Seafloor subsidence

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Seafloor height is thought to be a function of age, with old, cold crust subsiding over time. However, some of the oldest seafloor is higher than expected. Topographic analyses of the bottom of the Pacific Ocean now suggest that the rate at which the seafloor subsides is dictated by flow in the underlying mantle.

To assess the relationship between seafloor height and mantle flow, Claudia Adam at the Centro de Geofisica de Evora, Portugal, and Valérie Vidal at the Ecole Normale Supérieure de Lyon, France, looked at the Pacific basin, where a drastic change in plate motion about 50 million years ago led to a misalignment between the gradient of seafloor ages and the direction of the underlying mantle flow. The Pacific basin therefore provides the perfect test for the relative control of age versus mantle flow on seafloor height. Topographic profiles following the direction of mantle flow showed a clear decline in seafloor height, whereas those following the age gradient did not.

The researchers conclude that seafloor subsidence is primarily driven by the underlying mantle flow, rather than the age of the seafloor.

Origin of swirls

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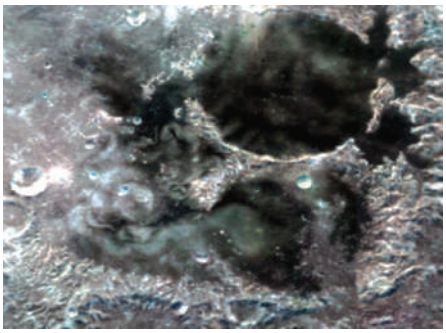

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Lunar swirls are distinctive, highly reflective markings that litter the surface of the Moon and have been associated with impacts from comets. However, a study of similar features on Mercury suggests that instead, magnetic shielding from the solar wind is primarily responsible for the Moon's swirls.

David Blewett, from Johns Hopkins University, and colleagues studied high-resolution images of potential swirls on Mercury. Like the Moon, Mercury is heavily cratered and lacks an abundant atmosphere, meaning that similar features on both objects should share a common origin. Although Mercury has unusual, highly reflective markings, the team found that these deposits lack the distinctive characteristics of lunar swirls. Because Mercury receives more comet impacts than the Moon, the lack of swirls on Mercury argues against the comet-impact hypothesis.

Instead, lunar swirls probably result from local magnetic anomalies in the crust that shield small areas of the Moon's surface against space weathering from the solar wind, preserving a bright, highly reflective, patterned surface.

Ecuadorian glacials

Paleoceanography
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Over the past half-million years, precipitation along the coast of Ecuador has varied across glacial–interglacial cycles, with more aridity associated with glacial conditions, according to marine sediment-based reconstructions.

Daniel Rincón-Martínez of the Alfred-Wegener Institute for Polar and Marine Research, Germany, and colleagues used a suite of proxies to reconstruct ocean surface conditions in the equatorial eastern Pacific Ocean. They find the lowest amounts of terrestrial run-off during glacial periods, along with strong latitudinal and meridional sea-surface temperature gradients in the Pacific. The team attributes this to more La Niña-like conditions, coupled with a northward shift of the intertropical zone during glacial periods.

Globally, however, the intertropical zone is thought to shift southward during glacials. The contrasting movement in the equatorial eastern Pacific may be driven by strong glacial cooling in the southeast Pacific, which would locally push the intertropical convergence zone northward.

Remote regions

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Atmospheric pollutants hinder the growth of vegetation in industrial centres and areas of intense pollution. New data suggest that at least one pollutant — sulphur — also limits growth in remote forests over large areas of northern Eurasia.

Yulia Savva and Frank Berninger, of the Université du Québec à Montréal, examined the impact of sulphur deposition on tree growth in Scots Pine forests in northern Eurasia that were assumed to be pristine between 1930 and 1980. Using measurements of tree-ring width, they found that tree growth declined by 17% over this period. After accounting for the effects of climate change in the region, they show that the decline in growth was closely correlated with sulphur deposition. Trees exposed to higher levels of sulphur deposition also proved to be more susceptible to damage from droughts.

The deposition of sulphur was associated with deposition of nitrogen, a fertilizer for the trees. This positive effect, however, was too slight to counter the negative impacts of sulphur.

Continental collision

Lithos doi:10.1016/j.lithos.2010.03.015 (2010)

Magmatic rocks from North Africa reveal a period of tectonic quiescence from 800 to 600 million years ago, before the burst of tectonic activity that marked the formation of the East African Mountains. This mountain belt was formed during the collision between the East and West Gondwanian continents.

Cosmas K. Shang at the University of Tübingen, Germany, and colleagues assessed the chemistry and age of magmatic rocks taken from central North Sudan. The rocks were found to have been derived from very young mantle sources, and were added to the crust about 707 to 718 million years ago. The chemistry of the rocks also suggests that they were added during a tectonically quiet period.

Although the region was relatively stable, the researchers suggest that the pulse of volcanism that formed the rocks was a result of the onset of the collision between East and West Gondwana, marking the start of the formation of the supercontinent Gondwana.