North Atlantic played pivotal role in last great climate tipping point

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North Atlantic played pivotal role in last great climate tipping point, research shows.

The North Atlantic Ocean played a key role in the last great tipping point in Earth's climate system, pioneering new research has shown.

An international research team has discovered ground-breaking new reasons why large continental ice-sheets first grew in North America and Scandinavia during the late Pliocene Epoch era, 2.7 millions of years ago.

The collaborative team was led by Dr Ian Bailey from the University of Exeter and Prof Paul Wilson from the University of Southampton, and also involved scientists from Woods Hole Oceanographic Institute in the USA and GEOMAR in Germany.

The researchers measured the composition of isotopes of the chemical element neodymium that can be found in fish teeth preserved in a North Atlantic marine core to track the origin of deep waters bathing the bottom of the Atlantic Ocean during this climate transition.

For the past 2.7 million years Earth's climate has switched more than 50 times between a cold glacial state and warm interglacial state much like today. Contrary to previous assertions, they found that the first of these glacial events in the northern hemisphere were associated with major expansions of carbon-rich southern-sourced deep waters into the northwestern Atlantic abyss, over one million years earlier than previously thought.

The team also found that three of the largest glacial cycles between 2.5 and 2.7 million years ago appear to be associated with southern-sourced water incursions into the deep Atlantic that were as significant as those documented for the last glacial maximum.

The research is published in leading scientific journal, *Nature Geoscience*, on Monday, 4 April 2016.

Dr Bailey, a Geology Lecturer from the Camborne School of Mines, based at the University of Exeter's Penryn Campus in Cornwall said:

"We could not have made these new findings with confidence using only a classic method for tracing watermass origin such as carbon isotopes.

"But when we combined such data with an alternative novel proxy such as neodymium isotopes, we were able to reveal a dramatically new picture of watermass mixing in the deep North Atlantic during late Pliocene glacial intensification."

Dr Bailey said that it has long been argued that changes in North Atlantic circulation played a leading role in driving late Pliocene northern hemisphere glaciation because of its capacity to modulate the transfer of heat and moisture from the tropics to the poles.

He added: "Our findings suggest, though, that the North Atlantic Ocean was not a driving factor in this transition, but, through storage of atmospheric carbon dioxide in the deep Atlantic, it operated as a positive feedback that helped to usher in glaciation at this time.

"What we've done is document a process which is thought to be special to the largest and longest glacial cycles of the past one million years, but we have shown that it has been occurring ever since large continental ice-sheets formed in the Northern Hemisphere."

Professor Wilson, who is Head of Palaeoceanography and Palaeoclimate Research Group at the University of Southampton, a unit within the School of Ocean and Earth Science based at the National Oceanography Centre said: "The mechanism driving these expansions of southern sourced water into the deep Atlantic still needs working on. It is thought that North Atlantic Deepwater formation is sensitive to glacial freshwater inputs to the ocean in the north.

"Yet our new data hint that these southern-hemisphere invasions may even predate the onset of major northern hemisphere glaciation. Counter

intuitively our findings may therefore suggest that they were driven from the south."

More information: *Nature Geoscience*, dx.doi.org/10.1038/ngeo2688

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