

Curriculum Vitae

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My research science interests lie in a multidisciplinary approach – combining observations from seismology with mineral physics and geodynamics - to further our understanding of the deep Earth; resolve the structure, composition and dynamics at depth and their links to surface processes and the history of our planet. My approach is both data-driven, hunting for clues constraining the deep Earth; and forward-modelling, predicting the possibilities and limitations of seismic data based on recent results in mineral physics and geodynamics.

Current Positions

2015- University Lecturer in Department of Earth Sciences at University of Cambridge, UK

2015- Fellow of Pembroke College, UK

Previous Positions

2013- 2015 Research Fellow at Pembroke College, and

Research Associate at University of Cambridge, UK

2013 Postdoctoral Position at University of California, Berkeley, USA

Education

2008-2013 Ph.D. at University of California, Berkeley, USA, May 2013

Thesis title: Heterogeneity and flow in the deep Earth

Advisor: Prof. Barbara Romanowicz

2006-2008 M.Sc. Geophysics at University Utrecht, Netherlands (*cum laude*)

2003-2006 B.Sc. Geosciences at University Utrecht, Netherlands (*with distinction*), minor in Physics

Awards/Fellowships/Honours

2020- Fellow of the Young Academy of Europe

2019 Bullerwell Lecturer given to an outstanding early career British geophysicist by the British Geophysical Association

2015 Keiiti Aki Young Scientist Award from the American Geophysical Union Awarded yearly to one scientist within three years of PhD in the field of seismology.

2013-2015 Drapers' Company Research Fellowship from Pembroke College. Three years of full support. Sole recipient, selected from 300+ candidates from all science disciplines.

2009-2010 Tocher Fellowship from the Berkeley Seismological Laboratory. One year of support and research fund awarded to a student in recognition of academic excellence and potential.

Grant Funding

2019-2024 European Research Council (ERC) Starting Grant under the European Union's Horizon 2020 research and innovation programme (grant agreement No. 804071 -ZoomDeep) (£1,245,000)

2018-2021 Natural Environment Research Council Standard Grant (£321,000)

2018-2019 Isaac Newton Trust grant (£49,000)

Publications in prep.

Li^b, Z., Leng, K., and Cottaar, S., **2020**, Mapping of the internal structure of the ultra-low velocity zone at the base of the Hawaiian plume

Cottaar, S., and Z. Li^b, **2020**, Imaging of the potentially primordial root to the Galapagos mantle plume

Pugh^b, S., and Cottaar, S., **2020**, Global observations of the X-discontinuity beneath hotspots

Boyce^a, A., Bastow, I.D., Cottaar, S., Caunt, E., Guilloud De Courbeville, J., Desai, S., Kounoudis, R., **2020**, Insights into multiple mantle upwellings and cratonic modification beneath Africa from absolute arrival-time P-wave tomography

Boyce^a, A., and Cottaar, S., **2020**, The Variable Seismic Signatures of Upwellings in the Transition Zone and Mid-mantle beneath Africa

Dannberg, J., Myhill, R., Gassmoeller, R., and Cottaar, S., **2020**, The morphology, evolution and seismic visibility of partial melt at the core-mantle boundary: Implications for ULVZs

Irving, J., Cottaar, S., and Lekic, V., **2020**, A thin E' layer atop the outer core revealed by normal mode center frequencies

Publications

(supervised ^apostdoctoral researcher, ^bgraduate student ^cundergraduate student)

20. Bonatto^a, L., Piromallo, C., Cottaar, S., **2020**, The transition zone beneath West Argentina-Central Chile using P-to-s converted waves, *Tectonophysics, in revision*
19. Citron^b, R., Lourenco^a, D., Wilson^b, A., Grima^b, A., Wipperfurth^b, S., Rudolph, M., Cottaar, S., Montesi, L., **2020**, Effects of heat-producing elements on the stability of deep mantle thermochemical piles, *Geochem. Geophys., Geosyst., accepted for publication*
18. Nowacki, A., and Cottaar, S., **2020**, Towards imaging flow at the base of the mantle with seismic, mineral physics and geodynamics constraints, *AGU Monograph Series, accepted for publication*
17. Kemp^c, M., Jenkins^a, J., Maclennan, J. and Cottaar, S., **2019**. X-discontinuity and transition zone structure beneath Hawaii suggests a heterogeneous plume. *Earth and Planetary Science Letters*, 527, p.115781.
16. Van Stiphout^c, A.M., Cottaar, S. and Deuss, A., **2019**. Receiver function mapping of mantle transition zone discontinuities beneath Alaska using scaled 3-D velocity corrections. *Geophysical Journal International*, 219(2), pp.1432-1446.
15. Irving, J., Cottaar, S. Lekic, V., **2018**, Seismically determined elastic parameters for Earth's outer core, *Science Advances*, Vol. 4, no. 6, eaar2538
14. Chandler^b, B.C., Yuan^a, K., Li, M., Cottaar, S., Romanowicz, B., Tomé, C.N. and Wenk, H.R., **2018**. A Refined Approach to Model Anisotropy in the Lowermost Mantle. In *IOP Conference Series: Materials Science and Engineering* (Vol. 375, No. 1, p. 012002). IOP Publishing.
13. Jenkins^b, J., Maclennan, J., Green, R., Cottaar, S., Deuss, A., White, R. **2018**, Crustal formation on a spreading ridge above a mantle plume: receiver function imaging of

- the Icelandic crust, *Journal of Geophysical Research - Solid Earth*, 123.6 (2018): 5190-5208.
12. Jenkins^b, J., Deuss A., Cottaar, S., **2017**, Converted phases from sharp heterogeneity around 1000 km depth beneath Western Europe, *Earth and Planetary Science Letters* 459, 196–207
 11. Cottaar, S. and Lekic, V., **2016**, Morphology of Seismically Slow Lower Mantle Structures *Geophysical Journal International* 2016; 207 (2): 1122-1136
 10. Cottaar, S. and Deuss, A., **2016**, Large-scale mantle discontinuity topography beneath Europe: signature of akimotoite in subducting slabs, *Journal of Geophysical Research*, 121, 279-292
 9. Jenkins^b, J., Cottaar, S., White, B., and Deuss, A., **2016**, Depressed Discontinuities beneath Iceland: Evidence of a garnet controlled 660?, *Earth and Planetary Science Letters*, 433, 159-168
 8. Zhang, S., Cottaar, S., Lui, T., Stackhouse, S., Militzer, B., **2016**, High- pressure, temperature elasticity of Fe- and Al- bearing MgSiO₃: implications for the Earth's lower mantle, *Earth and Planetary Science Letters*, 434, 264-273
 7. Cottaar, S., Li, M., McNamara, A. K., Romanowicz, B., and Wenk, H.-R., **2014**, Synthetic seismic anisotropy models within a slab impinging on the core-mantle boundary, *Geophysical Journal International*, 199(1), 164-177
 6. Cottaar, S., Heister, T., Rose, I., and Unterborn, C., **2014**, BurnMan: A lower mantle mineral physics toolkit, *Geochemistry, Geophysics, and Geosyst.*, 15(4), 1164-1179
 5. Cottaar, S., and Romanowicz, B., **2013**, Observations of changing anisotropy across the southern margin of the African LLSVP, *Geophysical J. Int.*, 195(2), 1184-1195
 4. Cottaar, S., and Romanowicz, B., **2012**, An unusually large ULVZ at the base of the mantle near Hawaii, *Earth and Planetary Science Letters*, 355-356, 213-222
 3. Lekic, V., Cottaar, S., Dziewonski, A., and Romanowicz, B., **2012**, Cluster analysis of global lower mantle tomography: a new class of structure and implications for chemical heterogeneity, *Earth and Planetary Science Letters*, 357-358, 68-77
 2. Cottaar, S., and Buffett, B.A., **2012**, Convection in the Earth's inner core, *Physics of Earth and Planetary Interiors*, 198-199, 67-78, (Highlighted in *Nature Geoscience*)
 1. Wenk, H.-R., Cottaar, S., Tome, C.N., McNamara, A., and Romanowicz, B. **2011**, Deformation in the lowermost mantle: From polycrystal plasticity to seismic anisotropy, *Earth and Planetary Science Letters*, 306 (1-2), 33-4

Conference Presentations

- Invited keynote speaker, Study of the Earth's Deep Interior (SEDI) conference in Taipei, Taiwan, July 2020, (declined for maternity leave)
- Union Lecture speaker at the International Union of Geodesy and Geophysics General Assembly in Montreal, Canada, July, 2019
- Bullerwell Lecture, European Geological Union, Vienna, Austria, April 2019
- Royal Astronomical Society, Dynamics and evolution of Earth's coupled core-mantle system, London, UK, May 2018
- DEEP Research School, General Assembly, Solid Earth: Composition and Evolution, Norway, March 2018
- UCL Workshop, Big Transition Zone: Below and Beyond, May 2017
- College de France, Colloquium, Flow in the Deep Earth, Paris, France, December 2016
- Study of the Earth's Deep Interior (SEDI) conference, Nantes, France, July 2016
- ppv@10: 10th anniversary of the discovery of post-perovskite, Bristol, UK, June 2014
- Gordon Research Seminar, Mount Holyoke, MA, June 2013

- American Geophysical Union Fall meetings invited presentations in 2010, 2011, 2014, 2016, and 2019 (2x), and other oral presentations in 2010, 2011, 2012, 2015, and 2018
- European Geological Union general assembly, invited presentations in 2015 (2x), 2017, and 2019

Invited Departmental Seminars

- University of Muenster, April 2020, (cancelled due to COVID-19)
- Centre for Earth Evolution and Dynamics, Oslo, May 2019
- Imperial College London, October 2018
- University of Bristol, March 2017
- Oxford University, March 2017
- University of Leeds, January 2017
- University College London, October, 2016
- ETH Zurich, April 2016
- University of Liverpool, March 2016
- Massachusetts Institute of Technology, April 2015
- Institut de Physique du Globe de Paris, November 2013
- University of California, Berkeley, May 2013
- University of Cambridge, September 2011, May 2015, February 2018

Research Team

Postdoctoral Researcheres

2018- Dr Alistair Boyce - Multi-method investigation of upwelling beneath the African continent

2017, 2019- Dr Jennifer Jenkins - Mapping the root of the Hawaiian plume

Postgraduate students

2014-2017 PhD student Jennifer Jenkins - deep structure of the Iceland plume
Received the Keith Runcorn 2017 thesis prize from the Royal Astronomical Society

2017- PhD student Zhi Li - zooming in on the roots of plumes

2017- PhD student Matthew Maitra - normal mode imaging

2018- PhD student Stephen Pugh - upper mantle plume signatures

2019- PhD student Carl Martin - imaging on the core-mantle boundary

2019- PhD student Stuart Russell - multi-disciplinary investigation of the thermal boundary layer in the lowermost mantle

Undergraduates

2016-2019 Supervised five Master's theses in Earth Sciences and four in Physics, as well as four summer internships. Two of these theses have led to publications.

Teaching

- *Introduction to earthquake seismology and tectonics* for 2nd year Earth Scientists
- *Introduction to global structural seismology* for 2nd year Earth Scientists
- *Co-designing Computing for Earth Scientists* course (for 2020 or 2021)
- *Deep Earth Geophysics* to part III Earth Scientists
- Fieldwork demonstrator on Arran for first years (2016, 2017, 2018)
- Lecturer at CIDER summer workshops (2016 and 2018),
- Lecturer at Solid Earth Doctoral Training School, October, 2019

University Service

- Director of Studies at Pembroke College, Cambridge (2014-)
- Graduate Tutor for Department of Earth Sciences (2016-)
- Graduate Tutor for Pembroke College (2017-)
- Bullard seminar speaker series organiser (2017-2019), Tea time talk organiser (2016)
- MaST selection committee (2019), DTP selection committee (2020)
- Examiner for 1A (2017-2019)
- Lectures for Cambridge Summer School and Sutton Trust Summer school (2018 and 2019), TED-style talks to alumni 'A Journey Halfway to the Centre of the Earth', (April and June 2018)
- First Aider at Bullard (2017-)

External Academic Participation and Service

- Member of the Youth Academy of Europe (2020-)
- Co-developer of multi-disciplinary, open-source toolbox BurnMan used in 20+ publications as well as for education (2012-)
- Editor for an AGU Monograph (publication set for 2020)
- Co-organiser of the UK-Study of the Deep Earth's Interior (UK-SEDI) conference, 8-9th of May, 2019, UCL, London, UK
- Reviewed for 9+ journals, including *Nature Geoscience*, *Earth and Planetary Science Letters*, *Journal of Geophysical Research*, *Geochemistry Geophysics*, and *Geosystems*, *Geophysical Research Letters*, and *Physics of the Earth and Planetary Interiors*
- Reviewed for funding bodies: NSF (3x), French National Research Agency, ETH Zurich Research Commission
- Session convener at the AGU fall meeting (2015, 2018, 2019)
- Participant in NSF-funded Cooperative Institute for Dynamic Earth Research Summer Programs and on-going multi-disciplinary research projects (2010, 2012, 2014), and as a lecturer (2016, 2018)
- Senior Treasurer for various student-led organizations related to Effective Altruism

Public Engagement

- Designing a one-year exhibit for the Sedgwick Museum in Cambridge, UK, entitled 'Deep Earth Explorers', set to open in March 2020
- Interviewed for articles in Quanta Magazine, NBC News, and EoS.
- Editor on Wikipedia for deep Earth and seismology subjects (2013-), organized a Deep Earth Edit-a-thon at CIDER workshop 2016
- Appeared on and co-wrote an episode about earthquakes for a Dutch scientific television program for children ('Het Klokhuis') (2012)
- Visited schools for Bay Area Scientists In Schools, teaching a mountain building experiment (2010-2012), hosted schools at the Berkeley Seismological Laboratory (2009-2012)