Ancient mantle samplers

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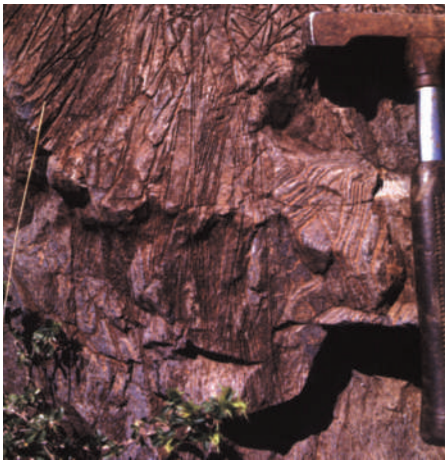

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The formation of the Earth's core and the subsequent addition of material to the planet by meteoritic bombardment left their mark on the concentrations of platinum group elements in the deep mantle, according to new analyses of ancient volcanic rocks.

Wolfgang Maier of the University of Oulu, Finland and colleagues analysed the concentrations of platinum group elements in ~3.2–3.5-billion-year-old komatiites — magnesium-rich volcanic rocks that were extracted from the deep mantle. They found much lower concentrations in these rocks compared with values reported for younger komatiites that date back to less than 3 billion years ago.

The researchers infer that the more ancient volcanic rocks originated from regions in the deep mantle where platinum group elements, with their strong affinity for iron, were lost to the Earth's iron-rich core at its formation. By contrast, the mantle source of the younger komatiites must have been replenished after core formation, most probably when meteoritic bombardment added material to the Earth's surface that was eventually mixed to depth by convection.

Coastal hum

Geophys. Res. Lett. **36,** L13303 (2009)

Gentle vibrations of the Earth that are unrelated to earthquakes originate dominantly owing to the interaction of ocean waves with coastlines — particularly the west coasts of North America, Central America and Europe — suggests a recent analysis. Measurements of these vibrations have been recorded as a constant hum by instruments used to detect earthquakes.

Peter Bromirski and Peter Gerstoft of the Scripps Institute of Oceanography, California, determined the sources of hum by analysing recordings made in the western United States. The researchers found that hum levels peak when waves from strong storms reach the coast. This suggests that waves generated in the deeper parts of the ocean by storms do not constitute important sources of hum.

The west coasts of North America and Europe were strong hum-source regions due to intense storms in the North Pacific and North Atlantic oceans. Surprisingly, intense South Pacific storms aligned to direct wave energy northwards, making the west coast of Central America a strong hum-source region.

Interglacial productivity

Earth Planet. Sci. Lett. doi:10.1016/j.epsl.2009.06.007 (2009)

Changes in the chemistry of tropical Indian Ocean deep water during the last interglacial were driven by increased surface productivity, rather than shifting deepwater circulation, according to a recent geochemical analysis of marine sediments.

Alexander Piotrowski of the University of Cambridge and colleagues combined measurements of neodymium isotopes in marine sediments and stable carbon isotopes of the shells of bottom dwelling foraminifera to tease apart the influences of productivity and water source on Indian Ocean deepwater chemistry over the past 150,000 years. The neodymium isotope ratios suggest that the water masses that bathed the site during both the Holocene and the most recent interglacial period came from a similar source. However, the carbon isotopes indicate differing amounts of nutrients in the deep waters, which can sometimes be an indicator of different water masses.

The team concludes that, instead, the higher nutrient concentrations during the last interglacial were driven by increased surface productivity and higher transport of organic matter from the surface to the deep ocean.

Tropical transplant

Glob. Biogeochem. Cycles **23,** GB3003 (2009)

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CO_2 fertilization could prevent the Amazon forest from drying up and being replaced by savannah. Increased levels of atmospheric CO_2 are predicted to increase vegetative growth at higher latitudes, but, until now, the impact of fertilization on tropical forests has remained uncertain.

David Lapola, of the National Institute for Space Research in Brazil, and colleagues examined the impact of climate change on vegetation in tropical South America in the latter half of the twenty-first century with a vegetation model and a range of future climate and CO_2 fertilization scenarios. When the fertilization effect of carbon dioxide was included in model simulations, the Amazonian biome remained relatively stable — due to increased water-use efficiency and photosynthetic rates. But when fertilization effects were excluded, the Amazonian tropical forest became increasingly dry, and was replaced by savannah.

In both scenarios, when the dry season exceeded an average of four months, less productive biomes, such as savannah, shrubland and semi-desert, predominated.

A monsoonal trigger?

Geology **37,** 599–602 (2009)

Around 2.7 million years ago, Earth's climate underwent a profound transformation that led to significant glaciation in the Northern Hemisphere. Mineralogical data indicate that the Asian monsoon strengthened markedly for about 1.5 million years preceding this transformation, and may have triggered the phase of glaciation.

Yi Ge Zhang from the Nanjing University in China and colleagues analysed the ratio of hematite to goethite — iron-bearing minerals that occur in weathered soils — in sediments from the South China Sea. They found that this ratio decreases notably in sediments that were deposited from about 4.2–2.7 million years ago. Because goethite forms in relatively humid conditions, the decreasing ratio suggests enhanced rainfall due to an intensified monsoon.

The researchers suggest that the stronger monsoon led to increased weathering of continental material, a process that consumes atmospheric carbon dioxide. Decreasing levels of the greenhouse gas could have led to global cooling and the onset of Northern Hemisphere glaciation.