Rain in the Negev

Quat. Sci. Rev.
doi:10.1016/j.quatscirev.2010.06.014 (2010)

ANTON VAKS

The Negev Desert of Israel is part of the Saharan–Arabian desert, the largest and most arid desert system in the world. Cave deposits reveal that this aridity was punctuated by four distinct clusters of humid episodes during the past 350,000 years.

Anton Vaks, of the Geological Survey of Israel, and colleagues analysed the age and isotopic composition of calcium carbonate deposits in caves scattered throughout the Negev Desert. Deposition, which can only occur under humid conditions, peaked during four periods: 350,000 to 310,000; 310,000 to 290,000; 220,000 to 190,000; and 142,000 to 109,000 years ago. Three of the humid periods occurred during interglacials, with another occurring during relatively warm conditions within a glacial period. All were, however, associated with a peak in incoming solar radiation during summers in the Northern Hemisphere.

The team attributes the precipitation to increased intensity of cyclones over the Atlantic and Mediterranean oceans, which allowed some of the storms to penetrate further south into the central and southern Negev, periodically increasing rainfall and moisture availability.

Tectonics delayed

Earth Planet. Sci. Lett.
doi:10.1016/j.epsl.2010.07.021 (2010)

Whether or not plate tectonics operated on a younger, hotter Earth is a matter of some debate. Preserved remnants of ancient crust in Canada now indicate that plate tectonics may not have been fully established until about 1.8 billion years ago.

David Thompson, of the University of Bristol, and colleagues used seismic data to assess the structure and thickness of the ancient continental crust in the Hudson Bay region. They found that crust between 3.9–2.7 billion years old has a relatively simple structure with no clear evidence that it was subjected to plate tectonic processes similar to those operating today. In contrast, crust formed about 1.8 billion years ago records the collision of two continents, in a setting similar to that of the ongoing collision between India and Asia.

A comparison of the observed structure of the Hudson Bay crust with continental crust of a similar age found elsewhere in the world led the researchers to conclude that modern-style plate tectonics could not be sustained on the young hot Earth, but instead developed later as it gradually cooled.

Collapsed crust

Geol. Soc. Amer. Bull. **122,** 1717–1728 (2010)

The collapse of the crust following the eruption of large volumes of magma can explain the unusual style of crustal extension seen in the Red Sea Rift, according to a regional tectonic analysis.

Valerio Acocella, of the Università Roma Tre, assessed the unusual topography created by domino-like, tilted blocks of crust in central Afar, east Africa. Usually, when a continent is split by diverging tectonic plates, the extending crust divides into large, kilometre-scale blocks that collapse away from the rift. But in parts of Afar, the blocks had collapsed inwards, towards the rift centre. The movement of these blocks was contemporaneous with the eruption of large volumes of volcanic rock, indicating that the crust had subsided in response to the magma chamber emptying at depth.

Acocella suggests that in regions where the underground magma chamber is very large, extensive tracks of crust could potentially cave in, creating a collapsed rift.

Arctic heat loss

Geophys. Res. Lett.
doi:10.1029/2010GL044136 (2010)

© ISTOCKPHOTO VEIKKO RIHU

The Arctic region has warmed faster than the rest of the globe in past decades, due in part to a decrease in surface albedo. Heat loss from the surface of the Arctic Ocean has exacerbated this warming, according to an analysis of meteorological data.

James Screen and Ian Simmonds, of the University of Melbourne, examined the impact of changes in sea ice cover on warming in the Arctic, using temperature and sea-ice data collected between 1989 and 2009. Surface warming was apparent throughout the 21-year measurement period, but was most pronounced in autumn and winter. Warming was greatest in areas of extensive autumn/winter sea-ice loss. Surface cooling was apparent in only one region, which was subject to an increase in sea ice. Measurements of ocean-to-atmosphere heat flux revealed that oceanic heat loss was exacerbated in the autumn and winter in regions where sea ice was lost.

The increase in heat loss from the ocean can be attributed to the escape of previously trapped heat, as well as an increase in energy gained by the ice-free ocean in the summer.

Nano nucleation

Atmos. Chem. Phys. **10,** 7009–7016 (2010)

Nanometre-sized clusters of particles or molecules may facilitate new particle formation in the atmosphere over forested sites, but not over coastal regions, atmospheric particle concentrations suggest. Nanoparticles are thought to provide a surface for the growth of new, larger particles that influence climate by reflecting and absorbing solar radiation, and by stimulating cloud formation.

Katrianne Lehtipalo, of the University of Helsinki, and colleagues measured atmospheric nanoparticle concentrations at a coastal location in Ireland and a boreal forest site in Finland, to determine mechanisms of new particle formation. They observed particles smaller than three nanometres at both sites. Forest nanoparticle concentrations were high — reaching tens of thousands of particles per cubic centimetre — and of sufficient magnitude to explain new particle formation events previously observed in the region. However, nanoparticle concentrations at the coastal site were an order of magnitude lower, and could not account for new particle formation events at this site.

The researchers suggest that new particles detected at coastal sites may arise from the condensation of iodine vapours commonly found in marine air masses.