Seashells provide million-year-old weather report

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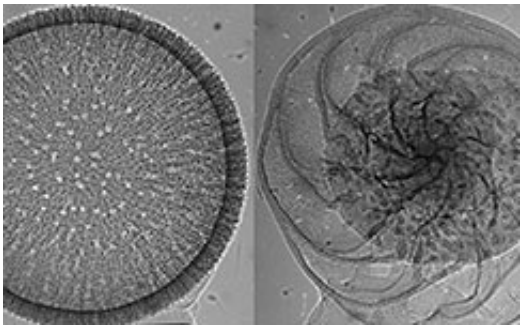

New research, published in Earth and Planetary Research Letters, led by scientists from the University of Cambridge, used plankton – tiny bugs, whose shells litter the ocean floors. By drilling into the seabed scientists can extract shells from plankton which lived millions of years ago.

'The shells we used are of a type of plankton called foraminifera. They're only about one tenth of a millimetre big, or small rather, and have been around over 150 million years, so we get a really well-preserved record of them in marine sediments going back tens of millions of years,' explains Oscar Branson, a PhD student at the University of Cambridge and lead author of the study. 'Recently people have been analysing them for climate records, but now we realise they're more complex.'

As plankton grow they build a bit more onto their shells every day by turning elements in the sea water into harder minerals and adding them on. The impurities in the shell depend on what was in the sea water as the plankton grew, so these million-year-old shells can give us an almost daily snapshot of the chemistry of the oceans as it was when they were still alive.

'We realised plankton have these growth bands, like tree rings, which we thought might tell us something in more detail. It turns out these bands are produced almost daily so you may one day be able to get a 5 day weather report by looking at them,' Branson says.

The team used a synchrotron in California to study the shells, which let them find out how much magnesium was in each growth band compared to other chemicals.

Synchrotrons use magnetic and electrical fields to accelerate particles round a huge ring. As these charged particles approach the speed of light they give off radiation known as synchrotron light.

Researchers divert this light away from the main ring and down a targeted beamline, where it can be used in a similar way to an X-ray to study the structure of matter at tiny scales.

'The concentration of magnesium changes depending on temperature of sea water, so by finding out how much there was in the shell it should allow us to find out the temperature of seawater virtually each day for the last 150 million years,' says Branson.

The magnesium is more likely to be built into shells in warmer waters because it replaces calcium in their atomic structure.

'Our X-ray data show that the trace magnesium sits inside the crystalline

mineral structure of the plankton shell,' concludes Professor Simon Redfern of the University of Cambridge, who also worked on the project. 'That's important because it validates previous assumptions about using magnesium contents as a measure of past ocean temperature.'

More information: Oscar Branson, Simon A.T. Redfern, Tolek Tyliszczak, Aleksey Sadekov, Gerald Langer, Katsunori Kimoto, Henry Elderfield, "The coordination of Mg in foraminiferal calcite," *Earth and Planetary Science Letters*, Volume 383, 1 December 2013, Pages 134-141, ISSN 0012-821X, dx.doi.org/10.1016/j.epsl.2013.09.037.