Pliocene glaciation

Paleoceanography http://dx.doi.org/10.1029/2010PA002055 (2011)

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Variations in atmospheric CO_2 levels between 4.6 and 2 million years ago correspond closely to the extent of glaciation on Greenland, suggests an analysis of marine sediments.

Gretta Bartoli of ETH Zürich and colleagues used the boron isotope composition of foraminiferal shells from the Caribbean Sea to reconstruct atmospheric CO_2 concentrations during the period spanning the transition from the warm climate of the Pliocene epoch to the glacial–interglacial cycles of the Pleistocene epoch. They found a broad trend of decreasing CO_2 levels, interspersed with more short-lived oscillations. The periods of lower atmospheric CO_2 coincided with the appearance of transient ice sheets on Greenland, most notably between 3.43 and 3.32 million years ago. Intriguingly, their CO_2 estimates are in line with inferred thresholds for Greenland glaciation.

The transition to permanently low, pre-industrial atmospheric CO_2 levels occurred 2.7 million years ago, and may have been linked to the stratification of polar oceans and enhanced marine productivity. *AN*

Second wave

Geophys. Res. Lett. http://dx.doi/10.1029/2011GL049146 (2011)

The 2011 Tohoku earthquake that occurred off the Pacific coast of Japan triggered a devastating tsunami. The tsunami, in turn, generated a series of atmospheric waves, according to an analysis of atmospheric pressure data.

Nobuo Arai of the Japan Weather Association and colleagues examined the impact of the tsunami on atmospheric dynamics, using atmospheric pressure data collected at four barograph stations in and around the Tohoku region during the tsunami. They detected large-scale undulations in pressure in the lower atmosphere following the earthquake. The amplitude of the waves declined with distance from the tsunami source, and the structure of the atmospheric waves mirrored that of waves detected in the ocean by ocean-bottom pressure gauges.

The researchers suggest that the atmospheric waves were generated by the uplift and subsidence of the ocean surface in the tsunami source region. The waves seemed to radiate outwards at a speed of approximately 300 m s^{-1}. *AA*

Textured core

Phys. Earth Planet. Int. http://dx.doi.org/10.1016/j.pepi.2011.08.008 (2011)

Seismic waves that pass through Earth's inner core slow down when travelling in some directions, but are unaffected in others. Numerical modelling indicates that this variation may be related to the stratification of the inner core.

Philippe Cardin at the Université Joseph-Fourier, Grenoble, and colleagues combined a numerical model of texture development in iron crystals with simulations of the dynamic evolution of Earth's inner core. The simulations show that as the inner core grows — through the addition of new material around its equator — it becomes radially stratified and forms concentric rings. Flow is concentrated along these rings so that strain is transferred from the equator of the inner core to its upper regions. Deformation of the iron crystals in the mid- to polar regions destroys the ancient texture. In contrast, deeper parts of the inner core are protected, preserving the texture of the crystals.

Together, the ancient iron-crystal texture preserved in deeper parts and deformation of upper parts of the inner core can slow passing seismic waves in the unusual manner measured at the surface. *AW*

Australia askew

Lithosphere **3,** 311–316 (2011)

Australia has subsided and tilted towards the northeast over the past 50 million years. Numerical modelling shows that the sinking results from the interplay of downwelling and upwelling in Earth's mantle.

Lydia DiCaprio at the University of Sydney and colleagues used plate tectonic reconstructions and a numerical model of mantle flow to recreate the subsidence of Australia as recorded by ancient shorelines. Movement of the continent towards subduction zones in the western Pacific Ocean could explain the northeastward tilting of Australia. Subduction of cold, dense oceanic crust creates cool regions of downwelling in the mantle that cause the overlying crust to sink. However, subduction alone could not explain the observed continent-wide sinking.

To recreate all of the subsidence experienced by Australia since the Eocene epoch also required the entire continent to have moved northwards, away from hot mantle upwelling beneath Antarctica in the south, into regions with cooler underlying mantle. *AW*

Nordic carbon in flux

Glob. Biogeochem. Cycles http://dx.doi/10.1029/2010GB003961 (2011)

The Nordic seas, which bridge the Atlantic and Arctic oceans, are an important conduit for carbon transport both laterally and vertically. An analysis of the Nordic carbon budget suggests that lateral fluxes of carbon into and out of these waters exceed air–sea fluxes by around two orders of magnitude.

Emil Jeansson, of the Bjerknes Centre for Climate Research, Norway, and colleagues examine existing estimates of seawater carbon content and mass transport to assess the movement of carbon through the Nordic seas. They estimate that about 12.3 Gt of carbon enter these seas each year, primarily across the Greenland–Scotland ridge, whereas 12.5 Gt are carried to the Atlantic and Arctic oceans. Most carbon is transported as dissolved inorganic carbon.

Balancing the budget, the researchers estimate that local air–sea fluxes of carbon dioxide contribute 0.2 Gt of carbon to these waters each year. *AA*

Written by Alicia Newton, Anna Armstrong and Amy Whitchurch.

Correction

In the Research Highlight 'Walker slows down' (*Nature Geosci.* **4,** 658; 2011), the doi link should have been 'http://dx.doi.org/10.1175/JCLI-D-11-00263.1'. This error has been corrected in the HTML version of the text.