HYDROGEOLOGY

Conduit complications

Geology http://doi.org/khj (2013)

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Eruptions from geysers begin with an overspill of water, followed by a violent fountain of water and steam. Video footage from inside geysers in Russia shows that this eruption sequence is generated by a highly contorted network of water-filled conduits.

Alexander Belousov at the Institute of Volcanology and Seismology, Petropavlovsk, Russia, and colleagues lowered a video camera into four geysers in Geyser Valley, Kamchatka. The footage shows that the plumbing system in all four geysers consists of a main, vertical upper conduit that is connected by a lower horizontal pipe to a complex system of underground cavities. After an eruption, water flows along the horizontal pipe, filling the vertical conduit until it overflows at the surface. Steam then builds up in the underground cavities and becomes increasingly pressurized until it bursts through the horizontal pipe and up towards the surface, ejecting the water in the main conduit as it escapes.

The observations suggest that periodic geyser eruptions can only occur in rock formations that provide a complex plumbing system of convoluted conduits and cavities, which helps explain why geyser fields are so rare. *AW*

PALAEOCLIMATE

Miocene carbon

Paleoceanography http://dx.doi.org/10.1002/palo.20015 (2013)

The middle of the Miocene epoch, about 14 million years ago, was marked by global cooling and the expansion of the Antarctic ice sheet. Marine sediment geochemistry indicates this cooling was accompanied by a drop in atmospheric CO_2 concentrations and an increase in organic carbon burial.

Marcus Badger of Cardiff University and colleagues used geochemical proxies in Miocene-aged marine sediments that are now exposed in Malta to assess environmental changes during the mid-Miocene transition. The transition is associated with a perturbation in the Earth's carbon cycle, as indicated by a change in the carbon isotope signature of carbonates. The team found that during this perturbation, sea surface temperatures at Malta fell, as did the concentration of atmospheric carbon dioxide. They attribute the decline to the burial of organic carbon, consistent with earlier evidence for high marine productivity at this time.

The enhanced productivity was probably linked to changes in ocean and atmospheric circulation associated with the expansion of the Antarctic ice sheet itself, suggesting that carbon burial may be a positive feedback on global cooling. *AN*

CLIMATE SCIENCE

Northern warming

J. Climate http://doi.org/khk (2013)

The Northern Hemisphere has warmed faster than the Southern Hemisphere in the past decades. Model simulations suggest that this trend can be attributed to inter-hemispheric differences in the impact of rising greenhouse gas concentrations on climate, and will continue throughout the twenty-first century.

Andrew Friedman of the University of California, Berkeley, and colleagues assessed inter-hemispheric differences in mean temperatures between 1880 and 2099, using observations and climate model simulations. Temperature differences between the two hemispheres remained fairly stable until 1980, at which point disproportionate warming in the Arctic and over the Northern Hemisphere land masses created a hemispheric asymmetry. The team suggests that anthropogenic aerosols masked this asymmetry until the implementation of air pollution regulations in the Northern Hemisphere in the 1970s.

The hemispheric asymmetry is projected to increase this century, which could cause the tropical atmospheric overturning circulation to weaken in the north and strengthen in the south. The researchers note that this could lead to a northward shift in tropical precipitation. *AA*

ARCHAEAN GEOLOGY

Earth bombarded

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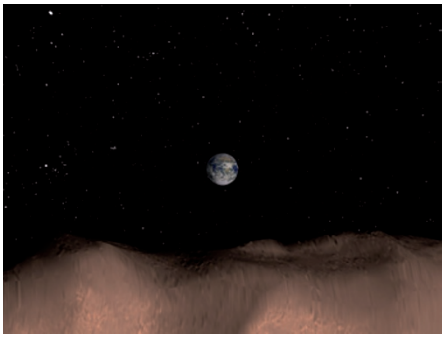

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Extraterrestrial craters and lunar samples suggest that the inner Solar System was pummelled by asteroids about 3.9 billion years ago, but the scarcity of contemporaneous rocks on Earth has limited our study of the terrestrial effects of the so-called Late Heavy Bombardment. An analysis of ancient zircons that were incorporated and preserved in younger sedimentary rocks suggests an intense thermal event on Earth at this time.

Elizabeth Bell and Mark Harrison from the University of California, Los Angeles, analysed the geochemistry of 4–3.6 billion-year-old detrital zircons from Western Australia. They found that the zircons from approximately 3.9 billion years ago were unique in showing geochemical characteristics that could be explained by recrystallization following exposure to extremely high temperatures.

The Late Heavy Bombardment is thought to have caused widespread heating of the Earth's ancient crust and provides a plausible — although not the only — mechanism to explain the evidence of thermal metamorphism preserved in the 3.9 billion-year-old zircons. *TG*

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