OLIVER SHORTTLE

Institute of Astronomy & Department of Earth Sciences
University of Cambridge, UK
shorttle@ast.cam.ac.uk | www.shorttle.com

Primary area of research: The formation and evolution of habitable planets.
Sub-fields: Planet formation | Mantle structure and composition | Planetary atmospheres | Origin of Life | Igneous and sedimentary geochemistry and petrology | Volcanology | Terrestrial remote sensing | Geoinformatics and data science.

POSITIONS

2021 Deputy Director of Education, School of Physical Sciences, U. Cambridge
2019 Trustee and member Council, Clare College
2018 Fellow and Director of Studies in Earth Sciences, Clare College
2017 Assistant Professor, IoA & Department of Earth Sciences, University of Cambridge, UK
2015 – 2016 Geology Option Postdoctoral Fellow, GPS, Caltech, USA
2013 – 2018 Title A Fellow (Junior Research Fellow), Trinity College, University of Cambridge, UK
2013 – 2015 Adjunct Associate Researcher, ISEI, University of Okayama, Japan
2013 – 2013 Japanese Society for the Promotion of Science post-doctoral fellow, Japan

ACADEMIC RECORD

2009–2013 Ph.D. in Earth Sciences, University of Cambridge, awarded without correction
2008–2009 MSci (1st class) Natural Sciences (Geology), University of Cambridge
2005–2008 Ba (Hons, 1st class) Natural Sciences (Geology), University of Cambridge

SELECTED AWARDS AND PRIZES

2015 Senior Pedan Fellow, Rice University
2014 President's Award, The Geological Society.
2013 Furusato Award, Japanese Society for the Promotion of Science

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ACADEMIC SERVICE

- Lead guest editor for Elements magazine special issue Geoscience beyond the solar system.
- Steering committee member of the Cambridge Initiative for Planetary Science and Life in the Universe.
- Co-founder and board member of the UK-wide Earth Sciences series Earth2Earth.
- Co-Organizer of the 2021 Lorentz Centre meeting The Volatile Content of Planets that Form Early: Under Budget and Ahead of Schedule.
- Member of the Sedimentary Geochemistry and Paleoenvironments project (Stanford).
- Member of the Ariel mission interiors and astrobiology working groups.
- Co-founder and organiser of the Rocky Worlds meeting (Cambridge 2020, Oxford 2022).
- Geological Society Year of Space organiser.
- Journal reviewer for: Nature Geosciences; Science Advances; Geochemistry Perspective Letters; Geology; Earth and Planetary Science Letters; Geochemica et Cosmochimica Acta, Geochemistry Geophysics and Geosystems; Journal of Petrology.
- Grant reviewer for: NSF, NERC, STFC, Royal Society.

FUNDING OR FUNDING IN KIND – AS PI/CO-I

2022 Leverhulme Centre £10,000,000 (FEC). Co-Author of University bid, Initiative for Planetary Science and Life in the Universe.
2021 NERC Standard grant NE/V011383/1: £608,049 (FEC). Principal Investigator: Unlocking the C and N budget of the Earth.
2021 NERC Standard grant NE/V000411/1: £759,702 (FEC). Co-Investigator: Finding the missing evidence for Earth's magma ocean: a novel stable isotope approach.

2020 NERC Large Grant NE/T012633/1: £3,684,159 (FEC). Co-Investigator: Mantle Circulation Constrained (MC2): A multidisciplinary 4D Earth framework for understanding mantle upwellings.
2020 NERC Standard Grant NE/T00696X/1: £681,644 (FEC). Co-Investigator: Searching for direct evidence of the consequences of land plant evolution on silicate weathering and continental sediment retention
2020 Isaac Newton Trust: £30465 (FEC). Principal Investigator. The meteorite record of early Earth bombardment and solar system dynamics.
2016 STFC Diamond Light Source facility: £80,000 (FEC). Principal Investigator: The redox budget of the Iceland mantle plume: a multi-proxy approach
2015 STFC Diamond Light Source facility: £95,940 (FEC). Principal Investigator: Probing the length scales of redox heterogeneity in ancient mantle domains
2015 STFC Diamond Light Source facility: £9,594 (FEC). Principal Investigator: The effect of beam damage on ferric iron determinations by XANES
2014–15 NERC ion microprobe facility: £22,500 (FEC). Principal Investigator: Resolving the origin of volatiles in the Icelandic mantle using boron isotopes
2013 STFC Diamond Light Source facility: £76,752 (FEC). 12 shifts (4 days). Principal Investigator: Are enriched mantle domains more reducing? Testing geochemical-redox relationships in the mantle using Mid-Atlantic Ridge basalts
2013 NERC ion microprobe facility: £7,500 (FEC). Principal Investigator: Understanding the role of degassing in setting the redox state of mid-ocean ridge basalts

– AS PROJECT PARTNER

2016 'Mantle volatiles: processes, reservoirs and fluxes' [NE/M000427/1]. PI Ballentine, Oxford.
2016 'How did primordial and recycled geochemical signatures come to coexist in the Earth's deep mantle?' [NE/P002331/1]. PI Hartley, Manchester.
2016 'Oxygen fugacity structure of mantle plumes: Reconciling elemental, isotopic and Fe redox proxies' [NE/N009568/1]. PI Maclennan, Cambridge.

INVITED TALKS

2022 CLEVER Planets colloquium, Rice
2021 Year of Space invited lecturer
2019 University of Oxford, Atmospheric, Ocean and Planetary Physics, Seminar
2019 University of Zurich, Department of Physics, Department Seminar
2019 Imperial College, Department of Earth Sciences, Department Seminar
2019 TESS-Kavli exoplanet futures planel member 2019 UKEXOM, keynote speaker
2018 Lancaster University, Department of Earth Sciences, Department Seminar 2015 Rice University, Fall 2015 Earth Sciences seminar series
2014 University of Edinburgh, Petrology Series
2013 ENS Lyon
2012 Caltech, Geological and Planetary Sciences Division
2012 University of Oxford, Department of Earth Sciences

UNDERGRADUATE SUPERVISION & TEACHING

New courses created:

- Designed the Earth Science STEM Start module;
- Earth Sciences courses designed on '*Geology Beyond the Solar System*' (First year, Natural Sciences, 3–4 lectures);
- *Scientific computing in python* (Third year, Earth Sciences, 8 python notebooks)
- '*Planetary chemistry and evolution*' (Fourth year, Earth Sciences, collaboratively with Helen Williams, 8 seminar-led discussions).
- '*Planet Formation and Evolution*' (Third year, Astrophysics, 12 lecture course).

Supervising:

- 1A Earth Sciences – whole course.
- ESA – Physical and chemical oceanography.

- Part II Astrophysics – Topics in Astrophysics.

Examining:

2020–21, Senior Examiner, Part II Astrophysics.
2018–19, Part II Astrophysics
2017–18, Part III Earth Sciences.

ADMISSIONS

2018–present, undergraduate admissions interviewer (Physical Sciences), Clare College.
2019 & 2020, MASt admissions interviewer at the Institute of Astronomy.
2019-2022, PhD admissions for C-CLEAR DTP. Chair of Solid Earth panel 2020-21.

- DTP EDI committee member.
- Authored white paper 'Achieving Diversity in Postgraduate Admissions'.

POSTGRADUATE SUPERVISION

Current primary supervisor [7 students]:

- 1 Industry funded CDT student - IoA
- 3 STFC funded students - IoA
- 1 Cambridge Trusts student - DoES
- 1 NERC DTP student - DoES
- 1 Jesus College Embiricos student - DoES

Current co-supervisor [4]:

- 1 NERC DTP student - DoES
- 1 Royal Society funded student - IoA
- 2 external students (Imperial College; U. Manchester)

Completed students [3]:

- 1–continued in academia; 1–postgraduate medicine; 1–science communication

POSTGRADUATE MASTERS SUPERVISION

- Supervised research projects for 7 Masters students across Earth Sciences and the Institute of Astronomy.
- 1 student received the prize for the best project in year
- 6 obtained first class project marks, and 1 obtained an upper second class.
- 6 students have continued onto PhD's.

OUTREACH ACTIVITIES

- 4 years of involvement in running a CAO Master Class on 'Geology Beyond the Solar System'
- 1 year participating in the Cambridge Physical Sciences Taster Day
- Science on Tap participant.

COMMITTEE MEMBERSHIP

- Faculty Board of Earth Sciences and Geography.
- Teaching Committee, Institute of Astronomy.
- Strategy Committee, Department of Earth Sciences.
- C-CLEAR DTP theme panel member.
- C-CLEAR DTP EDI committee member.
- Sedgwick Museum steering committee.

PUBLISHED & ACCEPTED ARTICLES

[papers 53; 1130 citations; H-index 20; i-10 index 29]
* = student paper

* Guimond, C., Rudge, R. & **Shorttle, O.** (2022). Blue marble, stagnant lid: Could dynamic topography avert a water world? *Planetary Science Journal*
arXiv.2201.05636

Bains, W., **Shorttle, O.**, et al. (2022). Constraints on the production of phosphine by Venusian volcanoes. *Universe*
10.0.13.62/universe8010054

Bains, W., **Shorttle, O.**, et al. (2022). Only extraordinary volcanism can explain the presence of ppb phosphine on Venus. *PNAS*
http://doi.org/10.1073/pnas.2121702119

* Walton, C., **Shorttle, O.** et al. (2022). Ancient and recent collisions revealed by phosphate minerals in the Chelyabinsk meteorite. *Nature Communications Earth and Environment*
10.1038/s43247-022-00373-1

* Soderman, C., Matthews, S., **Shorttle, O.** & Williams, H. (2022). Global trends in novel stable isotopes in basalts: theory and observations. *Geochimica et Cosmochimica Acta*
10.31223/X5S042

* Buchan, A., Bonsor, A., **Shorttle, O.** et al. (2022). Planets or asteroids? A geochemical method to constrain the masses of white dwarf pollutants. *Monthly Notices of the Royal Astronomical Society*
10.1093/mnras/stab3624

* Walton, C. & **Shorttle, O.** (2021). Scum of the Earth: could life have emerged from near-surface multi-compartmentalised environments? *Life*
10.1130/G49037.1

* Walton, C., **Shorttle, O.**, Jenner, F., Williams, H., Golden, J., Morrison, S., Downs, R., Zerkle, A., Hazen, R. and Pasek, M. (2021). Phosphorus mineral evolution and prebiotic chemistry: from minerals to microbes. *Earth Science Reviews*
10.1016/j.earscirev.2021.103806

Shorttle, O., Hinkel, N., and Unterborn, C. (2021). Why Geosciences and Exoplanetary Sciences Need Each Other. *Elements*
Elements Magazine

* Jordan, S., Rimmer, P., **Shorttle, O.**, and Constantinou, T. (2021). Photochemistry of Venus-like planets orbiting K- and M-Dwarf stars. *The Astrophysical Journal*
10.3847/1538-4357/ac1d46

Peters, S.E., Walton, C.R., Husson, J.M., Quinn, D.P., **Shorttle, O.**, Keller, C.B., Gaines, R.R. (2021). Igneous rock area and age in continental crust. *Geology*
10.1130/G49037.1

* Hobbs, R., Rimmer, P., **Shorttle, O.** and Nikku Madhusudhan (2021). Sulfur Chemistry in the Atmospheres of Warm and Hot Jupiters. *Monthly Notices of the Royal Astronomical Society*
10.1093/mnras/stab1839

The SGP Team. The Sedimentary Geochemistry and Paleoenvironments Project. *Geobiology*
10.1111/gbi.12462

Rimmer, P., Jordan, S., Constantinou, T., Woitke, P., **Shorttle, O.**, Hobbs, R., and Paschodimas, A. (2021). Hydroxide salts in the clouds of Venus: their effect on the sulfur cycle and cloud droplet pH. *Planetary Science Journal*

Helled, R., . . . **Shorttle, O.** et al. (2021). Ariel planetary interiors white paper. *Experimental Astronomy*
10.1007/s10686-021-09739-3

Williams, H., Matthews, M., Rizo, H., **Shorttle, O.** (2021), Fe isotopes trace primordial magma ocean cumulates melting in Earth's upper mantle. *Science Advances*
10.0.4.102/sciadv.abc7394

Mutch, E., Maclennan, J., **Shorttle, O.**, et al. (2021). DFENS: Diffusion chronometry using Finite Elements and Nested Sampling. *Geochemistry, Geophysics, Geosystems*
10.1029/2020GC009303

* Walton, C.R., Baziotis, I., Cernok, A., **Shorttle, O.**, et al. (2021), Formation and deformation of phosphorous-olivine-assemblages in the Chelyabink chondrite. *Meteoritics and Planetary Science*
10.1111/maps.13648

Bonsor, A., Jofré P., **Shorttle, O.**, et al. (2021), Host-star and exoplanet compositions: a pilot study using a wide binary with a polluted white dwarf. *Monthly Notices of the Royal Astronomical Society*
10.1093/mnras/stab370

* Matthews, S., Wong, K., **Shorttle, O.**, Edmonds, M., and Maclennan, J. (2021) Do olivine crystallisation temperatures faithfully record mantle temperature variability? *Geochemistry Geophysics*

Geosystems
10.1029/2020GC009157

* Lipp, A., **Shorttle, O.**, Sperling, E. & the SGP consortium, (2021), The composition and weathering of the continents over geologic time. *Geochemical Perspective Letters*
10.7185/geochemlet.2109

* Harrison, J., **Shorttle, O.** et al. (2021), Evidence for post-nebula volatilisation in an exo-planetary body. *Earth and Planetary Science Letters*
10.1016/j.epsl.2020.116694

Hartley, M., de Hoog, C-J., **Shorttle, O.** (2021), Boron isotopic signatures of melt inclusions from North Iceland reveal recycled material in the Icelandic mantle source. *Geochimica et Cosmochimica Acata*
10.1016/j.gca.2020.11.013

* Soderman, C., Matthews, S., **Shorttle, O.** et al., (2021) Heavy δ57Fe in ocean island basalts: A non-unique signature of processes and source lithologies in the mantle. *Geochimca et Cosmochimica Acta*
10.1016/j.gca.2020.09.033

* Matthews, S., **Shorttle, O.**, et al. (2021), The global melt inclusion C/Ba array: mantle variability, melting process, or degassing? *Geochimica et Cosmochimica Acta*
10.1016/j.gca.2020.09.030

* Liggins, O., **Shorttle, O.** and Paul B Rimmer, (2020), Can volcanism build hydrogen-rich early atmospheres? *Earth and Planetary Science Letters*
10.1016/j.epsl.2020.116546

* Lipp, A., Shorttle, O. et al. (2020), Major-element Composition of Sediments in Terms of Weathering and Provenance: Implications for Crustal Recycling. *Geochemistry Geophysics Geosystems*
10.1029/2019GC008758

Stolper, E., Shorttle O et al. (2020), The effects of solid-solid phase equilibria on the oxygen fugacity of the upper mantle. *American Mineralogist*
10.2138/am-2020-7162

* Novella, D., Maclennan, J., **Shorttle, O.** et al. (2020), A multi-proxy investigation of mantle oxygen fugacity along the Reykjanes Ridge. *Earth and Planetary Science Letters*
10.1016/j.epsl.2019.115973

* Lipp, A., **Shorttle, O.** et al. (2020), Major-element composition of sediments in terms of weathering and provenance: Implications for crustal recycling. *Geochemistry Geophysics Geosystems*
10.1029/2019GC008758

Kama, M., **Shorttle, O.**, et al. (2019), Abundant refractory sulfur in protoplanetary disks. *The Astrophysical Journal*.
10.3847/1538-4357/ab45f8

* Miller, W., Maclennan, J., **Shorttle, O.**, et al. (2019), Estimating the carbon content of the deep mantle with Icelandic melt inclusions. *Earth and Planetary Science Letters*.
10.1016/j.epsl.2019.07.002

Mutch, E., Maclennan, J., **Shorttle, O.** et al. (2019), Rapid trans-crustal magma movement under Iceland. *Nature Geosciences*.
10.1038/s41561-019-0376-9

Neave, D.A., Namur, O., **Shorttle, O.**, & Holtz, F. (2019), Magmatic evolution biases basaltic records of mantle chemistry towards melts from recycled sources. *Earth and Planetary Science Letters*
j.epsl.2019.06.003

* Hobbs, R., **Shorttle** et al. (2019), A chemical kinetics code for modelling atmospheric chemistry on exoplanets. *Monthly Notices of the Royal Astronomical Society*.
10.1093/mnras/stz1333

Rimmer, P., **Shorttle, O.** & Rugheimer, S. (2019), Oxidised Micrometeorites as Evidence for Low Atmospheric Pressure on the Early Earth. *Geochemical Perspective Letters*
10.7185/geochemlet.1903

Rimmer, P. & **Shorttle, O.** (2019), The Origin of Life's Building Blocks in Carbon- and Nitrogen-Rich

Surface Hydrothermal Vents. *Life*
10.3390/life9010012

Neave, D.A., **Shorttle, O.**, Oeser, M., Weyer, S. & Kobayashi, K. (2018), Mantle-derived trace element variability in olivines and their melt inclusions. *Earth and Planetary Science Letters*
10.1016/j.epsl.2017.12.014

Kral, Q., Wyatt, M.C., Triaud, A., Marino, S., Thebault, P. & **Shorttle, O.** (2018). Cometary impactors on the TRAPPIST-1 planets can destroy all planetary atmospheres and rebuild secondary atmospheres on planets f, g, and h. *Monthly Notices of the Royal Astronomical Society*
10.1093/mnras/sty1677

Tong, B., Katz, R.F., **Shorttle, O.** & Rudge, J.F. (2018), The melting column as a filter of mantle trace-element heterogeneity. *Geochemistry, Geophysics, Geosystems*
10.1029/2018GC007880

* Matthews, S., **Shorttle, O.**, Rudge, J.F. & Maclennan, J. (2017), Constraining mantle carbon: CO_2-trace element systematics in basalts and the roles of magma mixing and degassing. *Earth and Planetary Science Letters*
10.1016/j.epsl.2017.09.047

Hartley, M., **Shorttle, O.**, Maclennan, J., Moussallam, Y. & Edmonds, M. (2017), Olivine-hosted melt inclusions as an archive of redox heterogeneity in magmatic systems. *Earth and Planetary Science Letters*
10.1016/j.epsl.2017.09.029

Lee, C., Caves, J., Jiang, H., Cao, W., Lenardic, A., McKenzie, N.R. (2017), **Shorttle, O.**, Yin Q., Dyer B., Deep mantle roots and continental emergence: implications for whole-Earth elemental cycling, long-term climate, and the Cambrian explosion. *International Geology Review*
10.1080/00206814.2017.1340853

Jennings, E.S., Holland, T.J.B., **Shorttle, O.**, Maclennan, J. & Gibson, S.A. (2016), The composition of melts from a heterogeneous mantle and the origin of ferropicrite: application of a thermodynamic model. *Journal of Petrology*
10.1093/petrology/egw065

* Matthews, S., **Shorttle, O.** & Maclennan, J. (2016), The temperature of the Icelandic mantle from olivine-spinel aluminium exchange thermometry. *Geochemistry Geophysics Geosystems*
10.1002/2016GC006497

Shorttle, O., Rudge, J.F., Maclennan, J. & Rubin, K.H. (2016), A statistical description of concurrent mixing and crystallisation during MORB differentiation: Implications for trace element enrichment. *Journal of Petrology*
10.1093/petrology/egw056

Shorttle, O. (2015), Geochemical variability in MORB controlled by concurrent mixing and crystallisation. *Earth and Planetary Science Letters*
10.1016/j.epsl.2015.04.035

Shorttle, O., Moussallam, Y., Hartley, M.E., Maclennan, J., Edmonds, M. & Murton, B.J. (2015), Fe-XANES analyses of Reykjanes Ridge basalts: implications for oceanic crust's role in the solid-Earth oxygen cycle. *Earth and Planetary Science Letters*
10.1016/j.epsl.2015.07.017

Shorttle, O., Maclennan, J. & Lambart, S. (2014), Quantifying lithological variability in the mantle. *Earth and Planetary Science Letters*
10.1016/j.epsl.2014.03.040

Shorttle, O., et al. (2013), Geochemical provincialism in the Iceland plume. *Geochimica et Cosmochimica Acta*
10.1016/j.gca.2013.08.032

Shorttle, O. & Maclennan, J. (2011), Compositional trends of Icelandic basalts: Implications for short-length scale lithological heterogeneity in mantle plumes. *Geochemistry, Geophysics and Geosystems*
10.1029/2011GC003748

Shorttle, O. et al. (2010), Control of the symmetry of plume-ridge interaction by spreading ridge

geometry. *Geochemistry, Geophysics and Geosystems* 10.1029/2009GC002986

Tripati, A., Eagle, R., Morton, A., Dowdeswell, J., Atkinson, K., Bahe, Y., Dawber, C., Khadun, E., Shaw, R., **Shorttle, O.**, Thanabalasundaram, L., (2008), Evidence for Northern Hemisphere glaciation back to 44 Ma from ice-rafted debris in the Greenland Sea. *Earth and Planetary Science Letters* 10.1016/j.epsl.2007.09.045

PREPRINT ARTICLES

* Hobbs, R., **Shorttle, O.** & Madhusudhan, N. Molecular tracers of planet formation in the atmospheres of hot Jupiters. *In revision at Monthly Notices of the Royal Astronomical Society* | arXiv
* Walton, C., Rimmer, P., Williams, H. & **Shorttle, O.**. Prebiotic chemistry in the wild: how geology interferes with the origin of life. *In revision at Astrobiology* | arXiv
* Liggins, P., Jordan, S., Rimmer, P. & **Shorttle, O.**. Growth and evolution of secondary volcanic atmospheres: I. Identifying the geological character of warm rocky exoplanets. *In revision at JGR Planets* | arXiv
* Roberts, C.,**Shorttle, O.** et al. Enhanced monitoring of atmospheric methane from space with hierarchical Bayesian inference. *In revision at Environmental Research Letters* | arXiv