaciation." Katharine R. Hendry, Laura F. Robinson, Jerry F. McManus, James D. Hays. *Nature Communications* 5, Article number: 3107 DOI: 10.1038/ncomms4107. Received 18 June 2013 Accepted 13 December 2013 Published 23 January 2014

Provided by University of Bristol