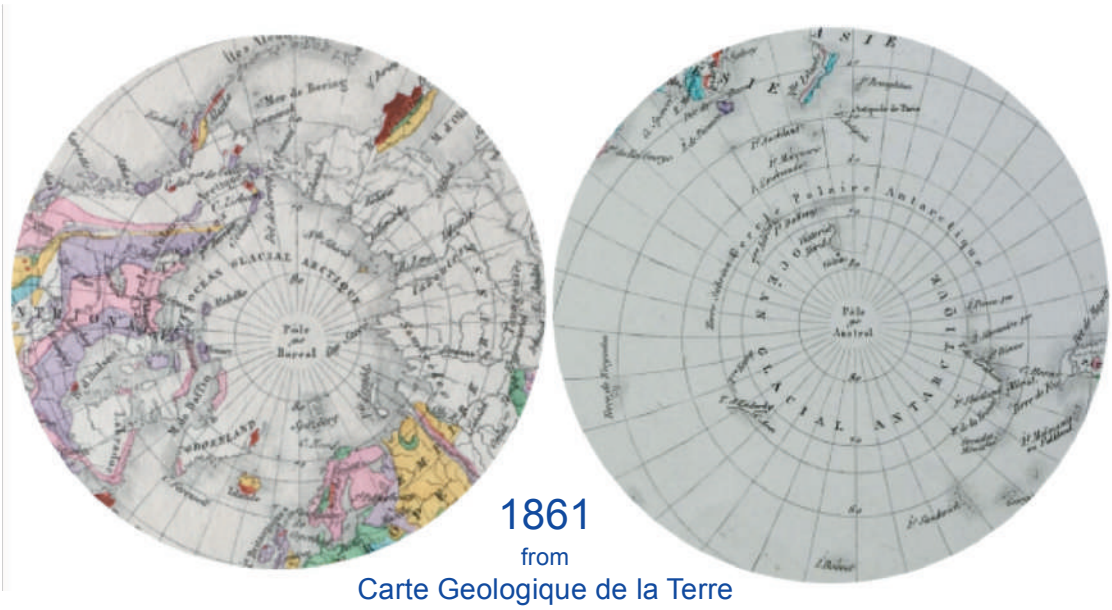
History of Geology Group & Geological Curators' Group

The History of Geological Discovery in Polar Regions

16th & 17th July 2024

Programme and Abstracts

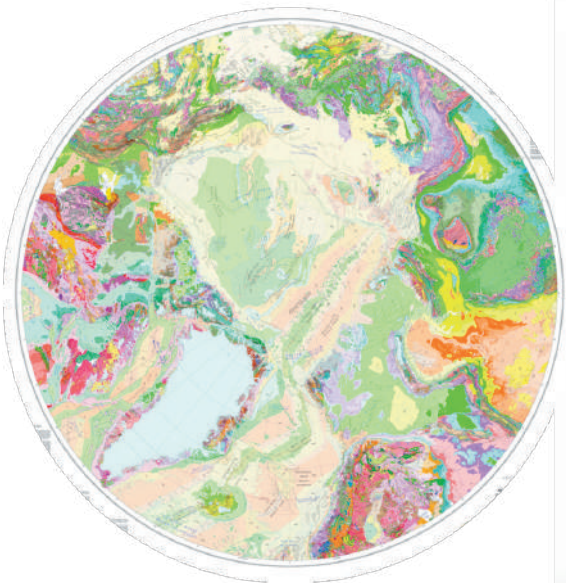


1861

from

Carte Geologique de la Terre

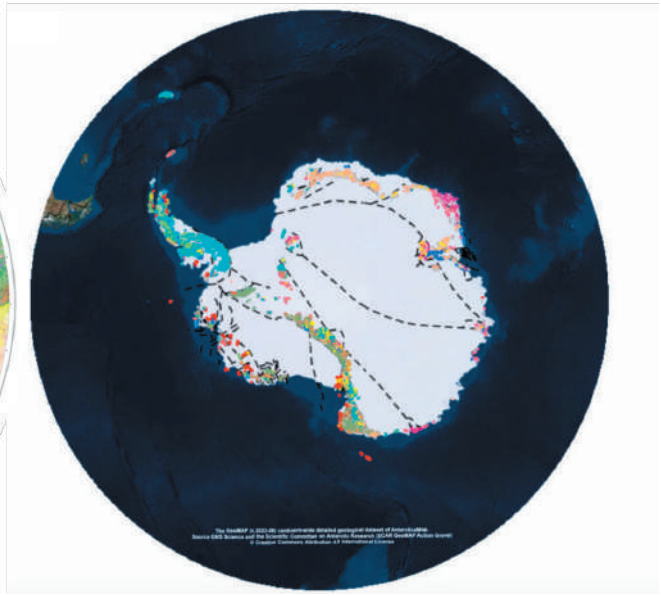
by Jules Marcou, published in this circumpolar projection in 1875



2008

Geological Map of the Arctic

Geological Survey of Canada



2022

Scientific Committee on Antarctic Research

(SCAR GeoMAP Action Group)

Tuesday 16th July: Conference Programme

9.30 Registration opens

10.00 Welcome & arrangements. **Cindy Howells & Mark Evans**

10.10 **1**. An Overview of the geological discoveries from early explorations of the northwest polar regions, 1819-1855. **Duncan Hawley**, HOGG Chairperson

10.30 **2**. Arctic palaeontological collections in the Oslo Natural History Museum. **Hans Arne Nakrem**, Natural History Museum, University of Oslo, Norway.

10.50 **3**. William Speirs Bruce and the early 20th century geological investigations by the Scottish Spitsbergen Syndicate. **Phil Stone**, British Geological Survey, Edinburgh & **Peder Aspen**, National Museums Scotland, Edinburgh

11.10 Break

11.40 **4**. Peering beneath the ice: how our understanding of the Arctic Ocean Basin evolved through the 20th century. **Andrew Hopkins**, University College London

12.00 **5**. An introduction to the early research on the Skaergaard Intrusion, East 5. Greenland. **Marion Holness**, University of Cambridge

12.20 **6**. The discovery and history of exploration of the Haughton impact crater on Devon Island, (High Arctic of Canada). **Thomas Frisch**, Formerly Geological Survey of Canada, Ottawa, Canada.

12.40 Discussion & Questions

13.00 Lunch

14.20 **7.** An overview of the geological work of the Heroic Age expeditions, 1896-1922. **Tom Sharpe**, Edinburgh

14.40 **8.** The British Antarctic Survey and the history of Antarctic palaeontology. **Alistair Crame**, British Antarctic Survey, Cambridge

15.00 **9.** Historical observations of volcanic activity in Antarctica and their value today. **John Smellie**, University of Leicester

15.20 **10.** Operation Tabarin – establishing the first British scientific station on Antarctica. **Camilla Nichol**, UK Antarctic Heritage Trust, Cambridge

15.40 **11.** To discover the geology and structure of the Scotia Sea and the Larsen Ice shelf - a personal account of pre-plate tectonics survey work (video presentation). **Peter Kennett**, Sheffield.

16.00 **12.** 19th and early 20th Century Polar Collections at the Sedgwick Museum of Earth Sciences. **Dan Pemberton**, Sedgwick Museum, Cambridge

16.20 Discussion & Questions + retiring refreshments.

17.00 Meeting ends

Wednesday 17th July: Museum & Archive Visits

N.B. Lunch is not provided on the Wednesday.

10.00 – 11.30 Sedgwick Museum,
Self-guided tour (conference contact, Nicola Skipper)

Location:
Downing Street.

Website:

The Museum's main entrance is located at the top of a stone staircase above the entrance to the Department of Earth Sciences on Downing Site.

For visitors with restricted mobility there is a lift located within the Department of Earth Sciences which can be used to access the Museum.

12.00 – 12.45 & 13.00–13.45. Sedgwick Archive
Guided tours in two time slots.
Participants will be allocated to one of two guided groups at conference registration.
(conference contacts, Dan Pemberton and Sandra Freshney)

Location:
Madingley Rise, Madingley.
CB3 0EZ.

Bus No. 4 bus runs regularly from Drummer St. bus station, Cambridge centre, to the Uni Vet School stop on Madingley Road + 5 minute walk to Sedgwick Archive building on Madingley Rise.

14.00 – 16.00 Scott Polar Research Institute (SPRI)
Self-guided tour
The Museum houses displays much original Antarctic archival material.
(conference contact, Gemima King)

Location:
Lensfield Road, Cambridge

Website:

Please note **SPRI has no facility to store luggage during your visit.**

Partcipants are advised to make arrangements and prebook space at a secure luggage storage facility e.g. **Bounce** at Parker's Piece, Cambridge. Luggage Storage Cambridge 24/7 usebounce.com.
£5 per bag for the day.

ABSTRACTS

1. An overview of the geological discoveries from early explorations of the northwest polar regions, 1819-1855.

Duncan Hawley

History of Geology Group

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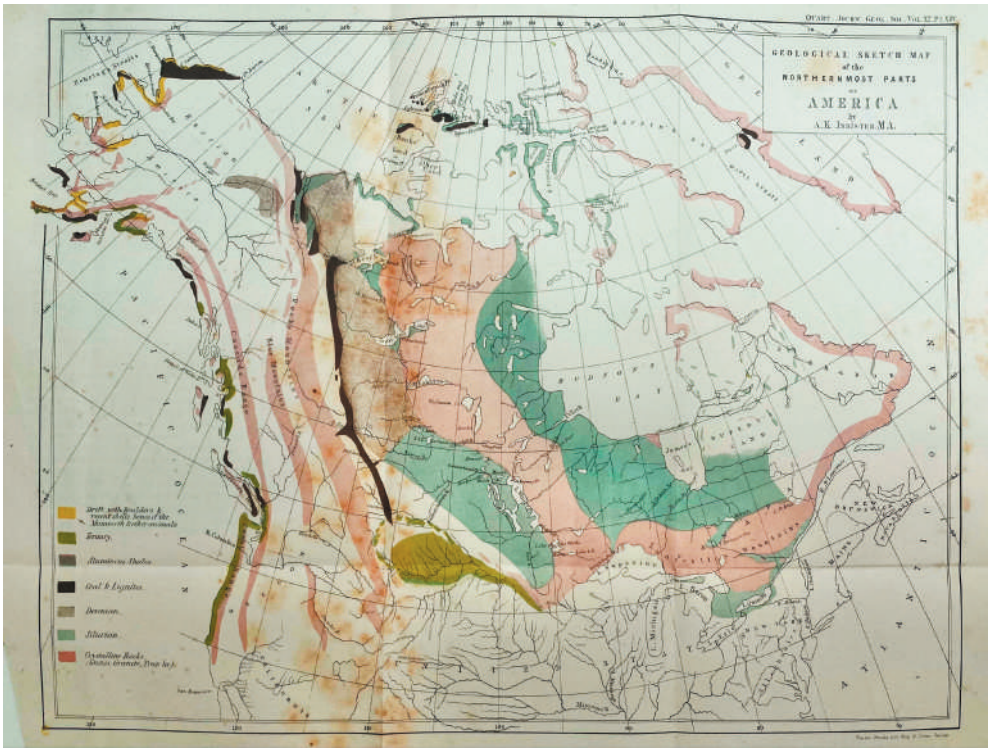
The northwest polar regions were a focus for exploration in the first half of the 19th century, primarily driven by the trade enterprises of the Hudson Bay Company, the exploits of whalers, the desire to find a Northwest Passage connecting the Atlantic and Pacific oceans via a northern route and the attempts to find the fate of the lost Franklin expedition of 1845. The primary purposes of these explorations were centred on navigation and charting the topography of the coastland and routeways, observations on the natural history and notes on the indigenous peoples that were encountered. Scientific observation to record and report meteorological and oceanographic data was a secondary but significant purpose of these explorations, and geology was a relatively 'poor relation' in these scientific ventures, albeit encouraged by several key supporters in Britain, notably Robert Jameson (1774–1854), Professor of Natural History at the University of Edinburgh. The reports and specimens brought back by the explorers and traders of the northwest provided sufficient information by the middle of the century for A.K. Isbister (1822–1883) to produce an admirable sketch of the geology of the northwest polar regions, presented in a paper to the Geological Society of London in 1855.



Isbister's geological sketch map if the northernmost parts of America, published in 1855. The legend records seven rock types: Crystalline (Gneiss, Granite, Trap) = pink; Silurian = blue-green; Devonian = dappled grey; Coals & Lignites = black; Aluminous Shales = solid grey, Tertiary = lime-green; Drift with Boulders & recent shells, bones of the Mammoth and other animals = yellow.

Duncan Hawley

Duncan was first exposed to the ‘greats’ of the heroic age when studying geology at school, then at UCL and Aberystwyth. He enjoyed a varied career as a geography and geoscience educator in schools, field centres, advisory roles, universities and teacher education, and is known for his work on teaching physical geography. He was awarded the Geographical Association’s ‘Award for Excellence’ in 2012 and ‘Award for Leading Geography’ in 2018 for inspiring teachers to improve the quality of their teaching.

Maintaining an interest in history of geology throughout, he joined HOGG in 1995, and has particular interests in early geological maps, the life and work of George Bellas Greenough (1778–1855) and the early Silurian fieldwork of R.I. Murchison (1792-1871) in mid-Wales and the Marches. He is and the Chairperson of HOGG and a member of INHIGEO**.**

Duncan has worked and published on the geology of the Old Red Sandstone (Devonian) in the Black Mountains (Powys) and Herefordshire. He is also an active geo-conservationist and Chairperson of the Sheffield Area Geology Trust.

2. Arctic palaeontological collections in the Oslo Natural History Museum

Hans Arne Nakrem
Natural History Museum, University of Oslo
h.a.nakrem@nhm.uio.no

The palaeontological collections in the Natural History Museum in Oslo (NHMO), Norway, comprise a large ensemble of fossils and sedimentary rocks from present day Arctic areas. The earliest Arctic collections were brought in by the expedition led by Baltazar Matthias Keilhau to Svalbard in 1828. He visited Bjørnøya and Spitsbergen, and collected geological as well as botanical material. The famous Fram expedition of 1893–1896 was an attempt by the Norwegian explorer Fridtjof Nansen to reach the geographical North Pole. During the expedition Nansen collected fossils in Russian Arctic areas, notably Franz Josef Land and Khaborovo. The subsequent Fram expedition to the Canadian Arctic (1898-1902), led by Otto Sverdrup, resulted in some 4,000 fossil and rock specimens. During the following years, the main focus from Norwegian palaeontologists and geologists was on Svalbard resulting in rich collections of Devonian fishes and plants. In 1921, the Norwegian geologist Olaf Holtedahl led an expedition to the Russian islands Novaya Zemlya. His group gathered more than 4,000 rock and fossil samples from localities now inaccessible due to nuclear pollution and political regulations.
Researchers at the museum are currently carrying out scientific projects based on these collections as well as on newly collected material, e.g. Late Devonian plants and vertebrates, Carboniferous to Triassic bryozoans and conodonts, and Mesozoic marine vertebrates and invertebrates. As such, the historical collections demonstrate that old museum collections are of high value for science today, especially in cases where the original field locations are no longer accessible. Not least do they also document the history of scientific exploration and collecting culture over time. The history of exploration and appropriation of land in the Arctic, where many areas were considered to be “no man’s land” until the early twentieth century, is reflected in the collections, as is the building of a national Norwegian identity through polar expeditions in the late Nineteenth century and the early Twentieth century.

Fossils collected by Baltazar M. Keilhau during his 1827 expedition to Svalbard.

A-B: The Permian bryozoan Dyscritella from the Miseryfjellet Formation on Bjørnøya.

C: Permian spiriferid brachiopod from Sørkappland (“SydCap”), southern Spitsbergen.

D-E: A Holocene gastropod from Edgeøya (“Stans Land”).

F: An equisetacean specimen from the *Carboniferous of Bjørnøya ("Bären Eiland").*

Fossils collected by Baltazar M. Keilhau during his 1827 expedition to Svalbard.

A-C: Tertiary plant fossil Cedroxylon orvini. Collected by Anders K. Orvin during the 1930 expedition to East Greenland.

D-E: Devonian fish fossil Bothriolepis groenlandica. Collected by Anders K. Orvin during the 1930 expedition to East Greenland.

F-G: Quaternary bivalves collected by Adolf Hoel, during the 1933 expedition to East Greenland.

Photos from the collections.

A, C, D: type collection showing storage of fossils together with the publication in which they were introduced, sorted chronologically according to year of publication.

B: general Arctic collection, sorted geographically and stratigraphically.

Hans Arne Nakrem

Hans is Professor in palaeontology and curator of the fossil invertebrate collections at the Natural History Museum, University of Oslo, where he responsible for several fossil collections at the museum including those from Norwegian polar expeditions. His scientific fieldwork and research is partly done in the Oslo region, but also on expeditions to Svalbard and Greenland, where he searches for fossils, aiming to bring new insight into evolution and the extinction of large animal groups over millions of years. The astonishing unknown biodiversity of the past is one of the key driving forces behind his research.

3. William Speirs Bruce and the early 20th century geological investigations by the Scottish Spitsbergen Syndicate.

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British Geological Survey, Edinburgh
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Peder Aspen
National Museums Scotland, Edinburgh
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In the early 20th century, William Speirs Bruce (1867-1921) was arguably Britain's most-travelled Polar explorer, having completed two Antarctic and several Arctic expeditions. During the latter he had visited Svalbard, recognised the economic potential of the geology, and in 1908 had launched the Scottish Spitsbergen Syndicate to promote geological exploration for coal (occurring in Carboniferous and Paleogene successions) and other minerals. Attention was initially on Prince Charles Foreland, but claims were subsequently extended to parts of the west Spitsbergen coastal region. There was much competition, with the first commercial coal mine having opened in 1906. The First World War interrupted Bruce's plans but in 1919 the Syndicate was relaunched as a public company and to add business acumen Henry Cadell (1860-1934) became one of the directors. Cadell had previously worked for the Geological Survey, mapping in the Highlands of Scotland and conducting experiments to model tectonic deformation. On the death of his father in 1888, he resigned from the Survey and took over the management of the extensive family business interests in Scottish coal mines, oil shale and iron foundries.

For the 1919 and 1920 Syndicate expeditions an elite geological team was assembled with Bruce taking advice on appropriate personnel from George Tyrrell (1883–1961) of Glasgow University. The geologists were complemented in both 1919 and 1920 by a group of miners from one of Cadell's collieries at Bo'ness, to the west of Edinburgh. They opened cuttings and drove adits into the more promising coal seams; boreholes were also attempted despite the difficulties posed by drilling through permafrost. An archive of documents and photographs illustrating these activities is held by Callander House Museum, Falkirk. Cadell joined the 1920 expedition, and though not impressed by Spitsbergen he nevertheless published a glowing account of the Syndicate's coal prospects. He was an accomplished artist and nine large watercolour paintings of his, illustrating glaciers and coastal cliffs with the stratigraphy emphasised, are held by the National Library of Scotland along with an extensive archive of his notebooks and field sketches.

Carboniferous strata at Bjona Haven and Mount Temple, Spitsbergen. A watercolour painting by Henry Cadell, 1920. 56 cm x 19 cm. National Library of Scotland.

The Nordenskjold Glacier at the head of Klaas Billen Bay, Spitsbergen. A watercolour painting by Henry Cadell, 1920. 54 cm x 18 cm. National Library of Scotland.

Ultimately, the Syndicate's efforts came to naught. Although coal occurred in both the Carboniferous and Paleogene successions, only Paleogene seams proved exploitable; the Scottish claims had unfortunately focussed on the Carboniferous. Bruce's other great hope was for the discovery of oil shale, but this also went unrealised. Finally wound-up in 1952, the Syndicate's legacy includes topographical maps of Prince Charles Foreland, specimen collections now held by National Museums Scotland, and a series of scientific publications most notably by George Tyrrell.

Fossil leaves from the Paleogene succession of Prince Charles Foreland. Bruce Collection, National Museums Scotland.

Phil Stone

Phil Stone is an Honorary Research Associate with the British Geological Survey, having retired from that organisation in 2010. He is a graduate of University College, Cardiff (when it was part of the University of Wales) and began his career with the British Antarctic Survey working on the island of South Georgia: two of the outcomes of that were a Ph.D. from Birmingham University (1975) and the award of a Polar Medal (1986). With the British Geological Survey, based in Edinburgh, he has worked mostly on the Lower Palaeozoic geology of southern Scotland and northern England, and from 1998 to 2010 provided geological support to the Falkland Islands Department of Mineral Resources. His current interests include the history of geological exploration in the South Atlantic region, and the personalities and circumstances behind specimen collections from early Polar expeditions.

4. Peering beneath the ice: how our understanding of the Arctic Ocean Basin evolved through the 20th century

Andrew Hopkins

Honorary Research Associate, Department of Science and Technology Studies,
University College London
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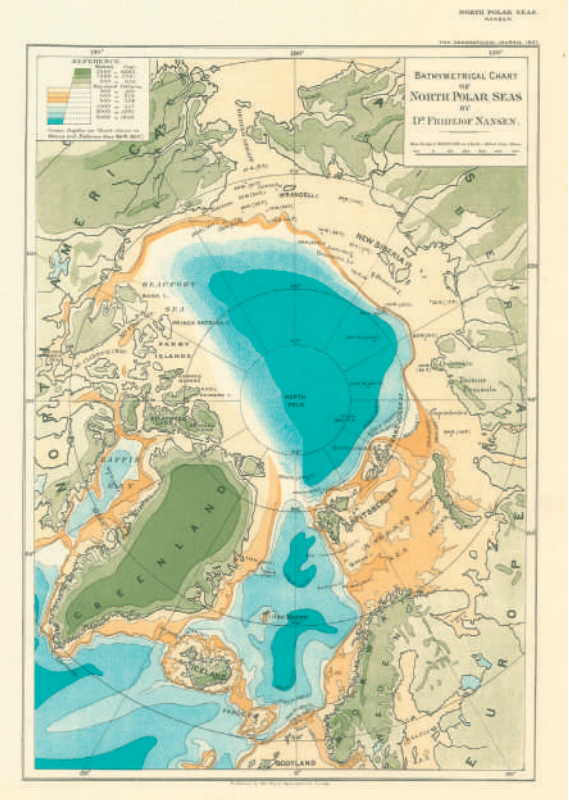

Until the late 19th century, the lack of observational data available from the harsh and inaccessible Arctic environment fuelled speculation about what lay beneath the vast ice sheet. It had been widely assumed that the ice either covered a shallow, "island-strewn" sea, or that ice covered land extended from Greenland, Canada or Siberia towards or across the North Pole. However, depth soundings obtained during the Fram expedition in the 1890s indicated the presence of a deep ocean basin beneath the Arctic ice, necessitating a drastic revision of previous ideas. The steady accumulation of soundings, including those obtained by sonar since the 1920s, together with other data continued throughout the first half of the 20th century until a step change occurred in the early 1950s.

By then, Soviet scientists had acquired sufficient bathymetry data to reveal the detailed contours of a startlingly dramatic Arctic seafloor topography. This included the presence of a massive elongate feature (the Lomonosov Ridge) rising more than 3000m above the sea floor. The plate tectonic revolution of the 1960s cast a spotlight on the hitherto unexplained topographic configuration of the Arctic Ocean Basin and posed the question of how it might fit into the new paradigm.

However, it was not until the following decade that a coherent understanding of the Arctic Ocean from a plate tectonic perspective became possible when a characteristic striped seafloor pattern, symmetrical about a central ridge, was uncovered by airborne magnetic surveys conducted by the US Navy. Contrary to some initial assumptions, the magnetic stripes were not associated with the Lomonosov Ridge, which, perhaps with an ironic nod to the "Arctic land" theorists of the 19th century, turned out to be a large band of continental crust, albeit deeply submerged. Data have continued to be acquired by various government, academic and industrial bodies from ice stations, ships, submarines, aircraft and satellites, with geophysical and other remote sensing techniques playing an increasing role. Furthermore, the first scientific drilling expedition to the Arctic Ocean was completed in 2004 by the Integrated Ocean Drilling Program. Ownership of the central Arctic is not assigned to any one country, though claims have been submitted to the United Nations body responsible by several of the countries surrounding the North Pole, doubtless motivated by questions of economics as well as by scientific curiosity.

Andrew Hopkins

Following his graduation in Geology from Imperial College, Andrew has spent most of his career in the (largely fruitless) search for oil and gas on behalf of various companies. He has also lectured in Further Education colleges. He completed a part-time PhD on Namibian contourites. He left the oil industry to undertake an MSc in the History and Philosophy of Science, following which he joined the Narrative Science Project in the Department of Economic History, London School of Economics (LSE) as a Research Officer. His main project studies were concerned with the narratives created by geologists and Earth scientists and how they serve to organise time-distant and disparate observations, how they are used for geological reasoning and in scientific practice.

Andrew is particularly interested in the history of ideas in geology, and in understanding how we reconstruct the past on the basis of the (often) meagre evidence available to us in the present. Recently Andrew has worked on Alfred Wegener's observations, his data and how he attempted to use these to reconcile with and support his idea of continental drift.

5. An introduction to the early research on the Skaergaard Intrusion, East Greenland

Marian Holness

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The work of Lawrence Rickard (Bill) Wager was seminal in the development of igneous petrology. His geological career was largely founded shortly after graduating from Cambridge University, with his discovery of the numerous Tertiary igneous bodies on the east coast of Greenland on the 1930-31 British Arctic Air-Route Expedition (led by Gino Watkins), with further work undertaken during the 1932 Scoresby Sund Committee's 2nd East Greenland Expedition (led by Ejnar Mikkelsen). The results of the expedition he led in 1935-36 to the Skaergaard Intrusion, published in 1939, revolutionised our understanding of magma chambers. This was built on with a further expedition to Skaergaard in 1953, and led to the widely-applicable concept of cumulates, an entirely new way of thinking and talking about plutonic mafic rocks. Many of his ideas have been questioned subsequently; there has also been a widespread move away from the approach of his earlier work, which was substantially underpinned by detailed field and microstructural observation, towards studies based primarily on geochemical analyses (in which, paradoxically, he was a pioneer). However, many of the disagreements have been shown to be inaccurate and his work stands today as a monumental achievement.

L.R. Wager Photo from from: Hargreaves, J..1991,L. R. Wager: A Life, 1904–1965. Oxford: Joshua Associates.

Layering: the iconic igneous layering of Skaergaard
Image: Victoria Holness. https://blog.esc.cam.ac.uk/skaergaard-intrusion/

Marion Holness

Marion is Professor of Petrology at the University of Cambridge, and a Fellow of Trinity College. Her research is based on microstructural observation of igneous and metamorphic rocks, with a particular focus on decoding the physical processes occurring during solidification of igneous rocks.

6. Discovery and history of exploration of the Haughton impact crater on Devon Island (High Arctic of Canada)

Thomas Frisch

Ottawa, Canada

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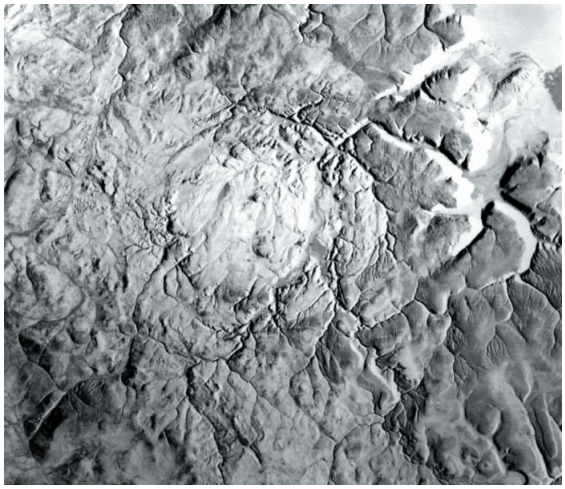
The Haughton structure at 75° N in western Devon Island appears as a roughly circular, >20 km-wide area of breccia and complexly deformed blocks of rock composed mainly of Ordovician-Silurian carbonates. It was first geologically investigated in reconnaissance fashion in 1955 and interpreted as a piercement dome. In the early 1970s, M.R. Dence, after studying topographic maps and air photos and noting the structure's circularity and solitary position, as well as the associated radial drainage pattern, suggested it might be of impact origin.

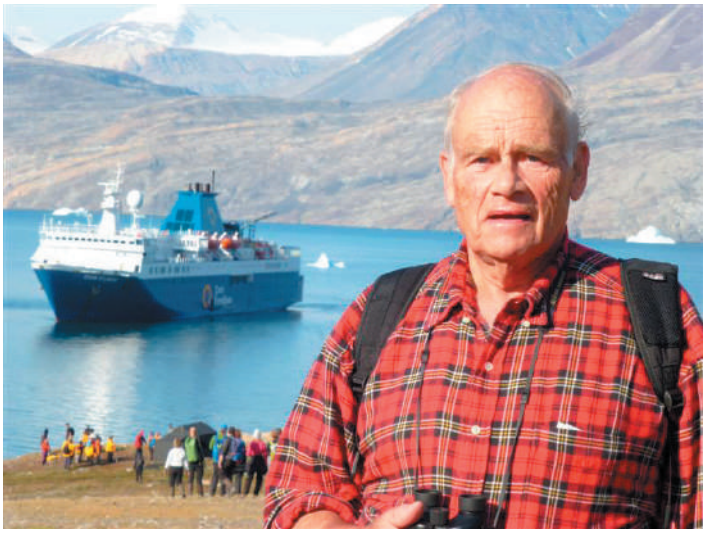


Synthetic aperture radar image of the Haughton impact crater.
Public Domain via Wikimedia Commons.

This was confirmed by discovery of shatter cones during a brief visit to the site by an exploration geologist in 1974. In 1976 the structure was mapped by R. Thorsteinsson and T. Frisch (Geological Survey of Canada), who recognised clasts of gneiss in the breccia – indicating that the impacting body had penetrated the Precambrian basement 2 km below the top of the sedimentary cover – and remnants of possibly datable lake sediments deposited in the crater after the impact. Subsequently, detailed geological, geophysical and geochronological work on the Haughton structure was carried out by international teams over a number of years; investigations continue to this day. One important result is that the impact occurred ~39 Ma ago, i.e. in Eocene time. Interest in the Haughton structure is heightened by the putative similarity of its terrain to that of Mars.

Thomas Frisch

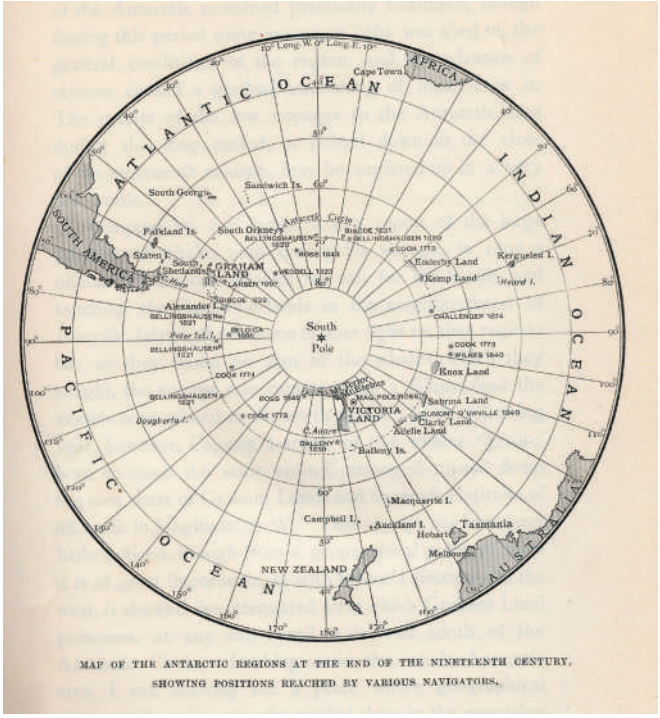
Baltic-German; born 1939 in Riga, Latvia. Educated in England, Canada (BSc 1962, Queen's University, Kingston, Ontario) and USA (PhD 1967, University of California, Santa Barbara). Thomas spent his entire career as a petrologist and regional geologist at the Geological Survey of Canada. He worked in northern Canada from 1962, in the Precambrian Shield of the eastern Arctic Islands and the central mainland coast, and also in Northwest, West and South Greenland. Spare time is spent as an avid book collector (Arctica, geology, volcanology, history of geology and biographical literature) and as lover of classical music.



7. An overview of the geological work of the Heroic Age expeditions, 1896-1922

Tom Sharpe

tom.sharpe1@me.com



MAP OF THE ANTARCTIC REGIONS AT THE END OF THE NINETEENTH CENTURY, SHOWING POSITIONS REACHED BY VARIOUS NAVIGATORS.

The intensive period of Antarctic exploration which followed the Sixth International Geographical Congress held in London in 1895 and which continued until the early 1920s saw not only major geographical exploration of the southern continent and the attainment of the Geographic South Pole but also some significant geological discoveries. In the 25 years between 1897 and 1922, eighteen expeditions went south, fifteen of them with geological staff. Ten expeditions carried out geological work in the Antarctic Peninsula/Weddell Sea region, three in the region of the Ross Sea, and two elsewhere in East Antarctica, on Wilhelm II Coast and in Wilkes Land.

These expeditions established that Antarctica was a continental mass; identified the geological links between the Antarctic Peninsula and the Andes of South America; outlined the stratigraphy of the Transantarctic Mountains; and conducted the first studies of Antarctic palaeontology. Fossil discoveries included Mesozoic and Paleogene marine and terrestrial faunas and floras as well as the identification of *Glossopteris*, the discovery of which supported the reconstruction of Gondwana first proposed by Alfred Wegener in January 1912 just as Scott's Polar Party approached the South Pole.

Tom Sharpe

Tom Sharpe was Curator of Palaeontology and Archives at the National Museum of Wales 1978–2013 during which time he curated several temporary exhibitions about Welsh connections with Antarctic exploration. From 2007 to 2020 he worked in the expedition travel industry as a geology lecturer and guide, mainly in the polar regions. He is a former Chairperson of the History of Geology Group and the Geological Curators' Group and has particular interests in the history of geological discovery in Antarctica, in early nineteenth century geological mapping, in the early discoveries of fossil marine reptiles, and in the life and works of the geologists William Smith (1769–1839), Henry De la Beche (1796–1855) and Mary Anning (1799–1847).

8. The British Antarctic Survey and the history of Antarctic palaeontology.

Alistair Crame

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The earliest known records of Antarctic fossils are very much tied to the latest nineteenth century expansion of whaling and sealing voyages to the north-western margins of the continent. The best documented of these was the voyage of the Norwegian C.A. Larsen in the austral summer 1892-93 to the James Ross Island group on the north-eastern tip of the Antarctic Peninsula. Here a series of fossils, which included ammonites with Cretaceous affinities, was collected but perhaps most exciting of all were fossil plants and wood which strongly suggested that the continent may not always have been ice-covered. These fossils in turn prompted the Swedish South Polar Expedition of 1901-03, led by Otto Nordenskjöld, when the first systematic palaeontological collections were made from the continent. Further exploration of Antarctica was sporadic in the early part of the twentieth century, but a notable exception was the British Graham Land Expedition of 1934-37 which confirmed the presence of fossiliferous Jurassic – Cretaceous sedimentary rocks on the western (i.e. Pacific) margin of the Antarctic Peninsula. Palaeontological research throughout the region greatly accelerated in the 1950's, due to the efforts of the Falkland Islands Dependencies Survey, which later became the British Antarctic Survey.

With the expansion of systematic research into the continental interior it has become possible to track the position of Antarctica within the Gondwana supercontinent through increasingly greater periods of deep time. Antarctica reached its present high-latitude position in the Southern Hemisphere in the late Middle Devonian approximately 385 Myr ago, and from that point in time onwards it has become progressively more isolated. However, research by BAS has been crucial in demonstrating the presence of temperate lowland rainforests at a palaeolatitude of 82°S approximately 92-83 Ma ago. The Cretaceous/Paleogene (K/Pg) mass extinction boundary on Seymour Island is one of the best-exposed in the Southern Hemisphere and has been a key research focus of BAS and its collaborators in recent years. Some of the roots of the modern Antarctic marine fauna can be traced directly back to this extinction event 66 Myr ago and its aftermath.

Alistair Crame

Alistair is a geologist and palaeontologist with a long-standing research interest in the Mesozoic and Cenozoic marine sedimentary sequences of the Antarctic Peninsula region. He is a specialist on bivalves and gastropods and has worked extensively on their evolutionary history in both polar regions. A particular interest of his is the biodiversity contrast between the polar regions and tropics at the present day, and how this may have arisen through deep time.

Alistair with the giant heteromorph ammonite *Diplomoceras*, Late Cretaceous of Antarctica.

9. Historical observations of volcanic activity in Antarctica and their value today

John L. Smellie

School of Geography, Geology & The Environment, University of Leicester LE1 7RH

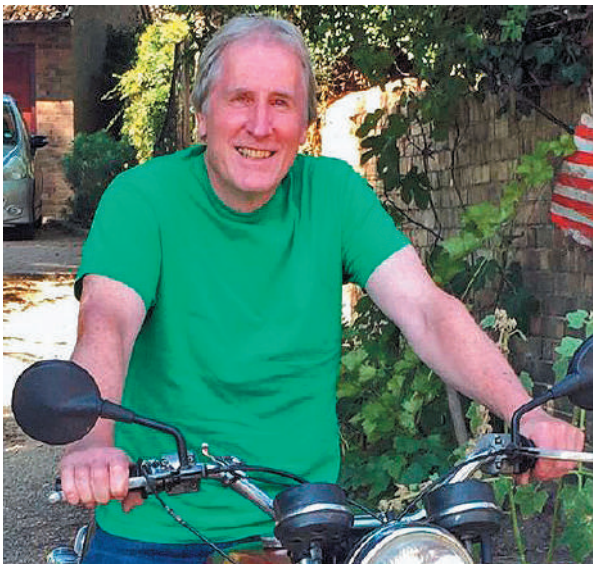
jls55@le.ac.uk

Contrary to its popular image as a region frozen in time and geologically unchanging, Antarctica is a continent of volcanoes, the most prominent of which extend back in time to c. 30 Ma. Several are still active today. The earliest observations of volcanic activity are by sealers and explorers during the 19th century, and they form the focus of this talk. Most of those observations remain unvalidated and, as a consequence, they have either been ignored, regarded as unreliable and dismissed, or completely missed. However, a reassessment suggests that they contain information that remains volcanologically relevant today. This talk shall outline pertinent observations of several volcanic centres in Antarctica at which volcanic activity, including eruptions, were said to have taken place, and it will show how those observations may be interpreted in a modern volcanological context. In all but two cases, which remain enigmatic, the observations can be regarded as reliable and informative and definitively refer to volcanic events. They include the first volcanic eruption to be seen in Antarctica, unrecognized eruptions of other volcanic centres and evidence for one of the youngest calderas to form on Earth. There are also numerous puzzling accounts of a violent eruption on Bridgeman Island (northern Antarctic Peninsula) in 1821, which triggered the mortality of many penguins and that shall form a particular focus of this talk. Those reports also include a remarkable, almost word-perfect description of cypressoid (cocks-comb) jetting activity written 150 years before such activity was recognized formally by modern volcanologists. However, the activity on Bridgeman Island lacks any physical evidence and has been disputed. The reports thus created an enigma that has persisted for over 200 years. It has only recently (2023) been resolved.

Synthetic photographic view of Bridgeman Island and the new volcano, observed from the north-north-east, constructed to show how the scene might have looked when visited by sealers Ames and Powell in 1821.

The image is a photomontage compiled from two unrelated photographs. Bridgeman Island is from January 2005 (image: Miguel Angel Otero Soliño, Creative Commons, Wikimedia.org), whereas the erupting island is Hunga Tonga-Hunga Ha'apai (Tonga, January 2015; image: New Zealand High Commission at Nuku'alofa, January 2022).

John Smellie



John Smellie is a volcanologist with a passion for volcanism, which he has pursued for more than 40 years, mainly working in Antarctica.

His principal current interest is glaciovolcanism (eruptions beneath ice) and its application to reconstructing ancient ice sheets. Prior to moving to Leicester University in 2010 as honorary professor he spent almost his entire career with the British Antarctic Survey as Project Leader, Senior Volcanologist, and Leader of the (Geological) Palaeoenvironments Discipline Group.

He first went to Antarctica as a 21 year old immediately after his first degree at Edinburgh University and subsequently spent 27 field seasons in Antarctica, cumulatively representing >1000 days in the field. He has visited & worked on more Antarctic volcanoes than anybody else, a statistic unlikely ever to be equalled.

He was co-founder & past Chair of the IAVCEI-IACS Commission on Volcano-Ice interactions (https://viic.iavceivolcano.org/AntVolc) and the SCAR Expert Group on Antarctic Volcanism [https://iavceivolcano.org/AntVolc/] served on the UK National Committee for Antarctic Research; and has held honorary positions at Lancaster and Aberystwyth universities. He is also a prolific author and has produced > 230 publications, including many edited volumes (including the recent (2021) 816-page Geol Soc Memoir on Volcanism in Antarctica) and a reference textbook on glaciovolcanism. He is a rare double recipient of the Polar Medal (UK), and three geographical places in Antarctica are named after him.

For more information, see website https://www.johnsmellievolcanologist.org/

10. Operation Tabarin – establishing the first British scientific station on Antarctica.

Camilla Nichol

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Operation Tabarin, a top-secret operation to Antarctica launched in 1943, represents a fascinating moment in Antarctic history, which converges geopolitics and scientific exploration during World War II. Originally conceived by the British government to secure British sovereignty and monitor enemy activities, Operation Tabarin quickly expanded to include scientific research, laying the groundwork for the future British scientific programme in Antarctica. The logistical challenges faced by the team to establish permanent research stations are outlined, and the array of scientific disciplines involved, from meteorology to biology and geology are described. The original secrecy of Operation Tabarin's activities probably resulted in the it not being widely known about or recognised as important; yet it was pivotal operation with a legacy that has stretched way beyond its original purpose

Operation Tabarin Crew Photo: © British Antarctic Survey

Port Lockroy today Photo © UKAHT

Camilla Nichol

Camilla conserves six former scientific stations on the Antarctic Peninsula and works to engage people with Antarctica and its past closer to home. She studied Geology at the University of Edinburgh followed by Museum Studies at the University of Leicester.

Prior to the Antarctica she worked as head of Collections for Leeds Museums and Galleries, was Keeper of Geology for York Museum Trust and also had roles at the University of Glasgow Hunterian Museum, the Museum of the Scottish Shale Oil Industry and the Scottish Football Museum.

In addition to the day job Camilla is also the Chair of the Cromwell Museum Trust, and is a member of the Antarctic Placenames Committee, the Advisory Board for the Scott Polar Research Institute and the South Georgia Government Heritage Advisory Panel. She is an Associate of the Museums Association and a Fellow of the Royal Geographical Society. Camilla has been a member of GCG since 1996 and served on the committee in the early noughties as membership secretary and briefly as webmaster.

11. To discover the geology and structure of the Scotia Sea and the Larsen Ice shelf - a personal account of pre-plate tectonics survey work.

Peter Kennett with Duncan Hawley
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Peter Kennett was a geophysicist with FIDS (which became BAS) from 1959-63. He worked on surveys attermpting to discover and interpret the geology of the Scotia Sea, the Antarctic peninsula and the Larsen Ice shelf by gathering data from magnetic and seismic surveys at sea and gravity surveys on isolated lumps of rock in and around the Antarctic Peninsula. This was followed by a year ashore, based at Stonington Island, surveying the Larsen Ice Shelf by dog sledge. The period was pre-Vine & Matthews, pre-the concept of plates and subduction zones and the Survey geologists had no model to predict which survey lines might prove valuable and which areas might be worth more detailed investigation. In addition, the equipment did not have the depth resolution to deal with the deep trench waters of the Scotia arc trench. Consequently, the 'voyages of discovery' were relatively blind and the team did not manage to target surveys on some of the key geology in the Scotia arc. Yet the work provided knowledge for later surveys that highlighted what now seems geologically obvious. This is a first-hand history of how collecting geological data in the hope of making sense was limited by methods and interpretation models not yet in place, that demonstrates how the discovery of geological knowledge is cumulative but breakthroughs are dependent on insights.

Peter Kennett taking magnetic reading on Larsen Ice Shelf, 1963 Photo by P. Kennett

Gravity meter landing from HMS Shackleton on Gibb Island, 1960 -61 Photo by P. Kennett

Worden gravimeter in its sling on RRS Shackleton, 1960
Photo by P. Kennett

Peter Kennett

Peter on the Larsson Ice Shelf, 1964

Peter at home in Sheffield,

Peter was born in Croydon in 1939, on Charles Darwin's birthday (a mere 130 years later!). Following school, he studied geology at UCL, then after taking a MSc in Applied Geophysics at Durham University, he joined the Falkland Islands Dependencies Survey (FIDS) as a field geophysicist, from 1960–1964 (following which FIDS became The British Antarctic Survey). His work and service was recognised by being awarded a Polar Medal and, sometime after, having a peak in Antarctica named, after him - Mount Kennett Following his return to the U.K. and writing up results of his survey work at Birmingham University, he trained as a secondary school teacher at the same university. Subsequently he taught geology, science and geography in schools first at Ashby-de-la-Zouch and from 1970 in Sheffield, where he inspired a generation of pupil to become geologists. He 'retired' in 1999 but has remained active in geoscience education ever since. He is a founding member and past Chairman of the Earth Science Teachers' Association (ESTA), was a founding workshop leader of the Earth Science Education Unit (training teachers), co-author of textbook 'Aspects of Geology', and co-founder of the website http://www.earthlearningidea.com and continues to be an editor, turning out geology teaching activity ideas every two weeks. In addition to his Polar Medal Peter is the recipient of the R.H. Worth Prize (Geological Society of London), 2011, and the Moore Medal (Yorkshire Geological Society), 2018. His is Secretary of the Sheffield Area Geology Trust and regularly leads geology walks around areas of the city.

12. 19th and early 20th Century Polar Collections at the Sedgwick Museum of Earth Sciences, University of Cambridge.

Dan Pemberton

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From the British Naval Northwest Passage Expedition (1824 - 1825) to the British Graham Land Expedition (BGLE) (1934 - 1937), the Sedgwick Museum holds a surprising number of 19th and early 20th C geological collections from the polar regions. How and why these collections came to be acquired, displayed and archived in the Sedgwick Museum is explored.

Dan Pemberton

Dan Pemberton is Collections Manager at the Sedgwick Museum of Earth Sciences, University of Cambridge. He is a Museum Professional with over 30 years' experience working in the Museum and Library Sectors. Educated in Marine Zoology & Vertebrate Palaeontology Dan has spent the last 20 years working with Geological Collections, with past experience of Archaeological, Social History and Maritime Collections. In recent years he has project managed a number of digitisation and 3D modelling projects and provided expert advice for specifications of the Colin Forbes Building, the Museum's new Geological Store in West Cambridge.

13. Poster presentation: Trilobites in the Arctic

Diana Clements and Richard Fortey

Natural History Museum, London

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Richard Fortey made fossil collections from Spitsbergen both as an undergraduate at Cambridge in 1967 and again in 1972 with a team from Norway

In addition, with Diana Clements, he described trilobites, found languishing in the drawers at the National History Museum, that were discovered in 'Arctic America' on the Nares Expedition to the North Pole via the Roberson Channel between present-day Greenland and Canada.

Acknowledgements

HOGG and GCG would like to thank Professor Jane Francis, Director, British Antarctic Survey (BAS) and the staff of BAS HQ in Cambridge for their generous support of the meeting and conference, without which it would have been much more difficult to facilitate and organise.

We are also indebted to the Sedgwick Museum and their staff for facilitating the museum visit and archive tour, and in particular we would like to thank Dan Pemberton and Sandra Freshney for their help in organising the visits day.

Cindy Howells (National Museum Wales, HOGG & GCG) and Mark Evans (British Antarctic Survey & GCG) undertook much of the detailed organisation of this conference in collaboration with Duncan Hawley (HOGG).

History of Geology Group & Geological Curators' Group

The History of Geological Discovery in Polar Regions

Conference Meeting

16 – 17 July 2024