

JON HAWKINGS

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EDUCATION

- 2011-2015 **University of Bristol.**
PhD (School of Geographical Sciences).
Title: "Production and Export of Bioavailable Nutrients Under Glaciers"
NERC funded studentship.
Supervisors: Professor Jemma Wadham and Professor Martyn Tranter.
- 2005-2009 **University of Bristol.**
MSci Geography, 1st class honors.
Masters Thesis: "The Characteristics, Rates and Limitations of Microbial Activity in Cryoconite Debris from Three Arctic Glaciers"
- 1998-2005 **Brentwood School, Essex.**
A Levels: History (A), Geography (A), Economics (A), Biology (A).
GCSEs: 6 'A's, 4 'A's.

RESEARCH INTERESTS

I am primarily interested in nutrient production, cycling and export in glaciated environments. Nutrients such as nitrogen, phosphorus, silica and iron are considered essential for stimulating microbial primary production in downstream ecosystems, for example the productive coastal regions surrounding the Greenland and Antarctic ice sheets.

In a broader context, my research interests span low temperature biogeochemistry, global nutrient cycles (with a particular interest in the iron biogeochemical cycle), microbiology in cold environments and global environmental change with respect to cryospheric response.

The majority of my research experience to date has been in fieldwork data collection and experimentation in remote environments, lab based analytical chemistry, and mineralogical analysis.

RESEARCH ABSTRACT

The Polar regions are home to some of the world's most highly productive oceanic ecosystems. There is an emerging body of evidence to suggest that meltwater and iceberg delivery from ice sheets play a key role in sustaining these systems by providing essential nutrients. Glacially derived nutrients may enhance primary and secondary production, helping to sustain and drive complex and economically important marine ecosystems. In a warming climate, understanding the changes that might occur in the future is important.

My research currently focuses on iron, phosphorus, nitrogen, silica and trace element (e.g. Mo, V, Mn) production, cycling and export from glacial environments, with a specific focus on the Greenland Ice Sheet. These elements are considered essential nutrients for stimulating primary production, and therefore potentially strengthening the biological pump in the oceans surrounding the Greenland and Antarctic ice sheets, and in other glaciated environments such as the Pacific Northwest and off the coast of Patagonia. Understanding the sensitivity of nutrient fluxes to increased mass loss from glaciers is important. It will allow us to ascertain the potential impact of rapidly melting ice sheets on downstream biogeochemical cycles not only in the future, but also during past glacial cycles, and snowball earth events.

PUBLICATIONS

Hawkings, J. R., Wadham, J. L., Tranter, M., Telling J., Bagshaw, E., Beaton, A., Simmons, S-L., Chandler, D., Tedstone, A., Nienow, P. (2016) The Greenland Ice Sheet as a hotspot of phosphorus export in the Arctic, *Global Biogeochemical Cycles*, 30: 191-210

Raiswell R., **Hawkings, J. R.**, Benning, L. G., Baker, A. R., Krom, M. D., Death, R., Poulton, S. W., Wadham, J., Tranter, M. (2016) Potentially bioavailable iron delivery by iceberg-hosted sediments and atmospheric dust to the polar oceans, *Biogeosciences*, doi: 10.5194/bg-13-3887-2016

Bagshaw, E., Beaton, A., Wadham, J., Mowlem, M., **Hawkings, J. R.**, Tranter, M. (2016) Chemical sensors for in situ data collection in icy meltwaters, *Trends in Analytical Chemistry*, 82, 348-357, doi: 10.1016/j.trac.2016.06.016

Wadham, J. L., **Hawkings, J. R.**, Telling, J., Chandler, D., Alcock, J., Lawson, E., Monteiro, F., Kaur, P., Bagshaw, E. A., Tranter, M., Tedstone, A., Nienow, P. and Mikelssen, A. (2016) Sources, cycling and export of nitrogen on the Greenland Ice Sheet, *Biogeosciences Discussions*, doi: 10.5194/bg-2015-484

Hawkings, J. R., Wadham, J. L., Benning, L. G., Hendry, K. R., Tranter, M., Tedstone, A., Nienow, P., Raiswell, R. (in review) Ice sheets as a missing source of silica to the world's oceans, *Nature Communications*

Hawkings, J. R., Hatton, J., Hendry, K. R., Wadham, J. L., Hain, M., Ivanovic, R., Kohler, T., Stibal, M., Beaton, A., Lamarche-Gagnon, G., Tedstone, A., Pike, J., Tranter, M. (in prep) The global silicon cycle impacted by past ice sheets

Hawkings, J. R., Benning, L., Kaulich, B., Araki, T., Abyaneh, M., Raiswell, R., Stockdale, A., Wadham, J., Tranter, M. (in prep) Ubiquitous presence of mixed valence nanophase iron in glacial meltwaters and icebergs

Bagshaw, E., Wadham, J., Beaton, A., Tranter, M., Mowlem, M., **Hawkings, J. R.** (in prep) Assessment of the suitability of ISFET sensors for pH measurement in glacial meltwaters, *Environmental Science and Technology*

Hawkings, J. R., Wadham, J. L., Tranter, M., Lawson, E., Sole, A., Cowton, T., Tedstone, A. J., Bartholomew, I., Nienow, P., Chandler, D., Telling, J. (2015) The impact of climatic warming on nutrient and solute export from the Greenland Ice Sheet, *Geochemical Perspectives Letters*, 1: 94-104

Hawkings, J. R., Wadham, J. L., Tranter, M., Raiswell, R., Benning, L. G., Statham, P., Tedstone, A., Nienow, P., Lee, K. and Telling, J. (2014) Ice sheets as a significant source of highly reactive nanoparticulate iron to the oceans, *Nature Communications*, 5, doi:10.1038/ncomms4929

Telling, J., Anesio, A. M., Tranter, M., Fountain, A., Nylén, T., **Hawkings, J. R.**, Singh, V. B., Kaur, P., Musilova, M., Wadham, J. L. (2014) Spring thaw ionic pulses boost nutrient availability and microbial growth in entombed Antarctic Dry Valley cryoconite holes, *Frontiers in Microbiology*, 5, doi:10.3389/fmicb.2014.00694

Telling, J., Anesio, A. M., Tranter, M., Stibal, M., **Hawkings, J. R.**, Irvine-Fynn, T., Hodson, A., Butler, C., Yallop, M. L. and Wadham, J. L. (2012) Controls on the autochthonous production and respiration of organic matter in cryoconite holes on High Arctic glaciers, *Journal of Geophysical Research: Biogeosciences*, 117, G1

Telling, J., Anesio, A. M., **Hawkings, J. R.**, Tranter, M., Wadham, J. L., Hodson, A. J., Irvine-Fynn, T., Yallop, M. L. (2011) Measuring rates of gross photosynthesis and net community production in cryoconite holes: a comparison of field methods, *Annals of Glaciology*, 51(56), 153-162

ACADEMIC/RESEARCH EXPERIENCE

October 2015 - **Temporary Lecturer**

June 2016 I covered two undergraduate lecture courses; Year 1 Cryosphere (Physical Geography) and Year 3 Ice and Oceans in the Carbon Cycle. I was involved with updating and delivering these lecture courses, as well as leading several practical classes.

May 2016 **Beamline time at the Diamond Light Source synchrotron facility**

I successfully applied for five days of beamline time on the I08-SXM facility with Prof Liane Benning at the University of Leeds/GFZ. Our project was entitled "The Biogeochemical Cycling of Nutrients in Subglacial Lake Whillans". We are using STXM/NEXAFS spectroscopy to investigate the reactivity and bioavailability of several elements, including iron, carbon and nitrogen in the Antarctic subglacial Lake Whillans in collaboration with colleagues at the Montana State University.

- May 2015 - present **Post Doctoral Research Associate in Glacial Biogeochemistry**
 PDRA on the NERC funded DELVE (DEvelopment and Validation of first generation chemical sensors for glacial Ecosystems) project, helping to test and optimise new sensors for measuring biogeochemical parameters in extreme environments. I have additionally been given an opportunity to extend research interests developed during my doctorate.
- May - June 2015 **Greenland 2015 Field Program - Kangerlussuaq**
 I spend four weeks in Southwest Greenland as part of the DELVE project, conducting geochemical sampling and hydrological monitoring of a large Greenland Ice Sheet glacial catchment. Included was the implementation and testing of a new suite of continuous geochemical sensors.
- October 2011 - April 2015 **Postgraduate Demonstrator**
 During my PhD studies I regularly supervised undergraduates in the School of Geographical Sciences.
 Units supervised include Cryosphere, Research Methods in Physical Geography and Global Environmental Change. Supervision has included computational work, analytical lab work and field work (e.g. the 2nd year Physical Geography field course to the Swiss Alps), with responsibility of up to 60 students at one time. More recently I have helped supervise four undergraduate/masters students (2012, 2013 and 2015) with their dissertation projects based in Greenland.
- October 2014 **Beamline time at the Diamond Light Source synchrotron facility**
 I successfully applied for five days of beamline time at the newly commissioned I08-SXM facility with Prof Liane Benning at the University of Leeds/GFZ. Our ongoing project is titled "Do Chemically Distinct Iron Nanoparticle Species control iron Delivery into the Northern Polar Oceans?". We are using STXM/NEXAFS spectroscopy to investigate the reactivity and bioavailability of iron nanoparticles from glacial sources.
- November 2014 **Guest lecturer in "Frontiers of Earth Science" course**
 I was asked to give a guest lecture to 4th year MSci Earth Science students as part of the Frontiers of Earth Science unit. The lecture revolved around the topics of my current research, and the broader field of global nutrient cycles.
- July - August 2014 **Greenland 2014 Field Program - Tasililaq/Sermilik Station**
 As part of an EU-Interact grant, I was part of a short, two-person research project (two weeks) at Sermilik station, East Greenland, monitoring downstream nutrient evolution from the Mittivakkat Glacier.
- March 2014 **Field assistant - North Andros, Bahamas**
 For two weeks I was part of a research trip investigating the groundwater chemistry of North Andros. The focus was predominantly on borehole sampling and carbonate chemistry.
- June - July 2013 **Greenland 2013 Field Program - Narsarsuaq**
 As part of my PhD research I spent 6 weeks in Greenland during the 2013 summer melt season as part of a University of Bristol research expedition lasting 4 months. Work included my own research, and assisting in a number of other scientific projects, such as stage discharge measurements, and electrochemical sensor maintenance at a number of sites along a glacial meltwater stream.
- May - July 2012 **Greenland 2012 Field Program - Kangerlussuaq**
 As part of my PhD research I spent 9 weeks in Southwest Greenland during the 2012 summer melt season. Research was conducted out of a remote field camp ca. 25 km outside of Kangerlussuaq, as part of a University of Bristol research expedition lasting 4 months. As well as my own research, a large proportion of time was spent assisting in a large SF₆ tracer project, which included 24 hour sampling, and processing of trace gas samples using a gas chromatograph in the field.
- May - Sept **Svalbard 2009 Research Assistant - Ny Alesund**

- 2009 After my undergraduate studies finished, I spent three months as a field assistant on a University of Bristol expedition to Svalbard. Research was conducted out of the remote high Arctic research settlement of Ny-Alesund. The position included logistical support as well as assisting in experimental research on glaciers and in a field laboratory.

AWARDS/GRANTS

- Early Career Science Ambassador for the European Association of Geochemistry. €2,000 for overseas conference attendance (AGU Fall Meeting 2016)
- I08 beamline time at Diamond Lightsource, the UK's national synchrotron. **Six days awarded** - May 2016. "The Biogeochemical Cycling of Nutrients in the Antarctic Subglacial Lake Whillans"
- Researcher Co-I on NERC/CONICYT funded PISCES project for **£733,000**.
- Goldschmidt 2015 Student Ambassador - 1 of only 25 selected for outstanding abstract
- University of Bristol Alumni Foundation Travel Grant for **£500** - American Geophysical Union Meeting, San Francisco, December 2014
- I08 beamline time at Diamond Lightsource, the UK's national synchrotron. **Four days awarded** - October 2014. "Do Chemically Distinct Iron Nanoparticle Species control iron Delivery into the Northern Polar Oceans?"
- PhD student conference travel grant - Iron Biogeochemistry Conference, Monte Vertia, Switzerland 2013
- Shortlisted for the 2013 NERC Photography and Short Article Writing competition

CONFERENCES AND COURSES ATTENDED

- Geochemistry Group Research In Progress meeting, March 2016
 - ➔ Oral presentation on "The global silicon cycle impacted by northern hemisphere ice sheets"
- Diamond Light Source Users Meeting: Diamond Light Source, September 2015
 - ➔ Invited oral presentation on "Chemically distinct iron nanoparticulate phases in glacial meltwaters and icebergs"
- Goldschmidt Conference: Prague, August 2015
 - ➔ Oral presentation given on "Glaciers as a missing source of silicon to the world's oceans"
- Nutrient Cycling on the Modern and Ancient Earth conference: University of Leeds, July 2015
 - ➔ Oral presentation given on "The Greenland Ice Sheet as a hotspot of phosphorus weathering and export in the Arctic"
- AGU Fall Meeting: San Francisco
 - ➔ 2013. Poster presentation given on "The Production and Export of Bioavailable Iron from Ice Sheets- the Importance of Colloidal and Nanoparticulate Phases"
 - ➔ 2014. Oral and poster presentation given on "The Glacial Iron Cycle from Source to Export"
- International Glaciology Society: British Branch Meetings
 - ➔ 2012 Aberdeen
 - ➔ 2013 Loughborough. Oral presentation given on "Bioavailable Iron Production Underneath Ice Sheets".
 - ➔ 2014 Bristol. Oral presentation given on "Solute Export Changes from the Greenland Ice Sheet in a Warming World".
- Monte Verita Iron Biogeochemistry: From Molecular Processes to Global Cycles, March 2013
 - ➔ Oral presentation given on "Subglacial Iron Biogeochemical Cycling and Export"
 - ➔ Awarded PhD student conference grant
- University of Bristol Postgraduate Natural Systems and Processes Poster Sessions:
 - ➔ 2013 poster presented
 - ➔ 2014 poster presented
 - ➔ 2015 poster presented

RESEARCH TECHNIQUES

I am competent in the following techniques:

- Low level nutrient sampling and analysis:
 - ➔ Manual spectrophotometric techniques and method development
 - ➔ Flow Injection/Auto Analyzer Analysis
 - ➔ Dionex ICS3000 and ICS5000 - Ion Chromatograph for major ions and nutrients (microbore/capillary)
- Trace element sampling and analysis
 - ➔ Trace element clean techniques (field sampling/clean lab work)
 - ➔ ICP-MS and AAS
- Spectroscopy/Mineralogical analysis

- ➔ Synchrotron powered Soft X-ray Spectroscopy (STXM) at Diamond Light Source with particular interest in changes at the Fe L-edge (thus far four days beamline time at the I08 facility)
- ➔ Microspectroscopic, nanodiffraction and elemental analysis (High Resolution Transmission Electron Microscopy techniques)
- ➔ Multiple particulate phase nutrient extraction techniques and analysis
- Gas analysis
 - ➔ Gas Chromatography sample collection and operation for trace detection of SF₆
- Radiotracers
 - ➔ Ionising radiation safety trained
 - ➔ Competent in use of radio-tracers 3H-Leucine and 3H-Thymidine

RESPONSIBILITIES & ACHIEVEMENTS

- University
- Ongoing role as postgraduate representative for the School of Geographical Sciences
 - Key role on organising committee for 2014 International Glaciology Society, British Branch meeting, and the 2014 UK Antarctic Research Symposium. Website design, finances, conference subscription and abstract submissions.
 - Part of Postgraduate Natural Systems and Processes Poster Session 2013 organising committee. Lead organiser and fund raiser for the 2014 session.
 - Postgraduate Lab Safety Officer.
 - 2013-2014 chair of the Bristol Glaciology Centre Seminar Series.
- Outreach
- Bristol representative on the UK Polar Network committee.
 - Multiple scientific outreach projects, including being featured in the University of Bristol Community Discover More magazine, visiting local schools to present on Polar Sciences, arranging a Polar Arts competition (Bristol Ice Explorers), and volunteering for the University of Bristol Discover event.
 - Current STEM ambassador (since 2013).

PROFESSIONAL BODY MEMBERSHIP

- European Association of Geochemists
- International Glaciological Society
- Cabot Institute
- American Geophysical Union
- UK Polar Network