MATTHEW J. ROCHE

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Research interests | The formation, evolution, and habitability of terrestrial planets.
Planetary impacts and numerical simulations.

EDUCATION

2022–present | **PhD** – School of Earth Sciences, University of Bristol, U.K.
Thesis: *Atmosphere–ocean loss during giant impacts and the volatile evolution of terrestrial planets*
Supervisors: Dr. Simon J. Lock & Prof. Zoë M. Leinhardt

2018–2022 | **Geology (MSci)** integrated masters, 1st Class (Hons.) – University of Bristol, U.K.
Thesis: *Iron redox cycling as viable metabolic pathways in Enceladus' ocean*
Supervisor: Dr. James Byrne

2013–2018 | **Prior Education** – St Joseph's R.C. High School, Newport, South Wales, U.K.

- x5 A Levels: Mathematics (A), Physics (A), Chemistry (A), Welsh Baccalaureate (A*), Music BTEC (Distinction*)
  - x1 AS Level: Welsh Language (A*)
- x14 GCSEs: x10 A*s and x4 As, including Mathematics (A*), English (A*), and French (A*)

RESEARCH FUNDING

2022–2026 | **Science & Technology Facilities Council (STFC) PhD Studentship**
Role: Graduate student
Amount: £81,631

AWARDS AND HONOURS

2022 | **Hancock Memorial Prize** (£100) – University of Bristol
Awarded for the highest performing MSci student in Earth Sciences.

2022 | **Top Final MSci Student in Geology** – University of Bristol

2022 | **Robert Andrew Scott Memorial Prize** (£50) – University of Bristol
Awarded for overall excellence in Geology fieldwork.

2021 | **Faculty of Science Undergraduate Award** (£100) – University of Bristol
Awarded to the highest performing 3rd year students in the Faculty of Science.

PUBLICATIONS

Lead author

2. **Roche, M.J.**, Lock., S.J., Dou, J., Carter, P.J., Kegerreis, J.A., and Leinhardt, Z.M. (2025). Atmospheric loss during giant impacts: mechanisms and scaling of near- and far-field loss. *Planetary Science Journal*, 6(6):149. doi: 10.3847/PSJ/add929

1. **Roche, M.J.**, Fox-Powell., M.G., Hamp, R.E., and Byrne, J.M. (2023). Iron reduction as a viable metabolic pathway in Enceladus' ocean. *International Journal of Astrobiology*, 1–20. doi: 10.1017/S1473550423000125

Co-author

1. Buckland, H.M., Saxby, J., **Roche, M.**, Meredith, P., Rust, A.C., Cashman, K.V. and Engwell, S.L. (2021). Measuring the size of non-spherical particles and the implications for grain size analysis in volcanology. *Journal of Volcanology & Geothermal Research, 415, 107257.* doi: 10.1016/j.jvolgeores.2021.107257

In prep.

Roche, M.J., Lock, S.J., and Leinhardt, Z.M. Delivery of impactor-hosted atmosphere during giant impacts onto Earth-like bodies.

Roche, M.J., Lock, S.J., and Leinhardt, Z.M. The effect of atmospheric mass on atmospheric loss during giant impacts.

Roche, M.J., Lock, S.J., Dou, J., and Leinhardt, Z.M. Pre-lunar oceans shaped Earth's volatile budget.

Witkowski, C.R., **Roche, M.J.**, Naafs, B.D., and Pancost, R.D. Isotope discrimination during photosynthesis remained constant across the Phanerozoic.

SERVICE

University of Bristol:

2025–present	Organiser and founder of the non-academic careers network.
2024	Co-organiser of 2nd year PhD seminar series.
2023–present	Co-organiser and founder of BESERC (Bristol Earth Sciences Enhancing Research Culture) – a 1-day catered conference that brings together all research groups for a series of talks, posters, and celebration of our department's research. Now a highly-anticipated annual event.
2023–present	Co-organiser of the Geophysics Coffee Break seminar series.
2022–present	Co-organiser of the School of Earth Sciences department band.
2021–2024	Departmental & faculty-level Student-Staff Liaison Committee representative (undergraduate & postgraduate).

PUBLIC ENGAGEMENT & OUTREACH

2025	Assisted in running '*Feel the Impact*' at Bristol Museum, an event designed to make planet formation and impacts more accessible to the visually impaired.

TEACHING EXPERIENCE

University of Bristol (Demonstrator):

2022–present

A range of theory-, computational-, and field-based undergraduate courses including:

- *EASC30053: Global Tectonics & Geodynamics*
- *EASC30051: Geomicrobiology*
- *EASC20053: Geospatial Data Analysis* (`Python`, & `QGIS`)
- *EASC20045: Mapping, Tectonics, & Remote Sensing*
- *EASC20043: Geochemistry 1*
- *EASC20035: Mineralogy & Petrology*
- *EASC10008: Introduction to Field Skills in Earth Sciences* (local day-long excursions and week-long trips to the Isle of Arran, Scotland)
- *EASC10007: Computing for Earth Scientists* (`MATLAB`)
- *EASC10006: Physics for Earth Scientists*
- *EASC10002: Environmental Geoscience (Mineral Resources)*
- *EASC10001: Dynamic Interior I*

RESEARCH INTERNSHIPS

University of Bristol:

2020–2023 — **Organic Geochemistry** – development of algal-derived biomarkers for palaeo-pCO_2 reconstruction with Dr. Caitlyn R. Witkowski. Involved data compilation and calculations, and paper reading/writing.

2021 — **Radiation detection** – simulation of high energy particle interactions with CsI detectors with Dr. Dean T. Connor. Involved writing and running code in `C++`.

2020 — **Nuclear Threat Reduction (NTR)** – study into the scope and scale of the U.K's NTR research capabilities with Dr. Peter G. Martin. Involved carrying out wide-reaching surveys to nuclear-adjacent academics, and data analysis in `R`.

2019 — **Volcanology** – characterisation of ash samples following explosive volcanic eruptions with Dr. Hannah M. Buckland. Involved running particle sorting experiments which resulted in a peer-reviewed publication (Buckland et al., 2021, JVGR).

SKILLS

Programming — Working knowledge of `Python`, `MATLAB`, `UNIX`, `bash`, `git`, and LaTeX. Basic knowledge of `R`, and `C/C++`.

Software — Proficient in graphic design using Adobe Illustrator. Working knowledge of `Arc/QGIS`.

Fieldwork — More than 8 weeks of geological field experience in South West England, South Wales, Snowdonia, the Isle of Arran, and Santorini.

Laboratory — 8+ months experience in experimental geomicrobiology/geochemistry. Proficient in optical/petrographical microscopy. Experience in Raman spectroscopy, SEM, EPMA, and particle analysis with the CAMSIZER X2.

Communication — Presented posters/talks at a number of international conferences (e.g., ESPC–DPS).

Languages — English (fluent), Welsh (intermediate), Spanish/French/Swedish (basic).

CONFERENCE PROCEEDINGS

Oral Presentations:

2025	**Roche, M.J.**, Lock., S.J., Dou, J., Carter, P.J., Kegerreis, J.A., and Leinhardt, Z.M. Atmospheric loss during giant impacts: mechanisms and scaling of near- and far-field loss. *EPSC–DPS*, Helsinki.
	Roche, M.J., Lock., S.J., Dou, J., Carter, P.J., Kegerreis, J.A., and Leinhardt, Z.M. Atmospheric loss during giant impacts and the volatile evolution of terrestrial planets. *Gordon Research Seminar: Origins of Solar Systems*, South Hadley.
	Roche, M.J., Lock., S.J., Dou, J., Carter, P.J., Kegerreis, J.A., and Leinhardt, Z.M. Atmospheric loss during giant impacts: mechanisms and scaling of near- and far-field loss. *Smashing It Workshop*, Leeds.
2024	**Roche, M.J.**, Lock., S.J., Dou, J., Carter, P.J., Kegerreis, J.A., and Leinhardt, Z.M. Atmospheric loss during giant impacts. *Earth & Planets Origin & Evolution Workshop*, Paris.
2023	Lock, S.J., Stewart, S.T., and **Roche, M.J.** Atmospheric loss in giant impacts depends on pre-impact surface conditions. *Goldschmidt Conference*, Lyon.
	Lock, S.J., Stewart, S.T., and **Roche, M.J.** Origin of volatiles on terrestrial planets: Will they stay or will they go? *Gordon Research Conference: Origins of Solar Systems*, South Hadley.

Poster Presentations:

2025	**Roche, M.J.**, Lock., S.J., Dou, J., Carter, P.J., Kegerreis, J.A., and Leinhardt, Z.M. Atmosphere–ocean loss during giant impacts and the volatile evolution of terrestrial planets. *Gordon Research Conference/Seminar: Origins of Solar Systems*, South Hadley.
2024	**Roche, M.J.**, Lock., S.J., Dou, J., and Leinhardt, Z.M. Quantifying the effect of atmospheric properties on atmospheric loss during planetary collisions using 3D impact simulations. *Rocky Worlds III*, Zürich.
2023	Lock, S.J., **Roche, M.J.**, Dou, J., Stewart, S.T., and Leinhardt, Z.M. The effect of pre-impact surface conditions on the efficiency of atmospheric loss in giant impacts. *American Geophysical Union (AGU) Fall Meeting*, San Francisco.
	Roche, M.J., Lock., S.J., Dou, J., and Leinhardt, Z.M. The effect of atmospheric properties on atmospheric loss during giant impacts. *Gordon Research Conference/Seminar: Origins of Solar Systems*, South Hadley.

PERSONAL INTERESTS

Music	Pianist (Grade 8+) and guitarist. Percussionist with the world's number one ranked brass band (The Cory Band). University of Bristol brass band conductor (2019–2020) and music society secretary (2020–21).
Other	Hiking, cooking/baking, and travel. Working towards achieving my Private Pilot's License.

REFERENCES

Dr. Simon Lock – Primary PhD supervisor (s.lock@bristol.ac.uk)
School of Earth Sciences, University of Bristol, Bristol, U.K., BS8 1RJ

Prof. Zoë Leinhardt – Secondary PhD supervisor (zoe.leinhardt@bristol.ac.uk)
School of Physics, University of Bristol, Bristol, U.K., BS8 1TL

Prof. Alison Rust – Head of School and undergraduate tutor (alison.rust@bristol.ac.uk)
School of Earth Sciences, University of Bristol, Bristol, U.K., BS8 1RJ

Prof. Nick Teanby – Director of Postgraduate Studies in Earth Sciences (n.teanby@bristol.ac.uk)
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