

Dr Alex G. Lipp

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EDUCATION

PhD, Geochemistry Oct. 2018 – Jul. 2022
Imperial College London

Thesis: *‘Predictive and invertible models of sediment geochemistry from catchment to continental scales’*

Supervisors: Dr Gareth Roberts, Dr Alex C. Whittaker, Dr Oliver Shorttle (University of Cambridge)

Examiners: Pieter Vermeesch (external), Yves Plancherel (internal)

MSci, Earth Sciences, 1st Class Oct. 2016 – Jun. 2017
University of Cambridge, Queens’ College

Thesis: *‘Using sulfur isotopes and concentrations as indicators of marine influence in sedimentary rocks’*

Supervisors: Dr Sasha Turchyn & Dr Neil Davies

BA, Natural Sciences, 1st Class Oct 2013 – Jun. 2016
University of Cambridge, Queens’ College

Thesis: *‘The Geology of Mount Chaukwe and the Ruaha River Valley, Chimala, Tanzania’*

Courses: Earth Science (IA – II), Mathematics (IA – IB), Physics (IA), Computer Science (IA). Highest grade in Earth Science cohort in Pt IB.

EMPLOYMENT

Merton College, University of Oxford Oct. 2022 –

Junior Research Fellow

- Awarded 3 year highly competitive fellowship to conduct independent research at Merton College, University of Oxford.
- Developing independent research agenda using quantitative approaches to understand Earth’s surface.
- I have primarily been working on two primary questions: What role does Earth’s surface have in regulating long-term climate change? How can we objectively identify and quantify pollutant sources in river networks?

Department of Earth Sciences & Engineering, Imperial College London Jun. 2022 – Oct. 2022

Postdoctoral Research Assistant

- Employed as PDRA (PI: Dr Gareth Roberts) to explore applications of methods developed during my PhD in particular for use in developing continental scale geochemical environmental baselines.

CASP August 2017 – March 2018

Field Assistant & Assistant Geologist

- Acted as field-assistant for month-long field expedition to Bjørnøya (Bear Island), Norway
 - Developed geochemical and mineralogical statistical analysis software still in use by organisation
 - Prepared reports summarising analysis of sedimentary provenance data for industrial sponsors
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PUBLICATIONS

* = PhD student (co-)supervision; † = Masters student (co-)supervision

Under Review/In Prep

- [18] Zheng, D., **Lipp, A. G.**, Valdes, P., and Mills, B. J. W. ‘Long-term stability of Earth’s temperature over the Phanerozoic Eon’ Under Preparation
- [17] Pryor, E. J., Hall, I. R., Simon, M. H., Andersen, M., Babin, D., **Lipp, A. G.**, Starr, A., and, van der Lubbe, H. J. L. ‘Geochemical - mineralogical constraints on the provenance of sediment supplied from South African river catchments draining into the southwestern Indian Ocean’ Under review at *Geophysics, Geochemistry, Geosystems*

Published

2024

- [16] Chrapkiewicz, K., **Lipp, A. G.**, Barron, L., Barnes, R. and Roberts, G. ‘Apportioning sources of chemicals of emerging concern along an urban river with inverse modelling’ Under review at *Science of the Total Environment* Preprint DOI: [10.31223/X52T22](https://doi.org/10.31223/X52T22)
- [15] Barnes, R. and **Lipp, A. G.** ‘Apportioning tracer and pollutant sources in drainage networks from nested concentration observations using an efficient convex unmixing scheme’ Accepted with Minor Revisions at *Water Resources Research* Preprint DOI: [10.31223/X5708M](https://doi.org/10.31223/X5708M)
- [14] Tipper, E. T., Bouchez, J., **Lipp, A. G.**, and Lupker, M. ‘The geochemistry of continental sediments: New developments & old problems’. In Press chapter in *Treatise of Geochemistry (3rd Edition): Lithosphere*
- [13] Walton, C., Rigley, J., **Lipp, A. G.**, Law, R., Suttle, M., Schönbächler, M., Wyatt, M. and Shorttle, O. ‘Cosmic dust fertilization of prebiotic chemistry on early Earth’ *Nature Astronomy* DOI: [10.1038/s41550-024-02212-z](https://doi.org/10.1038/s41550-024-02212-z)

2023

- [12] (*) Morris, M. J., **Lipp, A. G.**, and Roberts, G. G. ‘Towards inverse modeling of landscapes using the Wasserstein distance’. *Geophysical Research Letters* 50.14 DOI: [10.1029/2023GL103880](https://doi.org/10.1029/2023GL103880)
- [11] **Lipp, A. G.** and Vermeesch, P. ‘Short Communication: The Wasserstein distance as a dissimilarity metric for comparing detrital age spectra, and other geological distributions’. *Geochronology* 5.1 DOI: [10.5194/gchron-5-263-2023](https://doi.org/10.5194/gchron-5-263-2023)
- [10] Walton, C., Hao, J., Fang, H., Jenner, F., Williams, H., Zerkle, A., **Lipp, A. G.**, Hazen, R., Peters, S., and Shorttle, O. S. ‘Evolution of the crustal phosphorus reservoir’. *Science Advances* 9.18 DOI: [10.1126/sciadv.ade692](https://doi.org/10.1126/sciadv.ade692)
- [9] Vermeesch, P., **Lipp, A. G.**, Hatzenbuehler, D., Caracciolo, L., and Chew, D. ‘Multidimensional scaling of varietal data in sedimentary provenance analysis’. *Journal of Geophysical Research: Earth Surface* DOI: [10.1029/2022JF006992](https://doi.org/10.1029/2022JF006992)
- [8] (†) Eschenfelder, J. A., **Lipp, A. G.**, Roberts, G. G. ‘Quantifying excess heavy metal concentrations in drainage basins using conservative mixing modelling’. *Journal of Geochemical Exploration* DOI: [10.1016/j.gexplo.2023.107178](https://doi.org/10.1016/j.gexplo.2023.107178)
- [7] **Lipp, A. G.**, de Caritat, P. and Roberts, G. G. ‘Geochemical mapping by unmixing alluvial sediments’. *Journal of Geochemical Exploration* DOI: [10.1016/j.gexplo.2023.107174](https://doi.org/10.1016/j.gexplo.2023.107174).

2021

- [6] **Lipp, A. G.**, Roberts, G. G., C. J. B. Gowing, Whittaker, A. C., and Fernandes, V. M. ‘Source region geochemistry from unmixing downstream sedimentary elemental compositions’. *Geochemistry, Geophysics, Geosystems* 22.10 DOI: [10.1029/2021GC009838](https://doi.org/10.1029/2021GC009838).
- [5] Farrell, U., ... **Lipp, A. G.** ... Planavsky, N.J., Lau, K. V., Johnston, D. J., Sperling, E. A. ‘The Sedimentary Geochemistry and Paleoenvironments Project’. *Geobiology* 19.6 DOI: [10.1111/gbi.12462](https://doi.org/10.1111/gbi.12462)
- [4] **Lipp, A. G.** and Roberts, G. G. ‘Scale-dependent flow directions of rivers and the importance of sub-plate support’. *Geophysical Research Letters* 48.1. DOI: [10.1029/2020GL091107](https://doi.org/10.1029/2020GL091107)
- [3] **Lipp, A. G.**, Shorttle, O., Sperling, E., and Sedimentary Geochemistry Paleoenvironments Project Team Members. ‘The composition and weathering of the continents over geologic time’. *Geochemical Perspective*

Letters 17. DOI: [10.7185/geochemlet.2109](https://doi.org/10.7185/geochemlet.2109)

2020

[2] **Lipp, A. G.**, Roberts, G. G., Gowing, C. J. B., Whittaker, A. C., and Fernandes, V. M. ‘River sediment geochemistry as a conservative mixture of source regions: Observations and predictions from the Cairngorms, UK’. *Journal of Geophysical Research: Earth Surface* 125.12. DOI: [10.1029/2020JF005700](https://doi.org/10.1029/2020JF005700).

[1] **Lipp, A. G.**, Shorttle, O., Syvret, F. and Roberts, G. G. (2020). ‘Major Element Composition of Sediments in Terms of Weathering and Provenance: Implications for Crustal Recycling’. *Geochemistry, Geophysics, Geosystems* 21.6. DOI: [10.1029/2019GC008758](https://doi.org/10.1029/2019GC008758). - [Top 10% downloaded papers in G^3 , 2020]

SELECTED AWARDS & HONORS

- Janet Watson Prize for Research Excellence 2022
- Winner – MinSouth Young Person’s Lecture Competition 2021
- Imperial College Union Colours – Awarded for contributions to the student body 2020
- Best Student Poster Award – Geochemistry Group Research in Progress Conference 2019
- Queens’ College Cambridge Foundation Scholarship – Awarded for academic excellence 2015 – 2018
- Wiltshire Prize for distinction in Earth Sciences– Awarded for top mark in Earth Sciences 2015
- Alison Roper Prize for Natural Science 2015

FUNDING RECEIVED

- Junior Research Fellowship from Merton College, University of Oxford (**Salary + £3800 p.a.**; 2022 – 2026)
- Co-Investigator - ‘*Weathering on the Edge: Dynamic uplift, the carbon cycle, and the Great Escarpment*’ Director strategic funding, from Research School of Earth Sciences, Australia National University (**A\$ 20,260 ~ £10,400**; 2024)
- Co-Investigator - ‘*Tracking pollutants as continua throughout the Thames drainage basin*’ funded through NERC Exploring the Frontiers (**£100k**; 2023)
- Co-Investigator - ‘*Did cosmic dust fertilise prebiotic chemistry?*’ funded through Cambridge Planetary Science and Life in the Universe Research Grants Scheme (**£22k**; 2022-2023)
- NERC SSCP DTP Studentship (**£14k p.a stipend + £5k grant + £10k fieldwork supplement**; 2018 - 2022)
- BGS-Universities Funding Initiative from British Geological Survey (**in kind support via reduced cost geochemical analyses**)
- CASE industrial sponsorship from CASP (**£1000 p.a**; 2018 - 2021)
- Caltech Summer Undergraduate Research Fellowship (**\$6000**; 2016)

INVITED TALKS

- Exploring for the Future Seminar Series, Geoscience Australia, Canberra June, 2023
- Earth Sciences Departmental Seminar, University College London January, 2023
- Invited speaker at *International Association of Mathematical Geoscientists* conference August 2022
- Precambrian Geology Seminar Series, University California Riverside September, 2021
- Geomorphology Section Seminar, GeoForschungsZentrum Potsdam September, 2021
- Surface Processes Group Discussion Series, University of Pennsylvania August, 2021
- Invited speaker at *Goldschmidt* conference July, 2021

- Petrology & Geochemistry Discussion gets positive feedback from the group, University of Bristol July, 2021
- China University of Geosciences, Sedimentary Geochemistry Symposium March, 2021
- Earth Data Webinar Series, Zhejiang University March, 2021

POLICY, OUTREACH & SCIENTIFIC COMMUNICATION

Creator/Maintainer of sewagemap.co.uk 2023 –

- Developed online tool visualising, in real-time, rivers in the Thames Basin impacted by sewage pollution
- Tool can be used by public as part of assessing risks for entering water-ways and for raising awareness of pressing environmental issue
- This has featured in the national (*The i*, *The Times*) and local (*BBC Oxford News*, *Oxford Mail*) press as well as the radio (*BBC Radio Oxford & Berkshire*) and is widely shared by members of the public (e.g., on *Twitter* and *Facebook*)
- The back-end and front-end are fully [open-source](#) and has consequently resulted in new collaborations.

Advocate of open-data & open-source software in the environmental sciences

- [Submitted evidence](#) to UK Parliament's *Environmental Audit Committee* calling for greater transparency in Environmental modelling. In this evidence I criticise the use of proprietary water quality models which are impossible for external stakeholders users to scrutinise.
- Wrote an article for *The Conversation* ('[Water companies now have to release live sewage spill data – here's why more transparency is the key to cleaner rivers](#)') on the importance of transparent and accessible environmental data.

Tutor at *The Access Project* 2019 – 2023

- Volunteer tutor for social mobility charity *The Access Project* which supports high potential students from non-traditional academic backgrounds who aspire to attend university.

Policy Adviser (PhD Secondee) at *HMG's Open Innovation Team* April – July 2021

- Undertook four month placement at cross-government unit working with academia to generate analysis and ideas for policy.
- Contributed to report on longterm recovery of education & childrens care sector following COVID-19 pandemic, feeding into UK Education policy
- Interviewed relevant academics and performed desk research translating academic research into policy
- Included a placement in DfE parliamentary team, helping prep ministers for parliamentary questions

PROFESSIONAL SERVICE

Merton College, University of Oxford October 2023 –

Member of Governing Body

- Charitable Trustee of the College, an educational, research and religious charity
- Member of the 'Garden and Grounds' sub-committee

Department of Earth Sciences, University of Oxford January 2023 –

Postdoc Representative

- Represented postdoctoral interests across a range of departmental and faculty level activities including department faculty meetings, EDI committee, Outreach committee.
- Organise networking and career development events for departmental postdocs

- Initiated a set up a new biweekly seminar-series ‘*Postdoc Presentations*’ which showcases postdoctoral research conducted within the department.

AquaWatch UK

September 2023 –

Feasibility & Scope working-group member

- Headhunted to take part in scoping work for a UK Space Agency funded scoping project
- Project is exploring the viability and user-requirements of a UK version of the ‘AquaWatch’ earth observation system of water-quality monitoring developed in Australia

Department of Earth Sciences & Engineering, Imperial College

September 2019 – 2021

Athena SWAN Committee Member

- Collaboratively reviewed gender equality data within the department and developed an action plan to improve inclusivity
- Contributed to drafting department’s successful application for Bronze Athena SWAN award, awarded July 2021.
- Produced a report surveying the art displayed in the department and reviewed whether those depicted reflected the diversity and values of our department with proposals for who this diversity can be improved.

Sedimentary Geochemistry & Paleoenvironments Project

January 2019 – 2021

Weathering Intensity Working Group Leader

- Proposed and led the weathering intensity working group as part of Phase 1 of the Sedimentary Geochemistry and Paleoenvironments (SGP) international research consortium
- Led production of a publication of our working group results with 25 co-authors, from 23 institutions across the globe.
- Our working group’s publication was the first to arise from the SGP working groups.

Peer Review

- Journal Reviewer for *Basins Research*; *Earth Science, Systems and Society*; *Earth and Planetary Science Letters*; *Geochemical Perspective Letters*; *GSA: Bulletin*; *Journal of Archaeological Science*; *Journal of Geophysical Research: Solid Earth*; *Journal of Geophysical Research: Earth Surface*; *Geochemistry, Geophysics, Geosystems*; *Environmental Science: Water Research & Technology*; *Global and Planetary Change*
- Grant Reviewer for *Royal Society*; *Czech Science Foundation*

Conference sessions convened

- ‘*Recent advances in computational petrology and geochemical data analysis*’, EGU Annual Meeting 2023

TEACHING EXPERIENCE

Student Supervision

- Co-supervised MSci project for Jonas Eschenfelder (now PhD student at Simon Fraser University, Canada). Resulted in publication number [8] above. *Imperial, 2021 – 2022*
- Co-supervising Matthew Morris’ PhD project on an optimal transport approach to landscape inverse modelling. Resulted (to date) in publication number [12]. *Imperial, 2022 – present*
- Co-supervised undergraduate summer research projects for Matthew Roper (UROP; Imperial) and Jonas Yip (UNIQ+; Oxford) *2022 – present*
- College Adviser for PhD student. Providing ongoing pastoral support and meetings to check on research progress and well-being on behalf of college. *Merton College, Oxford 2022 – present*

Lectures & Practicals

- Prepared and delivered two lectures + 2 hour Python based practicals, on quantitative analysis of rivers and fluvial environmental data for ‘Environmental Data & Machine Learning’ MSci program at Department of Earth Sciences, Imperial College London *Imperial*, 2021

Small group teaching

- 1-to-1 A-level maths tutorials as a volunteer for social mobility charity *The Access Project*, 2018 – 22
- Delivered tutorial session on Sedimentary Geology for 1st year Earth Science students *Oxford*, 2023

Field Teaching

- 3rd year undergraduate Field Skills trip, Sardinia *Imperial*, 2019
- 2nd year undergraduate rocks and structures in the field, South Wales *Imperial*, 2022
- 4th year undergraduate Geophysics & Geology field trip, Apennines *Imperial*, 2022
- 2nd year undergraduate metamorphic & structural geology, Assynt, Scotland *Oxford*, 2023

Virtual ‘Field’ Teaching

- During the COVID pandemic, I helped the adoption of the custom virtual field teaching software ‘ESERC’ developed at Imperial. This interactive software used drone imagery and a video game engine to allow field teaching to continue during lockdowns.
- Taught on (the first ever) virtual ‘fieldtrip’ to South Wales for 2nd year undergraduates *Imperial*, 2020
- 4th year undergraduate Applied Geomorphology virtual field trip to South Wales *Imperial*, 2021
- 1st year undergraduate ‘field trip’ to the Sorbas Basin, Southern Spain *Imperial*, 2022

Demonstrator/Graduate Teaching Assistant

2018 – present

- Sedimentary rocks (1st year undergraduate, *Oxford*)
- Mathematical methods, (leading lab classes for 2nd year undergraduate, *Oxford*)
- Deforming the Earth (1st year undergraduate, *Imperial*)
- Surface Processes (1st year undergraduate, *Imperial*)
- Introduction to Sedimentology (1st year undergraduate, *Imperial*)
- Geological Maps and Structures (2nd year undergraduate, *Imperial*)
- Continental Tectonics (3rd year undergraduate, *Imperial*)
- Applied Geomorphology (3rd year undergraduate, *Imperial*)
- Sedimentary Basins Analysis (postgraduate, *Imperial*)

Co-learner at Horizons Department, Imperial College London

2018 – 2022

- Co-learner in ‘Global Challenges’ module teaching undergraduates concepts in global development using novel pedagogic techniques (e.g., flipped learning)
- Participant in the ‘*Dear Diary*’ pedagogic research project led by Dr Elizabeth Hauke. Project used ‘autoethnographic’ methods to understand the learning environment for students from all participants.

SELECTED CONFERENCE PRESENTATIONS

† = Masters student (co-)supervision

2023

[12] **Lipp, A. G.** and Barnes, R ‘Identifying tracer and pollutant sources in drainage networks from point observations using an efficient convex unmixing scheme’ *EGU General Assembly* DOI: [10.5194/egusphere-egu23-5368](https://doi.org/10.5194/egusphere-egu23-5368)

2022

[11] (INVITED) **Lipp, A. G.**, Shorttle, O. and Sediment Geochemistry and Paleoenvironments Project Weathering Working Group ‘Deducing the composition of Archean continents with a simple model for sediment geochemistry’. *International Association of Mathematical Geoscientists, Annual Conference*, Nancy,

France

- [10] **Lipp, A. G.**, G. G. Roberts, C. J. B. Gowing, A. C. Whittaker, and P. de Caritat ‘Generating geochemical maps from river sediment samples: an inverse modelling approach’. *Community Surface Dynamics Modelling System, Annual Meeting*, Boulder, USA
- [9] (†) Eschenfelder, J., **Lipp, A. G.** and Roberts, G. G. ‘Quantifying heavy metal concentrations throughout drainage basins from river sediment mixing’ *EGU General Assembly* DOI: [10.5194/egusphere-egu22-213](https://doi.org/10.5194/egusphere-egu22-213)
- [8] Walton, C., Shorttle, C., **Lipp, A. G.** and Suttle, M. ‘The cosmic desert: exogenous sediments on early Earth’ *2022 Astrobiology Science Conference - AGU*

2021

- [7] **Lipp, A. G.**, Shorttle, O. and Sediment Geochemistry & Paleoenvironments Project. ‘Silica-rich Archean continents reconstructed by ‘unweathering’ the major-element composition of sedimentary rocks’. *AGU Fall Meeting* DOI: [10.5194/egusphere-egu2020-5825](https://doi.org/10.5194/egusphere-egu2020-5825).
- [6] (INVITED) **Lipp, A. G.**, G. G. Roberts, C. J. B. Gowing, A. C. Whittaker, and V. M. Fernandes. ‘Unmixing river sediments for the elemental geochemistry of their source-regions’. *Goldschmidt Conference* DOI: [10.7185/gold2021.7177](https://doi.org/10.7185/gold2021.7177)

2020

- [5] **Lipp, A. G.**, Roberts, G. G. Gowing, C. J. B., Whittaker, A. C. and Fernandes, V. M. ‘Predicting Fluvial Sediment Geochemistry: Forward and Inverse Approaches’. *AGU Fall Meeting*
- [4] **Lipp, A. G.**, Shorttle, O., Syvret F., Roberts, G. G. and Sediment Geochemistry & Paleoenvironments Project. ‘The Modern Upper Crust is Altered and the Archean Upper Crust was Andesitic: Results from a Novel Analysis of Major Element Data’. *Goldschmidt Conference* DOI: [10.46427/gold2020.1575](https://doi.org/10.46427/gold2020.1575)
- [3] Baronas, J.J., **Lipp, A. G.**, Stevenson E., Bickle M., Shorttle O. and Tipper E. ‘Deconvolving the Effects of Lithology, Sorting, and Chemical Weathering Using Compositional Analysis of Irrawaddy River Sediments’. *Goldschmidt Conference* DOI: [10.46427/gold2020.136](https://doi.org/10.46427/gold2020.136)
- [2] Roberts, G. G., **Lipp, A. G.**, et al. ‘A predictive and invertible model of fluvial sediment geochemistry’. *EGU General Assembly* DOI: [10.5194/egusphere-egu2020-5839](https://doi.org/10.5194/egusphere-egu2020-5839)
- [1] **Lipp, A. G.**, Shorttle O, Syvret F, Roberts G and Sediment Geochemistry & Paleoenvironments Project. ‘Deconvolving weathering and provenance in the composition of the modern and ancient continental crust’. *EGU General Assembly* DOI: [10.5194/egusphere-egu2020-5825](https://doi.org/10.5194/egusphere-egu2020-5825).

SKILLS & TRAINING

- Advanced programmer in Python/Cython (including software development) and R. Familiarity in C++
- Experienced user of git, GitHub and GitHub Classroom (GitHub profile: github.com/AlexLipp)
- Experienced user of the Generic Mapping Tools, GDAL, and QGIS geospatial software
- Attendee (competitively selected) of the *Community Surface Dynamics Modeling System* summer school learning scientific modelling development, collaborative programming skills and introduction to the *LandLab* surface process modelling package.
- Significant field experience having conducted field campaigns in Svalbard (bedrock sampling for provenance analysis), Tanzania (bedrock mapping), & UK (water and sediment geochemical sampling) in addition to multiple taught trips as leader and student.