

SCIENCE ON THE ICE

by Neil Silverwood

Two sets of merino underwear, two fleece jackets, a windbreaker, a puffer jacket, five pairs of gloves, a hat, a balaclava, fleece pants, fleece-lined boots, and lastly – a set of extreme-cold weather gear (called ECWs by those in the know). My kit is issued at Antarctica New Zealand's Christchurch headquarters, and I'm told to return the following morning at six. I'm to wear my ECWs for the flight south.

The next day, I'm woken by my phone buzzing in the dark. It's 4.45 a.m. "Ice flight delayed twenty-four hours due to weather," the text says. The same message arrives five mornings in a row, and I learn my first lesson about Antarctica: dates are only estimates. On the sixth morning, no text arrives. I head for the airport, where I board a plane along with eighty other passengers, most of them scientists. We're ready for temperatures as low as minus 40 degrees Celsius.

Frozen World

In just five hours, I'm transported from the spring warmth of Canterbury to Scott Base and a frozen world, much colder and brighter than I'd imagined. I'm a photographer, and I've come to Antarctica to document the set-up for a science project, starting with a deep-field traverse. This is a fancy term for lugging a huge amount of science equipment many kilometres across the ice. Usually this is done by plane, but this time, a convoy of tracked vehicles will drive deep into the polar region. The vehicles can cope with many more tonnes of equipment than a plane. They can also travel in almost any weather.

Our prize possession is a hot-water drill, which scientists will use to bore through 350 metres of ice to the ocean below. Once there, they'll lower equipment another 400 metres to the sea floor to collect data about ice, ocean currents, and biodiversity. They'll also take samples of sediment. A great deal of this work is new; many of these measurements will be taken for only the first or second time. What lies beneath the Ross Ice Shelf hasn't been incorporated into our climate models. These models are used to make predictions about the world's climate – a bit like weather forecasts on an epic scale. If all goes well, the work will fill in some large gaps about what we know.



Convoy

The day before we're scheduled to leave, I talk to Rob Teasdale, traverse mechanic and team leader. Back home, Rob works at the Mount Hutt ski field, maintaining snow groomers. Now he's head down over an engine, working intently, tools strewn across the workshop floor. "Might not be leaving till the day after tomorrow," he jokes.

One of the biggest challenges of this traverse has been planning the amount of fuel to take. "Too much," Rob says, "and we'll be weighed down and slow. But too little, and we won't make it." Solving tricky problems like

this is just one of the reasons the project has taken two years to plan. In the end, Rob settles on a hefty 33,000 litres. In a small car, it's enough to circle the globe twelve times.

Rob's responsible for all the vehicles in our convoy: three are similar to snow groomers; the fourth is smaller and has a double cab. The vehicles are specially designed for travel in polar regions. They'll be towing all that fuel along with enough equipment to run a small village in the middle of nowhere for two months. Our convoy, the day we set out, looks like a camping trip gone very, very wrong.



“Warning: Heavily Crevassed Area”

On our second morning on the ice, we wake at the edge of the shear zone. This infamous region is formed as sections of the ice shelf grate against each other. This results in crevasses – deep cracks or fractures in the ice – and lots of them! A sign warns of imminent danger, and pictures of two Grim Reapers ram the point home. While the marked route provides some comfort, there are no guarantees. Ice is always changing, and crevasses leave no visual clues. Instead, we rely on ground-penetrating radar to find a safe path. We also put on helmets and harnesses for the shear-zone crossing, and no one leaves a vehicle without being attached to a rope.

Mapping experts Lawrence Kees and Dan Price guide our convoy from up front. The radar is mounted on a boom in front of their vehicle. The return signal is displayed on a screen in their cab. Horizontal lines mean the ice is safe; curved lines indicate a crevasse ahead. In safe areas, we travel at 10 kilometres an hour. Even then we’d only have seconds to stop. In less certain terrain, we move at walking pace.

If a crevasse is discovered, we follow the same process. First, the ground is probed to determine its “strike” (the direction the crevasse is travelling). Then Dan or Lawrence draws up the crevasse’s profile, which allows them to calculate size. Anything narrower than a third of the length of a vehicle’s track is safe to drive over. Anything wider, and we go around. This time, we’re in luck. The crevasses are narrow, and we’re able to drive straight through.



Dish Soup

Life on the traverse doesn’t vary. For eighteen hours each day, we travel at a speed most people could comfortably run. We stop to eat, refuel, and sleep. Meals are mostly boil-in-the-bag army rations. The ten of us either eat outside in the cold or cram into a vehicle cabin designed for four. Doing the dishes involves swilling warm water around in your bowl, then drinking the result before it freezes. This treat is nicknamed “dish soup”. The toilet is a bucket in a tiny uninsulated cubicle, and our sleeping quarters are no warmer. Five of us share a space 3 metres square by 2 metres high. To stay warm, I sleep in a fleece liner,

two bulky sleeping bags, and a protective outer bag. Even with four layers, I’m only just warm enough.

On day three, the temperature plummets to minus 34 degrees. To work outside, we need to keep every bit of skin covered. Frostbite is a serious business in Antarctica, and I think about the first explorers who crossed the Ross Ice Shelf. Our route closely follows that of Scott’s in 1911. Unlike us, his men had little protection from the elements and their success depended on much more than good planning. Back then, this involved luck, especially when it came to the weather and animal health.

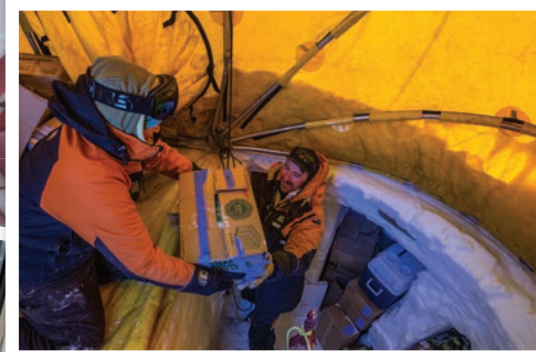
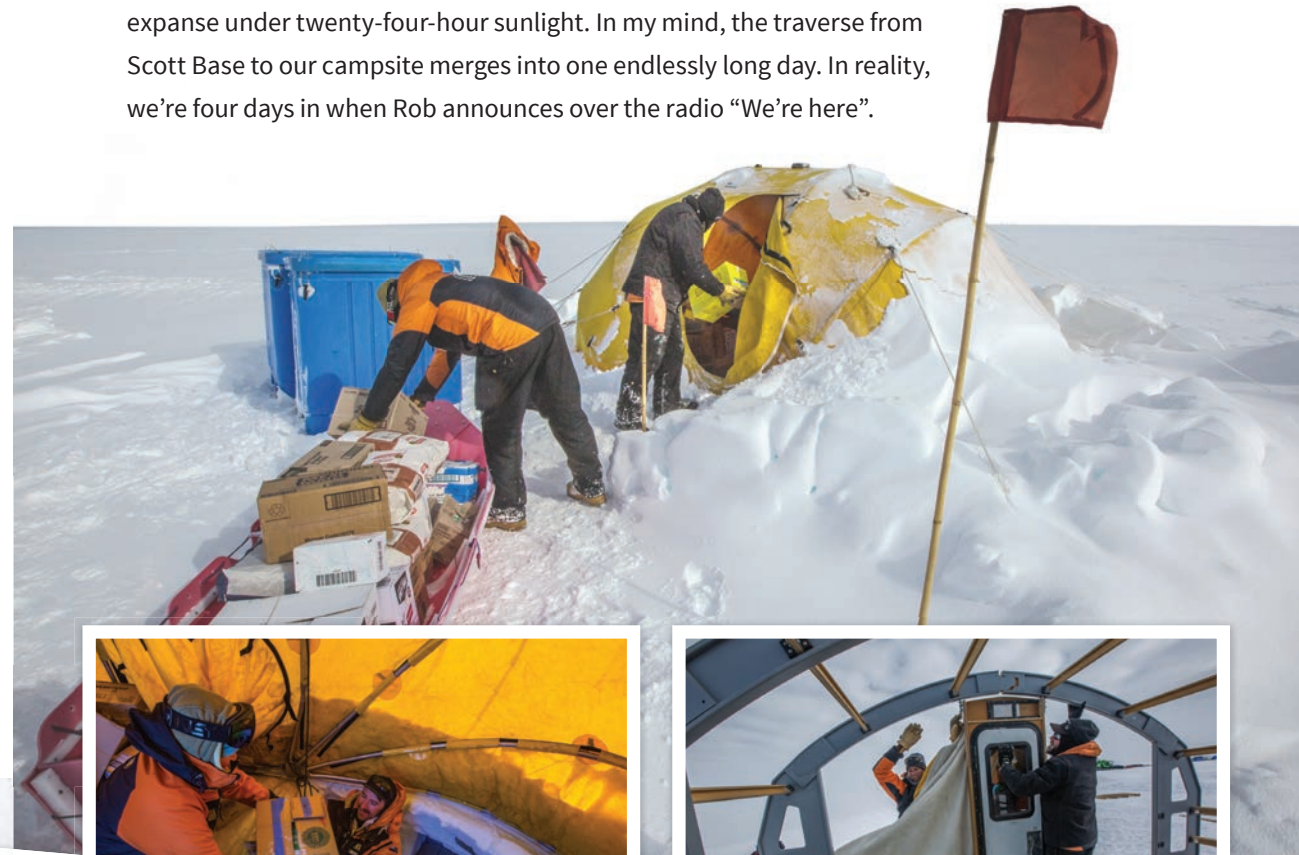


Buried somewhere beneath this ice lie the remains of Scott's and Shackleton's expeditions: food supplies never reached; men, dogs, and horses who perished along the way; and the tent and bodies of Henry Bowers, Edward Wilson, and Scott himself,

now on their final journey, carried by shifting ice towards the sea. Before I left on the traverse, I visited Scott's hut at Cape Evans. The building is a time capsule, a frozen monument to Scott's endeavours – and to the place where science in Antarctica first began.

Canvas Village

Out here, time has little meaning. We cross an endlessly flat, featureless expanse under twenty-four-hour sunlight. In my mind, the traverse from Scott Base to our campsite merges into one endlessly long day. In reality, we're four days in when Rob announces over the radio "We're here".



"Here" looks a lot like the 360 kilometres we've just crossed. Someone jokes about abandoning our mission and continuing to the South Pole. "We'd be the first motorised Kiwi team since Hillary." Instead, when the weather allows, we spend the next two weeks erecting tents. These range from a humble affair we'll use as a pantry to the Polar Haven science tent, which is larger than the average

four-bedroom house. The kitchen tent has running water – both hot and cold – as well as electricity, and the two large science tents are also fully powered. "A huge amount of effort is put in behind the scenes to allow the science to happen," says Jeff Dunne, the man in charge of setting up. "Nothing in Antarctica is easy. Every task takes twice as long as it would back home."



Antarctica isn't the fairytale land I'd imagined. Although the average summer temperature on the Ross Ice Shelf is minus 7.5 degrees, it never gets that warm while we're here. The thermometer rarely rises above minus 15. The ice might sparkle in the sunlight, but the wind is brutal. Outside, it can be hard to breathe, and the cold burns any exposed skin. Then there's

the featureless landscape: there are no mountains, no hills ... not even a bump. And there's no obvious horizon. Those who'd know tell me it's probably the flattest part of the planet. It's also surely the loneliest. Other than a United States resupply crew, which trundles past one day on its way back from the research station at the South Pole, we're the only living things here.





Underwater World

Far beneath the ice, it's a different story. The Ross Ice Shelf Cavity is the largest-known enclosed space on Earth, and it teems with life. Now that the camp's ready, the glaciologists, geophysicists, microbiologists, and oceanographers fly in; twenty-four scientists in total, all champing at the bit to explore this dark, not-quite-frozen world.

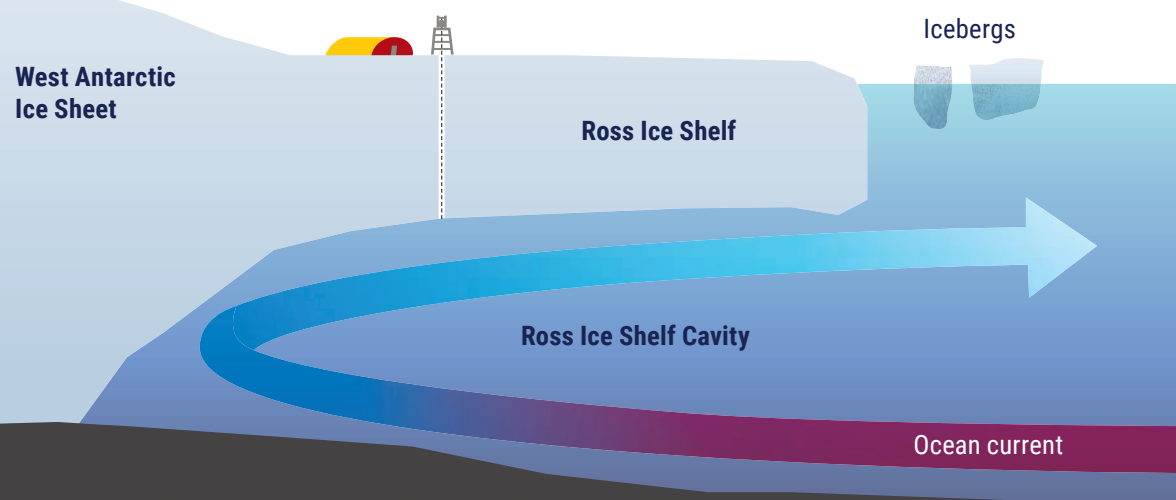
To create a portal to this underwater world, ice-drilling expert Alex Pyne and his team from Victoria University have designed and built a hot-water drill. It works a bit like a shower head: a fine nozzle on the end of a weight sprays hot water downwards

to melt a hole. Just above this weight, water also sprays outwards and, if needed, upwards, enlarging the hole to the diameter of a football. The nozzle can deliver 180 litres of water per minute (your shower at home delivers about 8). This water is melted from nearby snow that has been shovelled into rubber tanks and heated to almost boiling point. For this job, we have a series of boilers powered by five large generators. Once the hole is drilled, there's still the risk it will freeze over, so drillers and scientists work in tandem.



The scientists have three main tasks: extracting sediment cores from the sea floor, installing instruments for long-term monitoring, and lowering a tiny, remote-controlled submarine so they can observe the ocean below. “For me, it’s like going to Mars,” says lead oceanographer Craig Stevens. “We know almost nothing about the ocean beneath the ice shelf – an area that holds the same amount of water as two thousand Lake Taupōs.” Craig is especially interested in ocean currents. “Oceans absorb heat,” he says, “and ocean currents redistribute this heat. Any change in the climate can affect the force and direction of these currents.”

Craig and his team want to find out if warmer ocean currents are melting the Ross Ice Shelf from beneath. “Right now, we believe the ice shelf is stable, but it wouldn’t take much change in the currents for us to start to see dramatic differences,” he says. The Ross Ice Shelf is significant because it acts like a cork, holding back large sections of the West Antarctic Ice Sheet – part of the largest single mass of ice on Earth. In some places, it’s up to 2,000 metres thick, and it holds around 90 percent of the world’s freshwater. If the ice sheet were to melt, the world’s sea levels would rise by around 5 metres. What would happen after this has been much discussed. For some people, the effects will be catastrophic.



An ice shelf is a floating slab of ice that forms when a glacier or an ice sheet reaches the coastline. (An ice sheet, on the other hand, is a chunk of glacier ice that covers land.) Ice shelves are found only in Antarctica, Greenland, and Canada – and the Ross Ice Shelf is the world’s largest. It extends around 750 kilometres from the coast and is about the same size as France.



Home

After three weeks at the drill site, I board a twin-engine ski plane and head back to the comforts of Scott Base. Then I fly home. Shortly afterwards, the drillers break through the ice shelf, and the scientists are able to begin gathering their data.

Day by day, their work in Antarctica means they’re able to piece together the information needed to get more accurate climate-change projections. This means we can see a little more into the future. How we respond to this information is up to us.



Science on the Ice

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