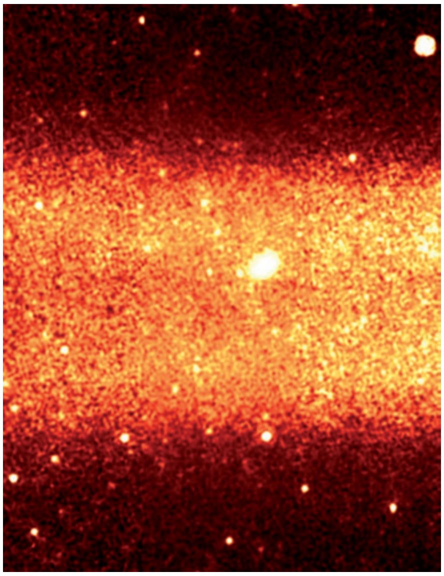
PLANETARY SCIENCE

Ring around Saturn

Icarus http://doi.org/rfq (2014)



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Particles in Saturn's largest and most recently discovered ring — the Phoebe ring — are so diffuse that they are difficult to observe. Spacecraft observations confirm that the particles could have originated from collisions with the nearby satellite, Phoebe.

Saturn's most distal ring is thought to be fed by collisions of micrometeoroids or larger objects with Phoebe or one of the other irregular satellites that make up the planet's outermost moons and travel around it on nonstandard orbits. Daniel Tamayo and colleagues at Cornell University, USA, analysed observations by the Cassini spacecraft of sunlight scattered off the Phoebe ring particles. Combined with previous observations at infrared wavelengths from the Spitzer Space Telescope, the team was able to measure the reflectance of light off the particles and show that the reflectivity of the ring material is consistent with material on the surface of Phoebe.

Material cast off Phoebe during collisions should migrate inwards over time and intersect the orbit of another of Saturn's moons, Iapetus. The ring material might thus coat the leading hemisphere of Iapetus, which could potentially explain the puzzling asymmetry in the colouration of the moon's surface. *TG*

CLIMATE CHANGE

Europe heats up

J. Clim. http://doi.org/rfr (2014)

Prolonged periods of extremely hot weather — heatwaves — can have a deleterious effect on human health. Climate model simulations suggest that the duration and frequency of such events could grow over the coming century.

Ngar-Cheung Lau and Mary Jo Nath, of the NOAA Geophysical Fluid Dynamics Laboratory, USA, examined the distribution and dynamics of heatwaves in Europe between 1979 and 2008, using a high-resolution atmospheric model and reanalysis data. They identified three key regions where heatwaves have occurred most often: western Russia, eastern Europe and western Europe. The heatwaves were accompanied by anomalous anticyclonic systems, indicative of the involvement of large-scale atmospheric waves in heatwave development. Additional simulations with the atmospheric model, assuming a total warming of 4.5 W m^{-2} over the twenty-first century, indicate that the duration of individual heatwaves in Europe could grow by a factor of 1.4 to 2, with the frequency increasing by a factor of 2.2 to 4.5, by the end of the century.

Simulations with a coupled general circulation model suggest that the number of heatwave days will rise monotonically over the twenty-first century. *AA*

DEEP EARTH

Cool core boundary

Science **343,** 522–525 (2014)

At the boundary between Earth's mantle and core, solid silicate rock meets liquid iron metal. High-pressure melting experiments on natural samples of mantle rocks now suggest that temperatures at the core–mantle boundary are lower than previously thought.

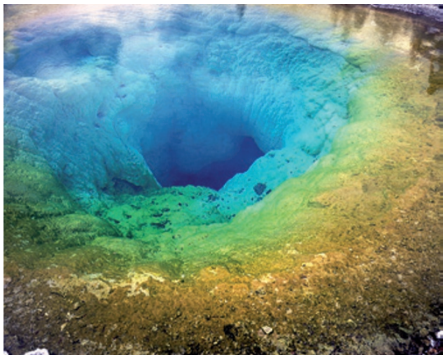
Ryuichi Nomura and Kei Hirose at the Tokyo Institute of Technology, Japan, and colleagues performed laboratory experiments to determine the maximum temperature at which primitive mantle rock remains completely solid, under the extreme pressures of the core–mantle boundary. Mantle rocks were thought to remain solid up to temperatures of about 4,000 K, but the researchers found that the rocks began to melt at just 3,570 K. Since the lowermost mantle is largely solid, this suggests temperatures cannot exceed 3,570 K. Such modest temperatures in the lowermost mantle also imply that the outer core is cooler than assumed, by up to 700 K. Pure iron would not be molten at these lower temperatures, but an iron-hydrogen mixture would.

The researchers suggest that hydrogen may have entered the core from the hydrous magma ocean that is thought to have existed on Earth during core formation. *AW*

GEOCHEMISTRY

Helium escape

Nature http://dx.doi.org/10.1038/nature12992 (2014)



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The fluids seeping from the Yellowstone caldera are rich in helium. The isotopic signature of this gas suggests that it is escaping from the underlying crust, where it had been accumulating for hundreds of millions of years.

Jacob Lowenstern and colleagues at the US Geological Survey measured the chemical and isotopic composition of gases escaping from hot springs and fumaroles in the Yellowstone Park in the northwest US over the past decade. Although much of the helium in these fluids comes from the mantle, the amount of ^{4}He and the composition of the coincident gases suggest an additional source. The authors argue that the helium is coming from a crustal reservoir that has been isolated for at least 172 million years — and possibly even billions of years. The most likely source is therefore the Archaean-aged rocks that underlie the caldera, which have been largely undisturbed for the past 2 billion years.

The onset of volcanism around the Yellowstone caldera about 2 million years ago probably mobilized this reservoir through metamorphism, fracturing and the migration of magmatic and hydrothermal fluids. *AN*

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