

# Soil sampling in serenity

Vladimir Samarkin, Michael Madigan and colleagues travelled to Don Juan Pond in Antarctica, in an attempt to understand life on Mars. Instead, they discovered an unexpected link between the geosphere and atmosphere.

## ■ Why did you choose this location?

We were interested to know whether harsh martian environments could sustain life and Don Juan Pond in Antarctica is an ideal Mars analogue. The pond is the most saline body of water on Earth. Because of its extreme salinity it never freezes, even during the severely cold Antarctic winters. The pond soils and brines, and the surrounding rock types, are similar to those found on Mars. Hence Don Juan Pond provides an ideal location to assess microbial activity in extreme environments.

## ■ How did your objectives change?

Microbial activity can be detected through measurement of 'bio-gases', like methane and hydrogen sulphide, in the brine and soils. We did not detect any of these gases at Don Juan Pond, indicating that microbial activity was either dormant or non-existent. Surprisingly, we measured high nitrous oxide concentrations and active emissions of this gas from the soils to the atmosphere. Nitrous oxide is normally considered an indicator of microbial activity. Our objective therefore changed as we tried to determine whether abiotic, rather than microbial, processes could drive the observed nitrous oxide formation.

## ■ What sorts of samples were you looking for?

We measured the flux of gases around Don Juan Pond to document the processes that were occurring there in real time. We also collected samples of the brine fluids, soil and rock material for later geochemical analyses and for use in laboratory experiments. We took pictures to document the geological features — and so that we could share the beauty of the place.

## ■ Can you describe the experience of getting to, and working at, Don Juan Pond?

Access is by a 40-minute



Vladimir Samarkin, in full sterile suit and mask, collects samples from the highly saline Don Juan Pond in Antarctica.

helicopter ride over the magnificent scenery of the McMurdo Sound. Rocky cliffs, with gargoyle-like protrusions, give way to the expanse of the Wright Valley. From the valley, you enter the Dias, a tight enclosure with steep, rocky cliffs on both sides, which is home to Don Juan Pond. From a distance, the Pond appears as a flat, rocky basin containing liquid water; odd, considering the temperature is below zero. On closer inspection, it becomes apparent that what looked like pebbles from the air are actually huge boulders that have fallen into the pond from the neighbouring cliffs. Don Juan Pond is the prettiest place in Antarctica. Working there, you are transfixed by the two huge mountains that bound the site from the north and south, giving it a sense of protection. After

setting up instruments and monitoring their progress, there was time to sit and admire the site and the constant song of the wind. The quiet at Don Juan Pond is unlike anything you can imagine; it is soothing and calming for the soul, making it a truly magical place.

## ■ What are the challenges of working in such an extreme environment?

Don Juan Pond is a protected ecosystem and access to the site is strictly regulated. Because the site is such an exceptional analogue for Mars, researchers continue to search for microbial life there. So, it is essential to plan the field expeditions carefully, ensuring that the affected area is small, the impact is inconsequential and the risk of microbial contamination is minimal. When working on site we dressed in sterile suits and donned masks; we used sterile instruments for sampling; and we collected the minimal amount of material necessary to achieve our research goals.

## ■ Was it straightforward to get the samples back to the base and laboratory?

The McMurdo station is an American–Antarctic research station and houses the Crary Research Laboratory. We were thus able to carry out our laboratory experiments in Antarctica, using cold rooms at different temperatures to mimic *in situ* conditions. The excellent support of the station and laboratory staff, as well as the amazing abilities of the helicopter pilots, made working in Don Juan Pond easy.

## ■ Did this work give you ideas for future research projects?

The work has generated many questions that we aim to answer through future visits to the Antarctic. For example, do reactions like the ones we discovered occur in other extreme Antarctic habitats? And, do such reactions contribute to nitrous oxide production in more common habitats, such as temperate soils?

*This is the Backstory to the work by Vladimir Samarkin and colleagues, published on page 341 of this issue.*

