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THE PUBLICATION OF THE NEW ZEALAND ANTARCTIC SOCIETY

ANTARCTIC

RED ALERT
The Southern Ocean's Response to a Changing Climate

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—use your cell phone to see inside

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Cover photo: People at the face of a grounded iceberg
Credit: Natalie Robinson/NIWA

Notes

NEW EDITOR

Elizabeth (Liz) Bridgeman, MComms with Distinction VUW, has taken up the role of editor and also the magazine layout and design under her company Words Worth Ltd. She learnt her craft of plain English writing and editing whilst working with the NZ Employment Service and, after going freelance, was the designer of *Navy Today* producing 11 copies a year for 7 years. She also researched articles for the *Tearaway* magazine and has produced books for private clients. She is now semi-retired. Her other interests include stone sculpture in the medium of Taranaki Andesite, creative writing, painting and sketching. Liz has recently moved from New Plymouth to Auckland to be closer to family.

The previous editor, Nicholas O'Flaherty, was farewelled at the Auckland Branch meeting in March and thanked for his sterling contribution in producing a stunning series of sponsored editions sent out to schools.

NEW NUMBERING & OTHER CHANGES

The Society's magazine *Antarctic* has been published four times a year until 2018 when it was decided to publish twice a year with a similar number of pages for efficiency and cost savings. These double issues were numbered as 1/2 and 3/4. As the biannual pattern is now established, we are revising the numbering to match. The June 2023 magazine will be Volume 41, Number 1 (pp 1-36). The November magazine will be Volume 41, Number 2 (pp 37-72).

We have made changes to the production of the magazine with the intention of delivering future magazines on schedule in June and November each year.

A few stylistic changes have been made affecting this new series including font changes. All the content is now in a non-serif font in order to make the information more accessible for people with Dyslexia who make up 10% of the adult population.

The new printer is Print House Ltd. This company is registered with the Forest Stewardship Council® (FSC®) https://fsc.org/en. The magazine is recyclable.

NEXT ISSUE

The copy deadline is 24 September for the November issue. Please email editor with the title in advance.

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Explore the new Scott Base in 3D

Red Alert: The Southern Ocean's response to a changing climate

Our changing climate is disrupting a delicate balance which exists in Antarctic waters. The end result will be devastating world wide. This article describes the fragile balance and how it is being affected by the warming climate.

Antarctica's influence on, and response to, the global climate has historically been mediated by the atmosphere and the global oceans approximately equally.

The atmosphere transmits large signals over great distances very rapidly. We experience this in the passage of storms and in the El Niño/La Niña oscillation.

The Southern Ocean draws heat and carbon dioxide down out of the atmosphere into the deepest layers of the global ocean.

The ocean, although it flows very much slower, moves vast quantities of water taking with it gases, nutrients and, critically, heat. In fact, the ocean can store as much heat in just its upper three metres as all the atmosphere stacked above it[1].

Interactions between Antarctica's ice and its surrounding ocean occupy a delicate balance of processes that occur within a narrow range of temperatures and salinities. The net result is that, for at least the last several thousand years, the Antarctic Ice Sheet has remained fairly stable. A dynamic equilibrium exists where new snowfall effectively replaces the ice lost to the ocean through direct melting or iceberg calving[2].

But this fragile balance is being threatened on a number of fronts simultaneously. 2022 saw the lowest September Antarctic sea ice extent on record[3], in a reversal of the decades-long trend of sea ice cover. The reasons for the previously increasing trend—which was non-intuitive behaviour in the context of a warming ocean—and for its sudden apparent switch, are not yet clear. This situation is troubling.

The cycle of Antarctic sea ice formation and retreat is one of the largest changes to occur annually on the planet. At its peak, in September, the apron of sea ice effectively doubles the size of Antarctica. Antarctica's land-based ice is melting, releasing fresh water.

The sea ice cycle performs many functions that help to keep our climate system the way we like it.

- Its vast white surface reflects almost all of the sun's incident energy back out to space, before it has a chance to heat Earth's system
- The flat, solid sea ice surface hosts and protects organisms that occupy many levels of the marine food web
- When sea ice forms, brine (salt) is rejected. This process provides the southern 'push' on the global ocean conveyor[4]. This complex network of currents, together known as the Antarctic Circumpolar Current (ACC), is driven principally by temperature and salinity variations.

The ACC is really the engine of the ocean. It transports heat, freshwater, oxygen, carbon dioxide and nutrients around the world via the deepest parts of the ocean.

In the Southern Ocean, there are four main regions where 'Antarctic Bottom Water' (AABW)—a very significant by-product of the sea ice formation process—is created. Plumes of cold, dense water coalesce and cascade down the continental slope, to be exported to the abyssal reaches of the Atlantic, Indian, and Pacific Oceans. Much of the global sea floor is covered by this water.

Approximately 40% of all ocean waters can be traced back to the process of sea ice formation around Antarctica's fringe[5].

In this way, the Southern Ocean has been drawing heat and carbon dioxide down out of the atmosphere and delivering it rapidly to the deepest layers of the global ocean. Changes within these deepest waters signal a true, as opposed to transient, shift in the equilibrium state of the climate.

Changes in these deepest waters signal a shift in the state of the climate.

And there's another factor at play which could further upset this extremely beneficial natural function. Antarctica is melting, releasing fresh water into the global ocean, at a faster rate than ever before.

Antarctica is made up of two principal ice sheets—the West Antarctic Ice Sheet (WAIS) and East Antarctic Ice Sheet (EAIS)—with global sea level equivalents of 5 m and 52 m, respectively.

The WAIS is grounded largely on bedrock that sits below sea level, so there are many locations at which it is vulnerable to melting by the ocean. At particular risk are the Pine Island and Thwaites Glaciers, through which much of West Antarctica drains. The water coming into direct contact with these ice streams is warming, so they are losing their grip on the bedrock along with their ability to hold back the ice streaming off the land[2]. If they collapse, which will be determined by human choices and behaviours in the coming decade, the rest of the WAIS will follow, although that may take several centuries.

By contrast, the EAIS is largely grounded well above sea level, and has long been considered relatively safe from destructive oceanic melting. Its fringes are in direct contact with the ocean, but with a wide continental shelf, that water has historically been very cold with little potential to melt ice.

However, with recent shifts in wind and ocean circulation patterns, warmer waters are pushing closer to the continent, allowing for intrusions of 'Circumpolar Deep Water' (CDW) which cross the shelf and contact the ice directly[6]. This water mass, historically several degrees above the freezing temperature, has warmed 0.8–2.0 °C over the past century[7], dramatically increasing its ability to melt ice. The summer of 2016/17 saw the highest fraction of glacial melt-water in the surface ocean of Prydz Bay on record, signalling a season of anomalously elevated melting[8].

The impact on global sea level is already being measured, and an accelerating rate of rise is committed for the next few centuries. But another, more immediate effect of dumping unimaginably large volumes of fresh water into the Southern Ocean is to strengthen the stratification—that is, the tendency for fresher, lighter water to sit above saltier, denser water.

Coupling this change in ocean structure with a decrease in brine rejection from reduced sea ice formation, we arrive at a two-fold lessening of the capacity for the ocean to draw down heat into the abyssal ocean:

- First, the reduced production of sea ice, and hence AABW, weakens the size and strength of the plumes that descend the continental slope[9]. They are therefore not able to move as much heat downwards and away from the ocean surface.
- Second, the stronger stratification acts like a barrier, making it harder for the plumes to descend to great depths. The net result is a reduced ability to access the very deepest ocean layers for storing heat, and a less effective southern push on the global ocean conveyor.

Slowing of the global ocean conveyor due to excess melt-water has long been speculated and even observed. Analysis of long observational records, along with new simulations of Earth's climate response, has signalled that substantial changes are already underway. The changes are locked in to be experienced by current and future generations. The shifts are, at present, just sufficient to emerge out of the inter-annual variability. But they have the potential to cascade through the system and deliver significant changes across the planet within a relatively short time frame.

Our window for avoiding the most disastrous climate change is rapidly closing

The science is clear. The necessary actions are clear. Our will to take them is all that stands in the way.

For the first time, the extent of the slowdown under realistic scenarios of near-future climate has been quantified. The results, recently published in *Nature*. Li et al.[10] found that, if our fossil fuel emissions continue at their current rates, the southern cell could slow by more than 40% by 2050, dramatically reducing its potential to move heat out of the atmosphere.

In another recent study[11], focussed on the Weddell Sea, the carbon sequestered to the deep ocean is similarly projected to reduce by ~40% by 2100 with accompanying reduction in sea ice formation of ~16% and increase in ice shelf basal melt of 79%. Each of these impacts lead to further warming, further entrenching the changes.

These projections are extremely sobering. They clearly demonstrate that our window for avoiding the most disastrous consequences of climate change is rapidly closing. Meeting the Paris Agreement—an international commitment to limit global warming to well below 2°C above pre-industrial temperatures—would be sufficient to prevent the complete collapse of the West Antarctic Ice Sheet[12]. The Agreement contains a further aspiration to limit warming to only 1.5 °C which would substantially limit the negative impacts of a changing climate.

However, we have already spent much of this buffer, with 2022 temperatures already 1.06 °C warmer than the pre-industrial period. In addition, the international pledges made under the Paris Agreement will only limit warming to 2.9 °C[12]. This is completely inadequate.

We are setting our planet on a course of change beyond anything humanity has ever seen, but which even the current generations will witness. The effects of climate change will reach into every aspect of our lives, so we must have cross-party support for meaningful climate-aware policies in all areas. The science is clear. The necessary actions are clear. Our will to take them is all that stands in the way.

By **Natalie Robinson,** Marine Physicist, NIWA

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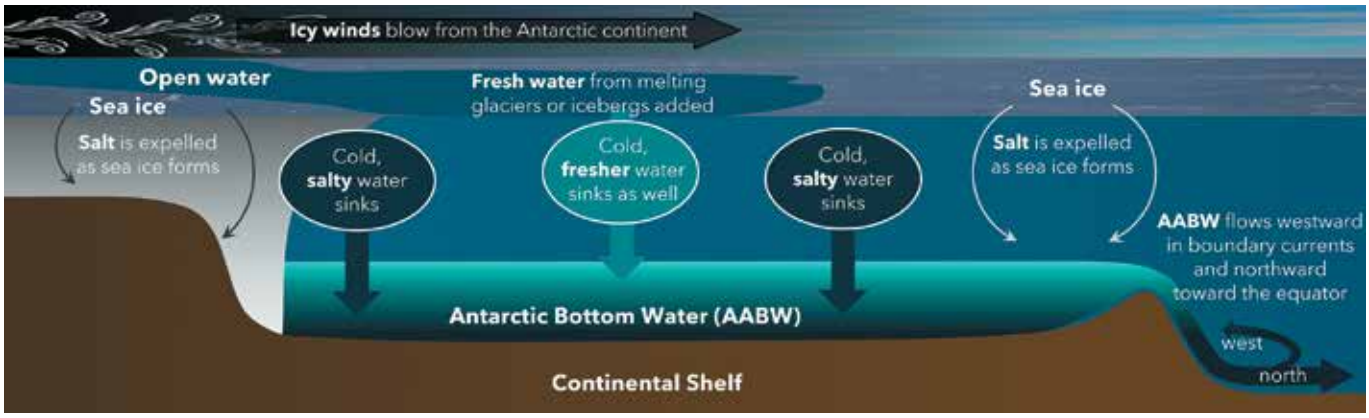


FIG. 1: Sea ice formation near Antarctica creates cold salty waters that replenish the greatest depths of the global ocean—the southern arm of the great ocean conveyor. Strong winds blow from Antarctica across the ocean, making surface waters cold. As the sea ice forms, salt is injected into the surface of the ocean. Colder and saltier water is denser, so eventually these waters will sink to great depth as Antarctic Bottom Water. If glacial meltwater is added, a fresher version of bottom water is created. It is still dense enough to sink, but only to shallower depths. Figure modified from Taylor et al., Woods Hole Oceanographic Institute, 2017 (https://www.whoi.edu/press-room/news-release/antarctic-bottom-waters-warming-freshening/)

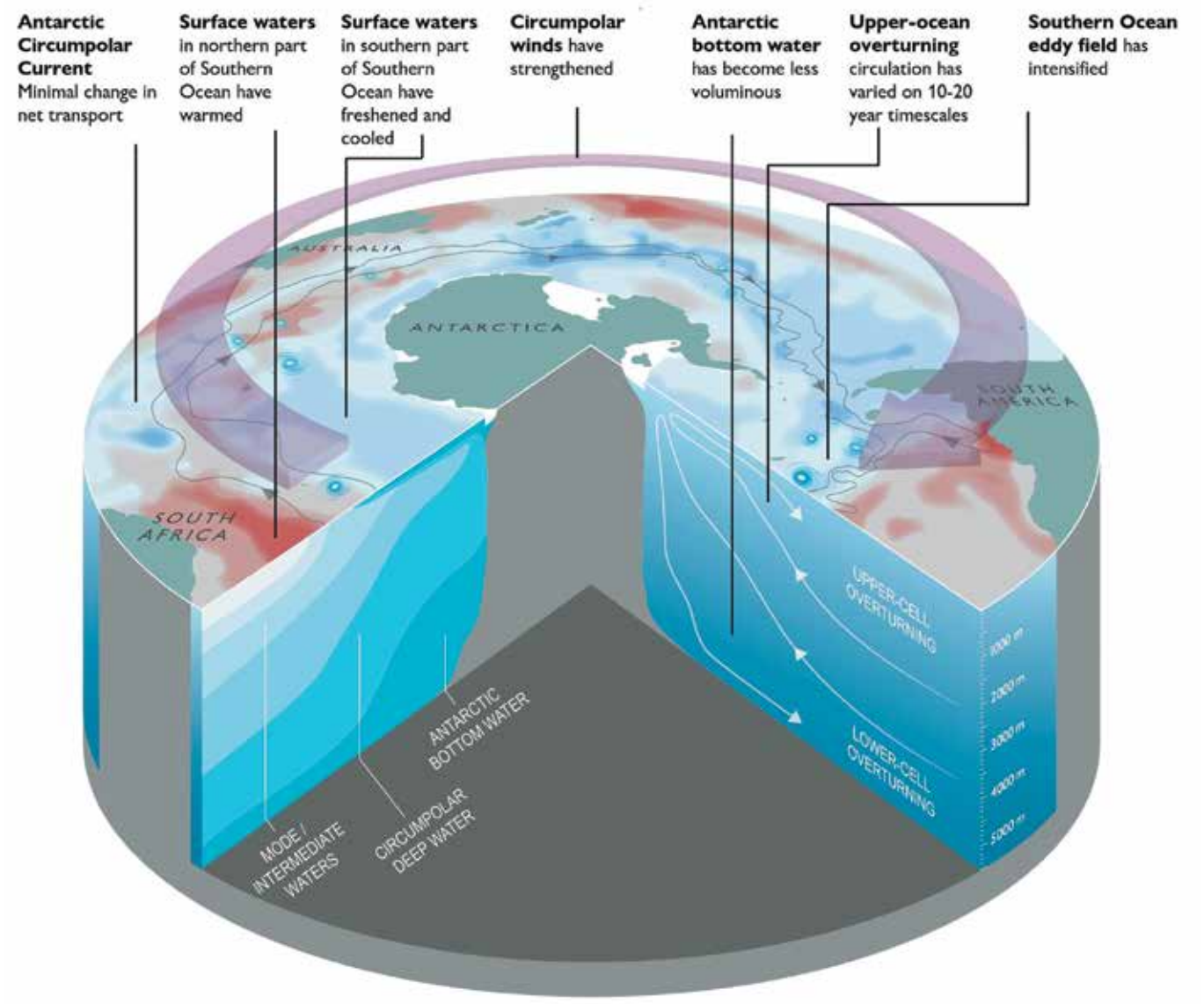


FIG. 2: The three-dimensional structure of the Southern Ocean results from various interactions between ice, ocean, and atmosphere, each dominating different geographic regions to varying degrees. The various types of water produced from these interactions reach to different depths—determined by their density. The water layers created are preserved as the water moves away from Antarctica to influence the rest of the globe. Adapted from IPCC report https://www.ipcc.ch/srocc/chapter/chapter-3-2/ and printed with permission.

Obituary
Graeme Wilson
1938–2023


Graeme Wilson restoring the Stevenson Meteorology Screen at Cape Evans 1960-61

Credit: Graeme Wilson

Graeme Carson Wilson, who joined the Wellington Branch of the New Zealand Antarctic Society about 1958, passed away at Nelson Hospice, 25 February 2023.

Graeme was the last surviving member of the party, led by Leslie B. Quartermain, that completed the first restoration of the historic huts left by Shackleton at Cape Royds in 1909 and Scott's expedition at Cape Evans in 1913. Shackleton's Ross Sea party used both in 1915-17.

Born in Christchurch 26 January 1938, he attended Christchurch East Primary School then had four years secondary education at St. Andrews College, completing study there in 1955.

Graeme joined Civil Aviation to become a trainee air traffic controller. Moving to Wellington in 1956-57, he attended meetings of the Society. He then met Leslie Quartermain, Head of the English Department at Wellington Boys' College and later Information Officer for Antarctic Division DSIR. He recalled Les as "a quietly spoken man, a great reader with a library in the house basement, and I really have to thank him."

Les introduced Graeme to prominent Antarctic Society members including Bob (later Sir Holmes) Miller, others from the Commonwealth Trans Antarctic Expedition (TAE 1955-58) and Dr Trevor Hatherton of the International Geophysical Year (IGY 1957-58). He became a close friend with Michael Prebble, of the same age, then a student at Victoria University Wellington. Graeme had also learned to fly, was familiar with radio communication and, with Quartermain, regularly attended Roseneath Presbyterian Church. About 1958 he was transferred to Whenuapai, the year he also met Dallas, a primary school teacher.

While at Wellington Airport, Graeme learned the Society had advertised for unpaid volunteers, to work on the historic huts at Cape Royds and Cape Evans. One of 16 applicants, he was given leave from work to apply and said "It was quite a surprise when he [Les Quartermain] rang me out of the blue". Biologist Dr Ron Balham (TAE) gave Graeme his TAE ice axe, boots and other items.

Quartermain flew south on 29 November 1960. The rest of the party sailed from Lyttelton on the Pvte John R. Towle arriving after seven days at Scott Base on 29 December. The party included Jack Sandman (carpenter), Michael Prebble, and Eric Gibbs. Eric "had a wonderful sense of humour" like Jack. "Antarctica was absolutely awe-inspiring," Graeme said.

Two winterers, Bob Buckley and Colin Jenness, were already at Cape Evans removing ice from within the hut. Work had also started at Cape Royds, where Graeme and Eric arrived by Sikorsky helicopter on the 30th. They lived in alpine tents, had a cooking tent and Graeme was amazed at "how well the building (had) stood up (and) the hardest job was covering the roof."

He then moved to Cape Evans which was "a big black shell inside" from blubber soot. He saw "Jack with a jemmy" open, after 40 years, Ponting's darkroom. They often went back to the hut in the evening where "Les worked tirelessly and was in his element. It was a great finale to his hobby of the Antarctic. We were following in his footsteps (and) he was absolutely insistent that everything should be done properly."

Leisure hours were spent walking, on photography, or with diary and letters in an American caravan. They returned to Lyttelton on the Alatna 12 February 1961. Graeme was again based at Wellington Airport, before his final training in Auckland after which he was posted to Christchurch in 1961 and then to the RNZAF airport at Wigram soon afterwards.

In January 1962 Graeme married Dallas Eaves and left Civil Aviation for share milking at Coutts Island (near Belfast). They moved to Golden Bay (Takaka) in 1968 and had a dairy farm. Maintaining his Society membership, he never lost interest in Antarctica.

Obituary by **David Harrowfield** (abridged)

ACNOWLEDGEMENTS: Resources used included excerpts from a recorded interview with Graeme by David Harrowfield (2001) and L.B. Quartermain's diary (Canterbury Museum). The assistance of Dallas and Ainslie Wilson was greatly appreciated.

The Aurora Australis
—a photographer's view

Aurora above one of the wanigans at Scott Base. This aurora was bright enough to cast shadows on the ground. The landscape was lit up far brighter than it would be by the full moon.
Credit: Anthony Powell

Aurora and the Milky Way passing behind the Satellite Dome at the Black Island Satellite Earth Station

The Aurora Australis—it is the southern hemisphere mirror-image of the Aurora Borealis in the north. It appears as a vivid glow in the night sky, ranging from shades of green to red, yellow, blue, and even violet. The mesmerizing dance of colours is created by the interaction of charged particles from the sun with the Earth's magnetic field and the atmosphere.

Green auroras are the most common and are caused by the interaction with oxygen atoms. Typically, green auroras occur at lower altitudes, around 100-150 kilometres above the Earth's surface.

Pink, blue and purple auroras are less common and are usually caused by the interaction of charged particles with nitrogen molecules in the atmosphere. These tend to occur at higher altitudes.

Normally at the start and end of winter is when you are likely to see slightly more colours appear at the higher altitudes, but they are not usually as bright as the main green auroras.

The most common questions I am asked about auroras are: “Do they really get that bright?”; along with “Do you really see that many colours?”; and “What are they really like to see in person?” Under the right circumstances the answers are, “Yes, yes and indescribable.”

It took many years of trial and error figuring out how to photograph and film them. My first couple of winter-overs in Antarctica, I was shooting all my photos on film, so the learning process was very slow. A year’s worth of photos would have to wait until I could get back to New Zealand to get them developed. Only then could I see the mistakes I had made, resigning myself to try again next winter. During my third winter-over I had bought an early model digital camera. While the resolution wasn’t great, it did give me instant results. This allowed me to figure out what settings to use on my film cameras, so my learning curve accelerated exponentially. Online aurora forecasting also got a lot better over the years which made the pursuit a lot easier.

Aurora above the Hillary Field Centre at Scott Base.

I've seen auroras fill the entire sky from one horizon to the other, lasting for hours.

The auroras you see in the Scott Base region are in a different league to what you see in New Zealand. Antarctica has some of the clearest skies on the planet. The low humidity, lack of dust and pollen, and minimal exhaust particulates in the air minimise atmospheric haze. Once you get away from the bases and runway lights, light pollution is negligible at best, so the stars are incredibly bright and clear right down to the horizon.

Since Scott Base is located south of the main auroral oval, auroras mostly appear in the northwest towards Cape Crozier. Mostly green in colour, an aurora of mild intensity is about the same brightness as the Milky Way.

If you can get away from the light pollution of the bases and spend a little bit of time to let your eyes adjust, even an average aurora will look quite vivid.

It is hard to spend a full 20 minutes outside at -40 degrees without any light. Having the patience to let your eyes fully adjust to the darkness properly is essential for good viewing. Turning on any light, whether it be a phone, the display on the camera or a flashlight resets the adjustment process.

A very low-power red LED light works well if you really need some extra temporary light,

Aurora above the Hangar and Pressure ridges in front of Scott Base looking towards Cape Crozier. Photo taken in early September in the evening twilight.

as it will not ruin your night vision. If you are taking photos, turn off the main rear display on your camera and only use the viewfinder. If the viewfinder is an electronic one, turn the brightness down to the lowest setting before heading out, and look through it with the same eye each time so that you are only reducing your night vision in one eye. If you really need to turn on a light, do it briefly and close one eye to preserve the night vision in that eye.

It's been my experience that some people do not see a lot of colour at night. I've had quite a few people tell me they have never seen anything other than pale white light from auroras. I remember one winter two of us were standing on Crater Hill shooting a real-time video recording of a large green aurora above Scott Base with a low-light camera. I had a display monitor hooked up to the camera and adjusted the settings so that the camera was recording exactly what I was seeing with my naked eyes. The person I was with looked at the monitor and said, "I can't see those colours, the aurora just looks white to me." Even though I was seeing the exact vivid green the monitor was showing, he was not. Different people often see very different things in low light conditions.

So, are auroras really that bright and impressive? If you put in the time and effort, they can be absolutely mind-blowing.

During my first winter in Antarctica, I was disappointed to find that the auroras I found were nowhere near as bright as I had come to expect

Credit; Anthony Powell

from the various photos I had seen. But we did not see any big displays that year, and we didn't really know how to look for them and or get good forecasts.

Since then, I've seen auroras fill the entire sky from one horizon to the other, lasting for hours. Other times they have been bright enough to cast shadows on the ground, lighting up the entire landscape, far brighter than the full moon. The shapes they form can vary a lot, from dainty picket fences to undulating solid curtains of light blocking out the stars. They can be surprisingly fast sometimes moving overhead and passing from one horizon to the other over a period of about 20 seconds, making you lose balance from the enormity of the movement. Starburst patterns can appear directly overhead, looking like a giant vortex opening in the sky, about to swallow you whole.

I've spent ten winters in Antarctica now, and during six of them, I was making regular trips out across the ice shelf to areas of zero light pollution around Black Island. Despite the hardships of the winter traverses, I was fortunate to have these opportunities, out in the vast darkness.

The really big auroras don't happen too often, but have no doubt, if you ever get the chance to see a major display, you will be absolutely blown away.

By **Anthony Powell**

A presence in my life
—reflections of a poet on Antarctica

Antarctica was a presence in my life almost from the beginning. Being born in Invercargill was probably part of it; as was the fact that the heroic age of exploration was quite a presence in my childhood. I had seen Scott of the Antarctic (largely filmed on a Swiss glacier, I believe), and of course there are various monuments to Scott in New Zealand's far south. Also, there was a stage when the US Operation Deepfreeze was a sea-borne operation based in Dunedin. Every so often the streets of Dunedin would fill up with very colourful American sailors, most of whom were going down to the ice. Many of them drank after-hours in the Crown Hotel, where my father was the publican.

So Antarctica was a long way away, but somehow it was part of my inner geography.

I wrote poems with Antarctic subjects, and later, while teaching at Victoria University, had even embarked on a bibliography of Antarctic fiction. I was intrigued by the fact that Antarctica, although it had no native population to create or sustain a literature, was nevertheless the setting for a huge range of imaginative writing, from Edgar Allen Poe and Samuel Taylor Coleridge through to the present day.

So I had no trouble saying yes to Tim Higham, the environmental writer who back then was Communications Manager at Antarctica New Zealand, when he phoned me up and asked if I would like to travel to Scott Base with the poet Chris Orsman and the painter Nigel Brown. The visit would be in January 1998, and we would be the first members of an 'Artists to Antarctica' programme. There had been visits in the past by one or two New Zealand painters and at least one writer–Graham Billing–but these were 'one-offs'. Our visit was to be the start of something much more substantial and ongoing.

This is how I found myself in a tent beside Lake Bonney, an ice-lake in the Taylor Valley, which for me will simply be one of the beautiful places of my life. Everything there somehow felt infinite. I didn't write many poems while I was in Antarctica, but I did write a couple at Lake Bonney, using rhyme to help me remember them until we were back in the settled warmth of Scott Base and I could write them down. Here's one of them.

Deep Field Song

Patch me out to Lake Bonney,
Patch me out to the ice:
Where the glaciers pour
And suspend at your door
And the world doesn't look at you twice.

And patch me out to McMurdo,
To Evans and Royds and Bird,
Where Shackleton and Scott,
By Jove, did a lot,
While admiring the tabular bergs.

But then patch me right back to Lake Bonney,
Patch me whatever the price:
The ice on the lake
Doesn't hurry or wait,
And it might be Paradise.

Of course, I've gone on patching myself back to Antarctica ever since—at least in memory and imagination. A two-week visit felt more like two years in terms of the impact on my life.

We had other ports of call in Antarctica, in particular Scott's hut at Cape Evans, and Shackleton's at Cape Royds. Inside Shackleton's hut I took furious notes from the Visitors' Book there, and once we were back at Scott Base turned them into a kind of 'found poem'. There was quite a crop of exclamation marks. I dedicated the poem to Chris Cochran, the heritage architect who has done so much important work on the NZ and UK Antarctic huts (opposite page).

I performed, if that's the word, both those poems during a poetry reading and book-launch at Scott Base. (Chris Orsman had somehow managed to print and publish a book of verse there—*Homelight*, 23 signed and numbered copies,

Visiting Mr Shackleton

Cool! Wow! Beautiful! Awesome!
Like going back in time.
Amazing! Historic! Finally
I am truly blessed.

Wow! History! Fantastic!
Wonderfully kept.
Shackleton's the man!
Like going back in time.

Wow! Cool! Historic! Yo!
Awesome! Privileged. Unreal!
And Thank you, God. And Happy
Birthday, Dad. And Thailand.

hand-sewn, with drawings and a lino-cut cover by Nigel Brown, which we put together in Hillary's TAE Hut.) There was a big audience, including a contingent who had come over from the American base at McMurdo. At the bar after the reading, one of the helicopter crew said to me that he thought this poetry stuff was really interesting. 'It's like you're somehow putting words inside the words.' That's as good a definition of poetry as I've ever heard.

That two-week trip had a big afterlife. I made a substantial sequence of poems worked up from field notes I made on the trip, and subsequently edited an anthology of imaginative writing about Antarctica–the first of its kind–called *The Wide White Page*. I also collaborated with the musician Norman Meehan and the photographer Anne Noble on the creation of a suite of Antarctic songs called, after a phrase from Scott's last journal, *These Rough Notes*. The songs dealt both with heroic-age Antarctica and with the life of the sciences down on the ice. The show subsequently became a book, incorporating the song lyrics alongside Anne's stunning photographs, and with an accompanying CD.

Probably the most significant event was a phone call I got in October 2004 from Peter Beck, the then Dean of Christchurch Cathedral. He was about to go to Antarctica to lead a commemorative service marking the 25th anniversary of the Erebus tragedy. Sir Edmund Hillary had agreed to contribute to the service, but not a Bible reading. Could I write something for him to read? Sure, I said, put down the phone—and went into a slow-motion panic.

Eventually, it came to me that there had been many, many voices in the wake of the disaster—distressed, angry, accusing, defensive—but that we had not heard the voice of the mountain. Nor had we heard the voices of the dead, who we might now remember after so many years as the full human beings they were, rather than as elements of a debris trail.

Anyway, I wrote my poem—a single poem in two parts—and called it 'Erebus Voices'. There was a glimpse of Ed Hillary reading it on the 6.00pm television news. He gave it heaps. A while later, I was sent a cutting from the Christchurch Press. It was a profile of Hillary, published just before he travelled to Antarctica. What would he be doing during his time there? He listed a number of things, one of which was this: 'I will be reading Bill Manhire's poem, which I quite like actually.'

Which I quite like actually! That's probably the best review I'm ever likely to receive.

EREBUS VOICES

The Mountain

I am here beside my brother, Terror.
I am the place of human error.

I am beauty and cloud, and I am sorrow;
I am tears which you will weep tomorrow.

I am the sky and the exhausting gale.
I am the place of ice. I am the debris trail

And I am still a hand, a fingertip, a ring.
I am what there is no forgetting.

I am the one with truly broken heart.
I watched them fall, and freeze, and break apart.

The Dead

We fell.
Yet we were loved and we are lifted.

We froze.
Yet we were loved and we are warm.

We broke apart.
Yet we are here and we are whole.

By **Bill Manhire**

Polar Tourism

An interview with Graham Charles

Co-founder and President
Polar Tourism Guides Association (PTGA)

Kia ora Graham, thanks for being available for an interview as you swing between commitments in Antarctic and those in the Northern Hemisphere.

What is the PTGA?

The Polar Tourism Guides Association (PTGA) is a performance standards body. We have a range of performance skill standards for guides and companies working in the polar tourism realm to use if they choose. We also offer a range of resources, forums and events, and benefits to guides as part of belonging to a professional industry association and creating a profession. We are registered as a non-profit entity in the USA.

POLAR TOURISM Guides Association
guiding guiding

Why did it come about? Was there any one incident where you thought this had to happen?

Whilst working on cruise ships through the mid 2000s, I realised companies were hiring completely unskilled people; dropping them into a fast changing challenging environment; and expecting them to manage, not only themselves, but important client safety.

My career and experience as a professional outdoor educator and Assessor for NZOIA* made me question this. Why was nothing established as an industry standard or expectation for someone 'guiding' in the polar regions?

Graham Charles, Senior Polar Guide, Assessor and PTGA President

I tried approaching the International Association of Antarctica Tour Operators (IAATO) at the time but didn't know enough about how Trade Associations work and that didn't work out. Eventually I just decided to enlist the support of other experienced guides who shared a similar outlook and do it ourselves.

When you look around the globe at pretty much any 'guide association' they are all a result of the same process—a guide or group of guides decide things are out of control and some standards need to be set. This is how NZOIA came about in the 1980s. There is no-one who knows the requirements of their job better so they do it themselves without a larger authority, which doesn't have the knowledge of the skills required, dictating their workplace skills and judgment. So, that's what we did.

We started drafting syllabi for foundation skill sets in 2016. We gained our US federal recognition late in 2016 and have been growing since then.

Initially things were very slow with a LOT of antagonists. Change is difficult. But, now we are seeing near exponential growth and uptake as people really start to see the writing on the wall for the industry, the expectation from polar tourism guests, and the demand for qualified guides.

Credit: Graham Charles/PGTA

Guiding on the Antarctic Peninsula

How does the PTGA work?

We have a range of syllabi covering core skills that polar guides use and our Assessors and Accredited Companies utilise our Workplace Based Assessment model to test guides against these syllabi. With successful completion a guide builds a portfolio of qualifications which add up to two different status levels—Polar Guide or Senior Polar Guide.

Mostly guides are assessed in the workplace by assessors who also work for the same company but assess to the PTGA methodology and systems. This is the most cost effective and time efficient option for the industry.

What is the relationship between the two organsiations?

PTGA is an Associate Member of IAATO. This means we are allowed to participate to a certain level within IAATO and contribute our expertise to any discussion and considerations that fall within our expertise. We are not tour operators so there is a higher level of IAATO meetings and discussions that we don't participate in. We support the IAATO mission and have been collaborating with them for a number of years by amplifying key messages pertaining to guides and guiding practices on the Antarctic Peninsula.

Where do you think tourism is heading in the Antarctic/Polar Regions?

It is busy. Very busy. Personally, I think places like the Antarctic peninsula are about at threshold for use, traffic and impact. I think it is time to somehow put some caps on visitor numbers. This isn't a simple task however and besides getting agreement from Treaty nations any numbers cap needs to be done in a mindful manner so that it doesn't immediately shut the door on those with less means. Basic economics suggests that if we make something restricted we increase its value and therefore people will pay more to see it. It seems antithetical of the stated industry goals and mission statements to make the polar regions only for the very wealthy.

It is easy to suggest and highlight what the problems are across the broader polar tourism industry. Implementing change to alleviate these problems is far harder and PTGA is a very small voice in this process.

Rigid Inflatable Boat (RIB) briefing

RIB Training for guides

What was the journey for you from an outdoor instructor to leading this international organisation?

I'm somewhat uniquely qualified for this organisation and role. I have had a career assessing criterion based syllabi through the New Zealand Outdoor Instructors Association (NZOIA) pathway and I have a history of over 20 years with the polar tourism industry and most of its facets.

This random blending was the unplanned result of a lifetime of outdoor activities starting as most Kiwi's do by tramping with my family as a youngster then progressing from there. I knew from a young age I wanted to be an outdoor educator and left home to work at Rotoiti Lodge at age 17. I went on to become an instructor at the Outdoor Pursuits Centre (now Hillary Outdoors). I was a pretty solid generalist and was as comfortable with mountaineering, ice climbing, rock climbing and kayaking before focusing on competitive white-water slalom kayaking for a number of years. Retirement from the global race circuit lead to a few years of multisport racing, a return to exploratory hard white-water kayaking and publishing the *NZ Whitewater Guidebook* with 5 editions over 14 years.

I had always been fascinated by all things polar and initially had an opportunity to work at Scott Base in 1998. It was during that time that I knew I wanted to be back in Antarctica doing some sort of private expedition. This desire gave rise to the Antarctic Peninsula Sea Kayak Expedition and the birth of our expedition team Adventure Philosophy. We spent almost the next decade putting together long and difficult expeditions around the globe looking for things people had not done before. One of our better known was the first sea kayak circumnavigation of South Georgia in October 2005.

A completely random meeting with a stranger lead me to taking a job as a sea kayak guide for an expedition cruise company. This was the beginning of a completely unplanned career as Expedition Leader and Polar Guide which has now surpassed twenty years.

Where to now—for PTGA, for you?

I'm not sure what next. PTGA is growing very fast and I'm, personally, not doing enough climbing, paddling or adventuring. I have some international mountaineering goals over the next 4-5 years I'd like to achieve. My daughter has just turned six and that uses up any spare time I might think I have but is a wonderful adventure in and of itself.

PTGA will mature in its administrative systems and I feel there is opportunity for us to use the same workplace based assessment process for the broader expedition cruise industry in which so many of our members already work. In the meantime, PTGA will continue to assess as many Polar and Senior Polar Guides as our capacity allows.

Interviewed by **Rex Hendry**

*NZOIA = New Zealand Outdoor Instructors Association www.nzoia.org.nz'

Credit: Graham Charles/PGTA

Leadership training for guides is becoming more important

WHAT ARE THE THREE BIGGEST CHALLENGES FACING PTGA NOW?

1. Northern sovereign nation control. Each northern nation could, if they choose, create their own version of guide standards and insist on these to operate in their territory. Norway are trying to do this in Svalbard currently. It would be a disaster for guides and companies because the cost and time to do this would be completely prohibitive. PTGA offers a set of minimum standards which are as relevant in Svalbard as they are in the Canadian Arctic.

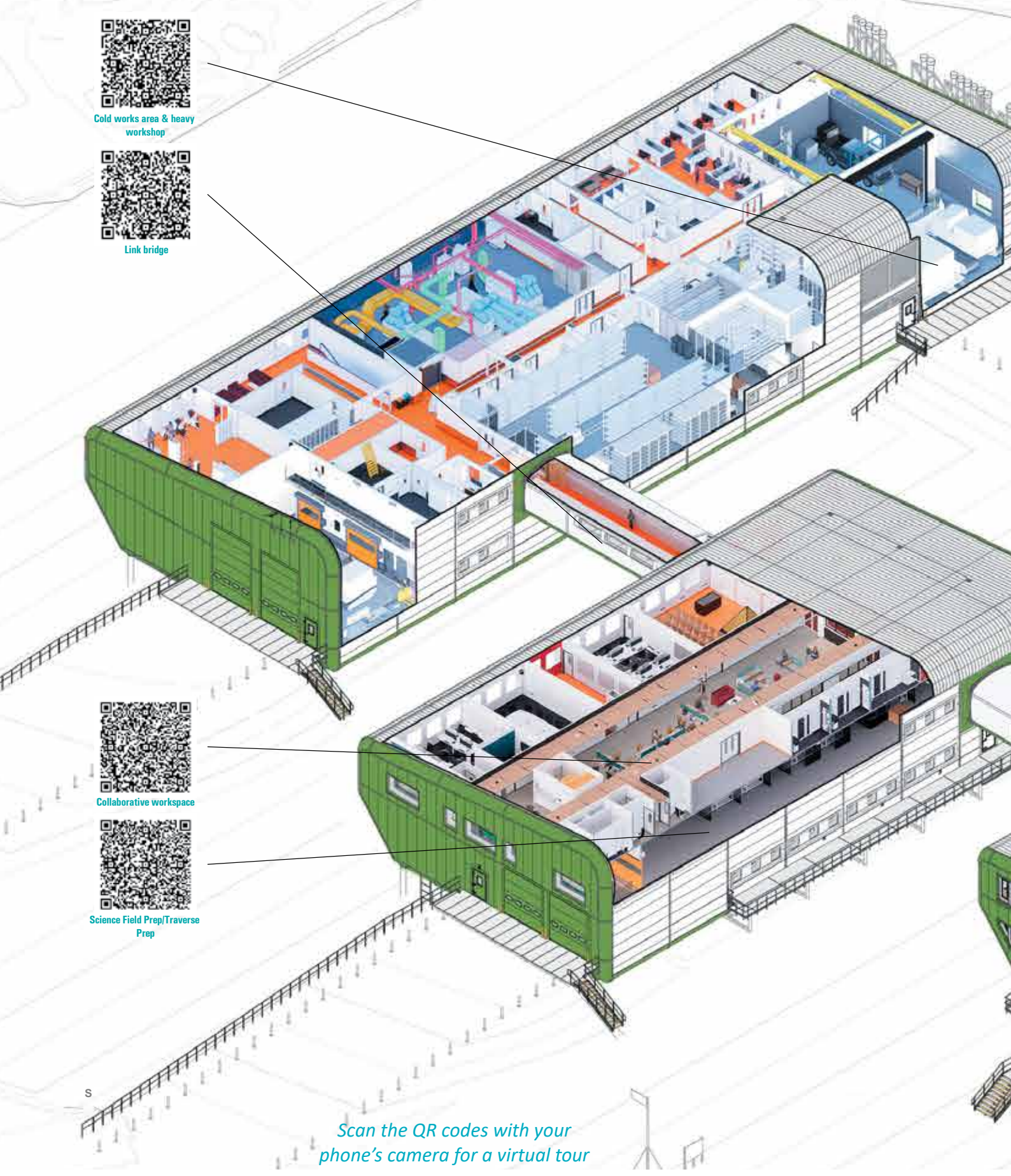
2. Scaling fast enough to meet demand with rising tourism numbers and operators. The 22/23 Antarctic season was the biggest on record by a large factor. The pressure to staff, ships and operations with skilled guides is one of the biggest concerns for operators. PTGA is uniquely positioned to help this but we also need to find staff who understand the industry deeply enough.

3. Administrative challenges of being an international association—there are very few international associations like ours that have not franchised operational control to different countries.

Multiday expedition

Credit: Graham Charles/PGTA

Explore the new Scott Base in 3D



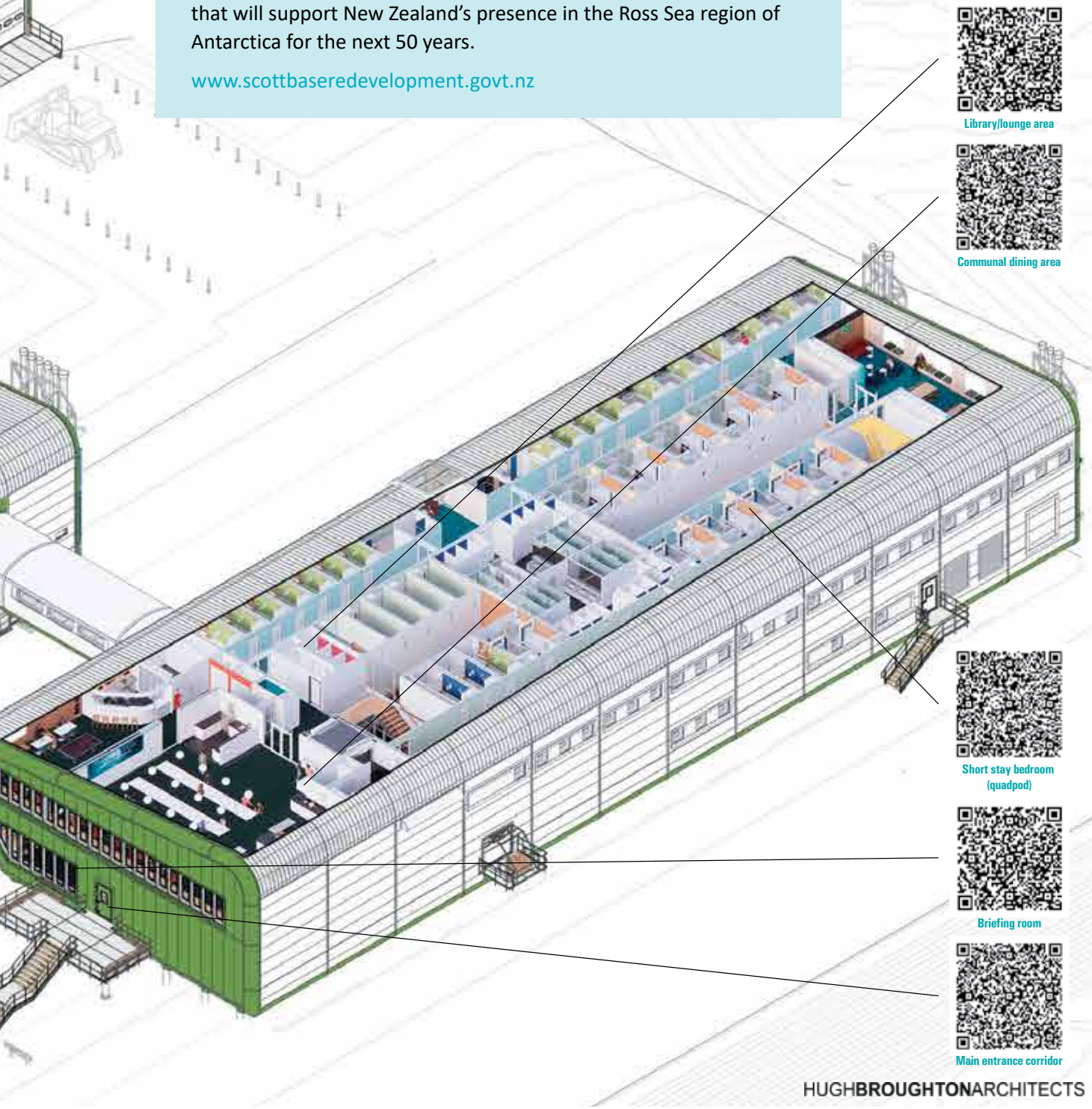
Scan the QR codes with your phone's camera for a virtual tour

Antarctica New Zealand

Scott Base is Aotearoa New Zealand's home on the ice. The facility is the strategic hub for scientists from New Zealand and across the globe to carry out some of the most important research in the world.

The redevelopment of Scott Base will see the aging infrastructure replaced with a safe, fit-for-purpose, and sustainable research facility that will support New Zealand's presence in the Ross Sea region of Antarctica for the next 50 years.

www.scottbaseredevelopment.govt.nz



Back to Base—but which one?

At the last count there were 76 scattered across the Continent

Concordia Station

Credit: Lucia Agnoletto

Most Kiwis will be familiar with Scott Base. In fact, many will have spent time there over the decades. As New Zealand's home-from-home in Antarctica, it's been the launch pad for countless scientific field trips or expeditions across the ice. But what about the other bases? This article takes a peek.

There is a sizable cluster on the South Shetland Islands and just over a dozen on the Antarctic Peninsula. Others are on the Antarctic Plateau or along the coast, offering direct access from the Southern Ocean or the five Gateway Cities.

Argentina has 13 Antarctic stations, the most of any country. Russia has ten. Chile has nine.

Most of the stations are year-round facilities, while 36 are seasonal, only operating between October and February.

Information about the facilities is held by the Council of Managers of National Programmes (COMNAP) which published its *Antarctic Station Catalogue* in 2017. The 154-page inventory (available online as a PDF) is incredibly detailed, providing a statistical breakdown of every site, including its size, infrastructure and the environment it's located in. With colour photos and a brief history of each station, it reads like the world's most extreme real estate brochure.

The first thing to note is that the stations vary in size. Among the smallest is Chile's Dr Guillermo Mann, in Cape Shirreff. It only has eight beds, with scientists drawn there to study the nearby Antarctic fur seal colony. While Argentina's Brown station is a modest collection of rustic-looking huts beside the water in Paradise Harbor. It can accommodate a maximum of 12 staff. Compare them to McMurdo, the United States' giant base on Ross Island which can house 1200 people in the summer months, a mixture of staff, scientists, visitors and military personnel.

"It really is a small town," says Allen Pope, science program officer at the US National Science Foundation (NSF).

McMurdo, which is affectionately known as Mac-Town, comprises more than 80 buildings, including a hospital, a fire station and a power plant.

"It could be a college town," says Pope. "Except there are no kids and no dogs."

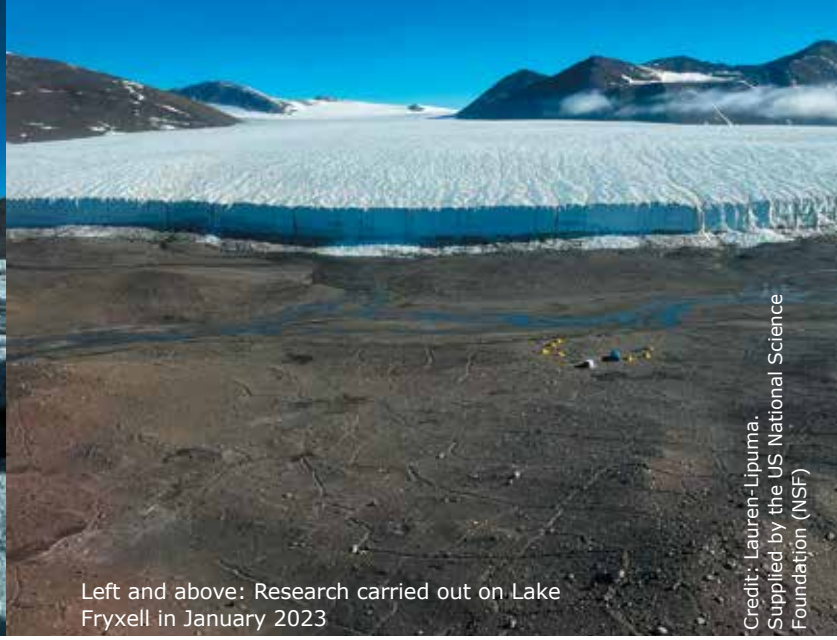
Established in 1955, McMurdo is one of three stations operated by the United States Antarctic Programme. The others are Amundsen-Scott at the South Pole and Palmer on Anvers Island, off the Antarctic Peninsula.

Like any town, McMurdo has its own culture and traditions, including Icestock, a one-day music festival held on New Year's Eve.

"They set up a stage, outdoors, in the middle of the station, and had bands made up of people from McMurdo play under the midnight sun," said Pope.

As well as the size, the design of each station greatly varies, each one bespoke to its location or finances of its national programme. Many are architectural wonders, such as Germany's 40-bed facility Neumayer III which looks like a cruise liner on stilts. Or South Africa's SANAE IV, a 132m caterpillar of a building which can house 80 staff and sits atop a rocky ridge surrounded by a glacier.

Among the most unique is the UK's Halley VI, which could be mistaken for a Moon base in a 1950's science fiction film. It stands on the barren Brunt Ice Shelf but can move. In fact, it was the world's first relocatable research facility. Operated by the British Antarctic Survey (BAS), it consists of eight modules with ski-fitted legs. However, each section can be separated and towed independently to a new location.



Left and above: Research carried out on Lake Fryxell in January 2023

Credit: Lauren-Lipuma. Supplied by the US National Science Foundation (NSF)

Equally striking in its design is China's Taishan, which looks like a red and white UFO—fittingly, it is used for the study of space physics.

Antarctica is renowned as a place for international cooperation and no station embodies that more than Concordia, shown here, the only joint-owned facility, operated by France and Italy. It's also one of the most remote, 1100km from the coast. It sits on an ice cap at an altitude of 3233 m—that's just 491 m lower than the summit of Aoraki/Mt Cook.

The stations are a source of national pride and are often named after significant people or places. Some honour royalty, such as Spain's King Juan Carlos I, or Belgium's Princess Elisabeth, the Duchess of Brabant. Argentina's Brown station was named for Admiral William Brown, known as "the father of the Argentine Navy". Others celebrate scientific figures, including Czech Republic's Johann Gregor Mendel or Ecuador's Pedro Vicente Maldonado. China's Great Wall and Peru's Machu Picchu pay homage to their famous landmarks.

Jang Bogo is one of two Antarctic research stations operated by the Republic of Korea. It was named after Jang Bogo, the legendary sailor who controlled the Yellow Sea in the 800s and it is imbued with other aspects of Korean history.

Jang Bogo

Credit: Korea Polar Research Institute (KOPRI)

"The main blue building has three wings on the basis of sky, Earth and man, which is the foundation of traditional Korean spirituality," said Dr Se Jong Han of the Korea Polar Research Institute (KOPRI).

Jang Bogo, which lies close to the Ross Sea in Terra Nova Bay, is one of the newest stations in Antarctica, opening in February 2014. It's also one of the most innovative. Its three "wings" extend from a central hub and it has a "jet-style" aerodynamic outer-shell to withstand winds of more than 140 kph. It was designed by Hugh Broughton Architects, the London-based firm which is also responsible for the Scott Base redevelopment.

Another high-tech facility is the Princess Elisabeth, the world's first zero-emission polar research station. Operated by the Belgian Federal Science Policy and Polar Secretariat it opened in February 2009 and boasts renewable wind and solar energy and water treatment facilities.

For all their differences, the aim of each station is to support science, both on-site and in the field. In the summer months 10,000 scientists and support staff work in the Antarctic. McMurdo alone accommodates more than 800 scientists and support staff. The station supported 68 science events in the 2022/23 summer, including astrophysics, glaciology and ecosystems.

"It's science of a continent," said Allen Pope, who was based at McMurdo for a month as NSF science representative. "It's not just disciplinary. It really is everything about Antarctica and using Antarctica as a unique platform."

By **Lee Kenny**

BIRTH and the Early Days

Victoria University of Wellington's Antarctic Expeditions (VUWAE)

The last issue of Antarctic reported on recent and future plans for Victoria University of Wellington's Antarctic Research Centre. Here Peter Barrett looks back to its origins and early days, outlining the lucky combination of good people and interesting opportunities that led to a history of success, with a few challenges along the way.

IN THE BEGINNING

Since 1954, when he took over the chair, Bob Clark, Professor of Geology at Victoria, had built a strong and varied academic staff with a research-oriented culture. It was a period of significant change in Earth Sciences generally, a consequence of the new Plate Tectonics. He was also alert to research opportunities for his students and staff. Soon after he arrived, he was invited to join the Ross Sea Committee as Universities representative for planning NZ's Antarctic scientific contribution to the International Geophysical Year (IGY) 1957-58. Bob had a couple of senior Geology students who were keen to go south for the summer and return on the supply ship Endeavour helping out wherever needed. Bob's persistence won out, and Barrie McKelvey and Peter Webb arrived at Scott Base on December 30, 1957.

IGY Science Leader Trevor Hatherton recalled at the time they were "*uninvited, unheralded and unwanted*". He went on to say ten years later, "*Somehow, and I have no clear recollection of how they achieved it, these two students 'infiltrated' a couple of non-geological parties intending to study the lakes of the so-called dry valleys. As a result of their work during the next few weeks the dry valleys became Dry Valleys, and during the next few years probably the most intensively studied parts of the Antarctic Continent*"[1].

Peter Barrett recalls the birth of his personal interest, "*I was a stranger to Wellington when I arrived in late 1969, having spent my early years in the Waikato before studying geology at Auckland University. My passion was exploring caves in the Waitomo district, but my University Masters roommate Vic McGregor arranged my first trip in 1962 to Antarctica and the Ellsworth Mountains with a US party. My interest was secured by a second trip in 1963 with Vic and two others as the NZARP Southern Party to map the coastal foothills of the Transantarctic Mountains at 85°S. That led to two further trips mapping the Beacon sandstone in the Beardmore Glacier area as a PhD project (1966-68) with Ohio State University. But I knew nothing about the Dry Valleys, the McMurdo Sound region, or the robust but friendly research culture of my new academic home.***"**

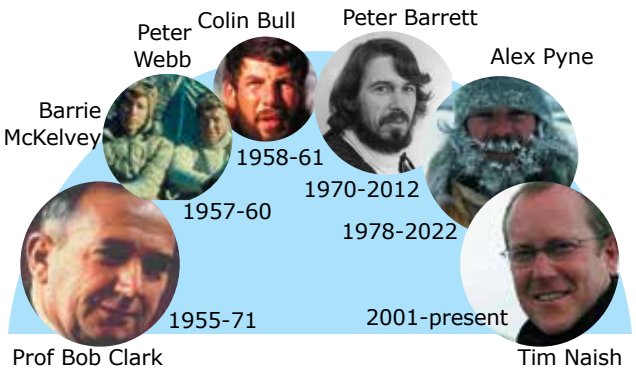
The following year, McKelvey and Webb with VUW explorer/physicist Colin Bull and biologist Dick Barwick returned for the second expedition into the McMurdo Dry Valleys.

The story is told well in *Innocents in the Dry Valleys*[2] of establishing a pattern of staff and students planning research a year or two ahead, and promptly publishing the results.

From 1960 to 1967 VUWAE expeditions had produced 50 peer-reviewed papers, 14 in *Nature*. Topics covered not only the first geological descriptions of the area, but also the salts in the soils and the warm saline lakes. Bob drew expedition leaders from: Biology (IGY veteran Ron Balham); Geography (Ralph Wheeler); and Geology, including Harold Wellman, Paul Vella, and John Bradley. All were somewhat controversial geological thinkers of the times, as was chemist Alex Wilson, who led or contributed to six of the *Nature* papers, then moved to the new University of Waikato to found their Antarctic Research Unit. Student expedition leaders included Ian Willis and Warick Prebble, with many members going on to highly successful careers in academia and industry.

A FOCUS ON THE BEACON SANDSTONE

Bob needed someone else to take over, and I was looking to extend my knowledge of the Beacon



Influential figures in the birth of VUWAE and growth of ARC

Picketing and other activities in 2000 succeeded in saving VUW's ARC

sandstone to the McMurdo region. Fortunately, the ground had been prepared through the continued interest of Barrie McKelvey and Peter Webb in the Beacon strata, culminating in VUWAE 13 (1968/69) to extend their mapping south of the Dry Valleys region. There they discovered Devonian fish beds, paving the way for VUWAE 15. This was a great introduction to the Beacon of the region, and also significant responsibility, being in the field for three months with Barry Kohn a student from VUWAE 13 as deputy, two Australian fossil fish experts (Alex Ritchie and Gavin Young), two Honours students Rosemary Askin and John McPherson, for theses on Beacon palynology and Devonian fish bed sedimentology, and petrologist Rodney Grapes with student David Reid for the dolerites.

The preparations went well, and our Hercules landing on the Skelton Névé was relatively smooth. However, we did have set backs. On the second morning I succumbed to asphyxia in the tent stirring porridge, but tent mate John's calls and Barry's subsequent resuscitation saved me. Also, as the season wore on, our four toboggans were reduced to two through travel stress from the hard sastrugi around the Skelton Névé. Nevertheless, we completed the season with over 5000 metres of measured sections through the Beacon, 1½ tons of fish-bearing rock, and an introduction to the Warren Range layered dolerite complex, though it remains a puzzle to this day.

International interest in the concept of the Gondwana Supercontinent was high in the 1970, so having just arrived in Wellington I persuaded Bob Clark and the Leave committee to support my travel that August to the 2nd Gondwana Symposium in South Africa and the 2nd Antarctic Geology and Geophysics conference in Oslo two weeks later. By then I knew enough of the stratigraphy of the Beacon strata along the Transantarctic Mountains through discussions with colleagues in Ohio and NZ to propose a new framework (Beacon Supergroup, with a lower Taylor Group and an upper Victoria Group), and it has lasted. While annual VUWAE expeditions continued to explore local aspects of Antarctica's Gondwana strata, with Victoria hosting the Fifth Gondwana Symposium in 1980, our expeditions came to include other quite different aspects of Antarctic geoscience.

FOCUS ON DRILLING TO GREENHOUSE WORLD

The first and most lasting shift in VUWAE focus began when Peter Webb and I were selected to join 10 other scientists for 10 weeks on the Glomar Challenger for DSDP Leg 28. One of our aims was to core sea floor sediment in the Ross Sea for its record of climate history. This was a transformational experience, showing us the obvious place to recover continuous records of the post Jurassic history of the Antarctic region. We knew that it would be a long time before the ship returned to core there again, but Peter Webb was about to move to the US, and had taken a leadership role in the fledgling Dry Valley Drilling Project (DVDP) 1973-75.

This was a joint US-NZ-Japan venture, with the Drilling Section of NZ's Department of Industrial Research (DSIR) responsible for the drilling. The goal was to try out the rig by coring outside McMurdo Station's Thiel Earth Science Lab on volcanic Hut Point Peninsula, and then shift the rig to several sites for coring sediment fill in the Dry Valleys. We decided the last (15th) hole should be from sea ice off the coast, the goal being to core back to the Greenhouse World. A seismic

refraction survey showed there was at least a kilometre of strata off Marble Point. But the first attempt, DVDP 15 in 1975, failed after coring to just 50 metres below the sea floor (m bsf). Decision-making delays led to a late start and the sea ice began to crack. However, it was useful for the small science team to test a core recovery and description process adapted from Webb and Barrett's Leg 28 experience. We thought it worth persevering.

VUW then took the lead in planning a second offshore coring attempt. We gained support from DSIR for the drilling, while US offered us the rig, along with science collaboration through Peter Webb, who had by then moved to the US. This second attempt was named the McMurdo Sound Tectonic & Sediment Studies (MSSTS) project, and planned to gain more time sending the drilling team to the ice on WINFLY in August, 1979, to set the rig up on new sea ice in cold dark September. Unfortunately, the camp and rig were too basic, and a failure to compensate for the weight of the drill string led to it kinking at the sea floor after coring to 229 m bsf. However, the core took us back to around 25 million years, and the planning and core processing benefited greatly from then MSc student and part-time expedition manager Alex Pyne.

The third offshore coring attempt, the Cenozoic Investigations in the western Ross Sea (CIROS) project was another NZ-US collaboration led by VUW, and this time Ohio State University, where Peter Webb had been appointed Chair of Geology. It was originally planned to have two holes in the first season (1984) supported from a camp at Butter Point in Ferrar Fiord, one close to the MSSTS-1 site on the downthrown side of the Transantarctic Mountains frontal fault, and the other on the upthrown side in Ferrar Fiord. The second season (1986) was to core the seaward-dipping strata off Cape Roberts, 100 km north and revealed in a seismic survey led Fred Davey, Geophysics Division DSIR in 1981.

The drilling and science operations team flew south on WINFLY in late August, and in September set up the rig on the CIROS site. However, Jack Hoffman, DSIR Drilling Superintendent, asked the pilot on the flight down to take a close look at the rig and the ice around it, and concluded that it wasn't safe. This led to a busy week during which the entire rig was shifted 15 km into Ferrar Fjord, and set up on the CIROS-2 site. But then flotation jackets for reducing the weight of the casing imploded as they were lowered to the sea floor, leading to a call from Scott Base to reschedule the project for next year. Alex and the drillers overcame the issue, and the hole was successfully cored to 168 m bsf, the lower 2 m being granite basement—just in time. A brief but furious storm 12 hours later destroyed the plywood protection on the rig and the Science Hut.

The many problems encountered in the drilling of CIROS-2 led to closer collaboration between Alex and Webster Drilling, and the remarkable achievement in 1986 with CIROS-1 reaching a depth of 702 m bsf with 98% recovery. This was just deep enough to reach the earliest Eocene, but sadly not quite the Greenhouse World. It did provide the interest and justification for drilling the strata off Cape Roberts, but that required a new name, the Cape Robert Project, and a decade of planning.

VOLCANOES, TECTONICS AND CONTROVERSY

The early years of VUWAE were marked by a diversity of research directions, which continued alongside the developments in offshore drilling. For example, the early interest in the warm saline lakes and the nature and origin of salts in the soil was continued almost annually through the 1970s by Harry Keys, culminating in a widely cited review of salts in the region in 1981. A persistent interest in the Erebus Volcano by Philip Kyle began as a VUW student assistant in 1968. It led to a series of expeditions in the 1970s (including a PhD in 1975) to understand crater lake behaviour and plumbing. These involved French volcanologist Haroun Tazieff, DSIR geochemists including Werner Giggenbach, polar guide/photographer Colin Monteath and many others. Philip continued his annual visits to Erebus from the US until recently. Meanwhile, VUW's Ray Dibble was a key contributor through his pioneering work for over three decades in developing equipment to record volcanic earthquakes and visual telemetry for Erebus lava lake activity. The whole Erebus story is magnificently captured by Colin Monteath in *Erebus—the Ice Dragon*[3].

Several VUWAE expeditions have also focused on the Transantarctic Mountains, their origin, structure and history. In 1990 Tim Stern working with Uri Ten Brink dragged a ton of explosives

to run a seismic line from the Ross Ice Shelf and across the Transantarctic Mountain Front at 85°S to reveal a sediment-filled buried basin seaward. They had previously collaborated to argue for an extensional rift margin and flexural uplift as the key to their origin.

On the question of timing, a collaboration between VUW's Paul Fitzgerald and U Melbourne's Andy Gleadow involved several field seasons in the 1980s sampling mountain sides. This allowed them to use new techniques in dating erosional uplift history of mountains. They've risen around 5 km in the last 55 million years but very little in the last 14 million years.

John Mercer's 1978 *Nature* paper arguing a threat of a melting Antarctic ice sheet from CO_2 emissions within the next 50-100 years profoundly changed the thinking for those in the Antarctic community who took it seriously. It immediately gave purpose to the need to document past ice sheet history, and the corresponding history of atmospheric CO_2. Previously our interest had been curiosity-driven. We can now say that, through continued data-gathering and the rise of Earth System modelling, John was right. The focus for the last few decades has been on improving robustness and detail in future projections for mitigating and adapting to the consequences.

FURTHER DRILLING, CRISIS AND REBIRTH

Drilling continued through the 1990s dominated by the Cape Roberts Project with an initial international workshop in 1992. The first year was planned for 1995, but in fact drilled over three seasons from 1997-99, recovering a total of 1500 m of core covering the period from 34 to 17 m.y. ago, warmer and more dynamic than today. Tim Naish and I were able to present early results to the Ministerial on Ice Conference at McMurdo Station in January 1999, and following that at the SCAR Antarctic Geoscience Conference at VUW in August. By then it was clear to the whole Antarctic community that the Cape Roberts Project was both a successful multinational Antarctic collaboration and a significant advance in recovering deep-time climate records—useful to test the still primitive and developing ice sheet models of the day.

It was time for a generational change, which began at the final session of the CRP-3 Workshop in Columbus, Ohio, on 9 September, 2000. The primary purpose of the workshop had been to present the results from the final drilling season, and plan work on analysis and publication of the results. In the final session Peter Webb and I talked about future drilling targets for this new system for sampling deep-time records on the continental margin. The name ANDRILL was agreed, along with a group of five younger scientists to take on the mission—Fabio Florindo (Italy), David Harwood (USA), Tim Naish (NZ), Ross Powell (USA) and Gary Wilson (then UK). We were confident its future was assured.

The following year those of us at VUW had our confidence challenged when the University found itself in deficit by 10% of its income, leading to a proposal by the Dean of Science on 2 October to cut the academic and technical staff from the Geology/Antarctic group with both Antarctic positions (Barrett and Pyne) to go. Fortunately, we had a sense that the VUW leadership needed advice from our friends and colleagues both locally and internationally. Attention was gained locally by picketing the Dean's office and a march to Parliament. The VUW leadership was persuaded, and two weeks later announced that the ARC would restructured with: two positions; a fully costed budget; the opportunity to attract research revenue; and a governance Board reporting to the Dean.

The ARC has since then continued to grow with an ongoing focus on Antarctic climate history through not only coring sediment but also ice, and the addition of a growing modelling capability.

By **Peter Barrett,** Founding Director, ARC

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FURTHER INFORMATION

- ARC activities are summarized in the twice-yearly newsletter *IceSked*. More substantial information is in the Annual Reviews available from https://www.wgtn.ac.nz/antarctic/publications.
- A list of postgraduate students and their theses from 1960 to 2008 is available from:https://antarcticsociety.org.nz/wp-content/uploads/2023/06/ARC-Antarctic-theses-1960-2008.pdf
- A history of ARC through to 2022, including an illustrated timeline by Michelle Dow, can be viewed on pp 6-14 of the ARC Annual Review and downloaded from https://www.wgtn.ac.nz/antarctic/publications/annual-review/AnnualReview2022_final-web.pdf

Life on the edge

Working at the crater of a slumbering giant

(1) Mt Erebus with its characteristic plume in the setting sun, March 1961

All those who have spent time at Scott Base would surely have felt a sense of awe gazing at the majestic Erebus volcano beyond the base, quietly steaming in frigid morning air or in the last rays of the summer sun (1). Not only does it have such a perfect classical volcano form but it is unique in being one of only two volcanoes in the world with a persistent lava lake. It is also the only one erupting rare "bombs" of phonolite full of giant crystals of a mineral known as anorthoclase.

Back in the early 1960s, there must have been others like me yearning for the opportunity to stand on the summit and peer into its fiery pit. Twenty years later that opportunity came my way thanks to Kiwi-born and bred Phil Kyle who, after completing his PhD at Victoria University in 1976, had moved to the USA and was working as a USARP geochemist and volcanologist. At Phil's request, the US National Science Foundation's Office of Polar Programs designed, built and installed a robust hut 150 metres below the crater rim. Initially known as the Erebus Hut, it later became the Upper Erebus Hut. This was to be the home for the International Mount Erebus Seismic Studies (IMESS) project under the leadership of Phil.

By 1980, volcanological and seismic studies led by Juergen Kienle from the University of Alaska, geophysicist Ray Dibble from Victoria university and seismologists from Japan were underway. Luckily for me, the door was still wide open for someone to monitor the deformation of the volcano to detect inflation which can help warn of pending eruptions. This required precise geodetic monitoring—detectable by the type of precise monitoring that I, as a surveyor in the NZ Geological Survey (NZGS), just happened to have been doing on New Zealand volcanoes for the past decade. Moreover, this would require a repeat survey every summer for as long as the programme could be sustained. How could I possibly resist! All I needed was the official support of my supervisor, geologist George Grindley. No problem! I became the leader of NZGS's new "Erebus volcanic deformation project" with a minimum of fuss and paperwork.

So in November 1980, after two VX-6 helicopter rides and nearly a week spent acclimatizing on Fang Glacier—stretching way beyond the planned two days thanks to bad weather—I finally stood at the door of Phil's "Mt Erebus Volcano Observatory" in the frigid air at 3,610 m (11,840ft) with the vigorously steaming crater looming menacingly above (2). We set up our trusty Scott Polar tents as our sleeping quarters beside the hut. There were already about a dozen of us

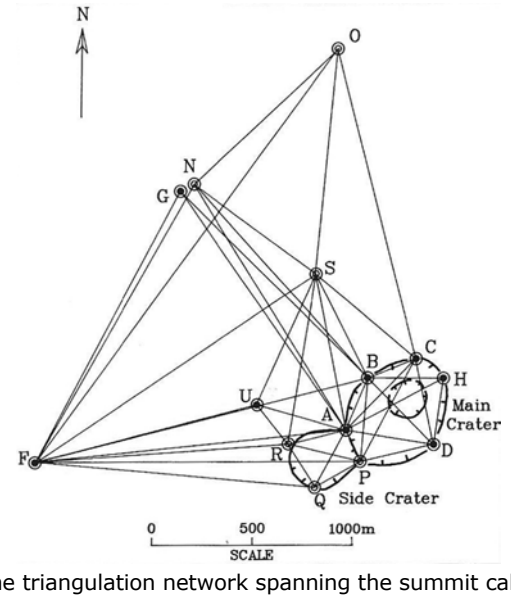
(2) Phil's "Mt Erebus Volcano Observatory" (officially the Upper Erebus Hut), 3,610m above sea level

(3) Inner Crater containing the lava lake 230m below, seen from the rim of Main Crater

from four different countries and the small hut was only intended as a communal living space. It was to prove its worth during the frequent blizzards and white-outs that followed. Almost too warm at head level with its super effective heater, albeit with frigid air flooding across the floor and freezing feet with each opening of the door. In keeping with our luxurious off-duty living conditions, Phil had thoughtfully provisioned the hut with typical American "field rations", such as turkey, shrimps, steak and ice cream—and much more! A lifestyle that had been only in my wildest dreams while lying cold and prone in a furiously flapping tent during a 5-day blizzard on the Polar Plateau. This encounter was during a "one day" mountaintop survey nearly two decades earlier. I nibbled on a dwindling stock of meat bars on Day 4 while my tent mate read aloud from the last page of Scott's diary!

The following day saw many of us scrambling up the remaining 150m to Shackleton's Cairn on the crater rim. Here, we peered into the 500m-wide Main Crater to catch glimpses of the slowly convecting red-hot lava lake a dizzy 230m below through frustrating clouds of steam (3 & 4). As I trudged around Main Crater rim taking in the scene, I was reconnoitring for locations to establish survey stations. I had mentally planned to form a 2km-wide pattern spanning the whole summit region of Main and Side Craters. The annual repeat surveys would be able to detect movements as small as 1 or 2 centimetres if they could be carried out accurately enough in the harsh conditions. Pausing on the actual 3,794m summit, just a few metres higher than Mt Cook, it occurred to me that this was the fulfilment of my early daydream. Now that I was finally there, it was just part of a much more meaningful plan.

The pattern ultimately required the installation of 14 geodetic stations for a full triangulation survey (5) to be performed by theodolite observations only. No electronic distance measuring (EDM) equipment was available at the time: that came at a later stage and increased the precision. This was long before the era of high precision GPS measurements which are today's tool of choice for volcano deformation monitoring. Station marks consisted of a section of galvanized water pipe driven vertically into the ground, topped with a threaded stainless steel plug to later screw on EDM reflectors. Each was surrounded by a stone cairn cemented together by "Antarctic concrete" —warm water from a Thermos flask instantly freezing solid attaching the cairn firmly to the permafrost beneath. To detect tilt, caused by any change in height, we installed four small tilt levelling patterns of ground level benchmarks on the flanks of the crater and up to 1.5km beyond. For all this installation work, I was extremely grateful for the assistance of NZARP mountaineer



(5) The triangulation network spanning the summit caldera

(4) A glimpse of the slowly convecting lava lake

(6) Ray Dibble adjusting a seismometer transmitting to Scott Base

field assistants Roy Parrish and Jon Prosser, and also from Gary Neale who was carrying out Lands and Survey Department's topographical mapping survey of the summit area. During this early phase, other members of the international group were carrying out their own reconnaissance and carrying out various experiments, such as: collecting the latest crystal-rich volcanic bombs and preparing for gas sampling (Phil's specialties); electro-magnetic experiments; or a study of rare microbes in the most extensive area of hot ground. For Erebus veteran, Ray Dibble, it was a case of installing and servicing his seismometers and camera transmitting video of the lava lake live to the Scott Base science lab (6). He spent many days sitting alone in the subzero cold patiently working on his fiddly electronic gear.

Once we had installed the full survey pattern, I was able to start work on the observations, usually with Roy or Jon as booker or staff-holder when they were available. Standing stationary for hours on end in a sub-zero wind that felt like liquid ice on my face—twiddling sensitive knobs on the theodolite with frozen fingers for precise readings on almost invisible targets through the passing cloud or through the everlasting steam rising from the crater—became a true test of frozen patience. It reminded me of the vow I had made 20 years earlier standing behind a theodolite in identical conditions on a lonely summit in the Transantarctic Mountains, that I would never again take on what was surely the coldest job in the world. Erebus was now proving only that I must have been an exceptionally slow learner. Too late now! Ahead, I had about another month of precisely observing masses of rays from 14 stations, as well as four patterns requiring precise levelling accurate to better than 0.1mm. The observations, especially when working on my own, trying to observe through occasional breaks in the cloud or steam between the frequent storms over following month, became a personal endurance test in the cutting -25 degree C wind. But one I strangely found satisfying—mainly when looking back many years later! In truth, there were also memorable occasions when the air was surprisingly calm and mild at only -18 degrees. Then, I absolutely revelled being up there, often alone as time went on, perhaps even the highest person in Antarctica at that moment, with the steaming crater beneath me (7). On the other side, the whole of ice choked McMurdo Sound and the inspiring Royal Society Range with the Polar Plateau spread out beyond. A sense I could never capture with a camera. As close to heaven as I was ever likely to get!

A rare experience of a the opposite kind came when a group of us, guided by Roy and Jon, made a daunting belayed descent 130m down the almost vertical crater wall to the flat floor of Main Crater. From there we cautiously approached the edge of Inner Crater, feeling the welcome radiant heat from the slowly convecting lava lake as we peered over the edge for a glimpse of it through the steam. It was another world down there, far removed from the Antarctic I knew, imprisoned by sheer cliffs with a scattering of Dr Suisse-styled turreted fumarole towers at their base. If the summit was heaven to me, then perhaps this pit full of fiery lava was the entrance to hell! Fresh lava bombs, some still hot, littered the snow-covered crater floor. Their presence was a constant reminder we were actually in the very heart of a continuously active volcano. Sure enough, every hour or so there would be a frightening boom, reverberating off the crater wall, as a bubble of hot gas forced its way through the partially congealing lava lake and exploded, flinging dozens of molten lava bombs high above us. We soon learned the trick of identifying the occasional one that appeared to be hanging motionless, a sign we were on the exact trajectory

(7) The author surveying from Station C on Main Crater rim

(8) Sitting out a blizzard: Phil Kyle (facing), Ray Dibble (far left)

of its descent! A quick trot out to one side or the other of no more than ten metres was enough to be safely clear as it hit the snow with a thud and hiss of steam.

This unique experience also gave me the idea of monitoring possible movement of the crater floor by installing a line of about 8 steel marker poles on the floor to be observed from stations high on the crater rim. (When we finally carried out this experiment in the following seasons, disappointingly we only detected subsidence probably due to geothermal melting of the underlying ice—but, so typical in this type of work, we would have never known until we tried.)

There was another minor but slightly more successful survey I was able to carry out even in white-out conditions. This was observing targets close to the hut to settle the question of whether it was on a lava flow ("Camp Flow") or on a small glacier littered with bombs. In fact, the area around the hut was, several years later, found to be moving at a very slow snail's pace of 15-25 mm per year down-slope and subsiding at a similar rate, but just fast enough to prove the glacier theory! This little survey, and the ability to observe the 50 m-long sight lines of the tilt levelling patterns, both in white-out conditions, was a blessing in disguise for me, helping to keep me reasonably active for my 6 weeks on the mountain. Meanwhile, the scientists who had already completed their missions were holed up in the hut playing monopoly or cards (8), waiting for the weather to clear and the helicopter to deliver them back down to McMurdo—the relative tropics.

My final excursion was an evening with a small group exploring the cluster of impressively large, fumarole towers up to ten metres tall and their underlying ice caves. The cluster was at Tower Ridge on the gentle slope southwest of Side Crater. Selecting the tallest one, we found we were able to chop a hole through the side (9) and secure two 10 metre crevasse ladders tied together to gingerly climb down. A few minutes later we stood in a miniature version of Waitomo caves with stalactites of sparkling ice crystals hanging from the ceiling of the cavern glowing dimly in various shades of blue and green where daylight was able to filter through. The geothermally heated air was pleasantly warm but the humidity immediately fogged my camera lens as I attempted to record some of the lads stripped off taking a quick sauna. A lost opportunity to make more money than I could ever have made from the rest of my slides put together!

Several days later came yet another major change of scene as I climbed out of the Huey helicopter at Scott Base. The landscape was harsh and barren, with rivulets from melting snow patches turning the volcanic ash to mud. Above and beyond this sad scene stood that white giant I had got to know personally over the past six weeks—Erebus, still steaming away as serenely as ever, just as she had when I first set my sights on her 20 years ago. I was content to be heading home knowing I should be back the following year.

By **Peter Otway**

(9) The hole made in the side of the tallest fumarole.

WHEN MY MAN WENT TO THE ICE

What was it like to be left behind when your partner flew off to Antarctica in the early decades when field parties were unable to communicate with families for weeks? What effect did that distance and silence have on their families? My partner spent the summer of 1979/80 in Antarctica, the year of the Erebus disaster. For me, the effect was profound.

In 1977, my partner, Geoff, and I both applied for jobs in the Antarctic. We had shared our dreams to go to the frozen continent on most nights while camping in the untracked Wilderness Area of the Karamea Forest Park. This was our second Possum Control Season and we were in there for the entire winter. When we finished the season, our hopes high, we set about the application process.

My application was based on mere hopefulness: a one-year Journalism Diploma; 18 months in a printing firm; six weeks on a local paper; and a lot of wishful thinking! Geoff applied on the strength of his summers as a Mt Cook Alpine Guide, years working for forestry and deer culling, and a decade as an independent bushman.

We were both rejected.

Geoff was shocked—for himself—what other credentials could they possibly want? A friend whispered in his ear that at Scott Base, New Zealand's Antarctic Research Station on Ross Island, things ran very much along military lines. To prove he could take orders, they suggested he do a winter season on a ski field. So he did, in 1978, at Porters Heights. That was to be the year I would possum alone.

Geoff's strategy worked. He was taken on and given training to support a New Zealand Antarctic Research Program Geology summer field party, 1979–80, led by Bob Findlay with two other geologists, Keith Brodie and Adrian Daly. After time at Scott Base, the party of four headed up the Blue Glacier for 83 days. Geoff's responsibilities were for the safety of the party and the maintenance of two motorized toboggans each pulling a loaded sledge. The toboggans proved temperamental requiring a fair bit of patient, pragmatic coaxing.

At the time of his departure, Geoff and I were three years into a deepening relationship begun in 1976 at Mt Cook. I'd booked a Basic Alpine Course and cycled down to Mt Cook from Northern Buller. On the way my carrier frame had broken, I entrusted my pack to the local bus company. My pack arrived too late. On the course, I amused the second guide, Geoff, with my attempts to turn my spare socks into mitts! I bought a place on the next Advanced Course. Geoff was again second guide. Gentle and kind, he herded our course gang from behind like a mother hen.

Afterwards, he invited me to climb with him. He talked about possum hunting and demonstrated where one might bait on possum trails. He was the first and only man of my generation to ignore my gender and invite me to step-up to a 'man's job'. I did and we possumed together for our living. In the off season, we skied, we cycled, we took up hang-gliding and we almost re-built my cottage 300 m above Granity. I followed him to Mt Cook every summer and found menial work or undertook duties as unpaid support on his courses. And we climbed. We were tight. When he left for Antarctica, I was very alone.

Geoff managed to send me a couple of postcards from Scott Base but inevitably, once they were heading up the Blue Glacier, there was silence. There were weeks of not knowing where he was or what he was doing. Then there was the Erebus disaster.

Air New Zealand had taken up the tourist business of flying Antarctica-lovers to the ice for a brief view of that frozen vastness before returning to Christchurch. Only this time they did not return.

The nation was in shock—nearly everyone had some connection with someone on that doomed flight. I didn't, but I did assume Geoff's team would be recalled to join the search and recovery.

I worried. How would that affect him? Hearing nothing allowed my mind free range to imagine the worst.

The fragility of life glared at me. One moment, people were fulfilling life-long dreams cruising serenely above a mysterious and beautiful continent. Then nada!

And no news of Geoff.

That nada grew in me. I became fearful that the Geoff I knew might not return, or not the same. We'd never talked about children. Now, I yearned for the comfort of his child should I ever lose him.

Geoff Hill driving the toboggan pulling the sledge with Rob Findlay across a crevasse.

Saying little of consequence, his last postcard came shortly before he himself arrived. Full of my fears, I was cautious as to how I should greet him. Geoff probably found this disconcerting because from his perspective nothing *had* happened. His party had been too far up the Blue Glacier to assist with the Erebus recovery, so luckily Geoff was spared—as I was. My man came back from the ice, whole and complete.

My desire for a child did not abate and eventually, after six years, a marvellous new being, our daughter, was born. We also separated soon after. Much as I wished otherwise, I was no longer able to share his life as the baby's needs were incompatible with the job conditions. The Mt Erebus tragedy led to my comfort child but this, in turn, lost me my man.

But not entirely. After two decades of solo parenting, our fledgling then flown, I found myself back working with Geoff—this time beach gold-mining. Another decade passed in frank and cheerful companionship. Then in 2015, at the age of 64, in the middle of winter, he was diagnosed with pancreatic cancer. He died in under a month.

His mates were shocked. They were from diverse and separate periods of his life. Panels of photos for each era lined the walls at his Memorial BBQ. When his property sold two years later, I created a memorial book based on those panels for 'Geoff's Final Farewell'.

Recently, I revisited the memorial book. The Antarctic section was barely a half page, with just a single photo. For such a huge event in our lives that was clearly not enough. Forty-three years had passed and I'd forgotten many of the stories Geoff told me so I contacted his fellow team members. Back in 1979, we did not have access to the Internet—nor even a large-scale map to visualize the location of the Blue Glacier. Now, after many hours online, I found a decent map at https://www.swisseduc.ch/glaciers/antarctic/mcmurdo_ice_shelf/maps/icons/annotated-map.jpg They also had naming rights to at least three locations the group had discovered—each had a tale. Keith didn't even recall that the Brodie Ponds had been named after him! It was my Eureka moment when I finally found incontrovertible proof.

My research was an absorbing detective experience. I tracked across so many online sources I'm not sure I could find my way back. Many times I was blocked by lack of legitimate access. The outcome: I finally have a mental picture of the journey the team took, and I'm awed! The Blue Glacier is just across from Ross Island, a cashew nut between the big Ferrar and the mighty Koettlitz Glaciers. They motored to the head and climbed up onto the ridges of the great Royal Society Mountains.

Camp at the head of the Blue Glacier (L to R): Bob Findlay, Keith Brodie, Adrian Daly, Geoff Hill.

My desire to visit Antarctica has never left me. My inspiration had been seeded at high school with our history classes celebrating Sir Edmund Hilary "knocking The Bastard off" and then undertaking his Trans Antarctic Tractor crossing. However, I had no idea of how to fulfil my dream. By the time I heard of less demanding routes than through academia, it was already too late. Tourist options enticed me in later years but they cost money I didn't have. I have, however, managed to go there in my mind via the photographic record I've put in place through painstaking satellite correlations.

My consolation is that Antarctica gave me my daughter, for whom I'm so grateful.

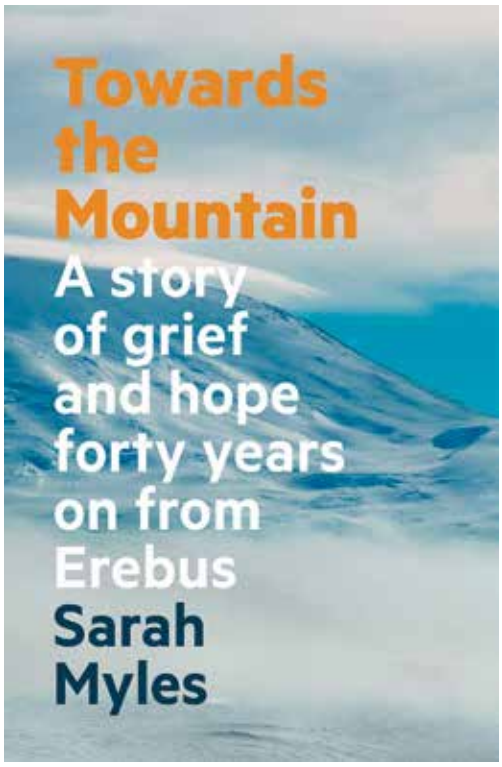
By **Jo Douglas,** Millerton, West Coast

Book Review

By **Barbara Dallas,** MLS Biochemistry

Barbara Dallas

Myles, S. (2019). *Towards the Mountain: A story of grief and hope forty years on from Erebus*. Allen & Unwin,Auckland,NZ.
360 pages
ISBN13 9781988547268



The author, Sarah Myles, is the daughter of my friend Raewyn. It is a record of Sarah's personal journey to find the truth about her grandfather's death on Mount Erebus and his journey home. In 2017, with little factual information, the family were still finding it difficult to deal with his death

On 28 November 1979, I was in the UK booking a flight home after 6 years of OE. The travel agent said "There's a NZ plane missing somewhere way down South."

257 people went on a sightseeing flight to Antarctica but did not come back: they died on Mt Erebus. Nearly everyone in New Zealand knew someone or of someone on the flight. The nation was grieving.

When the recovery teams arrived on the ice, most had little or no mountain experience. They were completely unprepared for the remoteness, the biting cold, the crevasses, the smell of unburned aviation fuel, gales with debris flying everywhere and the scale of the disaster. But, "They had a job to do and they just got on with it".

The teams of people involved in this mass trauma were huge. Sarah interviews some of these 'unsung heroes' who brought the bodies back to their families giving us an insight into coping with a large-scale disaster previously unknown in New Zealand. The mountaineers, recovery teams, helicopter pilots, the truck driver, morticians, identification staff, funeral directors, police, all the support staff, and their families—they all have a story to tell. Many were given no support, or counselling, and had no one to share their trauma with, and often were told 'just toughen up'. There was little or no acknowledgement of their work.

Sarah listened and shared with many of these people—many who had never spoken openly before—giving them a voice, and a platform to be heard.

This story covers many sides of the Erebus story: politics, lies and deception, the Chippendale and Justice Mahon reports, service, duty, and professionalism. It's also about grieving: 'People can't deal with not knowing, but the truth can be dealt with'. Above all, it's about hope and healing.

Many of the families of the victims have attended anniversaries over the 40 years since the crash but there is still no place to grieve collectively, and that may still be several years away.

Sarah put her heart and soul into this story, and I feel she has grown stronger and wiser. I felt she was very brave, believing in the truth, asking the awkward questions, following her heart and still accepting the fallout that came with this. She says that acknowledgement and good communication are very important and grief is something we learn to live with but it's always there.

I found the book really interesting, learning what really happened. The personal stories, made it moving and positive.

Towards the Mountain was shortlisted in the 2020 Ockham New Zealand Book Awards.

NEXT: Sarah tells the story behind writing her book >>>

Towards the mountain, and back again— exploring connections to a place I have never been

My beloved grandfather, Frank Christmas, died on the Air New Zealand sightseeing flight that crashed into Mount Erebus in November 1979, killing everyone on board. Back then, it was said "everyone knew someone who knew someone" —people lost friends, colleagues, neighbours, teachers, lovers—and I lost my Poppa, a father of 4, grandfather to 9, a builder from New Plymouth.

In the fallout that followed, the stories of the 257 passengers and crew were forgotten and their families' grief went largely unacknowledged. Mixed in with this was the trauma experienced by the first responders, the sense of national shame, a polarizing Commission of Inquiry, and controversial political and public debate. Comparing the reaction over Erebus to our more recent disasters in Christchurch, Pike River and Whakaari White Island is night and day. Everyone deserves compassion, support and mindful remembering after a national tragedy, and the lessons learned reverberate still.

Frank Christmas, circa 1979, taken not long before his departure for Antarctica.

CONNECTING TO THE PAST

With the large number of people affected by the disaster, and my own curiosity about why we hardly ever spoke about Frank (or could even recall the details of his funeral), I set about collecting stories and uncovering evidence of the lives that were lost and the people who brought them home. I wanted to meet families with whom I had a shared past, and see how our stories were similar or different. I wanted to meet with first responders and look them in the eye and say

Frank and I laughing from Christmas 1976—I'm 4 months old

'thank you'. As far as the book went, I thought there might be a bit of interest in what I had to say, but the more I shared with family and friends, the more I realised just how much we didn't know. I had unwittingly lifted the lid on a storehouse of information, years of unexpressed grief, but also overflowing gratitude towards everyone who contributed to bringing our loved ones home.

I returned to my parents and family many times with different questions, and then hesitantly with my findings. None of it was easy. Erebus is still a painful topic for many of us, and in my family, with all the questions I had, my mere presence was a constant reminder of that pain.

I decided to learn all I could about how my grandfather made it off the mountain, how he was identified and then repatriated to New Plymouth for burial. And once I started, I just couldn't stop. Discovering the truth was traumatic, and I started to realise the amount of unhealed trauma lying dormant in our family tree. The weight of secrets, especially when sequestered away by grandparents or governments and corporations for decades (whether in a misguided attempt at protection or for self-interest) is exponential when eventually revealed. And the not knowing is a labyrinth that a writer detective cannot give

The last photo we have of Frank alive, taken aboard flight TE901 on 28 November 1979—the film was recovered from the crash site. This photo is the property of Archives NZ, provided to me with permission to use in my work as I am a family member.

up on, no matter how long it takes for the truth to come bubbling to the surface. But I knew, if my grandfather made it home from the mountain, then surely I would make it back from this, too.

CONNECTING TO PEOPLE

I felt I had the blessing of my grandfather, that it was his desire I gather all the threads of this extraordinary family history I was weaving. Doors opened for me, people said yes. I even found coronial documents to support the vivid memory I had of the day the 'Big Blue Men' came to my grandmother's house to identify him—I was 3 years old at the time. I tracked down the very people who risked their lives and well-being to bring our loved ones home from the ice: the mountaineers, police, a helicopter crew chief, a funeral director, embalmers and others. For many, the scars left by the harrowing experience have never healed, and incredibly this has become the tie that binds us all. I value the deep, personal connections I have made over the past 6 years—I've sat across from them, been into their homes, and often shared a meal. It was one of the unexpected blessings of this experience, and the continuing connections remain.

I also found evidence that what we learned from Erebus still informs our national response to disaster management and mass fatalities to this very day. This gave me hope that we have become better citizens because of Erebus, that we will support families and response staff much better than we did in 1979.

Loss represents an empty seat at the dinner table, a mournful date on a calendar, a forgotten birthday, repeated. When my grandmother Eileen was alive, my family rarely spoke about Erebus—it was just too painful. All we knew was that Frank went to this mythical place where we can't go. Families can't physically go to the scene of the crash and lay a wreath, and so we struggle to find a way to process it. This was the start of the dysfunction and, unfortunately with the Memorial delays, the trauma for many continues.

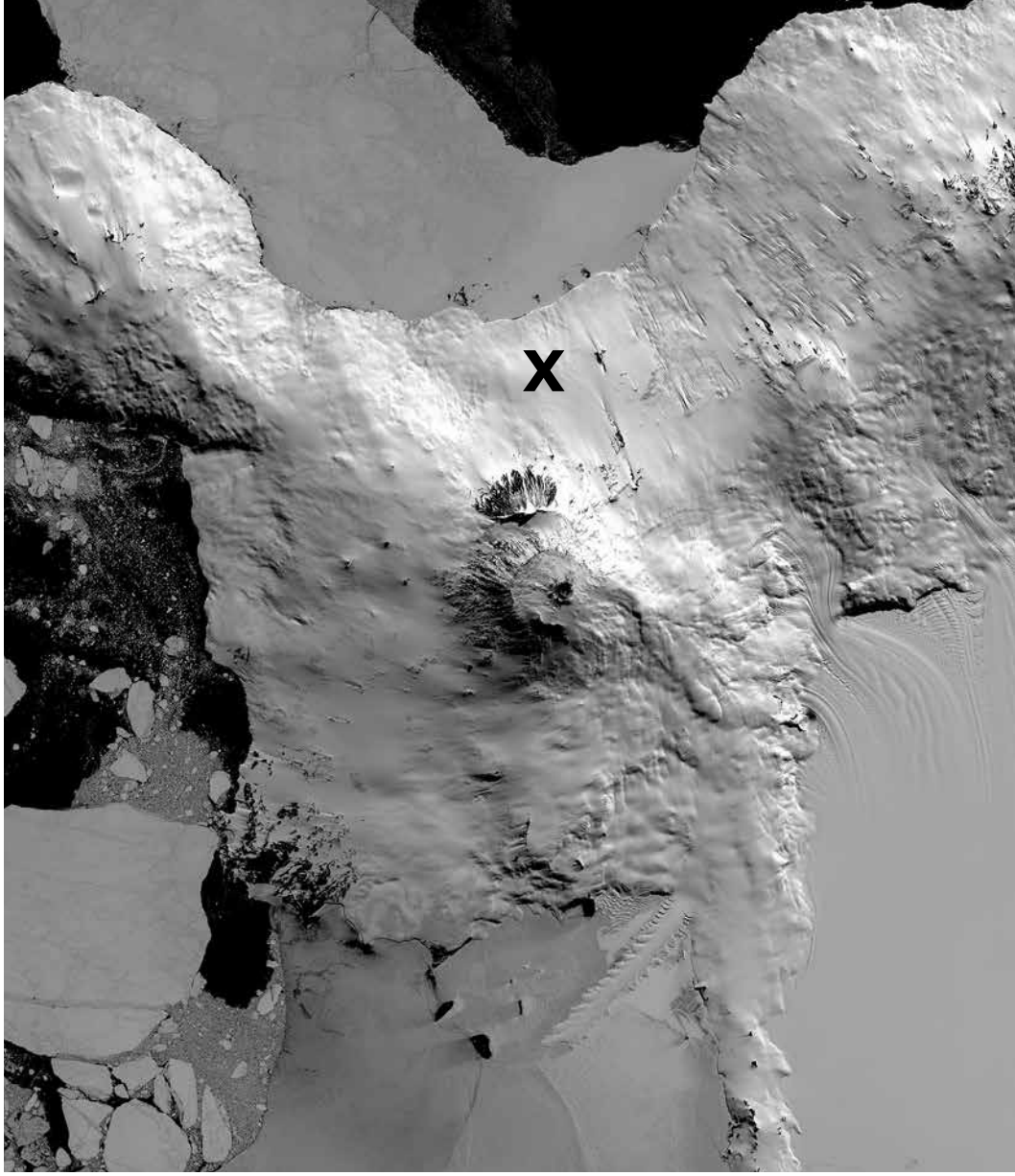
In a recent meeting of the Waitematā Local Board, where families had gathered to make further submissions in favour of the delayed Erebus National Memorial, I heard a man linked to the Board say that all things Erebus seemed to be cursed. . . as if the death of our loved ones was the result of dark magic, and that the families were cursed still. More than 40 years on, it hurts to hear—this trivialises our experiences of loss

This photo of the the Erebus Memorial site at Scott Base, Antarctica , with my book alongside, was taken by Erebus first responder Police Inspector Stuart Leighton (retired) when he was invited back to Scott Base by Antarctica NZ in 2019 for the 40th anniversary of the tragedy. Permission was given for it to be used in this article. He was in Team 2, the team that recovered my grandfather's body, and we have a deep and enduring connection.

and trauma into something resembling bad luck.

CONNECTING TO PLACE

People often ask me how I can write about Antarctica when I have never been there. When I need to distance myself from the longing I feel towards the frozen continent, I say I wasn't really writing about Antarctica but rather an event that happened there; at other times I say I borrow words and concepts from other writers more well-travelled than me, stolen (like an artist) to build a sense of time and place; then there are the generous interviews of the first responders, the police officers and mountaineers and helicopter crew chief who recovered the bodies and can remember in vivid detail the sounds and smells and weather and light that are unique to this great white landscape. Yet the truth, if pushed, is that I borrow from them all to craft my work and sometimes, with eyes closed, I can imagine myself there, an abominable snowman in my black and orange get-up, styled by Antarctica New Zealand, toes already frozen, eyelashes tipped in crystalised sunlight. I take a deep breath, exhale, it condenses then evaporates in front of me, before I remember I am in Dunedin (…close enough!) and I smile at the thought.



The X marks the crash site of Flight TE901 on 28 November 1979. Erebus volcano is 3794 metres high—the aircraft hit at 447 metres above sea level. In 1997, the crash site was designated an Antarctic Specially Protected Area out of respect for the dead.

One of my favourite parts of the book deals with the concept of Tūrangawaewae. Traditionally it speaks to the connection between tangata Māori and the whenua, marae or birthplace where they stand to be counted, a place of belonging, the land. A friend also shared the understanding her whānau have, which is the idea of 'first breath, last breath'.

Growing up, I had more than just a fascination with Antarctica and I wonder if this was, in part, because of this concept of tūrangawaewae, a connection to this land and a place in time, one that I share with others just like me, the place of my grandfather's last breath. In my book I wrote, "I once heard that there is hardly any new snowfall in Antarctica, that the continent is too dry, a desert, so each new snowstorm is just old snow being transported to another place. I think of Frank's last breath as it was pushed from his lungs, as it turned to frost and fell to the ground. If these stories of Antarctic snowfall are true, then Frank's breath still survives somewhere on this windswept frozen desert, in a place I cannot visit" (*Towards the Mountain* p. 114).

Antarctica is the place of my grandfather's last breath. I still mourn for him and for the mountain where he died. Because of my research and the connections I have made, I also mourn for the hundreds of adventurers who died by his side, for the men who worked tirelessly and in high danger to return their bodies home, and for the thousands who, like me, have loved and lost.

There's still no place we can go as a collective to acknowledge what happened, nowhere central to visit and meet others just like us. Anniversaries are poignant, and they're an important part of the processing of grief, so instead we gather in pockets—in homes or cemeteries or restaurants or churches—and we talk about the dead. We spend time around those with whom we can be ourselves, and then we dry our eyes and wipe our cheeks and try to come back to the present, to the place of the living, to the warm. And we hope.

CONNECTING TO HOPE

When I'd interviewed everyone I could, I felt all hope was lost. This was such a bleak, sad story, but I just couldn't accept that this was all there was to our Erebus, so I set about looking for points of light. I found it in Jonathan Lear's theory of radical hope—it's the idea that something good can come from our most tragic of pasts, even when it seems there is none. It demands courage and faith, it asks you to believe in goodness for all, even when you lack the ability to see what that might look like. Radical hope knows, it deeply knows, that the future is good.

I found radical hope when meeting the first responders from Operation Overdue. I found it at Archives New Zealand when I read the dozens of archived love letters written by family members to their dead. I found it at the first Erebus meeting with the Government in November 2018, in a room filled with hundreds of adult children of Erebus, all standing before the Prime Minister saying we lost someone special. And I found radical hope at Government House at the 40th commemoration of the Erebus Disaster, and in the long-awaited apology from Jacinda Ardern: 'We will never know your grief, but I know the time has come to say I am sorry.'

These words, and those that followed, were what many of us had lost hope of ever hearing: an unequivocal apology on behalf of the New Zealand Government and Air New Zealand for this 'orchestrated litany of lies'. It was an unforgettable moment. There was a collective exhale, a forceful release of breath that swept up the marquee. I remember sobbing, looking up and down the rows of families and first responders who were all doing the same.

The author, Sarah Myles, welcomes reader's feedback

Radical hope helped me dive in to the well and surface with the truth. It was a form of therapy, an 'emotional disaster response', and it helped me recognise and process the trauma in my family. Knowing the messy truth was an important part of us being able to move forward.

At a time of loss or personal challenge, radical hope helps me ask, how can I support the people at the heart of this situation? What would radical hope do / say at a time such as this?

Looking back to 2016 when my writing journey began, radical hope inspired me from the very beginning—not just to tell my family story, but to say thank you to everyone who helped bring Frank home, who worked to bring the truth to light. I wanted to find the people connected to my grandfather and look them in the eye and say 'thank you'. With this small gesture, I hoped the intention in my words would flow down to their colleagues, to the men and women I have no hope of meeting. I have an immediate and very personal connection to the relevance and importance of their work.

In my search for radical hope, I realised their presence in Antarctica that brief summer season gave me hope that maybe one day, I will get there too.

By **Sarah Myles,** University of Otago, Ōtepoti Dunedin

AN INVITATION TO READERS TO WRITE TO US

Do you have comments on this issue or stories to share? We would love to hear from you. Sarah is particularly keen to hear from families who lost loved ones in the Erebus disaster. We are also interested to hear of other people's experiences of Antarctica. Respond with the subject title 'Feedback' to **editor@antarcticsociety.org.nz**

Notices

NZAS CONSERVATION TROPHY

The trophy is awarded by the NZAS Council to any person or organization contributing significantly to any aspect of New Zealand activities in Antarctic or sub-Antarctic conservation. Nominations close 30 June. Contact the secretary for more information and the nomination form .

TALK IN WELLINGTON WEDS 5 JULY 2023

6.00 - 7.00 pm at the Royal Society Te Apārangi premises, 11 Turnbull St. Thorndon, Wellington. Dr. Natalie Robinson, Physical Oceanographer at NIWA on "Antarctica's Role and Response in Global Climate".

BOOK LAUNCH

Colin Monteath's new book *Erebus: The Ice Dragon,* published by Massey University Press ISBN: 978-1-99-101636-2, will be launched in Christchurch on 11 August.

GIRLS ON ICE EXPEDITION JANUARY 2024

Applications opening in August 2023. Details at https://www.inspiringgirls.org/goi-aotearoa-nz

ERRATUM:

We apologise for a mistake in Vol. 40, Nos. 3&4 in the attribution for the ANDRILL sundog photo on page 1 which was taken by Cliff Atkins, but wrongly credited to Tim Naish.

Aurora over Pisten Bully vehicles in foggy conditions in July on the Ross Ice Shelf traversing to Black Island. The overhead auroras were lighting up the ground fog giving everything a surreal green glow.

Credit: Anthony Powell