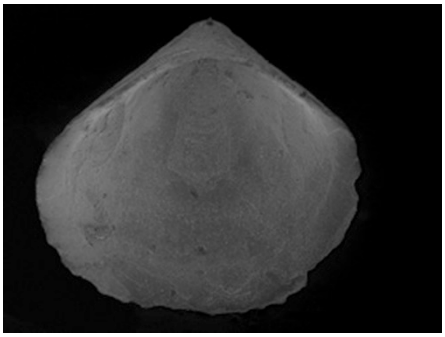
Spicy climate

Geology **39,** 987–990 (2011)



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The Late Cambrian carbon isotope excursion known as the SPICE event was linked to changing ocean temperatures, confirms an analysis of marine fossils.

Maya Elrick of the University of New Mexico and colleagues measured the oxygen isotope composition of fossil brachiopods from sites in Iowa and Utah. They found that the onset of the carbon isotope excursion was marked by an influx of cool waters onto the ocean shelves, probably related to global sea-level rise. The subsequent rapid shift in carbon isotope values was, in contrast, marked by warmer seawater temperatures. The researchers therefore suggest that this portion of the excursion — which was caused by the enhanced preservation and burial of organic matter — was at least in part a result of warm sea water reducing dissolved oxygen contents and supporting shelf anoxia.

Intriguingly, the burial of carbon should have had the opposite effect — drawing down atmospheric carbon dioxide and lowering temperatures. More carbon may have been added by volcanic or metamorphic outgassing or, alternatively, the removal of carbon dioxide by weathering may have decreased. *AN*

Churned up

Global Change Biol. http://dx.doi.org/10.1111/j.1365-2486.2011.02513.x (2011)

Invasive species have been shown to threaten the diversity and health of marine ecosystems. However, an invader in the oxygen-deficient waters of the Baltic Sea may be providing an important ecosystem service, according to model simulations.

Joanna Norkko of Åbo Akademi University, Finland, and Daniel Reed of Utrecht University, The Netherlands, and colleagues used a reactive transport model to examine the impact of invasive worms on nutrient cycling in marine sediments in the Baltic Sea over a ten-year period. They show that by churning up the sediments, the worms enhance the level of iron-bound phosphorus in the mud, and reduce the concentration of bioavailable organic carbon. Worm-induced preservation of these iron–phosphorus complexes facilitates their conversion into less digestible compounds, promoting the retention of phosphorus in marine sediments.

The researchers suggest that by helping to sequester phosphorus — a key nutrient in surface waters — in marine sediments, invasive worms could reduce the potential for eutrophication in the overlying waters. *AA*

Walker slows down

J. Clim. http://dx.doi.org/10.1130/G32109.1 (2011)

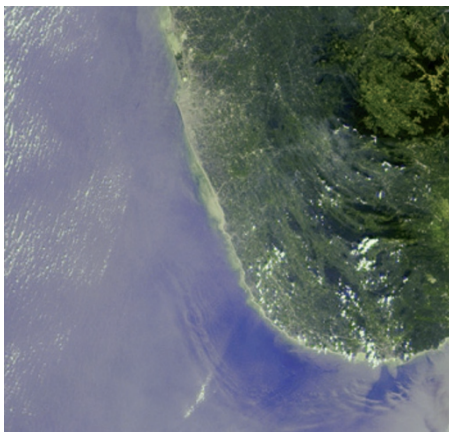
The tropical atmospheric circulation system known as the Walker circulation is expected to slow under global warming, according to climate model simulations. An analysis of changes in a suite of meteorological variables over the past 60 years corroborates this suggestion.

Hiroki Tokinaga of the University of Hawaii at Manoa and colleagues compiled numerous independent data sets documenting weather conditions in the tropical Indo-Pacific region over the past six decades. They detected a number of changes, including a decline in marine cloudiness over the western tropical Pacific Ocean, a reduction in precipitation over Indonesia, a slowdown in the northeast trade winds and a convergence of surface winds over the central tropical Pacific. All of the changes are consistent with a weakening of the Walker circulation.

The researchers note, however, that the factors responsible for the slowdown are not yet clear. *AA*

Stuck in the mud

Geophys. Res. Lett. http://dx.doi.org/10.1029/2011GL048552 (2011)



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Earthquakes at subduction zones can sometimes generate large tsunamis, but only when the rupture propagates towards the surface through thick accumulations of clay-rich sediments. Experimental analyses show that fault slip penetrates through clay only when the fault ruptures at a high velocity.

Daniel Faulkner of the University of Liverpool and colleagues used analogue models to simulate fault slips in clay materials in the laboratory. They found that if the initial fault slip during the nucleation of an earthquake was slow, the clays would become stronger and resist further breakage. This explains why earthquakes generally do not occur within the clay-rich sediments found at the surface in subduction zones. However, if the initial slip on the fault was very fast, fluids within the fault heated up and became pressurized. As a result, the clay-rich rocks weakened, allowing earthquake rupture to propagate through the material.

The researchers suggest that rapid fault slip is required for earthquake ruptures to propagate through clay-rich rocks at subduction zones and to generate a tsunami. *AW*

Titan's dry lakebeds

Icarus http://dx.doi.org/10.1016/j.icarus.2011.08.022 (2011)

Evaporites — minerals formed when dissolved solids precipitate out of an evaporating liquid — are only known to exist on Earth and Mars. Images collected by the Cassini mission now reveal evaporites on the surface of Saturn's moon Titan as well.

Giant lakes of liquid hydrocarbons are thought to exist on the surface of Titan. Jason Barnes of the University of Idaho and colleagues analysed visual and infrared spectral data captured by the Cassini spacecraft as it flew past Titan in June 2010. The data image the surface of Titan's north pole and reveal the presence of isolated patches of bright, highly reflective deposits with an organic composition. The distribution of the bright deposits correlates with the location of previously identified dry lakebeds. Thus, the researchers speculate that the deposits are fine-grained sediments left over after evaporation of a hydrocarbon lake.

The lakes probably dried up relatively recently, in the last few tens of thousands of years. *AW*

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