research highlights

Feeling the heat

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Geochemical and textural evidence suggests that pieces of the Earth's crust picked up by magma may at least partially melt in a matter of hours. These crustal xenoliths, as they are called, are then carried to the surface by volcanic eruptions, where they are prized for the insights they provide into the processes that alter magma composition.

Cliff Shaw of the University of New Brunswick in Fredericton, Canada compared the mineralogy, texture and chemical composition of crustal xenoliths and host lava from the Rockeskyllerkopf volcanic complex of the West Eifel volcanic field in Germany. The result indicated that the glassy rinds that coated many of the xenoliths formed in just 12 hours or so, as the silica-rich fragments reacted with the hot, silica-poor magma.

Xenoliths from this particular region are unique in that they are almost completely separated from the surrounding rock. Shaw suggests that the creation of gas bubbles during rind formation separated the xenoliths from the enveloping lava.

Restless Moon

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Clusters of quakes in the Moon's deep interior — called moonquakes — are generally attributed to deformation from the Earth's gravity. Although this is probably the case for some quakes, a seismic reanalysis shows that others may be caused by mineralogical changes deep within the Moon's interior.

Renee Weber, of the US Geological Survey, Flagstaff, and colleagues reanalysed 39 moonquake clusters that were recorded by lunar-based seismometers during the Apollo Passive Seismic Experiment, from 1969 to 1972. About a third of the quakes could be attributed to failure along discrete planes of weakness, triggered by tidal deformation arising from Earth's gravitational pull. However, this mechanism could not explain the remaining moonquakes.

The structure of minerals within the Moon's deep interior may evolve in response to increasing pressure with depth, as on Earth. The team speculates that that these structural changes could generate stresses that would give rise to some moonquakes.

A tough shell

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Desert pavements are hard surfaces consisting of a mosaic of pebbles, and are common in very arid regions. Dating of such pavements from the Negev Desert of Israel shows that these particular pebbles have resisted the forces of erosion for well over a million years.

Ari Matmon of the Hebrew University of Jerusalem and colleagues measured exposure ages from multiple samples of desert pavement at two sites separated by over eight kilometres in the Paran Plains region. Whereas individual samples of pavement from other deserts have suggested long exposure times at single locations, the samples of Negev pavement indicate that most of the surface has been exposed for up to 1.8 million years.

The ages of the Negev pavement point to a landscape that has been exceptionally stable for a long period of time, probably because of a combination of environmental conditions such as extreme dryness, surface flatness and a lack of significant tectonic disturbance, as well as the armouring effect of the pavement.

Carbon consumption

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The Intergovermental Panel on Climate Change projections show that the upper ocean is likely to warm by 1–6 °C by the end of this century. Experiments show that this warming could decrease the amount of carbon transported to the deep ocean.

Julia Wohlers, of the Leibniz Institute of Marine Sciences, Germany, and colleagues exposed natural plankton communities to temperature increases of up to 6 °C in an indoor mesocosm experiment. Under the maximum warming scenario, net consumption of dissolved inorganic carbon fell by 31%. Their measurements indicate that this was not due to a reduction in photosynthetic uptake, but rather to an increase in respiratory consumption of the photosynthetically derived organic carbon, which re-releases dissolved inorganic carbon. Furthermore, warming increased the concentration of dissolved organic carbon relative to particulate organic carbon, making the accumulating material less susceptible to sinking.

The researchers warn that an increased consumption of organic matter in the surface ocean, combined with a reduction in the amount of carbon sinking to depth, could increase the atmospheric load of carbon dioxide.

Interstadial timing

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The last glacial period was punctuated by abrupt transitions to interstadial (warm) conditions. An analysis of an event 38,000 years ago — as recorded in the ice core from the North Greenland Ice Core Project — reveals that mid-latitude climate change preceded Greenland warming by several years.

Elizabeth Thomas of the British Antarctic Survey and colleagues used multiple proxies to reconstruct climatic conditions during this abrupt warming, one of the most prominent of the last glacial period. The ice core's annual layers showed that the approximately 11 °C warming over Greenland occurred over about 26 years. However, the team also found that a few years before the warming kicked in, the dust supply from Asia declined, which they relate to a strengthening of the summer monsoon. At about the same time, there was a shift in the hydrogen and oxygen isotopes of the ice, suggesting a northward migration of the polar front.

The lag between the strengthening of the Asian monsoon and Greenland warming could point to a trigger for glacial abrupt climate change in the tropics or the Southern Hemisphere, rather than the north.