

The potential of the peatlands of southern South America as sources of information about past climates has been neglected compared to those of the Northern Hemisphere. Tom Roland describes weeks tramping through the bogs of Tierra del Fuego in an effort to redress the balance.

‘We’ll be walking in Charles Darwin’s footsteps,’ I announced grandly at London Heathrow, a few days into the New Year. Patagonia, my destination, has always held a mysterious fascination for explorers, travellers and those following *la ruta del fin del mundo* – the road to the end of the world. It wasn’t just Darwin we’d be following, but Ferdinand Magellan, Bruce Chatwin and any number of hopeful nineteenth-century gold prospectors!

Thirty-six hours, four flights and over 8000 miles later, I find myself squelching across some of the world’s most pristine peatlands. The snow-capped Southern Andes rise steeply on either side, and the bright red *Sphagnum magellanicum*, the moss species so characteristic of these bogs, contrasts sharply with the blue sky of an unseasonably warm austral summer.

Writing in *The Voyage of the Beagle*, Darwin was clearly in awe of the landscape around him as he landed on the Isla Grande de Tierra del Fuego, at the southernmost tip of Patagonia.

*‘A single glance at the landscape was sufficient to show me how widely different it was from anything I had ever beheld.’*

Some 180 years later, the region still evokes a feeling of wilderness that is hard to imagine anywhere else. As we trudge further up the valley, it very quickly becomes clear that the peatlands of southern South America themselves are also unique, not just in their geographical distribution, but also their surface vegetation and topography. Despite having visited numerous bogs across Europe and North America, none of us had seen anything quite like this!

So what is so special about the region’s bogs – why have we travelled halfway across the world to visit them? The answer is simple: the NERC-funded PATAGON project aims to explore the potential of the region’s exceptional peatlands for palaeoclimatic reconstruction.

Peatlands occupy about three per cent of the Earth’s land surface, but this distribution is heavily skewed towards the north. In fact, recent estimates suggest that, outside the tropics, bogs in the Southern Hemisphere represent just over

# Letters from Patagonia



one per cent of the world's peatlands, and are largely limited to southern Patagonia. Despite these figures, the region's bogs possess a wealth of scientific interest, but a historic bias towards sites in the Northern Hemisphere has left the South comparatively underrepresented in terms of palaeoclimate studies. This hampers our ability to examine where climate change has happened, and is happening, and to evaluate the predictions of climate models.

The PATAGON project also presents an excellent opportunity to examine peatlands in their natural state, as many northern bogs have been heavily modified by humans – in some cases as long ago as Roman times. Sadly, southern bogs too are coming under increasing environmental pressures, largely at the hands of those wishing to exploit the peat for fuel and fertilizer – this makes their examination even more timely.

The project involves academics and research staff from Aberdeen, Southampton, Swansea and Plymouth universities. It aims to apply techniques to learn about past climates by analysing peat, which were largely honed in the Northern Hemisphere, to the remote bogs

*Collecting plant samples.* Jonathan Poblete



of southern South America.

The project's study sites are ideal for research into past climatic variability in the Southern Hemisphere, owing to their position in the path of the Southern Westerlies, a major circulatory component in a complex region of the Earth's climate

system, which also includes the Southern Annular Mode – a shifting pattern in the atmospheric pressure gradient between Antarctica and the southern mid-latitudes – and the El Niño- Southern Oscillation.

One of the keys to unravelling past climate changes is the vegetation that

*The Southern Andes rise on either side of the characteristic red of a bog covered in Sphagnum magellanicum moss.* Tom Roland







*Rostkovia magellanica*, a species native to South American bogs.

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Both images: Tom Roland

grows on the surface of the bog. The plants growing here change as precipitation and temperature change over time, and the different types of surface vegetation are preserved as the bog accumulates. By taking a core sample down through the bog we can see which plants flourished at different points in the past and use that information to work out how the climate itself varied.

So one of the project's challenges was to identify and collect a range of regionally-distinctive plants and pinpoint their unique characteristics, so that when we find preserved plant remains in the core we can identify them as accurately as possible.

Another critical aspect of our research relies on the fact that the chemical composition of rain varies slightly depending on where the moisture originated and how far it travelled; if we can work out the chemical composition of rain that fell in the past we can link this directly to past changes in atmospheric circulation and, therefore, climate. All the water that enters our study sites – and therefore all the water taken up by plants in the bog – comes from precipitation, so the plants themselves contain chemical clues as to where that rain came from.

Studies in northern Britain and eastern Canada have already had encouraging results using isotope analysis to extract

these clues from *Sphagnum* mosses, very simple plants which can't regulate water uptake and loss. By analysing changes in the ratio of different oxygen and hydrogen isotopes – lighter and heavier versions of each element – preserved in cellulose extracted from the moss they were able to work out the origins of the rain that fell on the plants. We will be applying this recently-developed technique to these pristine Patagonian peatlands.

Microscopic testate amoebae, which live in the surface section of the bog and are well preserved in the low-oxygen conditions peatlands provide, can also help us estimate past changes in the level of the water table. A regional 'transfer function' model estimates the water-table depth associated with any testate amoebae remains we find in our samples, but as relatively little work has been undertaken in Patagonia, the task of creating this model falls to us!

As a result, one objective of our second field season in southern Chile and Argentina was to gather data on the ecological conditions in which each of these species is found today, to use as the basis of the transfer function's predictions. This involved visiting many sites, sampling amoebae at different places on the bog's surface and measuring the associated water tables. Tiring as it was, it was a fantastic way to see the landscape. Tierra del Fuego

is truly a land of two halves. The north is dominated by mile upon mile of dusty steppe grassland, run-down shacks and wind-battered cattle-shaped signs – the south's very own Wild West. It is hundreds of miles before the Southern Andes suddenly appear again on the horizon. The closer we get to the mountains, the more apparent the rain becomes; huge lakes, misty southern beech forests and mile upon mile of bright red peatland – just what we're after!

It's not quite exploration on a Darwinian level, but it still feels very exciting to be part of this project – pioneering the use of cutting-edge palaeoclimatic techniques in a new region of the globe. So, as we reflect on this at the end of an excellent field season – sitting in Santiago airport on an eight-hour layover, enjoying our last Pisco Sour; two flights down, two to go – we pray that our cores make it back to the UK in one piece. Just 7250 miles and 31 hours to go!

### MORE INFORMATION

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More information on the PATAGON project can be found at [www.patagonproject.org](http://www.patagonproject.org)