GEODYNAMICS

Mountains afloat

Geology http://doi.org/qb5 (2013)

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The Atlas Mountains of Morocco are unusually high, given that only a moderate amount of faulting has helped to build the topography. Now, seismic images show that hot mantle is upwelling beneath the Atlas Mountains, which may give the range extra buoyancy.

Meghan Miller and Thorsten Becker at the University of Southern California used seismic data to identify the boundary between the flowing asthenospheric mantle and the overlying rigid lithosphere in the North African region. Beneath the Atlas Mountains, the boundary is shallow and offset upwards relative to the surrounding area. The researchers suggest that hot mantle is rising up and being channelled beneath the mountain range. They use numerical simulations to show that the extra buoyancy provided by such hot, upwelling mantle can explain the unusual height of the Atlas Mountains.

Large Jurassic-aged faults bound the Atlas Mountains and were probably reactivated by the upwelling mantle, creating the observed offset in the lithosphere–asthenosphere boundary. The offset, which creates a ridge in the base of the lithosphere, probably helped guide and focus more rising mantle. The result implies that large, lithosphere-scale faults may play an important role in mountain building. *AW*

CLIMATE CHANGE

Tropics on the move

J. Clim. http://doi.org/qb7 (2013)

The tropics, as defined by climatological patterns of rainfall, evaporation and atmospheric circulation, have expanded polewards over the past 30 years, but the rate and cause of this expansion has remained unclear. Climate model simulations suggest that human-induced changes in the radiative balance of the atmosphere account for just a small fraction of the expansion of the tropical belt.

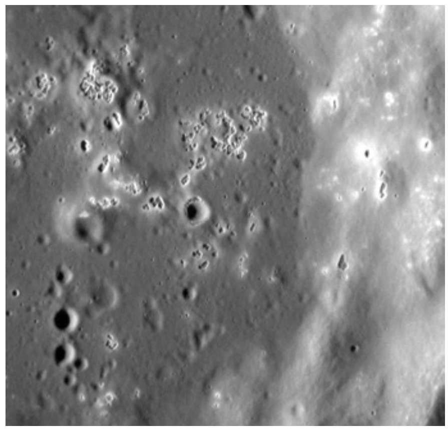
Xiao-Wei Quan, of the University of Colorado, and colleagues examined the rate at which the subtropical dry zone — which reflects the poleward edges of the tropical belt — expanded between 1979 and 2009, using the NCAR Community Climate model. Taking the average of multiple simulations, in which observed variations in radiative forcing and ocean changes were specified, they show that the rate of subtropical dry zone expansion ranged from 0.1 to 0.2° latitude per decade. The modelled rate of expansion is considerably lower than some previous estimates that rely on reanalysis data suggest. The authors suggest that observational errors make some of these empirically derived expansion rates — which can amount to over 1° latitude per decade — unreliable.

The researchers further show that the growth of the tropical belt over a 30-year period largely results from natural as opposed to human-induced variability in the sensitivity of the atmosphere to ocean warming. *AA*

PLANETARY SCIENCE

Holey Mercury

Icarus http://doi.org/qb6 (2013)



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The surface of Mercury is pockmarked by fresh, shallow, kilometre-wide depressions dubbed 'hollows'. A survey of recent images obtained by the MESSENGER spacecraft shows that the distribution of the hollows on Mercury's surface is consistent with an origin by sublimation of volatiles from a reservoir beneath the surface.

Rebecca Thomas and colleagues at The Open University, United Kingdom, mapped the occurrences of the depressions using available MESSENGER images. They find that hollows cover 0.08% of Mercury's surface and usually — but not exclusively — occur in clusters within impact craters. Most of the features occur in areas where heating of the surface by the Sun is high or where the subsurface has been heated by volcanism. The hollows could thus have been formed by sublimation from a volatile-bearing unit after it was exposed by an impact or volcanic eruption.

The hollows are present in many regions of Mercury, indicating that volatile-rich material is widespread across Mercury's subsurface. *TG*

PALAEOCLIMATE

Tethys effect

Clim. Past **9**, 2687–2702 (2013)

A period of relative climate warmth ended about 14 million years ago during the middle Miocene climate transition. The closure of the Tethys Seaway that connected the Indian and Mediterranean basins could have contributed to this cooling, numerical simulations suggest.

Noémie Hamon of IPHEP and LSCE, France, and colleagues used a coupled ocean–atmosphere general circulation model to assess the impacts of the closure of the Tethys Seaway on the global ocean circulation. In simulations with a deep seaway, a warm and saline water mass formed at intermediate depths, and carried heat from the northern Indian Ocean to the Southern Ocean. However, if the seaway shoaled or closed entirely, intermediate water formation ceased, and the Indian Ocean cooled and freshened as far south as 60° S. The closure of the eastern Tethys did, however, promote the flow of water from the Mediterranean to the Atlantic down to 400 m depth, strengthening the southern limb of meridional overturning circulation in the Atlantic.

The absence of Tethys intermediate water and the strengthening of Atlantic overturning should have strengthened the ocean current that circles Antarctica, but were probably not the only causes of cooling at this time. *AN*

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