Warm and salty

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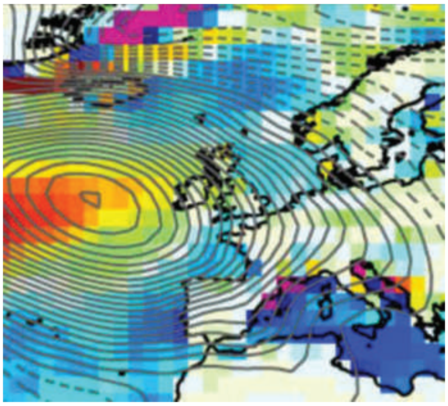

During the winters of 2004–5 and 2005–6, a greater amount of western Mediterranean deep water formed than during previous years, and the water itself was anomalously warm and salty. Observations indicate that both climatic and oceanographic conditions were key to the formation of the water mass.

Katrin Schroeder of CNR-ISMAR, Italy, and colleagues used temperature and salinity data from the western Mediterranean Sea, along with climate reanalysis products, to assess the factors driving the formation of the deep water. They report higher heat loss from the surface of the ocean than in the preceding years, which would have caused the surface of the ocean to become cooler and denser. In addition, evaporation in the months leading up to the formation of the water mass was high, but this alone was insufficient to account for the observed salinity.

Observations of nearby waters suggest that the extra salt could be supplied by the movement of a warm and salty water mass from the eastern Mediterranean into the region where the deep waters formed.

As the core cools

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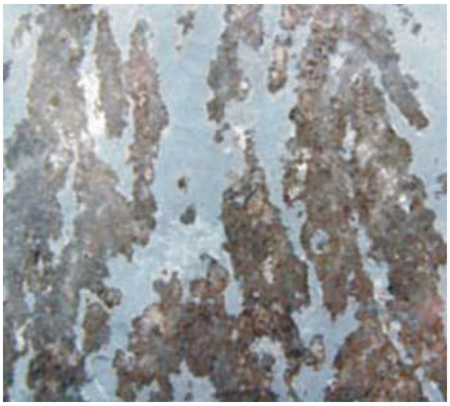
The heat lost by the Earth's core is sufficient to fuel the convection that drives the magnetic field, but is not so great that the solid inner part expands beyond its current size. Numerical modelling suggests that dense material found along the core/mantle boundary may have played an important role in maintaining this balance.

Takashi Nakagawa and Paul Tackley at ETH Zurich simulated the thermal evolution of the core, finding that the initial temperature has little influence on the final size of the inner core or the magnetic field. Instead, reproduction of the inner core size and magnetic field observed on Earth today resulted from a layer of dense material blanketing the core/mantle boundary. The dense layer restricts the transfer of heat from the core into the mantle, insulating the core and preventing the inner core from growing beyond its present size, whilst maintaining the convection that drives Earth's magnetic dynamo.

The researchers speculate that the dense material could reflect mid-ocean ridge basalt that, after being subducted, sank and accumulated in piles at the core/mantle boundary.

Volcanic blooms

Geology **38,** 447–450 (2010)



Palaeontological reconstructions suggest that during the Earth's most severe mass extinction event, extensive volcanic activity coincided with the development of widespread cyanobacterial mats in the shallow oceans covering what is now south China.

Shucheng Xie, of the China University of Geosciences, and colleagues used biochemical and sedimentary markers to document the timing and duration of cyanobacterial blooms in south China during the Permian–Triassic mass extinction, about 251 million years ago. The first and largest bloom followed the mass extinction, and coincided with the appearance of volcanic materials and other chemical signatures indicative of intense volcanic activity. The most probable candidate was volcanic activity in south China. Subsequent blooms were associated with volcanic episodes in Siberia.

The researchers suggest that volcanism-induced increases in oceanic carbon dioxide concentrations could have triggered the rapid growth and establishment of cyanobacterial mats.

Charred earth

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Vegetation burning and fossil fuel combustion generate black carbon, a highly stable carbon compound that is resistant to decomposition and could help to stabilize the soil organic matter pool. An analysis of temperate grassland soils suggests that black carbon makes up a significant proportion of soil carbon reserves.

Andrej Rodionov of the University of Bayreuth, Germany, and colleagues quantified the amount of black carbon in locations from Russia to Argentina. According to their measurements, black carbon comprises 5–30% of soil organic carbon stocks. The burning of local vegetation seemed to be the primary source. Black carbon stocks were highest in China and Russia, which the authors attribute to greater vegetation mass in these regions, and thus greater black carbon gains on burning.

Radiocarbon dating suggests that charred particles have been accumulating in these grassland soils over the past 7,000 years.

Martian mud

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Tens of thousands of unusual mounds, each up to a kilometre wide, litter the floor of the Acidalia plains on Mars. A comparison to similar features on Earth suggests the mounds may result from mud volcanism.

Dorothy Oehler and Carlton Allen at the NASA Johnson Space Center assessed the size, shape and mineralogy of the strange mounds using high-resolution images and the emitted infrared spectra recorded by the Mars Reconnaissance Orbiter. The mounds have smooth surfaces, and some have apron-like sloping extensions, whereas others are surrounded by moats. All are composed of different minerals from the surrounding plains. These distinct characteristics bear a striking resemblance to mud volcanoes on Earth.

Mud eruptions in the martian surface could result from the rapid outflow of over-pressurized fluid, triggered by tectonic or hydrothermal activity, destabilization of chemical compounds or simply from the sublimation of ice. Mud volcanism draws unaltered material from underground up to the surface, and thus could provide access to martian material from deep, otherwise-inaccessible zones.