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Book Reviews

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Around Antarctica: journal of a scientific expedition

V. Yok-Thot Sentilhes
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This book is the tale of an adventure in the Southern Ocean and on its islands in the summer of 2016–2017, on a unique Antarctic circumnavigation. Much of it is about oceanography. Studying the ocean is like studying outer space - much of it being done remotely using elaborate and robust instruments, in this case lowered from the surface rather than being sent aloft. It is expensive, high risk, and often exceedingly uncomfortable - even dangerous, when storms hit, as they often do in the wild reaches of the Southern Ocean. It is also a slow process - research ships travel the world at about the speed one might pedal the average bicycle around Cambridge. Imagine riding your bike slowly across a heaving and pitching surface, with cold winds covering you with salty spray. Imagine having to abandon your goals in the face of severe weather - a soul-destroying experience when you may have journeyed far. But battling a harsh, uncompromising and hostile environment is grist to the mill for anyone engaged in pitting their wits against the elements to extract scientific information from Antarctica, the Southern Ocean, and the sub-Antarctic islands. As the expedition leader, David Walton of the British Antarctic Survey, said, 'When you set off on an expedition of this type, nothing is certain - except the fact that it is going to be exciting', which is what it turned out to be.

The circumnavigation, sponsored by the Swiss Polar Institute (SPI), took place aboard the Russian ship *Akademik Treshnikov*, starting and ending in Cape Town and calling at Hobart and Punta Arenas, with scientific stops at or close to Marion Island, Iles Crozet, Kerguelen, Heard Island, the Mertz Glacier (on the Antarctic continent), the Balleny Islands, Scott Island, Siple Island (off Marie Byrd Land), Peter I Island, the Diego Ramirez Islands (off Cape Horn), South Georgia, the South Sandwich Islands, and Bouvet. On board for each leg during the expedition were 50 scientists from 30 countries. Their main goal was to determine the impact of pollution and environmental changes in the Southern Ocean, where mighty ocean and air currents connect the south polar region to the rest of the world, and where rising ocean waters emit old carbon dioxide from the deep, while sinking ocean waters take down new carbon dioxide.

The cruise was a fantastic scientific and educational experience for everyone aboard, with science leavened by tournaments of chess and table tennis. Sampling was interspersed with evening lectures explaining the ongoing research and setting it in the context of the islands and their surrounding ocean. Three zodiacs and two helicopters and their highly experienced pilots facilitated visits to the sub-Antarctic islands.

Marion Island came first, on Christmas Day 2016, when the team explored the island and studied its fantastic wildlife. Cats were eradicated between 1980 and 1999, but mice still abound, troubling ground-nesting birds, and floating plastic pollution proves a further menace for birds at sea.

The study of seabirds provides an opportunity for understanding the cycles and mechanisms of the Southern Ocean, as variations in the condition of the ocean and its food supplies are reflected in the health of the bird population. The team examined them again on the remote Iles Crozet. High winds hampered helicopter operations: as on-board scientist Steven Chown said, 'The biggest challenge is … always the weather.' But the zodiacs managed a landing. Chown was searching for aliens - insect and plant species brought in unintentionally by man.

Dredges fished creatures from the deep at night *en route* to the next stop, Kerguelen. Rabbits, cats, rats, mice, mouflon and reindeer are abundant there, along with European dandelions and other weeds. Aside from studying birds, the team collected marine organisms along the shore to study the recolonization of the coast after the removal of ice at the end of the last Ice Age.

En route to Heard Island, Peter Ryan observed that the most common bird sighted was the blue petrel. Volcanic Mawson's Peak, Australia's highest, at 2745 m, dominated the view. Denied permission to land, the team contented themselves with oceanography, dredging for specimens, counting birds, collecting microbes, and analysing plankton hauls. Ten days later they reached Hobart, where they took on board a remotely operated submersible, ROPOS, before setting off for Antarctica's Mertz Glacier. Among other things they would use the ship's radar to study wave patterns, one recorded as high as 17 m.

The Mertz Glacier had a projecting ice tongue originally several tens of kilometres long, in the shelter of which, on its western side, sits a large stretch of open water - a polynya - with an unusually rich ecosystem. Nosing the ship into the side of the glacier tongue gave the scientists a stable platform from which to launch ROPOS into the polynya. Photographs revealed an incredibly rich

seabed carpeted with sponges, corals, brittle stars and other animals, some 1000 m down. On the glacier, the team was able to deploy its ice coring equipment for the first time in the SubICE programme headed by Liz Thomas, which aimed to collect ice cores 10–25 m long from each ice-covered stop.

Then it was onwards to the Balleny Islands, a steeply bordered volcanic chain west of the Ross Sea, and home to colonies of Adélie and chinstrap penguins. Located on the Antarctic Circle, and almost inaccessible, the islands get few visits. The helicopters were used to make accurate maps of the islands and to count the penguins. Nets and bottles captured plankton, microbes and even viruses for later study, and the drillers extracted the first ever ice core from the islands.

A short distance away lay tiny volcanic Scott Island, a mere 500 m long by 300 m wide. It lies in the recently declared Ross Sea Marine Protected Area, the largest of its kind in the world. Aerosols, small particles in the air, were a prime target for study, as were the songs of blue whales, and their food - krill. Crossing the mouth of the Ross Sea to the east, the next target was Siple Island, another volcano, this one connected to the coast of Marie Byrd Land by the 500 m thick Getz ice shelf. The scientists busied themselves with ice coring, plankton sampling, observing penguins, and deploying the ROPOS to examine the seabed.

Further along the coast lay Peter I Island, still surrounded by pack ice. Air sampling for aerosols accompanied snow sampling for microbes, and the inevitable ice coring. Sophisticated analytical equipment in a container laboratory on the deck provided Julia Schmale with the character of the aerosols, most of which comprised sea salt. The data will inform models that simulate the climate.

En route to Punta Arenas, the ship visited the grass-covered Diego Ramirez Islands close to Cape Horn. Fortunately the seas were moderate and landing proved possible. Dominic Hodgson's drillers extracted cores of peat, for a record of climate change, and the beaches were searched for signs of plastic pollution.

South Georgia, with its 123 receding glaciers, was the next port of call. Rats and reindeer were eradicated there recently in a 4-year programme during 2011–2015, and the bird population has increased as a result. The island is home to 28 species of seabirds and nearly 95% of the world's population of fur seals. Despite some awful weather, ice cores were collected, along with samples of aerosols. The team assessed biodiversity and searched the shore for plastics, but dredging proved a problem. Water samples were collected for their isotopes, to examine the exchange between ocean and atmosphere, knowledge of which is crucial for understanding the climate in this inhospitable region.

Next came the South Sandwich Islands, yet another volcanic chain, where dredging continued, along with recordings of whale song and analyses of the saltiness of the seawater, which has been declining in recent decades - probably as a result of the ongoing melting of land ice and ice shelves. Last stop to Cape Town was Bouvet, another volcano, this one the most isolated island in the world and the property of Norway. Quick collections were made of moss, rocks, water and snow, and the drillers managed to extract a 14 m long ice core.

This 33 000 km journey in the southern summer of 2016–2017 was just the beginning. Now comes the scientific analysis. How is the Southern Ocean affected by what happens elsewhere, and how does it affect the rest of the globe? We may already know a lot about this, but soon we will know a great deal more thanks to this unique enterprise, its progress recorded in some beautiful photographs.

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Antarctica: the frozen continent's environment, changing logistics and relevance to India

Jagadish P. Khadilkar
Bloomsbury, New Delhi. 2017.
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There have been few accounts of the Indian activities in Antarctica and those few reports and books that have been published have not been available outside India. For that reason alone, I was delighted to see the efforts made by Jagadish Khandilkar to not only explain about Antarctica to his fellow countrymen but also to document, in English, some of the Indian Antarctic efforts. That said, there is unfortunately a great deal that is not quite correct in this new volume. The author makes a valiant attempt to cover everything from logistics to science and relies heavily on several older general accounts as well as Wikipedia. In addition, the book has clearly not been copy edited as well as might be expected for a Bloomsbury publication, leading to frequent errors in names etc.; for example, it should be Kerguelen not Kergulan, Priestley not Priestly, Drygalski not Dragalski, and Vivian not Vivien.

His objectives are twofold: to explain about the importance of Antarctica through its history and some of the science, and to review the Indian contribution to Antarctic development chiefly through its logistics. As an ex-Indian Army commander, he spent some time as the Base Commander at Dashkin Gangotri and now wishes to share his experiences with a wider audience.

There are too many errors to list them all but let me point out some of the more important ones. On page 22, in describing sealing discoveries, he fails to mention