Smashing Venus dry

NASA/JPL-CALTECH

Earth Planet. Sci. Lett.
doi: 10.1016/j.epsl.2008.01.031 (2008)

It is unclear why Venus, despite being similar in size and density to the Earth, has much less water in its planetary interior. A new study suggests that the formation of Venus by a head-on collision of two planetary embryos — and the resultant liquid vaporization — is to blame.

J. Huw Davies from Cardiff University, UK, generated a model for the formation of Venus during a mega-collision and its effects on the planet's water contents. According to the conceptual model, the shock of the impact released water from minerals in the colliding bodies. The turbulent environment facilitated the reaction of the released water with iron. The hydrogen freed during the reaction, by virtue of being light, probably escaped into space while the oxidized iron ultimately sank into the planet's interior.

Although the Earth also experienced a large collision, which formed the Moon, the event was smaller and there was therefore less potential for extensive reactions between iron and water, thus ensuring a much wetter planet Earth.

Mantle helium stores

Science **319,** 943–945 (2008)

Higher ratios of the stable isotope ^{3}He to ^{4}He in ocean island basalts relative to mid-ocean ridge basalts are usually suggested to reflect a deep primordial mantle reservoir source for ocean island basalts that has undergone minimal melt extraction. However, a recent study contends that ^{3}He may instead be stored in the refractory mantle rocks left behind after melting.

Francis Albarede of the Université de Lyon, France, used numerical simulations to study helium diffusion in the mantle. He suggests that early in Earth's history, helium rich in ^{3}He moved from primordial mantle rock to the refractory melt residues.

During the production of ocean island basalts, the residues undergo considerable stretching, and helium is consequently transferred to ^{3}He-poor mantle sources of ocean island basalts, which subsequently melt to generate magmas high in ^{3}He. This helium diffusion does not occur during mid-ocean ridge basalt production, leading to the lower ^{3}He concentrations.

High impact

Nature **452,** 206–209 (2008)

New observations show signatures of the Gulf Stream deep in the upper troposphere, suggesting that the current has a much larger effect on atmospheric processes than previously thought.

The heat transported from low to high latitudes through the Gulf Stream is known to influence daily weather phenomena such as the formation of cyclones and clouds, but its effect on longer-term climate is poorly understood. Shoshiro Minobe from Hokkaido University, Japan, and colleagues used circulation models, operational weather analyses and recent satellite observations to determine the current's influence on the atmosphere. They found that surface wind convergence in the marine boundary layer is the anchor for a narrow band of precipitation that meanders with the Gulf Stream front. Associated upward motion and cloud formation reach well into the upper troposphere.

Deep atmospheric heating by the Gulf Stream may also drive remote climate anomalies through the formation of planetary waves, a process with implications for predictions of the spatial variability of future climate change.

Nitrate under the pavement

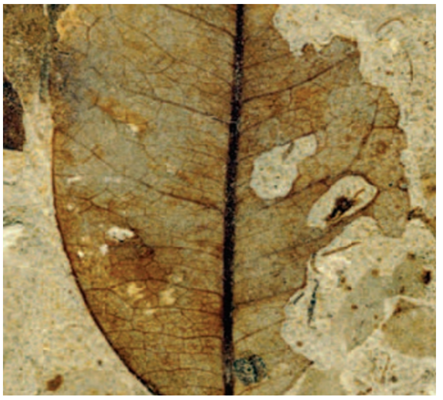
Geology 36, 259–262 (2008)

Desert pavement — a surficial mosaic of rock fragments — is a common feature of arid regions around the world. In the Mojave Desert of southern California, the soil immediately underlying desert pavement contains unusually high levels of nitrate, reports a new study.

Robert Graham from the University of California–Riverside, USA, and his colleagues measured the concentrations of nitrate and chloride from the uppermost metre of soils from three different locations in the Mojave Desert. They found that soils beneath desert pavement contained much higher nitrate concentrations than those lacking a pavement cover. Coexisting high concentrations of chloride indicate that these soils are poorly leached. As a result, nitrate deposited from the atmosphere or biogenic activity accumulates at shallow depth, rather than being carried away.

If these results are globally applicable, estimates of nitrogen stored in near-surface desert soils may increase fivefold.

The big buzz



ELLEN CURRANO

Proc. Natl Acad. Sci. USA **105,** 1960–1964 (2008)

The Palaeocene–Eocene Thermal Maximum, an abrupt global warming event 55.8 million years ago, is associated with high atmospheric CO_2, warmer oceans and, according to a new study, very hungry insects.

Ellen Currano of Pennsylvania State University, USA, and her colleagues analysed fossil leaves across the Palaeocene–Eocene boundary preserved in the Bighorn Basin, Wyoming, USA. They measured the amount and type of damage caused by feeding insects in thousands of fossils. The peak feeding frequency occurred at the height of the thermal maximum, before returning to background levels.

The team suggests that some insect habitats expanded northwards as temperatures rose, while other native populations flourished in the warm climate. Additionally, almost every plant species was targeted by specialized herbivores, which implies that the insects were able to respond quickly to changing climate and vegetation patterns caused by the rapid increase in atmospheric CO_2.