

Climate seesaw

Northern and southern hemisphere temperatures were very different at the end of the last ice age, reports David Sugden.

Odd though it sounds, our planet can get warmer and colder at the same time. At the end of the last ice age, glaciers in Patagonia, South America, were growing while those in Europe melted. And when glaciers were growing in Europe, they were melting in southernmost South America—ie, they were out of phase. Our 14 years of research now provides the first firm evidence for this climate seesaw from a landmass in the southern hemisphere.

Our team from the Universities of Edinburgh, Stirling (Bob McCulloch) and Durham (Mike Bentley) mapped former glacier limits between 46° and 55° latitude in South America, and dated them using isotope analyses. Tackling an area with the latitudinal spread of the UK was a real challenge, but eventually a coherent story, based on some 200 initial dates, emerged.

Our work supports the idea of a 'bipolar oceanic seesaw', driven by currents that circulate water vertically in the oceans (the thermohaline circulation).

Today, the Gulf Stream brings warmth to Europe and this is balanced by heat lost from the Southern Ocean. If the Gulf Stream flow slows, then the North Atlantic cools and the Southern Ocean retains more warmth. The process also operates in reverse.

During the transition from an ice age to a non-ice age, the oceanic seesaw comes to the fore. We think the global climate seesawed over several millennia during the transition from a full ice age climate 17,500 years ago to our present non-ice age climate which began 11,400 years ago. But other research shows big ice age events happen at the same time in Patagonia and the North Atlantic. In both hemispheres, the coldest time was 23,000-26,000 years ago, the full ice age ended abruptly 17,500 years ago, and our present non-ice age climate began simultaneously. This match and mismatch is an interesting puzzle. Possibly, global atmospheric processes related to changing levels of greenhouse gases, rather than ocean currents, control the big events of



It's not always easy to sample the bottom of a bog! Bob McCulloch (left) and David Sugden (right) using a Russian corer to sample peat for radiocarbon dating. Strait of Magellan area, Patagonia, Chile.

Mike Kaplan (right) and David Sugden (left) sampling a boulder, Tierra del Fuego, Chile.



an ice age world.

Whatever the explanation, our research confirms that the bipolar seesaw operated in the past. Could it start up again, driven by melt water from Greenland and the Arctic suppressing the flow of the Gulf Stream, or by changing winds and ocean currents around a warming Antarctica? Our world seems to be moving out of a settled climate period. The past 11,400 years have seen a relatively warm North Atlantic and cool Southern Ocean. We don't know how far the climate system can be pushed before we inadvertently switch on the bipolar seesaw.

David Sugden is Head of the School of Geosciences at the University of Edinburgh, Grant Institute, West Mains Road, Edinburgh EH9 3JW tel: 0131 650 1000 email: david.sugden@ed.ac.uk. NERC financed this research with additional support from the Royal Society, Royal Society of Edinburgh and the Carnegie Trust for the Universities of Scotland.