Early ice-surges

Paleoceanography
doi:10.1029/2009PA001736 (2009)

© ISTOCKPHOTO / JGARERI

Over the glacial cycles that span the past few hundred thousand years, glacial periods have been marked by periodic surges of icebergs from the ice sheets covering North America and Europe. Marine sediments reveal that earlier glacial periods 2.6 and 2.5 million years ago were punctuated by similar events.

Ian Bailey of the National Oceanography Centre, UK, and colleagues reconstructed the transport of ice-rafted debris and bottom-water conditions during early glacial periods from the composition and microfossils of marine sediments collected in the North Atlantic Ocean. They found evidence of the episodic delivery of terrestrial debris from icebergs. Like their more recent counterparts, these events were preceded by a drop in sea level. However, the sea-level fall leading up to the release of icebergs was much smaller during the early glacial periods.

The group suggests that the early ice-sheets were more prone to sliding at their base, and therefore responded to a lower degree of forcing.

Stormy waters

J. Clim. doi:10.1175/2009JCLI3064.1 (2009)

Mid-latitude storms travel eastwards preferentially along relatively narrow strips — the storm tracks. Statistical analyses of wind patterns over mid-latitude oceans in the Northern and Southern hemispheres show that the highest storm-related variability at the sea surface does not necessarily match the location of the storm track at greater altitudes.

James Booth and colleagues at the University of Washington analysed wind data from reanalyses of past observations — along with satellite measurements of wind speed and direction — for the North Atlantic and North Pacific oceans and for the Indian Ocean sector of the Southern Ocean. They found that regions with the greatest storminess at the surface reflect the spatial extent of the storm track aloft, and that surface storminess is more pronounced where the lower atmosphere is most unstable.

The researchers suggest that instabilities in the lower atmosphere allow a more efficient downward mixing of momentum from the upper-layer storm track. As a result, the stormiest regions at the surface are found where low-altitude instabilities co-occur with a vigorous storm track at higher levels.

Inheritance matters

Proc. Natl Acad. Sci. USA
doi:10.1073/pnas.0910663106 (2009)

© ISTOCKPHOTO / ABZEE

The magma that formed the granites of the eastern Peninsular Ranges in Southern California was derived at least in part from the melting of surrounding metamorphic rocks. Magnesium isotopes indicate that before they melted, these metamorphic rocks were subject to chemical weathering.

Bing Shen of Rice University, Texas, and colleagues used magnesium isotope measurements from the mineral biotite to investigate the source of the magmas that formed the Peninsular Ranges Batholith. They found a magnesium isotope ratio that was far higher than would be expected if the magma had been generated from just the melting or crystallization of a young basaltic source.

The chemical weathering of rocks at the surface tends to drive the magnesium isotope of the remaining rock higher. The authors conclude that chemically weathered rocks must have been incorporated into the magma, allowing the resulting granites to inherit a high magnesium isotope ratio.

Algal oscillations

Science **326,** 1253–1256 (2009)

Satellites have recorded fluctuations in the concentration of phytoplankton in the world's oceans over the past few decades. A comparison of sea surface temperature and chlorophyll concentration indicates that large-scale climate patterns are responsible for these multidecadal variations in phytoplankton abundance.

Elodie Martinez, of CNRS, the University of Paris 06, and colleagues used satellite measurements to reconstruct the covariability of chlorophyll and sea surface temperatures in the global ocean between 1979 and 2002. During this period, sea surface temperature and phytoplankton abundance were inversely correlated across about 60% of the ocean, between 50° S and 50° N.

Changes in sea surface temperature — and thus phytoplankton levels — in the Pacific and Atlantic oceans seem to have been driven by the Pacific Decadal Oscillation and the Atlantic Multidecadal Oscillation, respectively. The team suggests that these climate oscillations affect the stratification of the surface ocean, and thus the flux of nutrients to the upper, sunlit layers.

Hidden ridges

Geophys. Res. Lett. **36,** L22201 (2009)

The basaltic lava flows that dot the Moon's surface are generally thought to be smooth and uniform. New radar data reveal patches of blocky, rugged basalt hidden beneath metres of rock debris.

Bruce Campbell of the Smithsonian Institution, USA, and colleagues assessed the radar reflectance of various lava flows on the near side of the Moon. As expected, the team found variations in the amounts of titanium and iron in the lunar basalts. There were, however, a number of areas that showed unusual reflectance, even after variations in mineralogy and age were accounted for. After ruling out differences in the character of the debris cover, the researchers attributed the high values to greater relief in the underlying lava flows.

The presence of ridged and rugged flows does not necessarily imply a different lava chemistry relative to the more common smooth lava flows. Instead, the higher relief could arise from more rapidly emplaced lava or a cooler lava source.