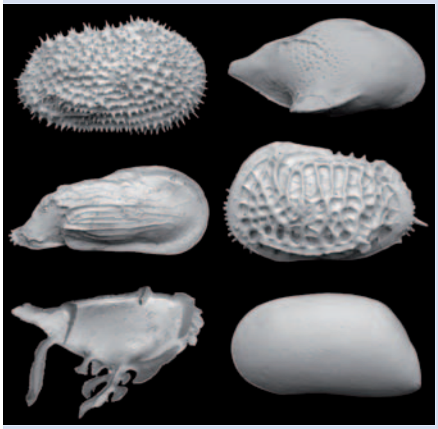
BIODIVERSITY AND ECOLOGY

Deep-sea collapse



MORIAKI YASUHARA

Proc. Natl Acad. Sci USA
doi:10.1073/pnas.0705486105 (2008)

The effects of human-caused climate change might eventually reach one of the least explored realms of the planet: the bottom of the ocean. A new analysis of miniscule marine fossils from the last 20,000 years shows that during past periods of global cooling, changes in ocean circulation led to the collapse of deep-sea ecosystems.

Moriaki Yasuhara, then with the US Geological Survey, and colleagues studied a core of ocean floor sediment drilled in the northwest Atlantic, identifying fossil ostracodes — bivalved crustaceans less than two millimetres long — in each layer. Because their shells fossilize so well, diverse ostracode remains represent a vibrant deep-sea community overall. Layers deposited during hundreds or thousands of years of natural cooling revealed dramatic drops in the diversity of ostracode species. During these episodes, 'opportunistic' species, able to thrive amid decay, predominated. After one particularly vicious cooling cycle ended, species diversity took thousands of years to recover, probably because of a persistent change in deep ocean currents.

Deep-sea ecosystem collapses, the authors argue, could have arisen from both altered circulation and changing populations of the ostracodes' main food source, surface algae — which might result from anthropogenic warming as well as natural cooling. A rapidly changing climate could disrupt even deep-sea life, they conclude.

Anna Barnett

CRYOSPHERE

Baffin basks

GIFFORD H. MILLER

Geophys. Res. Lett. **35,** L01502 (2008)

The melting of ancient ice caps on Baffin Island in the Canadian Arctic, one of the North American regions most sensitive to climate change, shows that the twentieth century was the island's warmest since AD 350. Vegetation that died when first covered by ice is now emerging, as are undisturbed rock surfaces.

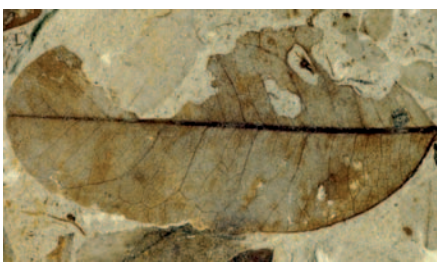
Gifford Miller of the University of Colorado and colleagues used carbon-14 to date both the vegetation and, in a novel approach, the quartz-rich rock, from which they reconstructed changes in Baffin's ice caps. As cosmic rays hit quartz, they produce carbon-14, but production is greatly reduced or eliminated under ice. By studying quartz at the melting edge of several ice caps, the researchers determined that the last ice age ended on Baffin 6,000 years ago and that local ice caps began re-forming 2,800 years ago.

Carbon-14 in emerging vegetation revealed that some of the ice caps remained intact from AD 350 through the Medieval Warm Period (around 800 to 1300) and beyond, but have shrunk by more than 50 percent since 1958. The researchers conclude that the last century was the warmest on Baffin for at least the past 1,600 years.

Harvey Leifert

BIODIVERSITY AND ECOLOGY

Warm swarms



ELLEN D. CURRANO

Proc. Natl Acad. Sci. USA
doi:10.1073/pnas.070864105 (2008)

Hungry herbivorous insects thrived during a period on Earth when temperatures and carbon dioxide levels soared, according to a new study, which could foreshadow a surge in swarming pests. Scientists believe that the Paleocene–Eocene Thermal Maximum (PETM), an event that occurred 55.8 million years ago, is one of the best analogues of current climate change and could hint at what lies ahead.

Ellen Currano of Pennsylvania State University and co-workers examined over 5,000 fossil leaves from Wyoming's Bighorn Basin for the telltale holes and galls left by different types of ancient insects. Recently discovered fossils from the abrupt warming event were compared with leaves that fossilized earlier or later. As temperatures rose, the authors found, so did the frequency of damaged leaves and the diversity of insects whose damage patterns could be identified.

The ravaging insects may have first followed tropical host plants whose ranges were expanding with increasing temperature, before spreading to northern plants, the scientists say. Some insects, however, apparently arrived under their own steam, before plant diversification was underway. In our rapidly warming world, say the researchers, ecological disruption on a similar scale can be expected.

Anna Barnett

REGIONAL CLIMATE

Water woes

CANDACE HARTLEY

Science doi:10.1126/science.1152538 (2008)

In the western US, where water is perhaps the most precious natural resource, anthropogenic global warming is responsible for more than half of the well-documented changes to the hydrological cycle from 1950 to 1999, researchers report. Over the last half of the twentieth century, the region's mountains received less winter snow and more rain, with snow melting earlier, causing rivers to flow more strongly in the spring and more weakly in the summer.

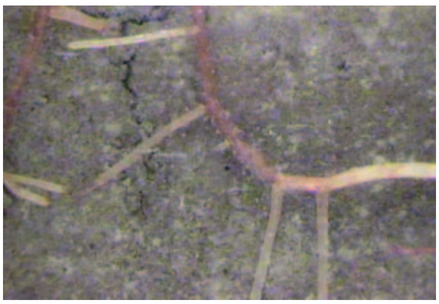
Tim Barnett of the Scripps Institution of Oceanography, US, and colleagues analyzed hydroclimatic data from the region for the 1950–1999 period and compared observed changes to results from sophisticated climate models. They found that up to 60 percent of the observed hydrological changes resulted from man-made greenhouse gases and aerosols, with other factors, such as variations in total precipitation, solar activity and volcanic eruptions, unable to account for the changes.

Climate models project more of the same, the scientists say. The region, whose population is steadily growing, faces water shortages because of insufficient capacity to store ever-increasing early mountain runoffs, the anticipated transfer of water from agriculture to cities, and other constraints. The researchers urge immediate action to forestall "a coming crisis in water supply".

Harvey Leifert

EARTH SCIENCE

The root problem



SETH PRITCHARD

Science doi:10.1125/science.1151382 (2008)

The amount of carbon naturally sequestered underground by the delicate roots of plants remains hugely uncertain, suggests a new study. This casts doubt on predictions of how much the soil carbon sink can buffer carbon dioxide emissions and mitigate future warming.

Images from miniature underground cameras have shown that tiny roots die and are replaced within one year, suggesting that they may rapidly transfer atmospheric carbon to the soil. In contrast, experiments measuring the rate at which certain carbon isotopes are incorporated into new roots have indicated that the roots persist for over four years. Seth Pritchard of the College of Charleston, South Carolina, and co-workers tested possible explanations for the discrepancy, comparing images they captured from forest plots to previously published isotope data from the same plots. They found that, in general, short-term imaging studies overestimated root growth, whereas isotopic data — now used in some global climate models — substantially underestimated it.

Reinterpreting isotopic results from past studies could increase the expected size of the soil carbon sink, suggest the authors, though this also depends heavily on hard-to-predict carbon cycling by soil microbes. The potential for soil carbon storage to mitigate the greenhouse effect is therefore still unclear, they say.

Anna Barnett

CLIMATE IMPACTS

Poor projections

SHAHEE ILYAS

Geophys. Res. Lett. doi:10.1026/2007GL032486 (2008)

The extent to which sea level could rise by 2100 is greatly underestimated in current models, suggests a new study, highlighting the risk faced by coastal areas and island nations.

Radley Horton at Columbia University, US, and colleagues estimated that sea level could rise by 54 to 89 centimetres by the end of the century, in contrast to the latest estimate by the Intergovernmental Panel on Climate Change (IPCC) of 18 to 59 centimetres. The team used a different approach to directly estimate rates of sea-level rise on the basis of model projections of ground surface temperature changes. The future sea-level rise predicted was mostly determined by the assumed rate of greenhouse gas emissions, suggesting that changes in emissions will be the main determinant of sea-level rise in the twenty-first century.

Neither these estimates nor those of the latest IPCC report take into account the recent acceleration of ice loss in the Greenland and West Antarctic Ice Sheets or the indirect effects of loss of Arctic sea ice cover, however. The scientists point out that current projections could therefore strongly underestimate the magnitude of sea-level rise in the coming century if ice loss continues to accelerate in polar regions.

Alicia Newton