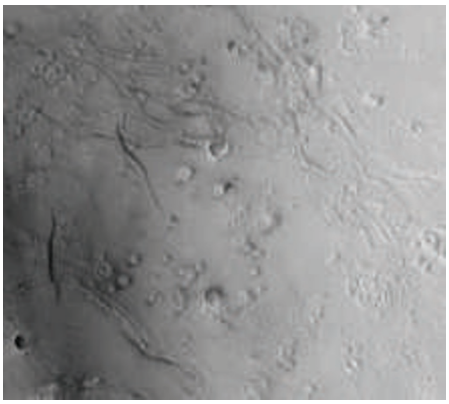
Volcanoes all around

J. Geophys. Res. doi:10.1029/2010JE003578 (2010)



NASA/JPL/ASU

The main phase of activity in the largest volcanic centres on Mars occurred between three and four billion years ago. Now images of smaller-scale eruptions located far from the giant volcanoes indicate that this episode of volcanism may have been widespread.

Using high-resolution images from the Mars Reconnaissance Orbiter, Julia Lanz at the Universität Stuttgart and colleagues identified a small volcanic rift zone in Utopia Planitia in the northern lowlands. These images reveal ancient volcanic fissures, lava flows and fingered intrusions that are similar to those observed in rift zones on Earth. Based on the number of impact craters dotting the surface of the rift zone, the researchers estimate that it formed at the same time as large volumes of lava were erupting from giant volcanoes in the southern highlands and Syrtis Major.

The findings imply that volcanic processes may have been active across the surface of Mars, rather than being confined to the few large volcanic complexes that have so far been identified.

Southern connections

J. Clim. doi:10.1175/2010JCLI3722.1 (2010)

Model simulations and observational analysis suggest that the South American summer monsoon influences the development of the Benguela Niño — a climate event characterized by anomalous sea surface temperatures in the southeast Atlantic Ocean.

Alice Grimm of the Federal University of Paraná, Brazil, and Christopher Reason of the University of Cape Town investigated potential connections between the South American monsoon and rainfall in southern Africa during years when Benguela Niño conditions occurred. The observations showed that South American rainfall anomalies during the summer monsoon precede the peak of the Benguela Niño and the associated rainfall anomalies in Africa. According to the simulations, monsoon convection anomalies perturb the tropical Walker circulation between the two continents, affecting southerly winds near the African coast and sea surface temperatures.

However, this teleconnection seems to operate in only one direction; changes in convection over Africa have little impact on the South American monsoon.

Anchors in the mantle

Earth Planet. Sci. Lett. doi:10.1016/j.epsl.2010.08.013 (2010)

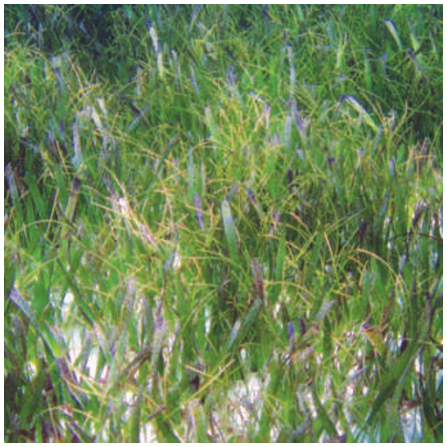
Two regions of excess mass near the core–mantle boundary may control continental motion and large-scale mantle flow, according to numerical simulations.

Adam Dziewonski of Harvard University and colleagues re-examined several three-dimensional global models of shear velocity in the mantle. In the deepest 1,000 km of the mantle, above the core–mantle boundary, the velocity models are dominated by two slow areas located on opposite sides of the Equator. These slow areas are separated by a band of fast velocity. This observed structure is unlikely to have formed randomly. The pattern, which the authors term the 'mantle anchor structure', is associated with the distribution of hotspots and subduction zones. They suggest that this structure formed early in the history of the Earth — perhaps when the core separated from the mantle — and will probably remain stable in the future.

The anchor structure reflects the location of the African and Pacific superplumes, suggesting that the plumes have been fixed for at least 200 million years.

Sea-meadow sediment

Glob. Biogeochem. Cycles doi:10.1029/2010GB003848 (2010)



ALEX HARBER, FLORIDA KEYS NATIONAL MARINE SANCTUARY

Seagrass meadows line much of the world's coast. Sediments at these sites accumulate large quantities of carbon, but the source of that carbon has been uncertain. Isotopic analyses indicate that more than half of the sedimentary carbon is derived from the seagrass itself.

Hilary Kennedy of Bangor University, UK, and colleagues combined isotopic measurements of seagrass leaves and sediments with a multisource mixing model to determine the source of sedimentary organic carbon in more than 200 seagrass meadows around the globe. The results suggest that organic debris from these marine plants comprises just over half of the organic carbon pool in the meadows' surface sediments. The researchers estimate that seagrass organic matter accumulates at a rate of 41–66 g carbon m^{-2} yr^{-1}.

The reductions of these meadows in recent years by pollution and habitat destruction may have diminished the size of this coastal carbon sink.

Muted variability

Paleoceanography doi:10.1029/2010PA001951 (2010)

Millennial-scale variability was a persistent feature of North Atlantic climate from 2.6 to 2.4 million years ago, marine sediment records suggest. Dramatic climate swings are known from more recent glacial periods, but the existence of such variability in early glacial–interglacial cycles has been unclear.

Clara Bolton of the University of Southampton and colleagues analysed a marine sediment core from the subpolar North Atlantic Ocean, looking for signs of changes in surface water properties and ice-rafted debris. They found evidence for millennial-scale changes in climate during the four glacial–interglacial cycles from this period. However, unlike more recent variations, which were amplified during glacial periods, they found no relationship between the magnitude of the climate swings and the amount of continental ice, as inferred by changes in sea level. Instead, moderate variability characterized the entire interval.

The researchers suggest that the threshold for amplification of climate variability — thought to be related to ice volume in the Northern Hemisphere — was not crossed during these early glacial events, or that ice volume was not the most important factor.