Abstractions

FIRST AUTHOR
Chile's Chaitén volcano, in northern Patagonia, erupted suddenly on 1 May 2008. Soon after, scientists captured the first ever data from a volcano erupting rhyolite magma — the source of light-coloured igneous rock — which has fuelled some of Earth's most explosive eruptions. On page 780, Jonathan Castro at the French National Centre for Scientific Research in Orléans and Donald Dingwell of the Ludwig Maximillians University in Munich, Germany, detail the rapid ascent of rhyolite magma at Chaitén, which continues to erupt today. Castro tells *Nature* why rhyolite volcanoes merit monitoring.

Was an eruption expected at Chaitén?
No. It hadn't erupted in about 9,000 years, and was shrouded in dense forest. Most people considered it to be extinct.

How quickly did you get to the scene?
As soon as I saw pictures on the Internet, I thought the ash looked like a silica-rich magma, one that was charged with bubbles, and therefore water. Both of these attributes are consistent with a rhyolitic composition. The last rhyolite eruption occurred in Alaska in 1912. No active rhyolite system had previously been observed scientifically. I was in Chile by early June, and convinced the authorities to let me conduct scientific studies in real time, while the volcano was still erupting.

What did your analyses tell you?
We found that, prior to an eruption, rhyolite magma can rise at a surprising rate: 1 metre per second, which translates to very little pre-eruptive warning. Magma in most volcanoes in analogous terrain — such as Mount St Helens in Washington state — seems to move slowly before eruption, so these eruptions are typically preceded by weeks to months of seismic unrest. Our findings suggest that because magma moves quickly from where it has been stored, in some cases for hundreds or thousands of years, it doesn't have time to adjust chemically or physically to the new shallower environment. As a result, it generates powerful explosions due to its rapid decompression and the release of dissolved water.

Are other rhyolite volcanoes currently being monitored?
Only a small fraction of all active volcanoes on Earth are being monitored because of the costly equipment and human resources needed. I think this work underscores the importance of monitoring the calderas of Yellowstone in Wyoming and the Long Valley in eastern California, where many prehistoric rhyolite eruptions occurred. An eruption this close to San Francisco could be devastating. ■

MAKING THE PAPER

Jay and Maureen Neitz

Gene therapy fills in the gaps in the rainbow for colour-blind monkeys.

Everyday tasks such as telling whether a steak is well done or spotting sunburn can be next to impossible for people with red–green colour blindness. Now Jay and Maureen Neitz, a husband-and-wife research team at the Eye Institute of the University of Washington in Seattle, and their colleagues have successfully used gene therapy to fix the condition in adult monkeys, bringing new colour to their world.

Colour blindness affects about 1 in 12 men and 1 in 230 women. Red–green colour blindness is by far the most common type, and is typically caused by mutations in genes on the X chromosome that inactivate the light-absorbing pigments of the retina. One type of mutation, in the long-wavelength (L) opsin gene, results in an absence of red photopigment, making both red and green objects appear grey.

Interestingly, some male squirrel monkeys (*Saimiri sciureus*) also lack red photopigment in their eyes. Jay and Maureen Neitz wondered whether introducing the gene for the missing photopigment by gene therapy could provide a basis for full colour vision in these monkeys.

But the project was something of a leap of faith. "The word on the scientific street was that it wouldn't be possible to add new sensations to adults," says Maureen. Experiments conducted in the 1970s had indicated that there is a critical period for the development of many of the brain's capabilities, including vision, and that new ones could not be added later in life. "It seemed unlikely to work, but would be so amazing if it did that we had to try," she adds.

It took close to a decade for the Neitzes and their collaborators to get all of the facets of the experiment working, such as selecting the appropriate vector to carry the L-opsin gene inside the eye and making sure it was active in the cells of the retina. One crucial component was developing a way to determine which colours the monkeys could discriminate. In the study described on page 784, the researchers used a computer-based test in which two monkeys, Dalton and Sam, who had been colour-blind since birth, were shown a screen with a patch of coloured dots — blue, yellow, red or green — against a background of grey dots. The animals had to touch the screen in the position of the colour, and for every accurate answer received a squirt of grape juice.

The colour-blind monkeys could readily identify yellow and blue patches, but when the colour was a hue of red or green they hesitated, eventually making a tentative guess as to where to touch the screen. "This is similar to how humans behave. We tend to guess too," says Jay.

But five months after having their retinas injected with a virus carrying the human L-opsin gene, the monkeys were suddenly able to spot red and green patches, no matter how faint. "They seemed to enjoy doing the tests more after that," says Jay.

The work shows that the adult nervous system can pick up new faculties. It also offers hope for treating colour blindness, and other diseases that affect the retina, in humans. "We receive a lot of e-mails from people who are interested in participating in pilot studies and my heart goes out to all of them," says Jay. But, he cautions, that day is still in the future. However, he adds that he, his wife and others are forging ahead with making the technique safe for humans. ■

FROM THE BLOGOSPHERE

More funding for human embryonic stem cell (hESC) research should have researchers jumping for joy. But it's left many scratching their heads, reports Monya Baker, editor of *Nature Reports Stem Cells*, on The Niche blog (http://go.nature.com/zESIXc).

In late September, the US National Institutes of Health (NIH) announced that it would begin screening applications from researchers to determine which hESC lines are eligible for NIH funding. This left a wake of concern and confusion. Should researchers in possession of lines derived by others seek approval for them? What about older cell lines that were not derived following the NIH's strict guidelines of informed consent, published in July? (See http://stemcells.nih.gov/policy/2009guidelines.htm.)

In her post, Baker addresses these and other areas of concern, and provides a link to the draft list of cell lines that have already been submitted to the NIH. She also warns that private organizations and individual states, which are free to fund research with hESC lines not approved by the NIH, "may prove reluctant to award funds to material lacking such approval". ■

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