PALAEOCLIMATE

Drying times

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Today, the Atacama Desert in Chile is one of the driest places on Earth. A reconstruction of the desert's former fluvial systems shows that a decline in precipitation from at least 125 mm to less than 3 mm per year began about two million years ago.

Ronald Amundson of the University of California, Berkeley, and colleagues compiled geological maps and field observations of basin fill and soil characteristics to reconstruct the nature of the Atacama landscape before aridification. The ancient fluvial systems were characterized by at least episodic occurrences of vigorous deposition and erosion, with the average magnitude of Pliocene incision approximately ten times greater than that of the subsequent Quaternary. Furthermore, thick, bedrock-derived soils mantled the hillslopes during the Pliocene, whereas today's thin soil layer is composed primarily of dust and salts deposited from the atmosphere. Thick salt layers that formed after the main aridification provide evidence for extreme, but rare, rainfall events.

The timing of the aridification suggests that the uplift of the Andes was not the primary driver of the climate shift. Instead, the drying coincides with the intensification of upwelling in the eastern tropical Pacific Ocean, which cooled sea surface temperatures and reduced the amount of precipitation generated in the region. *AN*

VOLCANOLOGY

Earthquake interaction

Geophys. Res. Lett. http://doi.org/hzh (2012)

A large earthquake near the Yasur Volcano, on the south Pacific island of Vanuatu, altered the shallow crust that hosts the volcano's magma conduit, but didn't result in a change in eruptive activity, a seismic study suggests.

Jean Battaglia at CNRS, Université Blaise Pascal, France, and colleagues monitored seismic waves generated by magma moving in the conduit beneath the active Yasur Volcano for over a year. In April 2009, a magnitude 7.3 earthquake occurred about 80 km away from the volcano. Although the morphology and eruptive activity of the volcano did not appear to change, the velocity of the seismic waves generated within the volcano's conduit suddenly dropped during the earthquake. The velocity partially recovered over the next few days. The drop in velocity could be explained by a generation of cracks in the volcano conduit that would have allowed magma to permeate through the crust or, alternatively, by the escape of gas from the magma.

The identification of clear cause and effect relationships between specific earthquakes and volcanic eruptions has been sparse. However, these findings imply that the effects of larger earthquakes on volcanic plumbing may be more subtle, and thus more common, than previously thought. *AW*

CARBON CYCLE

Emissions from ponds

Glob. Biogeochem. Cycles http://doi.org/hx4 (2012)

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Ponds permeate permafrost landscapes, but because constraints on their surface area and distribution are poor, their contribution to Arctic carbon cycling has largely been overlooked. Field-based analyses in northeastern Siberia suggest that ponds and small lakes account for a significant fraction of landscape-level carbon dioxide emissions.

Anna Abnizova of the Alfred Wegener Institute, Germany, and colleagues measured the carbon content of ponds and small lakes on Samoylov Island, Siberia, during the summer of 2008. The waters sampled were super-saturated with respect to carbon dioxide, resulting in the release of carbon to the atmosphere. During September, emissions from ponds peaked at 10–12 g carbon m^{-2} d^{-1}, some of the highest emissions reported for surface water bodies so far. Scaling up their findings, they estimate that ponds and lakes collectively account for 74 to 81% of carbon dioxide emissions on the landscape scale during late summer, with ponds contributing between 50–70% of these water-based emissions.

The team suggests that water bodies in permafrost landscapes represent hotspots for carbon dioxide emissions. *AA*

PLANETARY SCIENCE

Orbital assist

Icarus http://doi.org/hzj (2012)

The axis of rotation of many planetary bodies is offset from the orbital axis, a difference known as obliquity. Numerical modelling suggests that, for the moons of the outer Solar System, obliquity may be indicative of the internal structures of the satellites.

Rose-Marie Baland at the Université de Nantes, France, and colleagues developed a model of rotation of Jupiter's satellites assuming entirely solid moons, and compared these results to models employing combinations of rigid and liquid layers of variable thicknesses. For Io, they used a fluid core within a rock mantle, whereas models of Europa, Ganymede and Callisto included a global liquid layer sandwiched between an ice shell and rigid interior. They found that the presence of a liquid ocean influences the obliquity of Europa and — even more significantly — Ganymede and Callisto, but internal structure had little effect on the obliquity of Io.

Future high-precision measurements of the obliquities of Jupiter's moons may help to constrain the presence and depths of subsurface oceans, which represent potential abodes for extraterrestrial life. *TG*

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