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Study gets to grips with ancient global warming

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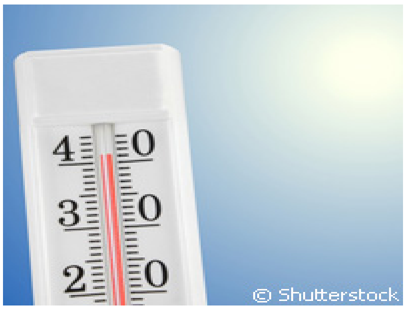

The ancient Earth underwent periods of intense global warming more frequently than previously thought, new research suggests. The study, published in the journal Nature, also shows that these periods of warming were most likely caused by the release of carbon dioxide (CO2) from stores in the deep ocean. Studying these ancient warming events helps scientists predict how current climate change could affect ecosystems and ocean circulation patterns.

The work was partly funded by the EU through the 'Climate change, hydrography and the paradox of plankton extinctions' (PLANKTON PARADOX) project, a EUR 265,000 Marie Curie Outgoing International Fellowship under the Sixth Framework Programme (FP6) that allowed the lead author of the paper, Philip Sexton, to work at the prestigious Scripps Institution of Oceanography in the US. Dr Sexton is now based at the UK's Open University.

During the Palaeocene and Eocene epochs (i.e. between 65 and 34 million years ago), our planet experienced a number of periods of global warming which started rapidly and lasted for tens of thousands of years. These warming events stopped occurring when the Earth entered a cooling phase around 40 million years ago.

The most intensely studied of these warming events is the Palaeocene-Eocene Thermal Maximum (PETM) 56 million years ago, during which global temperatures rose by between 4°C and 7deg;C. The PETM is thought to have been caused by the release of greenhouse gases from buried sediments. When it ended, it took around 200,000 years for temperatures to return to normal levels.

In this study, Dr Sexton, along with colleagues from Scripps Institution of Oceanography, the University of Southampton in the UK and the University of Bremen in Germany, set out to study the other, less dramatic warming events during the Palaeocene and Eocene. Known as hyperthermals, these events saw average global temperatures rise by up to 3°C and lasted around 40,000 years.

Their analyses revealed that these hyperthermals took place more frequently than was thought, every 100,000 to 400,000 years. The average hyperthermal developed in under 10,000 years, which is very rapid in geological terms, but it took longer (over 30,000 years) for temperatures to return to normal.

Furthermore, while the PETM was probably driven by the release of greenhouse gases from sediments, the shorter duration of the hyperthermals indicates that they were driven by a different mechanism.

The researchers point the finger at the exchange of carbon between the atmosphere and the oceans. The depths of the oceans represent important carbon stores; changes in ocean circulation could have caused a build-up of CO2 in the deep oceans. The release of this carbon could have triggered a hyperthermal, the researchers suggest.

The average length of the hyperthermals, 40,000 years, leads the scientists to propose that they were ultimately triggered by changes in the tilt of the Earth's axis. The axis of the Earth is distinctly tilted, and it moves between 22.1° and 24.5° and back again over cycles that last 41,000 years.

'These hyperthermals seem not to have been rare events, hence there are lots of ancient examples of global warming on a scale broadly like the expected future warming. We can use these events to examine the impact of global change on marine ecosystems, climate and ocean circulation,' commented Richard Norris of Scripps Institution of Oceanography.

The researchers arrived at their conclusions after studying sediment cores collected off the coast of South America. In the pale-green muddy cores, warm periods are represented by bands of grey sediments that are rich in clay left behind when the calcareous shells of microscopic organisms were dissolved on the sea floor. During these periods, the ocean was more acidic because when the ocean absorbs carbon dioxide, it is converted into carbonic acid.For more information, please visit: Nature:http://www.nature.com/natureScripps Institution of Oceanography:http://scripps.ucsd.edu/

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