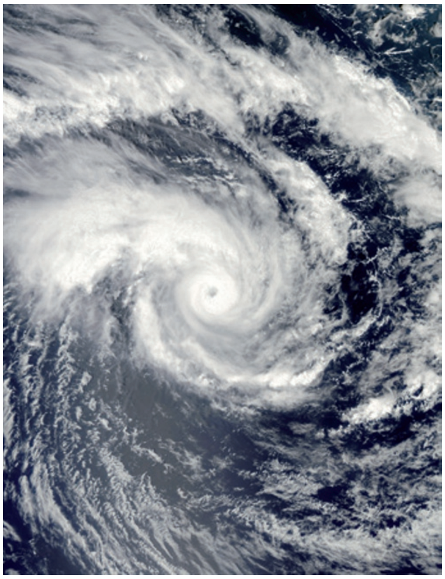
ATMOSPHERIC SCIENCE

Central Pacific cyclones

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



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Large-scale modes of climate variability such as the El Niño/Southern Oscillation influence the frequency of tropical cyclones. A statistical analysis of tropical cyclone data suggests that, in the North Central Pacific, the Madden–Julian Oscillation is also a key driver of tropical cyclone intensification.

Philip Klotzbach, of Colorado State University, and Eric Blake, of the National Hurricane Center, used reanalysis and observational data collected between 1974 and 2010 to identify the oceanic and atmospheric conditions associated with tropical cyclone activity in the North Central Pacific. As expected, tropical cyclone frequency was greater during El Niño years. Cyclone frequency was also enhanced when the wet phase of the Madden–Julian Oscillation occurred over the eastern and central tropical Pacific, which they attribute to a concomitant reduction in vertical wind shear. At the same time, the likelihood of rapid intensification was also enhanced, such that the wet phase of the Madden–Julian Oscillation was responsible for the majority of tropical cycles that intensified rapidly over the measurement period.

Consideration of both El Niño and Madden–Julian Oscillation dynamics could improve sub-seasonal forecasts of both the frequency and intensity of tropical cyclones in the Pacific, argue the researchers. *AA*

PALAEOCLIMATE

Cold and dry

Geochem. Geophys. Geosys. http://doi.org/mjd (2013)

The growth of the East Antarctic ice sheet 34 million years ago altered high-latitude atmospheric circulation patterns and led to drying over the continent, an analysis of continental weathering suggests. The growth of the ice sheet at this time was linked to a drop in atmospheric CO_2 concentrations and global temperature.

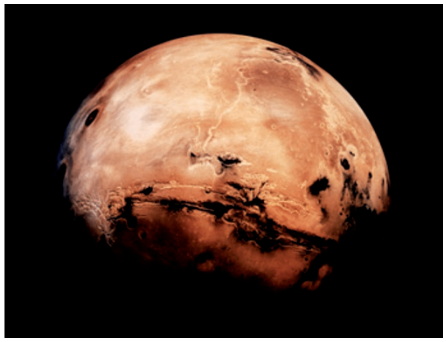
Sandra Passchier of Montclair State University, New Jersey, and colleagues used the elemental composition of sediments deposited off the coast of East Antarctica to assess the amount and type of continental weathering that occurred between 54 and 13 million years ago. By looking at which elements were specifically removed and which rocks were chemically and physically broken down, they linked the weathering regimes to broader climate patterns. The warmest and wettest conditions occurred at the beginning of the record. According to their reconstruction, temperatures then fell by over 8 °C over the next 41 million years. The greatest drop in precipitation occurred as ice volume on the continent grew 34 million years ago.

The spread of an ice sheet would have increased the reflectivity of the continent, altering the polar high pressure cell and promoting the development of northward-blowing cold and dry winds. *AN*

PLANETARY SCIENCE

Wet martian mantle

Earth Planet. Sci. Lett. http://doi.org/mjf (2013)



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Compared with basalts on Earth, most basaltic meteorites from Mars contain little water, but it is unclear whether this reflects a lack of water in the martian mantle or the release of volatiles from the rocks when they were erupted to the surface. Analyses of mineral grains in a martian meteorite suggest that the mantles of Mars and Earth may indeed be similarly wet.

Juliane Gross at the American Museum of Natural History and colleagues analysed the composition of the hydrous mineral apatite in the martian meteorite NWA 6234. The basalt in this meteorite did not experience degassing, so if any volatiles were present in the magma, they should still be contained in the rock. The apatite grains they analysed contained the highest contents of volatiles measured in martian meteorites to date. Furthermore, NWA 6234 contains similar ratios of the measured volatiles to those of terrestrial basalts. The findings suggest that the volatile content of the martian mantle is similar to that of terrestrial mid-ocean ridge basalts.

A wet martian interior could have fed an active hydrological cycle and is consistent with growing evidence from orbiter and lander missions for water on the surface of Mars. *TG*

TECTONICS

Failed break-up

Geophys. Res. Lett. http://doi.org/mjg (2013)

The topographic depression that today forms Lake Superior in North America developed more than a billion years ago during a period of volcanic activity. Maps of the distribution and thickness of the lava flows show that this region once marked the boundary of a tectonic microplate.

Miguel Merino at Northwestern University, Illinois, and colleagues analysed the volumes of magmatic rocks in the crust around the Great Lakes using gravity data, which show thick and dense magmas as gravity anomalies. The lava flows form two distinct arms, one extending to the southwest into Kansas and the other extending southeast through Michigan. The western arm was more volcanically active compared with the eastern one, and the volume of magma increases towards Lake Superior. The patterns of magmatism are consistent with a scenario of eruptions above a mantle plume that upwells beneath Lake Superior. The plume could have caused the North American continent to begin to break apart. The western arm of volcanic activity therefore marked a nascent plate-spreading centre — the edge of a newly forming microplate.

The researchers suggest that the magmatic activity in the Great Lakes region marks the part of an evolving plate boundary that failed to develop into full continental break-up, rather than a short-lived episode of mid-plate volcanism as currently thought. *AW*

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