New technique suggests Medieval Warm Period made it to Antarctica

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Scientists have developed a new method of reconstructing past climates that uses the water locked inside crystals in seabed sediment to shed light on the history of the Antarctic.

The technique's first results suggest that recent climate fluctuations for which there's never been much evidence outside the northern hemisphere may have affected more of the globe.

Much more research is needed, but the implication is that the unusually warm and cold periods known as the Medieval Warm Period (MWP) and Little Ice Age (LIA) were felt as far south as the Antarctic Peninsula . If this turns out to be true, scientists' understanding of how the global climate has changed over the last few hundred years may need to be revised.

'Our work suggests that there have been recent climate oscillations on the Antarctic peninsula that seem to coincide with these well-known climate events,' says Professor Rosalind Rickaby, a biogeochemist at the University of Oxford, who led the research. 'It's a further indication that these events had a footprint in the southern hemisphere - at the moment it's hard to say more than that.'

An international team of scientists worked with cores of the mud from the sea floor, taken on a recent Antarctic research cruise. At intervals within each core they found crystals of ikaite - an unusual variant of calcium carbonate, more commonly found as limestone. Ikaite forms

only in very cold conditions and fresh crystals have only recently become the object of scientific attention.

As it forms, ikaite traps molecules of the surrounding water within its crystal structure. The researchers devised a way to recover this water, and then analysed its ratio of two different variants of oxygen, known as isotopes.

This provides information about the balance of freshwater and saltwater flowing into the area the crystal formed in. This can in turn be used to work out how quickly the Antarctic ice far above was melting, and hence how warm the climate was at the time. By dating the mud the crystals are buried in, scientists can accurately match the climate signals they contain to records elsewhere. They estimate the technique's margin of error for dating in this area is about 60 years.

Rickaby had already come up with the idea of using these crystals to reconstruct past climates, but the chance to put it into practice came only a few years ago when she was invited to join a US Antarctic Program cruise and collect sediment cores in areas that looked promising for ikaite formation.

Unfortunately only one core turned out to yield significant numbers of ikaite crystals, in the Firth of Tay at the far northeast of the Antarctic Peninsula. And even here there weren't many. 'We only found 11 ikaite crystals over 2000 years. The sediments here accumulated quickly, at about 2mm per year, but the crystals are about two metres apart, so the study doesn't give us very high resolution,' Rickaby says.

Still, in time more crystals should be found from around the Antarctic. And the ikaite technique has major advantages. Before now, scientists have tried to work with the water that's trapped within sediment itself. But because this isn't completely sealed from the outside environment,

its climate information fades over time. This means it can only be used to study dramatic environmental shifts like the end of the last ice age. By contrast, the ikaite record is far more sensitive and can illuminate much subtler changes.

Rickaby says much more study of Antarctic ikaite is needed before we can be sure of the findings. 'Our study only looked at one place, and the results are a long way from being definitive - it's far too early to draw broad conclusions from this,' she says.

If it's confirmed that the MWP and LIA did reach the Antarctic, there will be important implications for our overall understanding of climate change that may well need to be taken into account in the next report from the United Nations Intergovernmental Report on Climate Change, expected in 2014, but these will be complex and not easily summarised in headlines.

In the meantime the ikaite technique could be an important addition to the arsenal of ways to investigate ancient climates. More recently, Rickaby has been coring in the Zaire Fan sediments off the west coast of Africa in search of much older ikaite crystals - perhaps from as much as 50,000 years ago. She adds that glendonites, the mineral into which ikaite eventually decays, also preserves climate records, and could potentially illuminate conditions going back hundreds of millions of years.

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