GEODYNAMICS

Dense mountain roots

Earth Planet. Sci. Lett. **361,** 195–207 (2013)

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Parts of the lowest crust and lithospheric mantle are missing beneath many mountain ranges worldwide. Numerical modelling shows that the deep crustal root of a mountain belt can become so dense that it breaks away and sinks into the underlying mantle.

Neil Krystopowicz and Claire Currie at the University of Alberta, Canada, simulated the formation of a mountain range as two tectonic plates converge using a thermal-mechanical numerical model. During the simulated plate collision, the crust thickens to create a high mountain range at the surface, while a deep crustal root forms below. Because the pressures at depth are higher, the root undergoes metamorphism and is transformed into eclogite, an unusually dense rock type. The eclogitic root is denser than the underlying mantle, so it sinks further into the mantle. This, in turn, causes localized deformation at the surface above the root, and promotes further crustal thickening and further eclogitization.

In the simulations, the root eventually becomes gravitationally unstable, peels away from the remainder of the crust and sinks. Hot mantle wells upwards in the wake of the sinking crustal root, causing magmatism and abrupt uplift at the surface. *AW*

PALAEOCEANOGRAPHY

Sea level trigger

Geol. Soc. Am. Bull. http://doi.org/j7p (2012)

About 6 million years ago, the water exchange between the Atlantic Ocean and the Mediterranean Sea closed down, leaving the Mediterranean to desiccate. A reconstruction of climate at that time suggests that falling sea level may have been the final trigger.

Gonzalo Jiménez-Moreno of the Universidad de Granada, Spain, and colleagues collected a core of marine sediments from the Atlantic side of the connection with the Mediterranean. They analysed pollen grains and marine fossils, and found that sea level was relatively high in the Atlantic ocean in the 350,000 years leading up to the isolation of the Mediterranean. However, immediately preceding the desiccation, the climate cooled and sea level dropped rapidly. The magnitude of the sea level change could have been as little as a few tens of metres. However, earlier tectonic activity in the region of what is today the Strait of Gibraltar had left only a shallow gateway between the Mediterranean and Atlantic.

Once sea level fell, the main source of water inflow to the Mediterranean was cut off and the ocean began to evaporate. The authors suggest that the negative water balance may have been compounded by regional aridity, which would also have limited continental runoff into the basin. *AN*

CLIMATE SCIENCE

Shifting storm tracks

J. Climate http://doi.org/j7q (2013)

The intensity of tropical cyclones is projected to increase over the coming century. Model simulations in the North Atlantic suggest that the tracks of tropical cyclones are also set to shift.

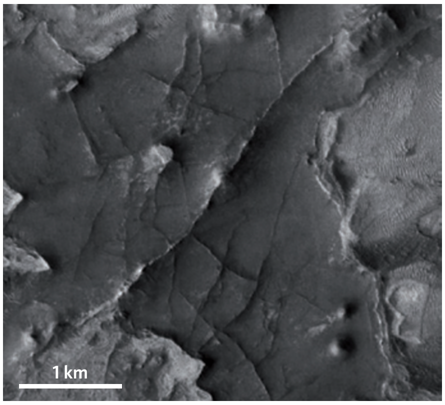
Angela Colbert of the Rosenstiel School of Marine and Atmospheric Science, University of Miami, and colleagues assessed the impact of a rise in greenhouse gas concentrations over the twenty-first century on tropical cyclone tracks in the North Atlantic, using climate model simulations and a hurricane track model. The frequency of straight-moving cyclones — which tend to hit the Caribbean coast and the Gulf of Mexico — is projected to decline by 5.5%. In contrast, the frequency of cyclones that re-curve into the open Atlantic Ocean and avoid the US coast is projected to grow. As a result, the tropical storm count is projected to fall by 1–1.5 tropical cyclones per decade over the southern Gulf of Mexico, the Caribbean and Central America. The mid-Atlantic storm count is projected to rise by the same amount.

The researchers suggest that an eastward shift of locations where the cyclones form, together with a weakening of the subtropical easterly winds, is responsible for the change in curvature of tropical storm tracks. *AA*

PLANETARY SCIENCE

Ridged terrain

Geophys. Res. Lett. http://dx.doi.org/10.1002/grl.50106 (2013)



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Alteration of the early martian crust by subsurface hydrologic processes has been proposed to explain the presence of clay minerals exposed on the surface of Mars. High-resolution images of topographic ridges on the floors of martian impact craters suggest that the ridges represent fossilized conduits through which subsurface fluids once flowed.

Lee Saper and John Mustard at Brown University, USA, used orbital spacecraft imagery to map the distribution, orientations and characteristics of linear ridges in Nilosyrtis and Nili Fossae, two heavily eroded regions of Mars. They find that the ridges are associated with clay-bearing basement rocks. They exclude a magmatic origin and instead interpret the ridges as a complex of fractures and other impact-related structural features through which hydrothermal fluids percolated. Cemented by precipitated minerals, the filled fractures would have been relatively resistant to erosion compared to the surrounding rocks, leading to the ridges observed today.

The hydrologically active conduits would have facilitated widespread alteration of the early martian crust. The evidence for regional hydrothermal activity in the martian subsurface suggests that these regions could have once contained a viable and persistent habitable zone. *TG*

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