Abigail Plimmer

PhD Researcher in Mantle Geodynamics

abiplimmer.github.io | Abigail Plimmer | plimmerar@cardiff.ac.uk | abigailplimmer

Summary

I am a PhD researcher at Cardiff University, funded by the NERC GW4+ Doctoral Training Partnership (DTP). My research focusses on the evolution of the Earth's interior, using numerical modelling to investigate the interactions between mantle geodynamics and tectonic processes, and how these relationships shift throughout the supercontinent cycle. I am especially interested in how slabs and plumes connect the shallow and deep Earth, driving the dynamics of the mantle circulation system. In my work, I primarily use and develop the 3D mantle convection code TERRA to simulate Earth's long-term evolution, with a focus on the most recent supercontinent cycle.

Research Interests:

- Supercontinent cycles
- Mantle circulation
- Slab dynamics
- Plate tectonics
- LLSVP stability
- Plume origins & evolution
- Lithosphere & mantle coupling
- Earth's tectonic evolution
- Evolution of planetary interiors

Education and Academic Experience

Cardiff University **September 2021 - Present:** *PhD*
Thesis: "Constraining the relationship between mantle convection and supercontinent cycles".
Supervisors: Prof Huw Davies, Prof James Wookey, and Dr James Panton

- Coupling between plate tectonics and deep Earth dynamics
- Slab and plume dynamics
- Programming in Python & Fortran (modelling using TERRA code)

University of Leeds **September 2020 - September 2021:** *MSc*
Structural Geology with Geophysics (Awarded: Distinction)
Dissertation: Assessing the role of extension velocity and magmatic additions as controls on magmatic budget during rifting and rifted margin formation.
Supervisors: Dr Mohamed Gouiza, Dr Tim Craig

- 2D numerical modelling using ASPECT code
- Lithosphere & upper mantle dynamics
- Evolution of rift systems

University of Liverpool **September 2017 - September 2020:** *BSc(Hons.)*
Geology and Physical Geography (Awarded: 1st Class)
Dissertation: 'Geological History of the Camaret-Sur-Mer Region of the Crozon Peninsula
Supervisors: Dr Paul Wallace, Prof Peter Burgess

Publications

ARTICLES

Plimmer, A., Davies, J. H., & Panton, J. (2024). Investigating the effect of lithosphere thickness and viscosity on mantle dynamics throughout the supercontinent cycle. Geochemistry, Geophysics, Geosystems, 25, e2024GC011688. https://doi.org/10.1029/2024GC011688

SUBMITTED

Davies, J.H., Panton, J., Anderson, M., Beguelin, P., Biggin, A., Davies, C., Elliot, T., Engbers, Y.A., Fernandes, V. M., Ferreira, A. M. G., Fowler, S., Ghelichkhan, S., Koelemeijer, P., Latallerie, F., Li, W., Morgan, G., Mason, S. J., Myhill, R., Nowacki, A., Récalde, N., O'Malley, C. O., **Plimmer, A.**, Porcelli, D., Roberts, G. R., Rodney, J., Shea J., Shorttle O., Sturgeon, W., Walker, A. M., Ward, J., Wookey, J. M. (2024). How to assess similarities and differences between mantle circulation models and Earth using disparate independent observations. *Submitted to Royal Society Proceedings.*

IN PREPARATION

Plimmer, A., Davies, J.H. (2024). Exploring the coupling between LLSVP stability and plate tectonics across the supercontinent cycle. *In preparation for Earth and Planetary Science Letters.*

Plimmer, A., Davies, J.H.(2025). Towards better understanding of slab dynamics through the mantle by predicting slab sinking velocities in 3D mantle circulation models. *In preparation for AGU Solid Earth.*

Davies, J.H., Panton, J., Anderson, M., Beguelin, P., Biggin, A., Davies, C., Elliot, T., Engbers, Y.A., Fernandes, V. M., Ferreira, A. M. G., Fowler, S., Ghelichkhan, S., Koelemeijer, P., Latallerie, F., Li, W., Morgan, G., Mason, S. J., Myhill, R., Nowacki, A., Récalde, N., O'Malley, C. O., **Plimmer, A.**, Porcelli, D., Roberts, G. R., Rodney, J., Shea J., Shorttle O., Sturgeon, W., Walker, A. M., Ward, J., Wookey, J. M. (2025). Application of using disparate independent observations to constrain mantle circulation models. *In preparation for Royal Society Proceedings*

CONFERENCE PROCEEDINGS

Plimmer, A., Davies, H., and Panton, J.: Investigating the role of plate tectonics on the stability and plume generating capacity of deep mantle structures., AGU Fall Meeting 2024, Washington DC, USA, 9-13 Dec 2024.

Plimmer, A., Davies, H., and Panton, J.: Slab dynamics in the mantle: a back-to-basics approach, EGU General Assembly 2024, Vienna, Austria, 14-19 Apr 2024, EGU24-6247, https://doi.org/10.5194/egusphere-egu24-6247, 2024.

Conferences & Presentations

AGU Fall Meeting 2024 **12.2024:**
Investigating the role of plate tectonics on the stability and plume generating capacity of deep mantle structures [poster].

Ada Lovelace Workshop on Modelling Mantle and Lithosphere Dynamics **09.2024:**
The effect of lithosphere structure on mantle dynamics through the supercontinent cycle [poster].

NERC GW4+: Earth Science & Hazards **06.2024:**
Mantle structures beneath an evolving supercontinent [poster & talk].

EGU General Assembly **04.2024:**
Slab dynamics in the mantle: a back-to-basics approach [poster].

UK-SEDI **01.2024:**
Mantle upwellings and supercontinent breakup in response to lithosphere heterogeneity [talk].

Cardiff EARTH Seminar **11.2023:**
Assessing the role of lithosphere heterogeneity on mantle circulation models [talk].

BGA PGRiP (Postgraduate Research in Progress **09.2023:**
The role of oceanic, continental, and cratonic lithosphere on mantle circulation [poster].

BGA PGRiP **09.2022:**
Sensitivity of slab sinking times to mantle viscosity and slab buoyancy. [poster].

Ada Lovelace Workshop on Modelling Mantle and Lithosphere Dynamics **08.2022:**
Sensitivity of slab sinking times to mantle viscosity and slab buoyancy. [poster].

Selected Training & Workshops

ASPECT workshop **2024:**
Ada Lovelace Workshop on Modelling Mantle and Lithosphere Dynamics

Cardiff University Education Associate Fellow Progamme **2023/24:**
Cardiff Learning & Teaching Academy

Project Management for Researchers **2023:**
Cardiff Doctoral Academy

Advanced Infographics Training **2023:**
NERC GW4+ DTP, Infohackit

Academic Immersive Writing Course **2022:**
NERC GW4+ DTP

Mantle Modelling Workshop **2022:**
Ada Lovelace Workshop on Modelling Mantle and Lithosphere Dynamics

Awards & Grants

Ada Lovelace Workshop Poster Prize Winner **09.2024:**
Awarded for poster presentation at EGU Geodynamics Division: Ada Lovelace Workshop on Modelling Mantle & Lithosphere Processes.

BGA PGRiP Poster Prize Winner **09.2023:**
Awarded for poster presentation at BGA Postgraduate Research in Progress (PGRiP) conference.

Schlumberger Oilfield UK Plc Prize for best taught performance **10.2021:**
Awarded to the student in the final year of a programme of study leading to the degree of MSc Structural Geology with Geophysics who achieves the highest overall grade point average in the taught modules for the programme.

NERC GW4+ Doctoral Training Partnership PhD Studentship **09.2021:**
Fully funded PhD studentship at Cardiff University.

£9000 Marsden Alumnus Award **09.2021:**
Scholarship to facilitate Masters studies at University of Leeds.

£7000 Leeds Masters Scholarship **09.2021:**
Scholarship to facilitate students from under-represented groups to study a Masters qualification at University of Leeds.

Liverpool Geological Society Overall Excellence Prize for BSc Geology and Physical Geography **09.2020:**
Awarded to the student in the third year who attains the highest grade point average for the programme Geology and Physical Geography.

Mineralogical Society of Great Britain & Ireland Student Award **07.2019:**
Awarded to second-year student with the highest ranking marks in mineralogy and petrology.

Teaching

Throughout my time at Cardiff University I have facilitated teaching on a range of undergraduate modules. I am committed to creating an inclusive and supportive learning environment which encourages students to become independent learners, and have explored this through my the AdvanceHE-accredited Education Associate Fellow Programme (Cardiff University, 2024).

- **GIS, Maps, and Analytical Skills**
- **Earth Science Fieldwork**
- **Structural Geology and Geophysical Investigation**
- **Geological Fieldwork, Data Analysis, and Professional Skills**

Key Responsibilities:

- Teaching and Pastoral Support
- Technical and Logistics Support
- Assessment and Feedback
- Field First Aid

Outreach & Extra-curriculars

- French - B1
- A-Level Geodynamics Masterclass at local 6th Form College through the Brilliant Club (2022)
- Member of Athena SWAN EDI subgroup (2021-present)
- Member of URGE podlet (Unlearning Racism in Geosciences; 2021-present)
- Postgraduate EDI Representative (2021-Present)
- Delivered Scholars Programme Environmental Science course to local secondary school through the Brilliant Club (2021-2022)
- MSc Course Representative (2020-2021)
- Liverpool Women in Geoscience Earth Day Event (2020)
- Liverpool Women in Geoscience International Women's Day Seminar (2020)
- Created & led Liverpool Women in Geoscience (2019-2020)
- Herdman Geological Society Vice President

References

Additional references available upon request.