is 800 million years old, it would be the youngest identified volcanic feature on the Moon, extending the period of active lunar volcanism by some 200 million years.

The compositionally evolved rocks observed in the Compton–Belkovich region could be volcanic rocks emplaced deep in the crust and later exposed at the surface by a chance impact. Indeed, impact craters across the Moon have long been recognized as excellent probes into the lunar crust. However, there are no large craters surrounding the Compton–Belkovich feature that would indicate that it is related to an impact. Alternatively, the rocks could have originally come from the lunar nearside and, during a large meteorite impact, could have been excavated and transported to the Compton–Belkovich region. However, taken together, the geomorphology and composition of the rocks in the Compton–Belkovich thorium anomaly strongly suggest a volcanic origin. The location on the lunar farside and relative youth of the deposits demonstrate that compositionally evolved magmas, though still extremely rare, were produced in several locations across the entire Moon, very late in its magmatic history.

Jolliff *et al.*[1] demonstrate that the Compton–Belkovich thorium anomaly is volcanic in origin and represents a rare example of non-mare volcanism on the lunar farside. It has been more than 40 years since the Apollo samples provided the first hint that compositionally evolved magmas might be distributed across the lunar surface. Yet, thanks to a suite of data from numerous recent missions, the Moon continues to surprise us. ❐

Noah Petro is at the NASA Goddard Space Flight Center, Greenbelt, Maryland 20771, USA.
e-mail: noah.e.petro@nasa.gov

References

1. Jolliff, B. L. *et al. Nature Geosci.* **4**, 566–571 (2011).
2. Lawrence, D. J. *et al. J. Geophys. Res.* **108,** 5102 (2003).
3. Wood, J. A., Dickey, J. S. Jr, Marvin, U. B. & Powell, B. N. *Science* **167,** 602–604 (1970).
4. Oberbeck, V. R., Morrison, R. H. & Hoerz, F. *Moon* **13,** 9–26 (1975).
5. Glotch, T. D. *et al. Science* **329,** 1510–1513 (2010).
6. Schultz, P. H. & Spudis, P. D. *Nature* **302,** 233–236 (1983).

Published online: 24 July 2011

ATMOSPHERIC SCIENCE

Cloud rupture

Sightings of colossal kilometre-scale holes in high-altitude clouds date back to the 1940s. Once thought to originate from passing UFOs, these unusual cloud formations — known as hole-punch clouds — are now known to originate from passing planes.

When aircraft pass through subfreezing, liquid clouds, they lower the temperature of the surrounding water vapour, creating ice. The ice crystals grow rapidly at the expense of the water droplets, and eventually fall from the sky as snow or rain, leaving holes in the clouds. Yet exactly how aircraft generate holes that are so much larger than the planes themselves has remained a mystery.

Now, Andrew Heymsfield and colleagues show that vertical motion and evaporation hold the key to the growth of these holes (*Science* **333,** 77–81; 2011). The researchers studied the development of 92 aircraft-generated holes over Texas in 2007 using satellite images and flight paths of aircraft in the area. The holes grew rapidly, doubling in area within the first 30 min of detection; some reached 100 km in length and persisted for four hours. Candidate aircraft included large passenger planes, together with regional, private and military planes.

A weather and forecasting model helped the researchers study the mechanisms of growth. The simulations suggest that the injection of ice crystals into the cloud layer creates an upward flow of air near the centre of the hole, due to heating associated with the conversion of water dropplets and vapour into ice, and a compensating downward flow of air at the edge of the hole. This downward draft, together with the growth of ice into snow, causes water to evaporate, leading to the erosion of the cloud and the rapid growth of the hole. When the heat liberated by the growing ice is omitted from the model, holes still form, but they fail to expand.

Although hole-punch clouds may not be important globally, they are likely to modulate climate at a regional level. Indeed, satellite observations around seven key airports in the mid and high latitudes suggest that hole-punch clouds are particularly likely to form around heavily trafficked airports. Averaged over the course of a year, propeller aircraft have a 5–6% chance of generating ice in supercooled clouds during takeoff and landing, and jet aircraft a 2–3% chance. Air traffic can therefore be expected to exacerbate the likelihood of rainfall and snow around busy airports.

ANNA ARMSTRONG