## Abstractions

**FIRST AUTHOR**

Much of Earth's crust has been formed over time by volcanoes at mid-ocean ridges on the sea floor. Geologists thought that the occurrence of explosive volcanic eruptions — such as that seen in 1980 at Mount St Helens in Oregon — would be rare, if not non-existent, along great tracts of these ridges owing to the extreme water pressure at depths of more than 3,000 metres. Such pressure both counteracts magma expansion and prevents the formation of steam. But while mapping and imaging parts of the Gakkel Ridge, which stretches across the eastern Arctic Basin, geophysicist Robert Sohn and an international team found multiple cratered volcanoes and evidence of an explosive eruption that may have thrown debris 1–2 kilometres up in the water (see page 1236). Sohn, based at the Woods Hole Oceanographic Institution in Massachusetts, tells *Nature* how such an event could occur.

**How did you study the ocean floor beneath the Arctic ice?**

We spent two weeks on the Swedish icebreaker *Oden*, drifting around in the ice floes above an area of a suspected eruption, where a swarm of magnitude 4–6 earthquakes was recorded in 1999. We passed over the same points 15–30 times, making low-noise sonar measurements. We also deployed a tethered vehicle, CAMPER, to take samples and video footage of the site.

**How did you know an explosion had occurred?**

On the video of the sea floor, we saw a coarse, black sediment covering absolutely everything. The only explanation for this that made sense was that it was pyroclastic material — bits of molten rock ejected during a volcanic explosion. We sampled the deposits and found fragments that provided conclusive evidence of explosive activity.

**What mechanism would account for an explosion at that depth?**

Nowhere near the amount of carbon dioxide gas that would be needed for an explosion at those depths has ever been found dissolved in basaltic magma. But $CO_2$ can 'exsolve', or come out of solution, in lower concentrations and build up over time — and if it did so would probably become trapped at the top of the magma chamber. If a very large volume of $CO_2$ built up, then an earthquake swarm could crack the chamber roof, which would be akin to tapping a keg, releasing the gas in a catastrophic explosion.

**What would it have been like?**

Tremendously energetic. There was probably a massive kill-off of deep-sea animals in the immediate area. ■

# MAKING THE PAPER

## Roland Strauss

**Flies can remember where they are going even when distracted en route.**

The movements of flies buzzing around a picnic table may seem random, but in fact flies exhibit decision-making processes when choosing whether to circle overhead or land on the potato salad. Flies' ability to choose how to adroitly navigate their surroundings depends on their capacity for short-term, spatial memory. A group of German researchers led by Roland Strauss of the Johannes Gutenberg University in Mainz, Germany, is teasing apart how insects' brains direct their movements and behaviours. Through this work, the authors hope to gain insight into the basic principles that govern memory and decision-making abilities in humans. "Complicated human brains and the small brains of flies are interacting with the same world, and they have to solve the same types of problem," says Strauss.

Previous work by Strauss and his colleagues had shown that fruitflies can maintain their direction along a straight path towards a target object even after the target disappears. But these experiments did not prove that the fruitflies have memory; the flies could simply have been continuing their walk towards the vanished object much like a mountaineer who continues climbing a peak obscured by clouds. In order to demonstrate that flies have spatial memory, the team needed to show that the insects can still find their way to an invisible object after being temporarily distracted en route.

To this end, Strauss and his colleagues built a virtual reality fly 'arena'. The flies' wings were clipped to prevent them from flying away and they were surrounded by a water 'moat'. Flies cannot discern between water obstacles and the "end of the world", says Strauss, so faced with such a situation, most flies choose to stay inside the moat.

Building on the efforts of former graduate student Josef Pichler, Strauss and co-author Markus Mronz designed a way to lure the flies off course by means of a visual distraction. Strauss has long advocated the use of electronics to investigate brain function — as a teenager, he designed an electronic device to simulate the visual system of the horseshoe crab, for which he won a national prize.

To investigate the flies' spatial memory, the team designed a fly arena studded with more than 5,000 light-emitting diodes, and used these to project vertical stripes onto a cylindrical screen around the arena perimeter. In this situation, flies are drawn to vertical stripes that emerge from the floor because they perceive them to be an escape route. The authors monitored how flies reacted when the stripe they were walking towards disappeared and a vertical 'distracter' stripe appeared to their side, then disappeared after one second.

The team found that flies stored memory about their orientation and would turn back towards their original — still invisible — target after between one and four seconds. The researchers went on to untangle some of the key biochemical pathways involved in orientation and memory in flies (see page 1244).

Strauss says that flies' capacity for short-term memory is comparable to that of humans. If placed in an unfamiliar room and briefly pointed toward the exit before having the lights switched off, he explains, we would have a few seconds' worth of memory to guide our decision about how to procede before having to rely on search behaviour. The same decision-making processes, says Strauss, enable us to "learn from the past to improve the basic behaviour of the future". ■

# FROM THE BLOGOSPHERE

The citations-versus-downloads conversation continues. *Nature Neuroscience*'s editors have analysed the number of downloads a paper receives immediately after its appearance online, and find a high correlation with its citation frequency years after publication. Associate editor Noah Gray provides the details at the journal's blog, Action Potential (http://blogs.nature.com/nn/actionpotential/2008/05/downloads_vs_citations.html).

Despite well-known concerns about impact factors, he notes, "these numbers are typically used to rate the importance or prominence of a particular journal, and thus by proxy, the importance of the individual papers published within". This flawed association often leads individuals and organizations to equate the total number of citations with scientific impact.

Instead, the editors wanted to measure readership of an article that would reflect its levels of outside interest and perceived value. Although the "number of downloads" measure is subject to misuse and has its own flaws, it provides a piece of an alternative solution for a more informative picture of manuscript influence. ■

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