# Abstractions

**FIRST AUTHOR**

Glacial ice can shed light on the climate and atmospheric composition found on early Earth. But until recently, only one glacial period — up to 420,000 years ago — was covered by sufficient data. That is now changing thanks to a new core, going back 800,000 years and covering eight glacial cycles, which was drilled from Antarctica by an international team of scientists. As revealed on page 491 of this issue, this ice core has provided data that run counter to earlier understanding — and that will have implications for climate modellers. *Nature* spoke to Eric Wolff from the British Antarctic Survey based in Cambridge, UK, to find out more.

**What is the big picture you have derived for the eight glacial cycles?**

Every time it is colder there is more sea ice, which is not so surprising. When it gets colder, there is more dust from South America; when it goes from cold to warm, there is less dust during the transition. The dust changes first and the sea ice second. Both of those are factors that, in themselves, alter the climate by changing the amount of carbon going into the ocean. It's a link to know how the natural carbon cycle works. You need to know the amount of sea ice and dust. The data will provide information for new models.

**What did this project teach you about doing science?**

You need a lot of people working together. Just getting an ice core like this is a very big undertaking and interpreting it is, too. It will be several years before all the interpretation is done.

**What was it like working in Antarctica?**

It was a cold, remote place, 1,000 kilometres from the coast. We had about 40 people from 10 different countries. It is exciting to be working in that international programme. It's exciting to be bringing up ice that shows periods of climate that no one has ever seen in this way before.

**What did you do in the field?**

I spent a lot of time chopping up the ice into different sections, to be sent back to different laboratories. We used manual band saws, the kind you find in wood or metal workshops — nothing particularly high-tech. Then we put the samples into plastic bags and sent them to various labs in insulated boxes.

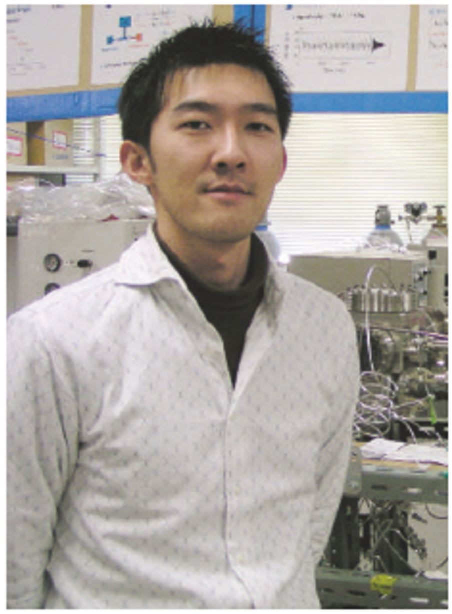
**You spent two periods of ten weeks in Antarctica. What did you do when you returned?**

The first thing I did when I got back to Christchurch, New Zealand, the project's staging area, was to take a hot bath, change into clean clothes and enjoy a glass of wine. ■

# MAKING THE PAPER

## Yuichiro Ueno

**Gas bubbles in rocks offer evidence for life on Earth 3.5 billion years ago.**



For seven years, Yuichiro Ueno made an annual pilgrimage to a hot and arid region of Australia, where he would spend up to three months collecting and looking at rocks. "The nearest town was 100 kilometres away," he recalls. "Every two weeks we would go there to buy supplies." His visits to town also gave him the opportunity to check in with his lab at the Tokyo Institute of Technology.

Ueno and his colleagues were in the Pilbara area of northwest Australia studying some of the world's oldest sedimentary rock formations. "My personal focus was trying to find traces of early life," says Ueno, who began the project as an undergraduate student and pursued it for his PhD under Shigenori Maruyama.

Although it took several years, Ueno found what he was after. The paper on page 516 of this issue describes evidence for one of the most primitive organisms known — one that may have helped to regulate Earth's climate during the Archaean era, more than 2.5 billion years ago.

In 2001, Ueno and Maruyama found organic matter in their Australian rock samples. By analysing the carbon within this matter, they realized that it had come from a living organism. In fact, the samples showed the signature of single-celled organisms that had been alive some 3.5 billion years ago.

But what were the organisms? Ueno suspected that they were a type of microbe known as methanogens, which produce the greenhouse gas methane. To prove his idea, Ueno began a very tricky experiment. "I thought the best way to show the existence of methanogens is to find methane in the rocks," he explains.

By examining his rocks under the microscope, Ueno found that they contained tiny liquid puddles with gas bubbles inside them. He decided to extract the contents of these bubbles to see whether they contained methane. No mean feat: it was a "very difficult task", Ueno says. It was particularly challenging to keep the methane in the surrounding air from contaminating his samples. "It took me half a year to reduce the chances of introducing methane artificially into the system," says Ueno. "I had to develop procedures for cleaning the samples, crushing the rocks and extracting the gas."

Having perfected his technique, Ueno took his methane samples to Naohiro Yoshida, also at the Tokyo Institute of Technology. Yoshida had developed a technique that would reveal whether the gas had been produced by microbes. The answer was a resounding 'yes'. Because of where the gas was found, methane-producing microbes — distant relatives of those that exist today — must have been alive on Earth 3.5 billion years ago.

"If methanogens existed at that time, there is a very strong possibility that they provided sufficient greenhouse gas to keep the surface temperature of Earth above freezing," explains Ueno. ■

# QUANTIFIED *NATURE* TOP TEN

**A numerical perspective on *Nature* authors.**

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One paper in particular has dominated the top ten in recent months — topping the list since September 2005. Written by Monica Bricelj of the Institute for Marine Biosciences in Halifax, Canada, and her colleagues, the paper shows how genetic mutations of a protein in clams can lead to the accumulation of toxins and increase the risk of poisoning in humans (*Nature* **434**, 763–767; 2005).

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