Minke whale surfaces in the Weddell Sea

Cover photograph: Tilted and stable tabular icebergs in the western Weddell Sea, Antarctica
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The year 2019 has seen the work of the Institute move forward with fieldwork in both polar regions, through publications in the form of books and papers in international journals, and via the information and outreach services of our Polar Library, Archive and Museum. This diversity in our activities reflects the mission of the Institute in research, education and the projection of the Arctic and Antarctic to wider communities. Superimposed on all this has been the planning of a number of events to celebrate the Institute’s foundation a century ago and the initiation of our 2020 Centenary Fundraising Campaign in support of new academic, museum and archive posts, together with studentships and polar fieldwork.

Getting into the field to undertake scientific experiments and make novel observations has been a key part of SPRI research since the Institute’s foundation by Frank Debenham in 1920, now augmented by numerical modelling, satellite data analysis and, in the case of the social sciences, through archival work. During 2019 a series of major field projects has taken place in both polar regions. In Antarctica, fieldwork on George VI Ice Shelf, western Antarctic Peninsula, by Ian Willis and Alison Banwell and supported by the UK and American national funding agencies, investigated the effects of surface meltwater ponding on ice-shelf flexure and possible breakup. A paper has appeared in *Nature Communications* about their earlier work on ice-shelf flexure.

On the eastern side of the Peninsula, five members of SPRI took part in the Weddell Sea Expedition 2019 aboard the South African icebreaker *Aguhlas II* offshore of the Larsen C Ice Shelf. The presence of the huge 150 km-long iceberg A68 made the area more accessible than usual, although an ice-strengthened ship was still required to navigate the sea-ice cover in the area. Julian Dowdeswell, as Chief Scientist of the Flotilla Foundation funded expedition, oversaw scientific work on the marine geology, glaciology, oceanography and biology of the western Weddell Sea; John Shears, Chair of the Friends of SPRI was Expedition Leader. The research of the expedition was featured on BBC Radio 4’s *Inside Science* and *Today* programmes and an interview with the Director from the Antarctic sea ice was also shown in the final of *BBC2’s Icons* series about great Britons, which included Sir Ernest Shackleton. Julian and John also gave a presentation to parliamentarians in a House of Commons meeting room on returning from the Antarctic.

In the Arctic, Poul Christoffersen’s European Research Council (ERC) funded investigations of the basal properties of fast-flowing glaciers in Greenland, and their interactions with the adjacent seas, has continued with geophysical fieldwork on the ice surface, down boreholes and from the air using instrumented drones and satellites. Doctoral student Tom Chudley has written several papers from this fieldwork, including one in the prestigious American *Proceedings of the National Academy of Sciences*, a journal which saw a further paper about the digitisation of early SPRI ice-penetrating radar measurements jointly with Stanford University colleagues. In the forests of northern Siberia, Gareth Rees and co-workers from Moscow State University including Institute Associate Olga Tutubalina have been studying the dynamics of the boreal forest and its response to a warming Arctic. Beyond the Earth, Neil Arnold has continued his numerical-model investigations of water beneath the ice caps on Mars in collaboration with colleagues at the Open University.

In the social sciences and humanities, archival work has been undertaken with Danish, American, Canadian and UK collections for Richard Powell’s *Arctic Cultures* project through a six-member team funded by the ERC. The project investigates constructions of the Arctic that emerged from exploration by Europeans and North Americans and their contacts with indigenous peoples from the middle of the sixteenth century. By focusing on a diverse range of materials, including historical archives, maps, images and ethnographic objects, the project connects research in cultural history with aspects of museology and museum curation. In addition, several Arts and Humanities Research Council doctoral studentships are supporting historical polar research linked to UK museum and archive collections held at, for example, the Royal Society, the Royal Geographical Society and SPRI’s Polar Museum. New teaching fellow Dr Samantha Saville has also been awarded funding by the Swedish Polar Research Secretariat to work at their Abisko Arctic Research Station over the next three years.

In the context of SPRI research, it is a pleasure to record the promotion of Ian Willis to a Readership in the University. Emeritus Associate Phil Gibbard was awarded the Digby McClaren Medal at the International Commission on Stratigraphy’s 2019 Congress in Milan, Italy. The medal is awarded to honour a significant body of internationally important contributions to stratigraphy, in Phil’s case much of his work being related to Quaternary glacial deposits. The Director was also awarded the W S Bruce Medal of the Royal Scottish Geographical Society for his contributions to glaciology and polar science. In October, Michael Bravo was invited to deliver the prestigious annual Vilhjalmar Stefansson Memorial Lecture in Reykjavik, Iceland. Michael’s book, *North Pole: Nature and Culture*, continues to receive critical acclaim.

Utilisation of the SPRI Picture Library’s collection of Herbert Ponting’s original glass-plate negatives also continued with the publication jointly with Belgium company Salto-Ulbeek of *Captain Scott’s Antarctic Photographs, 1911*, a fine-art book of platinum-palladium prints and associated diary text. The first of
The limited edition of 15 of these books was displayed at a reception at The Ritz followed by the formal launch of the SPRI Centenary Campaign after dinner in the splendid William Kent Room in the presence of our campaign Patron, HSH Prince Albert II of Monaco. Indeed, the Prince Albert II of Monaco Foundation has agreed to support a three-year Research Fellowship on ice-shelf change beginning in the centenary year. The SPRI Centenary has also been marked by the issue of two sets of commemorative postage stamps by the governments of the British Antarctic Territory and South Georgia and the South Sandwich Islands, with the former set including images of the Institute’s façade and the Captain Scott bust above the entrance door.

The Polar Museum has hosted several exhibitions during the year. As part of our Alaskan Art exhibition, Tikigaq/Point Hope – life on Alaska’s North Slope, we were visited by indigenous artists Willy Topkok and Othniel Oonitruk Jr. In summer 2019 the Museum invited twelve Year 12 students, through a national competition, to co-curate an exhibition about climate change. The students spent a residential week at the university, were supported in learning about applying to Cambridge, and were encouraged to feed back to their teachers and fellow pupils about their experience. The project culminated in the exhibition Walking on Thin Ice, with the students and their families attending the official opening. Museum-team member Naomi Chapman was awarded a Vice-Chancellor’s Impact and Outreach Award for her role in developing tactile maps of the Arctic and Antarctic to engage blind and partially sighted people. In addition, from December the Polar Museum began opening on Sundays between 12.00 and 16.00, an important new initiative that we intend to continue in subsequent years to provide increased public access to our collections.

It is a pleasure to thank the very dedicated staff of the Institute for their work over the year, and to acknowledge the commitment of our Friends’ organisation together with material and in-kind support from many generous benefactors to the SPRI.

Professor Julian Dowdeswell
Institute Staff

Senior Academic Staff
Professor Julian Dowdeswell
Dr Neil Arnold
Dr Michael Bravo
Dr Poul Christoffersen
Dr Richard Powell
Dr Gareth Rees
Dr Ian Willis
Director and Professor of Physical Geography
University Senior Lecturer
University Senior Lecturer
University Reader
University Lecturer
University Senior Lecturer
University Reader

Teaching Staff
Dr Samantha Saville
Teaching Associate (from September)

 Researchers
Mr Toby Benham
Dr Marion Bougamont
Dr Johanne Bruun
Dr Frazer Christie
Mrs Evelyn Dowdeswell
Dr Mari Kleist
Dr Bryan Lintott
Dr Nanna Luders Kaalund
Dr Peter Martin
Dr Aleksandr Montelli
Dr Nikolas Sellheim
Dr Charlotte Schoonman
Dr Rachael Turton
Dr John Woitkowitz
Research Associate (until June)
Research Associate
Research Associate
Research Associate
Research Associate
Research Associate (until February)
Research Associate
Research Associate
Research Associate (from June)
Research Associate (from May)
Editor, Polar Record
Research Associate
Research Associate (from October)
Research Associate

Library, Archive and Museum Staff
Rosie Amos
Meg Barclay
Naomi Boneham
Naomi Chapman
Charlotte Connelly
Julie Godden
Henrietta Hammant
Laura Ibbett
Peter Lund
Frances Marsh
Lucy Martin
Alexander Partridge
Dr Eleanor Peers
Emily Rigby
Sophie Rowe
Mia Surridge
Education and Outreach Assistant (job share)
Education and Outreach Assistant (until September)
Archives Manager
Education and Outreach Assistant (job share)
Museum Curator
Library Assistant (from October 2019)
Collections Project Cataloguer (from March 2019)
Archives Collection Assistant
Librarian
Senior Library Assistant
Picture Library Manager
Collections Coordinator
Arctic Information Specialist (from July)
Fundraising and Communications Assistant
Conservator (until March)
Collections Assistant (from July)

Support Staff
Grahame Adley
Joanna Carruthers
Helen Carter
Fiona Craig
Hannah Dennis
Jenny Dunstall
Emily Higgins
Martin Lucas-Smith
Aziz Marufov
Oliver Neale
Maria Pearman
Celene Pickard
Maintenance
Personal Assistant to the Director
Receptionist
Institute Administrator
Saturday Visitor Services Assistant
ERC Project Coordinator
Shop Administrator
Web Manager
Maintenance
Saturday Visitor Services Assistant (from November)
Senior Accounts Clerk
Executive Secretary to the Friends of SPRI
Adam Priestley  Sunday Visitor Services Assistant (from December)
Ilona Roth  Sunday Visitor Services Assistant (from December)
Dr Bill Rothwell  Computer Officer
Roy Smith  Maintenance
Rebecca Stancombe  General Office Administrative Assistant
Dr Adam Strange  Administrator (Dept. of Geography)

**SPRI Committee of Management**

- **Chair of the Council of the School of Physical Sciences**
  - Prof. A.L. Greer, Chair
- **Director, Scott Polar Research Institute**
  - Prof. J.A. Dowdeswell, Sec.
- **Head, Department of Geography**
  - Prof. A. Amin
- **Department of Earth Sciences**
  - Prof. L. Harper
- **Department of Earth Sciences**
  - Prof. D.A. Hodell
- **Department of History and Philosophy of Science**
  - Prof. S. Schaffer
- **Department of Earth Sciences, BP Institute**
  - Prof. A.W. Woods

**SPRI Advisory Committee**

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  - Prof. S. Redfern, Chair
- **Director, Scott Polar Research Institute**
  - Prof. J.A. Dowdeswell, Sec.
- **Director, British Antarctic Survey**
  - Prof. Dame J. Francis
- **UK Hydrographer and Deputy Chief Executive**
  - Rear Admiral T. Lowe
- **Head of the Polar Regions Department, FCO**
  - Ms J. Rumble
- **General Board nominee**
  - The Hon. Ms Janice Charette
- **General Board nominee**
  - Rear Admiral T. Lowe
- **Department of Earth Sciences**
  - Dr A.M. Greenaway
- **Department of Geography, Oxford University**
  - Dr J. Craig
- **Department of Earth Sciences**
  - Professor E.A. Wolff
- **Department of Geography, Oxford University**
  - Professor H.A. Viles

**Doctoral Students**

- Rebecca Vignols
- Maximilien Zahnd

**M.Phil. Students**

- Eleanor Absalom
- Aoife Blanchard
- Seungbong Lee
- Eva Prendergast
- Iain Sheridan
- Amelia Vale
- Iain Wheel
- Adam Williams

**Institute Associates**

- Dr John Ash
- Dr Alison Banwell (from September)
- Dr Christine Bateclor
- Dr Lawson Brigham
- Dr Jean de Pomereu
- Professor Kevin Edwards
- Mrs Penny Goodman
- Mr Bob Headland
- Professor Neil Kent

**Emeritus Associates**

- Dr Peter Clarkson, MBE
- Professor Phil Gibbard
- Professor Liz Morris, OBE
- Dr Simon Ommannay (until September)
- Professor Larry Rockhill
- Dr Ian Stone
- Dr Colin Summerhayes
- Dr Piers Vitebsky
- Dr Janet West

**Other organisations based at SPRI**

**Scientific Committee on Antarctic Research**

- Johanna Grabow  Communications and Information Officer (from September)
- Dr Eoghan Griffin  Executive Officer
- Rosemary Nash  Administrative Officer
- Dr Chandrika Nath  Executive Director
- Alice Oates  Communications and Information Officer (until September)

- Dr Elena Khlinovskaya Rockhill
- Dr Ruth Maclennan (from April)
- Ms Dinah Molloy (deceased 29 October 2019)
- Dr Ursula Rack (from September)
- Dr Beau Riffenburgh
- Dr Florian Stammeler
- Dr John Tichotsky
- Dr Olga Tutubalina
- Dr Emma Wilson
- Dr Corine Wood-Donnelly
Polar Research

Research Structure

The research work of the Institute continues to focus around several research themes, each of which has a mix of senior academic staff, post-doctoral researchers and postgraduate students. Work on these topics is supported by a number of externally funded research grants, which are listed later in this report. The research themes are:

- Glaciology and Climate Change
- Glacier-Influenced Marine Sedimentary Environments
- Polar Landscapes and Remote Sensing
- Polar Histories, Cultures, Environments and Politics

Institute staff organise seminar series in both polar physical sciences and social sciences and humanities. Speakers from a number of universities and research centres in the UK and overseas, together with Cambridge colleagues, have contributed during the year. The seminars are well attended by staff and research students from several Cambridge departments and from, for example, the British Antarctic Survey. A selection of the physical and social-science research projects in which we are currently engaged is outlined briefly below.

Polar Natural Sciences Research

Rapid lake drainage on a fast-flowing glacier observed using drones

Supraglacial lakes form abundantly on the Greenland Ice Sheet in summer. They frequently drain rapidly to the bed over the course of a few hours, but the triggering mechanism for drainage is not well understood. Previous research has shown that there is no clear relationship between the time of lake drainage and lake area, volume or morphology, leaving no clear understanding of the drainage mechanism. Research at SPRI provides new insights into lake drainage mechanisms. While carrying out fieldwork in the EU-funded RESPONDER programme, lake drainage was observed in detail. The new study differs from previous work in that observations were made using custom-built drones, which surveyed autonomously along pre-programmed flight-lines and captured the lake-drainage event with imagery of exceptionally high resolution and accuracy. The drone survey showed that the lake drained because it expanded through surface melting and intercepted a pre-existing fracture. In just five hours, 5 million m³ of water drained to the ice-sheet bed via the fracture, which propagated 500 m further into the lake. The drone surveys also showed that the injection of water at the ice-sheet bed caused ice flow to accelerate from 2 m/day to >5 m/day, and locally lifted the ice sheet by half a metre. The drone footage supports computer models showing that drainage of melt lakes in Greenland can occur in a chain reaction in which drainage of one lake leads to the drainage of numerous more lakes as ice flow accelerates.

Tom Chudley and Poul Christoffersen

The ocean-terminating Store Glacier, West Greenland
The Ross Ice Shelf in Antarctica is the floating portion of the West Antarctic Ice Sheet, covering an area of 400,000 km². Supported by Antarctica New Zealand and the Rutherford Foundation’s Scott Centenary Scholarship held at the SPRI, Craig Stewart and Poul Christoffersen travelled more than 1000 km by snowmobile in order to observe how this ice shelf - the world’s largest - interacts with the ocean beneath it. The team used an extremely precise radar system to record ice-shelf thickness and the rate of melting beneath it. The team, which also included collaborators at the National Institute of Water and Atmospheric Research in New Zealand, collected several years of data. Using instruments deployed through a 260 m-deep borehole, temperature, salinity, melt rates and ocean currents were measured directly in the water-filled cavity under the ice shelf. The unique records from these moored instruments showed that solar heated surface water in the Ross Sea flows into the cavity near Ross Island, causing melt rates to nearly triple during summer. Whereas the Ross Ice Shelf is considered to be relatively stable, the new findings show that it may be more vulnerable than previously thought. The vulnerability is because solar-heated surface water flows into the cavity near a pinning point, where the ice shelf pushes against Ross Island. This pinning point has a stabilising influence, which affects the ice shelf’s flow as far as 900 km away near the grounding line of the large ice streams that feed it. The study shows that basal melting by solar-heated water at this pinning point is 10 times higher than the average melt rate expected for the ice shelf as a whole.

Craig Stewart, Poul Christoffersen and Julian Dowdeswell

Mars has large polar ice caps made up of water, and an extensive mid-latitude ice cover. Given Mars’ thin atmosphere and frigid present-day climate, these ice masses are generally believed to be well below the melting point of water. However, in 2018, a joint ESA/NASA group published the first evidence for liquid water beneath Mars’ south polar ice cap from a ground-penetrating radar system (the MARSIS system) carried on the Mars Express orbiter. This evidence came in the form of a 20 km-radius area of very bright radar reflectance observed at the base of the ice cap – exactly the same evidence used to detect lakes beneath the Antarctic Ice Sheet on Earth. In this research, we adapted a computer algorithm developed at SPRI to model the possible locations of subglacial water beneath Mars’ south polar ice cap. The research suggested that the radar-observed area of liquid water does not coincide with any model-predicted lake locations, even allowing for an extensive analysis of uncertainty in the radar data. This finding supports other investigations indicating that the liquid probably originated from an area of localised geothermal heating beneath the ice cap, and therefore was unlikely to be a true subglacial lake analogous to those beneath terrestrial ice sheets. Instead, the radar-feature was probably an isolated area of liquid trapped by the surrounding frozen ice-cap base. The work was collaborative with scientists at the Open University and the universities of Sheffield and Nantes.

Neil Arnold

Surface meltwater on ice shelves is stored in slush, lakes and streams, and may also fill crevasses. Such surface meltwater systems have been identified across numerous Antarctic ice shelves; their size, the volume of water they hold, and the way in which they evolve over summer melt seasons is poorly quantified, but may affect ice-shelf stability, in some cases prompting rapid breakup. To better understand the role of surface meltwater systems on ice shelves, we have developed an automatic algorithm that uses optical imagery from the Landsat 8 and Sentinel-2 satellites to track the locations of circular and linear water bodies, together with their changing areas and volumes. This algorithm was applied across the Nivlisen Ice Shelf, East Antarctica, for the 2016-2017 summer. The development of around 1,600 distinct water bodies was identified and tracked. The total volume of surface meltwater peaked in late January at 55 million cubic metres. Two-thirds of this total volume was held within two large linear surface-water systems, which gradually extended away from the ice-shelf grounding line towards the ice shelf edge. Over the melt season there is, therefore, evidence for broad-scale lateral water transfer towards the ice-shelf front, as progressively larger water bodies envelop smaller ones as the water moves down the shallow gradient of the ice shelf. This work was undertaken in collaboration with Hamish Pritchard (BAS).

Becky Dell, Neil Arnold, Ian Willis and Alison Banwell

Lateral water transfer across Antarctic ice shelves
Ice-shelf instability caused by active surface meltwater systems, George VI Ice Shelf, Antarctica

Building on our recent work investigating hydrological and dynamic processes on the McMurdo Ice Shelf, East Antarctica, we have recently begun a joint US-NSF/UK-NERC research programme to investigate the role of surface and shallow subsurface meltwater production, movement, ponding and draining on ice-shelf flexure and possible fracture. Fieldwork took place on George VI Ice Shelf, Antarctic Peninsula, in November 2019 to instrument three sites with: i) automatic-weather and GPS stations; ii) temperature profile instruments to depths of 10 m within the ice; and iii) water-level sensors in surface depressions (which will probably become lakes in the summer). These instruments are collecting data each hour and will be used, together with satellite data and physics-based models, to calculate melt and freezing rates across the ice shelf, the movement of water, and the effects of melt and water movement on ice-shelf flexure and possible fracture. The sites will be revisited in summers 2020-21 and 2021-22 to download data and finally retrieve the instruments. Next year, we will also collect shallow ice cores and undertake ground-penetrating radar surveys in order to better understand the processes of shallow subsurface water storage and freezing in firm. The work is collaborative with Doug MacAyeal (University of Chicago) and Laura Stevens (Columbia University).

Ian Willis and Alison Banwell

The changing extent of marine-terminating glaciers and ice caps in NE Svalbard since the Little Ice Age

Climate warming in Svalbard since the end of the Little Ice Age early in the 20th Century has reduced glacier extent. Previous attempts to reconstruct Little Ice Age glacier limits have encountered problems in specifying the area of tidewater glacier advances because it is difficult to estimate the past positions of their marine termini. Multibeam echo-sounding data are needed to map past glacier extent offshore, using the submarine glacial landform record to measure the recent limits of advance of over 30 marine-terminating NE Svalbard glaciers and ice caps. Previous work appears to have underestimated the ice-covered area relative to today by about 40% for NE Svalbard largely because marine-geophysical evidence in the form of submarine terminal moraines was not included. Recent ice extent was 1750 km² larger than today over our full area of multibeam data coverage; about 5% of the total modern ice cover of Svalbard. It has often been assumed that moraine ridges located within a few kilometres of modern ice fronts in Svalbard represent either a Little Ice Age maximum or relate to surge activity over the past century or so. In the marine environment of NE Svalbard this timing can often be confirmed by reference to early historical maps and aerial photographs. Assemblages of submarine glacial landforms inshore of recently deposited terminal moraines suggest whether a recent advance may be a result of surging or Little Ice Age climatic cooling relative to today. This work was carried out in Collaboration with Dag Ottesen and Valerie Bellec of the Geological Survey of Norway.

Julian Dowdeswell

SPRI scientists watch a lake-drainage event on the Greenland Ice Sheet
A deep and extensive meltwater system beneath the former Eurasian Ice Sheet in the Kara Sea

The Eurasian Ice Sheet extended across the Barents and Kara seas during the late Quaternary, yet evidence on past ice dynamics and thermal structure along its huge eastern periphery remains largely unknown. Here we use three-dimensional seismic data sets covering about 4,500 km² of the Kara Sea west of Yamal Peninsula (71-73°N) to identify, for the first time in the Russian Arctic seas, several buried generations of vast tunnel valley networks representing former subglacial hydrological systems. Individual valleys are up to 50 km long and are incised up to 400 m deep, being among the largest tunnel valleys ever reported. This discovery represents the first documentation of an extensively warm-based eastern margin of the Eurasian Ice Sheet during Quaternary glaciations. The presence of major subglacial channel networks on the shallow shelf, with no evidence of ice streaming, suggests that significant meltwater discharge and subsequent freshwater forcing may be long-lived rather than catastrophic, occurring during the latest stages of deglaciation in areas where the ice sheet is relatively stable, slow-flowing and grounded largely above sea level. Furthermore, the first account of an extensive hydrological network across large areas of the Kara Sea provides important empirical evidence for active subglacial hydrological processes that should be considered in future numerical modelling of the eastern margin of the Quaternary Eurasian Ice Sheet. This work was undertaken in collaboration with Russian colleagues A. Pirogova, Y. Terekhina, M. Tokarev, N. Rybin, A. Martyn and V. Khoshtaniya.

Sasha Montelli and Julian Dowdeswell

The ‘Missing Glaciations’ of the Middle Pleistocene

Global glaciations have varied in size and magnitude since the Early-Middle Pleistocene transition (~773,000 years ago), despite the apparent regular and high-amplitude 100,000-year pacing of glacial-interglacial cycles recorded in marine isotopic records. The terrestrial palaeo-glacial evidence, compiled in this joint project by Phil Gibbard, Philip Hughes (Manchester Univ.) and Jürgen Ehlers (Witzeee, Germany), indicates that patterns of glaciation varied dramatically between different glacial-interglacial cycles. For example, MIS (Marine Isotope Stages) 8, 10 and 14 are all noticeably absent from many terrestrial glacial records in North America and Europe. Globally, however, the patterns are more complicated with major glaciations recorded in MIS 8 in Asia, and MIS 10 and 8 in parts of the Southern Hemisphere, such as Patagonia and Tasmania. This spatial variability in glaciation between glacial-interglacial cycles is likely to be driven by ice-volume changes in the West Antarctic Ice Sheet and associated inter-hemispheric connections through ocean-atmosphere circulatory changes. The weak global glacial imprint in some glacial-interglacial cycles is related to the pattern and chronology of global ice build-up. This is caused by feedback mechanisms within glacier systems themselves which partly result from long-term orbital changes driven by eccentricity.

Phil Gibbard
Knowledge of the climate history of the Southern Ocean is limited largely to the last few decades, when meteorological station and satellite data have been available. Trends over the last century are uncertain. In this project, logbooks from the Christian Salvesen Whaling Company’s ships operating in the Southern Ocean have been exploited as a novel source of meteorological data, in order to produce a new historical climate dataset for the 1930s and 1950s in this isolated region. Results that have emerged from the analysis of these data include the different behaviour of mean sea-level pressure over time in southerly and more northerly latitudes, and that cyclones have become more frequent in the Southern Ocean since the mid-20th century. It has also been shown that the new data can be successfully assimilated into current climate reanalysis models, improving their accuracy.

Praveen Teleti, Julian Dowdeswell and Gareth Rees

The Northern Hemisphere’s boreal forest accounts for one third of global forest area, and the transition zone between boreal forest and Arctic tundra, the Forest-Tundra Ecotone (FTE), is an area of particular ecological and climatological significance. The FTE is little studied as a result of its size and remoteness, and is poorly represented in the coupled climate-vegetation models that predict climate change. Because of its size and remoteness, the boreal forest is particularly well suited to satellite investigations. We have developed new methods, using texture analysis and the considerable potential of the Google Earth Engine, to robustly identify different spatial forms of the FTE, including its degree of fragmentation. A UK-Russian project is investigating how biomass is distributed across the Russian boreal forest, how this has been changing since 2000, and how this relates to climate change. The project is a collaboration between SPRI, the British Antarctic Survey (Gareth Marshall), Moscow State University (Olga Tutubalina), and the Institutes of Geography and of Space Science of the Russian Academy of Sciences. It requires development of novel upscaling from individual trees to continental scale using satellite observations, data collected from UAVs (drones), and detailed field measurements. Fieldwork in 2019 was carried out in the Sakha Republic of the Russian Federation, around Yakutsk and along the Kolyma Highway. A student field-training course, attended by students from Russia, Sakha and the UK, was also organised during the main field season. A shorter field campaign took place in the Khibiny Mountains in north-west Russia.

Wenkai Guo, Bronwen Fraser, Gareth Rees, Rachael Turton

Experimental gantry in the boreal forest of Russian Siberia
Arctic cultures

How did the Arctic come to be understood in the Western imagination as a ‘natural region’? Why have these formulations been so persistent? These questions are central to the ARCTIC CULT project and are being investigated by a team of six researchers based at SPRI funded by the European Research Council. The project investigates the construction of the Arctic that emerged from exploration of the region by Europeans and North Americans and their contacts with indigenous people from the middle of the sixteenth century. By focusing on a diverse range of materials (e.g. historical archives, maps, images and ethnographic objects), the project connects research in cultural history with aspects of museology and museum curation. The team have conducted field work in archives and collections in Denmark, Germany and the UK during 2019, as well as developing links with repositories across Europe, North America and Greenland. Presentations have taken place at international conferences and workshops in Canada, Denmark, Iceland and the UK. The project has made significant research findings during the year, and is disseminating knowledge through public talks, social media and a blog. In doing so, the project presents new understandings of the enduring consequences of colonial representation for debates about the Circumpolar Arctic today.

Richard Powell, Johanne Bruun, Nanna Kaalund, Mari Kleist, Peter Martin and John Woitkowitz

Historical geographies of Halley Bay and Antarctic governance

This PhD project examines the emergence of scientific governance in Antarctica by focusing on Halley Bay research station. Halley Bay was established by the Royal Society in 1956 in preparation for the International Geophysical Year, 1957-58. The scientific station operated continuously until 2017, when overwintering became problematic due to a growing crack in the Brunt Ice Shelf. The station has become an important centre for global science, including the discovery of the ozone hole in the 1980s. The project involves use of archive collections at the Royal Geographical Society, the Royal Society and SPRI, supplemented by material from other collections, to investigate the history of Halley Bay and its place in the international story of Antarctic science and governance. It aims to inspire innovative collaborations across these collections and others. This project is funded through a grant awarded by the AHRC Collaborative Doctoral Partnership (CDP), Science Museums and Archives Consortium, partnering with the Royal Geographical Society and Royal Society.

Alice Oates and Richard Powell

Ethnographies of polar expertise

Investigations have continued into the social practices involved in the constitution of the polar environmental sciences and the consequences for geopolitics, governance and resource development. Research, including participant observation at scientific field stations in the High Arctic, is now being developed to think comparatively about the development of Antarctic knowledges and expertise. The findings of this research are being used to inform discussions about polar science policy in the UK. A major contribution in this area, ‘Studying Arctic Fields: Cultures, Practices, and Environmental Sciences’, was described in 2019 by a reviewer: ‘this ethnography of science in Canada’s High Arctic is the most fascinating Arctic book I’ve ever read’.

Richard Powell

The mythology of the Poles through the Ages

This project has examined the importance of mythology in the understanding of the poles across western and non-western civilisations. Too often told simply as a race to reach the Pole first, visions of the North Pole have been supremely important to the world’s cultures and political leaders, from Alexander the Great to Hindu nationalists. Tracing poles and polarity back to sacred ancient civilizations, the idea of a North Pole has given rise to satires, fantasies, paradoxes, science fiction and nationalist ideologies. From the cartographers of the Renaissance through the narratives and memoirs of Nansen and Peary, myths passed down through the study of classics played a key role in conveying to readers an image of the North Pole as a place of paradise, or a garden of Eden. The key ideas, published in ‘North Pole: Nature and Culture’, were presented at the Stoke Newington Literary Festival, and the distinguished Vilhjalmur Stefansson Lecture at the 2019 Arctic Circle conference in Reykjavik, Iceland.

Michael Bravo
Live, work or leave? Youth – well-being and the viability of (post)-extractive Arctic industrial cities in Finland and Russia

Youth in 21st century Arctic industrial cities is caught between two trends. On the one hand, the Arctic is urbanising; more than two-thirds of the Arctic human population is urban. On the other, there is a trend of outmigration from the Arctic to southern metropolitan areas. By analysing the attractiveness of Arctic industrial cities as places to live and work, this project contributes to understanding the determinants of youth well-being. The future and sustainability of Arctic-city communities will depend on how the young generation sees prospects for their personal development. Rather than seeing youth decision-making simply as ‘coping strategies’, this research studies more positive perspectives, namely the pursuit of happiness and opportunities in Arctic industrial cities. The project contributes to a broader theory of viable Arctic communities, combining approaches from different disciplines. Integrating anthropology, legal studies, geography, political sciences and economics, we study how authorities, civil society and (industrial) companies provide conditions for youth well-being. Using a political-legal approach we investigate how youth legislation is being implemented in the city-municipalities and how the implementation of laws and policies is perceived by young Arctic urban inhabitants. We intend to assess the extent to which there is a match or a misfit between youth’s expectations and the socio-legal-political-economic-cultural frameworks in which they grow up. The project will establish a renewed holistic theory of sustainable Arctic industrial cities based on young people’s aspirations and provide a toolkit for assessing how Arctic industrial cities create conditions for youth well-being.

Florian Stammler

Diversity and inclusion in Polar research: an intersectional approach

Building on primary doctoral research on the topic of ‘equal opportunities on ice: gendered institutional change in 20th century Antarctic science’, this project takes an applied, intersectional approach to feminist historical and geographical research in polar studies. The project focuses on intersectionality in discourse on diversity and inclusion in polar research by examining overlapping, interconnected barriers to inclusivity along the lines of race, sexuality, language, nationality and disability, among others. Public-facing outputs support awareness and action among practitioners and decision-makers. Project activities include: a paper published in Polar Record (Seag, Badhe, & Choudhry, 2019); establishment of an international project group on Diversity, Equity, and Inclusion (APECS, 2018-present); discussions at a Polar Humanities and Social Sciences Workshop held at SPRI in 2019; an international collaboration with researchers at the University of Tasmania; and two sessions on inclusive collaborations at the forthcoming coming 2020 SCAR Open Science Conference (co-convened with Badhe, Choudhry, and Thornton).

Morgan Seag

Nanna Kaalund’s fieldwork was at the Arctic Institute in Copenhagen
Current Research Grants

Staff of the Institute currently hold research grants of £5.81 million, of which £601,000 is from the UK research councils and £3.9 million from the European Research Council and other EU sources.

Grants from UK Research Councils

The role of shear margin dynamics in the future evolution of the Thwaites Drainage Basin (TIME - Thwaites Interdisciplinary Margin Evolution)
Source: Natural Environment Research Council
£438,822 (2018-2023)

Ice-shelf instability caused by active surface meltwater production, movement, ponding and hydrofracture
Source: Natural Environment Research Council
£91,474 (2019-2021)

Grants from Other Sources

Arctic Cultures: sites of collection in the formation of the European and American northlands
Source: European Research Council, Consolidator Grant ERC-2016-CoG-724317
€1,996,250 (2017-2022)

Resolving subglacial properties, hydrological networks and dynamic evolution of ice flow on the Greenland Ice Sheet (RESPONDER)
Source: European Research Council, Consolidator Grant ERC-2015-CoG-683043
€2,443,800 (2016-2021)

Hydrology and dynamics of the Greenland Ice Sheet and Antarctic ice shelves
Source: University of Colorado, Boulder, Sabbatical Fellowship
£17,100 (2018-2019)

Pleistocene glaciation of Fenland, England and its implications for evolution of the region
Source: Leverhulme Foundation Emeritus Fellowship
£20,210 (2018-2019)

Autonomous Underwater Vehicle (AUV) investigations of floating ice shelves in the Weddell Sea sector, Antarctica
Source: The Flotilla Foundation
£350,000 (2018-2020)

Multiplatform remote sensing of the impact of climate change on northern forests of Russia
Source: The British Council
£150,000 (2018-2021)

Strengthening Russia-UK Links in Arctic ecological remote sensing
Source: UK Foreign and Commonwealth Office (Global Britain Initiative)
£37,910 (2018-2019)

Instruments of scientific governance? Historical geographies of Halley Bay, 1956 - present
Source: Arts and Humanities Research Council (AHRC), Collaborative Doctoral Student Training Grant with The Royal Society and the Royal Geographical Society
£70,717 (2018-2022)

Transferring from ship to the sea ice of the Weddell Sea

Expanding Moscow-Cambridge links in Arctic ecological science and outreach
Source: UK Foreign and Commonwealth Office (International Projects)
£96,000 (2019-2020)

Conserving and sharing SPRI's Antarctic heritage collections
Source: UK Antarctic Heritage Trust
£150,000 (2017-2020)

Heritage Lottery Fund, Collecting Cultures - By Endurance We Conquer: the Shackleton Project
Source: Heritage Lottery Fund, Grant CC-13-21559
£500,000 (2014-2019)

The third pole as a geographical imaginary: its historical, philosophical and political roots
Source: Cambridge Humanities Research Grant
£19,705 (2019-2020)
Publications by Institute Staff

Books

Papers


Absalom, E., M.Phil., Drivers of spatial and temporal variability in the fire regime of boreal forest in western Russia

Blanchard, A., M.Phil., Unearthing Greenland’s resource frontier: mineral resource extraction and Naalakkersuisut’s bid for Greenlandic independence

Dale, R., Ph.D., Making resource futures: petroleum and performance by the Norwegian Barents Sea

Guo, W., Ph.D., Remote sensing characterisation of the forest-tundra ecotone

Herrmann, V., Ph.D., Alaska through the looking glass: and what twentieth century American photojournalists saw there

Lee, S., M.Phil., Resolving surface currents of a proglacial Greenlandic fjord using a high-resolution terrestrial radar interferometer
McCarthy, M., Ph.D., Quantifying supraglacial debris thickness at local to regional scales
Montelli, A., Ph.D., The Quaternary evolution of the mid-Norwegian continental margin
Potter, E., Ph.D., Wind and temperature in a glacierised Himalayan valley and their controlling mechanisms
Prendergast, E., M.Phil., Pre-whaling population structuring and diversity of blue whales (*Balaenoptera musculus*) in the high latitudes of the North Atlantic
Sheridan, I., M.Phil., Drone navigation in polar and cryospheric regions

Vale, A., M.Phil., Remote detection of surging glaciers across high mountain Asia
Wheel, I., M.Phil., The winds of change: the effects of katabatic winds on fjord circulation, sea-ice export and glacier stability at Sermilik Fjord and Helheim Glacier
Williams, A., M.Phil., A critical geopolitical approach to digital infrastructure in the European Arctic: to what extent, and how, have satellites contributed to EU geopolitical discourses about the European Arctic?

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**Seminars in the Institute, including:**

*‘As far North as whale hunters go’: the medieval Arctic environment, experienced and imagined*
Eleanor Rosamund Barraclough (Durham University)

*The use of marine geophysical data to investigate the climate and environment of the Quaternary*
Christine Batchelor (Norwegian University of Science and Technology, Trondheim, Norway)

*The sublimity of sublimating ice: ruins of the Anthropocene*
Mia Bennett (University of Hong Kong)

*Characteristics and changes of glaciers, rock glaciers and glacial lakes in High Mountain Asia since the 1960s*
Tobias Bolch (University of St. Andrews)

*Integrating photogrammetry and computer vision into the study of glacier change*
Penny How (University of York)

*Antarctic Mosaic: integrating science and history in the McMurdo Dry Valleys*
Adrian Howkins (University of Bristol)

*The role of the Arctic in the development of Soviet climate science*
Jon Oldfield (University of Birmingham)

*Introducing Tikīqaq - Living with the whale in the Arctic*
Othniel Art Oomittuk Jr and Ellis Doeven (Visiting Artists, Alaska)

*Subglacial landscapes: tunnel valleys in the central and northern North Sea*
Margaret Stewart (British Geological Survey, Edinburgh)

*Life in Alaska as an Inupiaq artist*
Willy Topkok (Visiting Artist, Alaska)

*Mittimatalik Arnait Miqsuqtuit collective and the art of sealskin sewing*
Nancy Wachowich (University of Aberdeen)

*Critical geopolitics of the Polar regions: an inter-American perspective*
Dorothea Wehrmann (Deutsches Institut für Entwicklungspolitik, Germany)
Polar Information and Historic Archives

Library and Information Service

The Polar Library catalogue became part of the University of Cambridge iDiscover platform from October 2019. Our catalogue is now fully available online, enabling existing and new users to find the Polar Library's books and other resources alongside the holdings of libraries across the University of Cambridge. Users can also search simultaneously across all University of Cambridge Libraries if required. Visits and inter-library loan requests have immediately increased. With catalogue records in 90 languages (including those in Cyrillic script) and the inclusion of over 100,000 journal-article records linking to their parent journal titles, the work on this project has been challenging. We thank Martin Lucas-Smith, our Webmaster, for the many hours of systems programming needed to make our legacy catalogue data compliant with the necessary standards. During the year, our Cyber Essentials accreditation was also renewed successfully. This cyber security initiative enables the Library and General Office to communicate and work effectively with government agencies, notably the Ministry of Defence. Thanks go to our Computer Officer, Bill Rothwell, for help with this renewal.

This is the final year of National Lottery Heritage-funded By Endurance We Conquer: the Shackleton Project. This award has enabled the Institute to acquire, conserve and display materials relating to Sir Ernest Shackleton and his Antarctic expeditions. A large new display cabinet has now been installed in the Shackleton Memorial Library’s Friends’ Room, showcasing Museum objects and archival documents on Shackleton purchased through the National Lottery Heritage award. Among the documents purchased this year was an employment contract from Shackleton’s Nimrod Expedition.

In October, new Polar Studies MPhil and PhD students were guided through the library’s extensive print and electronic resources and we were able to promote the new library catalogue, providing demonstrations and iDiscover tips and tricks to ease the transition to the catalogue for new students and our existing library users. Tours of the Library were provided throughout the year for a wide range of societies and organisations. These included Cambridge Libraries’ graduate trainees, UNC Chapel Hill library and information studies postgraduates, Cambridge alumni and Bishop Grosseteste University history undergraduates. In support of Open Cambridge, we provided a self-guided tour, exhibition and short quiz entitled Small Library – Big State, showcasing our Alaska materials. The Library continues to receive extended visits from overseas scholars and we were delighted to welcome researchers this year from Brazil, China, Finland, Germany, Hong Kong, Japan and Sweden.

In the summer we were joined by Dr Eleanor Peers as our Arctic Information Specialist. Eleanor’s fluency in Russian language and cultural sensitivity, developed through work as an anthropologist in the Sakha Republic, means the Library has regained the capacity to source new materials on the Russian Arctic and to better exploit our Russian language collections. Eleanor has successfully guided researchers to library resources on themes as varied as: Soviet-era ice-breakers, publications from the International Geophysical Year, and early nineteenth-century Russian shipping routes. Julie Godden also joined us as Library Assistant in October, so completing our staffing complement.

During the year we continued to acquire books, conference proceedings, reports, DVDs and maps and to make their catalogue records available through the University of Cambridge iDiscover interface. These included works from indigenous publishers, by northern indigenous authors and relating to relevant indigenous subjects more generally. Purchasing and much of the book cataloguing was undertaken by Frankie Marsh who now adds lists of our new accessions to the library website each month. Ann Keith and Jeremy Wong completed the tasks of cataloguing maps of the British Overseas Territories and Greenland. We are pleased to report that 2,000 maps are now discoverable through the catalogue, although there is much work still to do to catalogue maps of other polar areas. Following the end of their temporary contracts, we are pleased that both Ann and Jeremy have returned as volunteers. We are also grateful to Erika Drucker for maintaining the newspaper cuttings collection in a voluntary capacity.

During the financial year the Institute received grants for the general support of information and library services from the following generous supporting bodies:

<table>
<thead>
<tr>
<th>Grant Provider</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Defence grant-in-aid</td>
<td>£37,500</td>
</tr>
<tr>
<td>FCO Polar Regions Department</td>
<td>£5,000</td>
</tr>
</tbody>
</table>

Peter Lund

The settlement of Qaanaaq in NW Greenland
The Picture Library

The Picture Library continues to assist enquirers and visitors from many countries with their research of photographic material for use in a variety of publications, films and displays concerning the polar regions. Photographic material has been supplied for a number of exhibitions, academic theses, journals and lectures, books, magazines and television programmes. Included amongst these are exhibitions at the British Museum, Swiss National Museum, Preston Park Museum, Canterbury Museum in New Zealand, the Royal Canadian Geographical Society in Ottawa and The Box, Plymouth.

Images have been supplied for a number of book publications, which include Woman with the Iceberg Eyes, by Katherine MacInnes; Expeditions Unpacked by Ed Stafford; Long, Strange and Wondrous Trip by Neil H. Shubin; The Lost Pianos of Siberia, by Sophy Roberts; Monumental Tales, by Jackie Buckle; Murhentäytämä Grönlandissa, by Timo Polari; Okkupasion av land på Svalbard 1898-1927, by Peter Brugmans and Per Kyrre Reyment; Through Astronaut Eyes, by J.K. Levasseur; in a re-print of An Unsung Hero, by Michael Smith; and Wayfinding, by Michael Bond. Other publications include Arctic: Culture and Climate, an exhibition catalogue for the British Museum, the journal International Journal of Historical Archeology; the journal Victorian Studies; the Journal of Historical Geography and in the Outback Magazine, an article by Peter Rymill. Images have also been reproduced on board ship for Aurora Expeditions, in an Archaeological Report for the Newcastle Light Rail Project, Australia and BBC news items for Look North.

The Picture Library is also collaborating on a Leverhulme Trust funded project to extract quantitative data on the past geometry of East Greenland glaciers using digitised oblique aerial photographs from Gino Watkins’ British Arctic Air Route Expedition of the early 1930s. This work, involving Dr David Rippin of York University and Julian Dowdeswell at SPRI, has the aim of extending the baseline of historical fluctuations of these glaciers.

The project to catalogue and digitise Charles Swithinbank’s extensive polar photographic collection of about 8,500 35 mm slides is well under way with approximately half of the slides completed. A group of volunteers has been cataloguing each individual slide, the information on which has then been transferred to the Picture Library’s main database. The gradual process of digitising the collection is also running concurrently and the images linked to the database. These will be made available on the SPRI Picture Library website at the end of the project. The Picture Library would like to thank Carrie Marks, David Matzliach, Suzy Rickard, Neville Taylor and Mark Wilson for their voluntary work which has enabled the progress of this project.

Lucy Martin

The Thomas H Manning Polar Archives

Staff of the Archive continue to provide reader services to our external scholarly visitors, SPRI staff and students and have also participated in several outreach events in collaboration with the University of Cambridge Museums (UCM) and Cambridge Archivists Group (CAG). These events included highlighting our scientific archives in March, looking at anonymously written archives at the Castle Hill open day in July, and showcasing the research value of the collections at the University’s dissertation and research fair in November. The year ended with an ‘Archive Celebrated’ event at the Sedgwick Museum as part of the annual national ‘explore your archives’ campaign.

We were delighted to accept the following additions to the Archive’s Arctic collection during 2019: Augustus Reginald Hoare, Point Hope Alaska papers, correspondence from the early 20th century; diaries by Richard Hamilton relating to the Oxford University Arctic Expedition 1935-36; letters by Jennifer Morris to her family while working as a nurse in the Canadian Arctic during the 1970s. New Antarctic documents included: Victor Hayward’s scrap book from the Ross Sea Party of Shackleton’s Imperial Trans-Antarctic Expedition 1914-17; the journal written by Eleanor Francis (later Rymill) for John Rymill to take to Graham Land in 1934, together with memorabilia relating to the Institute; Lieutenant Foster’s scrap book of his time with the United States Operation Deep Freeze.

Laura Ibbett provided information for the latest map of Greenland and the European Arctic published by the British Antarctic Survey. The map and accompanying information sheet are designed to be a resource for scientists, tourist visitors and those with a general interest in the Arctic. As always, we thank our volunteers, Judy Skelton and Michael Laughton, for their assistance in the archives. In September Deirdre Hannah, who has been an archive volunteer at SPRI for nearly 20 years, stood down from her customary Monday afternoon visit; we wish her well for the future.

Naomi Boneham

Bust of Antarctic sea captain C.A. Larsen after whom Larsen Ice Shelf is named
Teaching, Learning and Understanding

University Teaching

Academic members of the Institute’s staff coordinate and deliver undergraduate lecture courses, and run laboratory classes, in the Department of Geography. Long-running Geography courses include ‘The Cryosphere’, ‘Glacial Environments’, ‘Glaciology’ and ‘Geographies of the Arctic’. Undergraduate supervisions are also provided to students in many colleges. Members of our staff are Fellows of Christ’s, Downing, Fitzwilliam, Jesus, St. Catharine’s and St. John’s colleges. Our M.Phil. course in Polar Studies, with eight students graduating in 2019, has academic strands in Natural Sciences and in the Social Sciences and Humanities. We have more than twenty doctoral students, registered to study topics ranging from processes at the base of the Greenland Ice Sheet to ethnographic investigations of Arctic peoples. Each student works within one of our established research themes, providing a strong and integrated research culture.

Julian Dowdeswell

The Polar Museum

Visits to the Museum continue to be buoyant with 51,500 visitors during 2019, enhanced slightly by the introduction of Sunday opening (12.00-16.00) from December. To help facilitate these new hours, we have recruited three new Visitor Service Assistants, Oliver Neale, Adam Priestley and Ilona Roth. As ever, the ongoing success of the museum is also dependent upon the strong support of our group of volunteers; we thank them for their hard work throughout the year. The Polar Museum has seen two further new appointments this year. Henrietta Hammant, our Collections Project Cataloguer, began her role in March and has been working on several exhibitions. Mia Surridge, our Collections Assistant, started work in July and has been invaluable in her support to the museum team in a range of areas. Rosie Amos, Education and Outreach Assistant, returned from maternity leave in the autumn and we bid farewell to Meg Barclay, her maternity cover, as she moved to the Norfolk Museums Service. Meanwhile, our curator Charlotte Connelly has taken maternity leave from October. Finally, Education and Outreach Assistant Naomi Chapman was the recipient of a Vice-Chancellor’s Research and Impact Engagement Award for her work in developing innovative tactile maps of the Arctic and Antarctic.

Polar Record

Polar Record continued during 2019 as an internationally refereed journal of polar research for the sciences, social sciences and humanities. It has become an e-journal with up to six issues being published electronically each year by Cambridge University Press. We thank the many reviewers of manuscripts submitted for publication for their input towards maintaining high scholarly standards for the journal.

Nikolas Sellheim (Editor)

SPRI Website

The key project completed this year was the conversion of the Library’s catalogue into iDiscover, the University’s online catalogue system. This project was very challenging technically, with the previous system, Muscat, dating from the 1980s and using completely different cataloguing standards to those in wide use today. The project involved dealing with many of the special aspects of SPRI’s polar library collection, including the creation of over 140,000 Russian strings from an older transliteration system, to enable people to be able to search in Russian, and the use of connected records such as articles within a journal. As a result of this project, details of SPRI’s holdings can now be accessed online at: www.spri.cam.ac.uk/library. Another project completed in 2019 was a new ‘Shackleton Online’ section to the SPRI website, with information about Shackleton’s expeditions and their members, together with the exceptional collections of papers, photographs and objects related to Shackleton held in the Institute. This resource is online at: www.spri.cam.ac.uk/museum/shackleton. The website has also seen new sections for the SPRI Centenary, and overhauls of the Museum, Library and several other sections.

Martin Lucas-Smith

Gentoo penguin, South Shetland Islands

Gentoo penguin, South Shetland Islands
This year saw a group of teenagers work with Henrietta Hammant to express their views on climate change. Having spent a week in the Institute, learning from researchers about climate science, as well as the social science behind a changing climate, the co-curation team produced carefully nuanced plans for a new temporary exhibition. The exhibition, *Walking on Thin Ice: Co-operation in the face of a changing climate*, complete with giant floor map of Antarctica, ‘collage wall’ of climate strike photographs, and ‘voting wall’ with counters and thought-provoking questions, opened in November and will run until March 2020. As well as learning from SPRI and British Antarctic Survey researchers during their week with us, the team were also informed about the University admissions process. Of the 12 teenagers involved in the project, 9 went on to interviews at either Cambridge or Oxford universities: we wish them well with their A levels.

In the first half of the year, our exhibition *Tikig̱aq | Point Hope - life on Alaska’s North Slope* showcased a new collection of objects donated to the museum in 2018. Through this donation, the museum forged ties with Othniel Art Oomittuk Jr., an Iñupiaq artist from Point Hope. Art and his partner Ellis Doeven were able to visit the museum to see the collection on display, alongside one of Art’s carvings which was loaned to the museum for the duration of the exhibition. The museum also welcomed Willy Topkok, another Iñupiaq artist from Teller and Wales, Alaska to the museum in October for a week of talks and knowledge sharing. Willy delighted visitors at our Family Open Day as well as our Museum volunteers and SPRI researchers in various events organised throughout his trip. His knowledge and enthusiasm were infectious.

Alongside our permanent and temporary exhibitions, a number of events such as *Twilight* and *Little Explorers* welcomed visitors this year, providing activities for all ages. In addition, the museum hosted a series of *Bridging Binaries* tours, which consider LGBTQ+ elements of museum collections across the University of Cambridge. Our tours looked at topics from homosexuality in penguins to the significance of Huntley and Palmer biscuits in the partial decriminalisation of homosexuality in England and Wales in 1967. On the topic of penguins, a rather lovely example of an Emperor Penguin was given to the museum earlier in the year. It is the only known complete Emperor Penguin specimen from Scott’s *Terra Nova* expedition in a museum collection (with the possible exception of the Cape Evans Hut in Antarctica).

A series of successful loans from our collection this year included: several pieces by anonymous Inuit artists to Kettle’s Yard’s *Unknown Artist* exhibition; Edward Wilson’s Polar Medal and a band of eight medals belonging to Frank Worsley to Spink and Son Ltd. in London, for their exhibition *200 Years of Polar Exploration*; several items belonging to Frank Wild to Preston Park Museum and Grounds for their exhibition *To Boldly Go: The Adventurous Spirit of the Tees Valley*; and a number of Shackleton’s expedition items, as well as some pieces of Sami origin, to the Green Howards Museum in Richmond for *Hostile Environment: the British in Russia 1918 to 1919*.

2019 also marked the completion of our National Lottery Heritage Fund project *By Endurance We Conquer: The Shackleton Project* which saw the acquisition of a number of items relating to Ernest Shackleton and his Antarctic expeditions, many of which are now on display in a dedicated case in the Friends’ Room at SPRI. Additionally, a Shackleton Online website has been launched – a rich source of information on Shackleton, his men and expeditions, as well as the objects they took with them. Ten short films were also made in-house and voted on by the public, showcasing some of the most exciting Shackleton-related objects in our collection, with the three winning objects going on to be made into longer films by a professional filmmaker. *By Endurance We Conquer* has also sought to make our collections more accessible, with the production of an audio-described tour of the museum and several objects in the Shackleton collections. VocalEyes, who produced these resources, also ran two training sessions which were attended by 23 members of SPRI staff and volunteers. Finally, a model of a pair of Charles Royds’ eye shades and a model sledge from the Antarctic era were commissioned to be used as handling objects by blind or partially sighted visitors.

As 2019 draws to a close we look forward to the Institute’s centenary year in 2020. The celebrations have already begun as this year we introduced a new logo for the Polar Museum which unifies our visual identity with the rest of the Institute.

Henrietta Hammant
Projecting the Significance of the Polar Regions

Institute academic staff and research students continue to be engaged in the outward projection of polar research and education through, media work, public lectures and visits by schools to our Polar Museum. The Director, for example, spoke on Radio 4’s Today Programme about Shackleton’s Endurance and ice hazard in the Weddell Sea, and an interview from Antarctica also featured in the final of BBC2’s Icons series. Views and quotations on polar topics, many of which include an emphasis on polar heritage and environmental-change issues, have also appeared in broadsheet newspapers both in Britain and internationally (e.g. The Times, The Daily Telegraph, The New York Times), and on the increasingly visited websites of media organisations.

A number of our staff have given external talks at primary and secondary schools, in addition to academic seminars at UK and foreign universities. Emeritus Associates of the Institute, including Drs Peter Clarkson and Colin Summerhayes have been particularly active in giving public lectures. These external activities are important in making sure that the work of the Institute, in terms of both its scholarship and heritage activities, is projected as widely as possible.

Julian Dowdeswell

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Expedition Support: Gino Watkins Memorial Fund

The Gino Watkins Memorial Fund, under the joint trusteeship of the University of Cambridge and the Royal Geographical Society, awards grants towards expeditions that meet its objectives of guiding and inspiring enterprising people towards scientific research and exploration in the polar regions. The Committee of Managers of the Fund would like to thank the Augustine Courtauld Trust for their generous contribution of £9,000. The members of the Committee who served during the year were Dr L Craig (Chair), Professor J A Dowdeswell, Mr R Durbridge, Dr D Goodman, Mr N Gwynne, Dr M Humphreys, Professor M Lea, Mr R Page, Professor R C Schroter, Dr M Tinsley and Dr F Wensley.

The Committee met on 23 February 2019 and made the following awards:

<table>
<thead>
<tr>
<th>Expedition</th>
<th>Award</th>
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<tbody>
<tr>
<td>Arctic Research Group Bockfjorden Expedition, Svalbard 2019</td>
<td>£500</td>
</tr>
<tr>
<td>Renland Expedition, Greenland, 2019</td>
<td>£3,000 + £3,000 Arctic Club £6,000</td>
</tr>
<tr>
<td>Sisterhood of Adventure 2019, a kite crossing of Greenland</td>
<td>£1,500</td>
</tr>
<tr>
<td>Green-X 2019, kite crossing of Greenland</td>
<td>£2,000 + £3,000 Arctic Club £5,000</td>
</tr>
<tr>
<td>Greenland self-supported ‘Sail to Climb’ Expedition, 2019</td>
<td>£3,000 + £3,000 Arctic Club £6,000 Simpson Award</td>
</tr>
<tr>
<td>North Jameson Land Expedition, Greenland, 2019</td>
<td>£500</td>
</tr>
<tr>
<td>Arctic Connections Ski Expedition, Norway, 2019</td>
<td>£2,000</td>
</tr>
<tr>
<td>Baffin Paddle/Climb Expedition, Canada, 2019</td>
<td>£4,000</td>
</tr>
<tr>
<td>Retracing the Scott Polar Research Institute’s 1932 Vatnajokull Expedition, Iceland</td>
<td>£2,500</td>
</tr>
<tr>
<td>University of St Andrews Tugtutoq Alkaline Giant Dyke Mapping and Research Expedition, Greenland, 2019</td>
<td>£2,500</td>
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</table>
External Contributions to Polar Activities

National and International Roles of Staff

Members of the Institute are active in many roles relating to national and international committees and advisory groups involving the Arctic and Antarctic, and are members of the editorial boards of a number of international journals. These include:

- UK representative on the International Arctic Science Committee (IASC) Working Group on the Cryosphere; P. Christofferson
- UK representative on the International Arctic Science Committee (IASC) Working Group on the Humanities and Social Sciences; M. Bravo
- UK representative on International Science Initiative for the Russian Arctic (IASC); W.G. Rees
- Member of Council of the University of the Arctic (SPRI representative); W.G. Rees
- Member of the Place-Names Committee of the British Antarctic Territory; J.A. Dowdeswell, R.K. Headland
- Member of UK National Committee on Antarctic Research; J.A. Dowdeswell
- Member of Steering Committee, UK Arctic and Antarctic Partnership; R.C. Powell
- Member of the NERC Peer Review College; N.S. Arnold
- Treasurer, International Glaciological Society; I.C. Willis
- Member of the Advisory Council, European Union Arctic Forum Foundation.; M. Bravo
- Co-leader PPS Arctic Programme for international Arctic treeline research; W.G. Rees
- Trans-Antarctic Association; P.D. Clarkson (Chair); R.K. Headland, E.M. Morris (UK Advisory Committee members).
- Secretary General, International Commission on Stratigraphy of the International Union of Geological Sciences; P.L Gibbard
- Member of the International Subcommission on Quaternary Stratigraphy (ISQS); P.L. Gibbard
- Permanent UK representative of the Association of Marine Mammal Hunters of Chukotka; P. Vitebsky
- Trustee: Sutasoma Trust - P. Vitebsky; Fuchs Foundation, Royal Museums Greenwich - J.A. Dowdeswell
- Secretary General of the International Council on Monuments and Sites' International Polar Heritage Committee (ICOMOS-IPHC); B. Lintott
- Member of SCAR's Antarctic Climate Change and the Environment (ACCE) Advisory Group; C. Summerhayes
- Member of Council, International Arctic Social Sciences Association; F. Stammler

Friends of SPRI and the SPRI Centenary Campaign

Friends of the Scott Polar Research Institute

The Friends have had a very successful 2019, delivering an excellent series of events and activities, as well as fundraising for the Institute’s wider Centenary Campaign.

Our Artist in Residence programme continued in 2019 with Andrew Lansley visiting the Antarctic Peninsula onboard the Royal Navy’s ice patrol vessel HMS Protector, and Lesley Burr sailing to Baffin Island in the Arctic onboard One Ocean Expeditions’ RCGS Resolute. Meanwhile, past Artists in Residence have been exhibiting their polar paintings at various galleries around the UK, including Nick Jones at the Crane Kalman Gallery, London in February, and Nick Romeril at the Chris Beetles Gallery in London in April. The Friends are very grateful to Bonhams, the Royal Navy, and One Ocean Expeditions for their generous support of our Artist in Residence programme.

During the year, the Friends’ were pleased to welcome a range of guest speakers at our various events held at the SPRI in Cambridge. At our Spring lecture in May we heard from Dr John Ash about Arctic exploration and climate change. At the Summer event in June Dr John Dudeney talked about Britain and the Antarctic between 1900 and 1950.

The Friends’ AGM in November heard guest speaker Paul Cox, Director of the UK Shark Trust, who gave an excellent lecture about the Greenland shark.

We have continued to work hard to raise funds for the SPRI 100 – Centenary Campaign. Our goal is to raise £250,000 to support the permanent endowment for a studentship. During the year we received major donations from several Friends, including Andrew Sheaf, Debby Horsman, and Sir Ranulph Fiennes. Our thanks go to everyone who has contributed during 2019. I am pleased to report that by the end of the year we had raised over £50,000, but still have much to do to ensure we reach our overall target next year.

I would like to thank Celene Pickard, our Executive Secretary, for her outstanding hard work, and the members of the Friends’ Committee for all their help and contributions over the past year. As a result of their efforts, the Friends of SPRI continue to grow and flourish. We now look forward to 2020 and to working closely with the Institute to organise an exciting programme of events to celebrate the Centenary.

Dr John Shears (Chair, Friends of the Scott Polar Research Institute)

Scientific Committee on Antarctic Research (SCAR)

SCAR is an interdisciplinary body of the International Science Council. Its mission is to facilitate international research in and from the Antarctic and Southern Ocean region and provide objective scientific advice to the Antarctic Treaty System and related bodies. The SCAR Secretariat has been hosted at the SPRI since was established 60 years ago.

Highlights from 2019 included SCAR’s International Symposium on Antarctic Earth Sciences, held from 22-26 July in Incheon, Korea, with over 450 participants. SCAR has also supported the training and development of the Antarctic research community, with the award of eight Fellowships and three Visiting Scholar Awards held at a variety of institutions internationally over the year. SCAR has continued its efforts to inform international policymaking, presenting a poster on the Southern Ocean at the United Nations Framework Convention on Climate Change (UNFCCC) in Bonn, Germany. We also assisted the International Cryosphere Climate Initiative in organising the first dedicated Cryosphere Pavilion at the UNFCCC meetings held within the Convention on Climate Change (COP25) in Madrid, Spain.

SCAR submitted twenty-three papers to the Antarctic Treaty Consultative Meeting in Prague (ATCM XLII). SCAR President Prof. Steven Chown gave the annual SCAR Science lecture to the ATCM entitled ‘What does the Paris Climate Agreement mean for Antarctic and Southern Ocean Environmental Protection?’ SCAR's contribution to the Treaty since its inception was recognised in Resolution 7 on ‘SCAR'S Sixtieth Anniversary and the role of SCAR in providing scientific advice to support the work of the Antarctic Treaty System’.

2020 will see the ninth SCAR ‘Open Science Conference’ to be held from 3-7 August in Hobart, Tasmania (www.scaromnap2020.org).

Chandrika Nath, Eoghan Griffin, Rosemary Nash and Johanna Grabow
SPRI 2020 Centenary Campaign

The Scott Polar Research Institute is an international centre for research into the polar regions and is also home to unrivalled resources of polar information and expertise, housing the world’s largest polar library, Britain’s only dedicated polar museum, and a national repository for polar archives that record some of the most memorable episodes in exploration of the Arctic and Antarctic. The Institute’s Archives, Museum and Library provide members of the general public, as well as scientists, government bodies, industry and polar inhabitants with important information on a variety of polar topics, including climate change, management of natural resources and historical polar expeditions. Through both the publication of our research and by public outreach, the Institute helps to educate and inform a worldwide audience about the polar regions.

The one-hundredth anniversary of the Institute is in 2020. We have established a number of fundraising priorities, relating to research, heritage and outreach activities, to strengthen the Institute’s national and international roles over the coming decades. We wish to endow academic posts, and especially a Professorship in the field of Polar Environmental Science along with several lectureships. We are also working to underpin the further development of the Institute’s Archive and Museum. Our highest priorities in these areas are to provide permanent endowment funding for the important posts of Institute Archivist and Polar Museum Curator. Funding for these positions has until now been supported by a series of short-term grants – an inherently unstable position. We also wish to build up endowment funds for the support of research students at the Institute (now initiated as the Scott Polar Scholarships Fund and the Debenham Scholars Fund), and to enable increasingly expensive polar fieldwork to continue to take place on a regular basis.

A series of events is being set up to celebrate the centenary. There will be a formal Centenary Gala Dinner on Saturday 28 November 2020 in Downing College. Those interested in further details should contact development@spri.cam.ac.uk.

The generosity to the Institute of a number of individual donors, together with private trusts and foundations, is gratefully acknowledged. Particular thanks are due to William Stancer for taking on the role of Campaign Chair and to HSH Prince Albert II of Monaco for acting as our Patron.

Further information on the Institute’s Centenary Campaign is available from the Director, Professor Julian Dowdeswell (director@spri.cam.ac.uk; +44-(0)1223-336560)

Zodiac cruising and kayaks near Ilulissat, Greenland, during a Friends of SPRI voyage