

Fred A Davis

University of Minnesota Duluth
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Education

- UNIVERSITY OF MINNESOTA, Minneapolis, MN 2008-2012
Ph.D., Geology
Concentration: Experimental Petrology, Igneous Petrology
Thesis: *The role of partial melts of peridotite in the formation of oceanic island basalts*
Advisor: Marc M Hirschmann
- UNIVERSITY OF MINNESOTA, Minneapolis, MN 2006-2011
M.S., Geology
Concentration: Experimental Petrology, Igneous Petrology
Thesis: *Determination of small melt fraction peridotite partial melts using Re foil melt traps*
Advisor: Marc M Hirschmann
- UNIVERSITY OF MISSOURI, Columbia, MO 2001-2005
B.S., with honors in Geological Sciences, Cum Laude
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Positions Held

- 2015-present Assistant Professor, Department of Earth and Environmental Sciences, University of Minnesota Duluth
- 2012-2015 Peter Buck Postdoctoral Fellow, Department of Mineral Sciences, National Museum of Natural History, Smithsonian Institution
- 2012 Interim Laboratory Manager, Electron Microprobe Laboratory, Department of Earth Sciences, University of Minnesota Twin Cities
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Grants

| Agency/Grant # | Amount | Lead PI | Co-PIs | Institution | Duration |
|---|-----------|----------|--------|-----------------|------------------------------|
| NSF EAR 1624691 | \$156,123 | F. Davis | none | Univ. MN Duluth | Sep. 1, 2016 - Aug. 31, 2018 |
| <i>Title: "Experimental Investigation of Mantle Heterogeneity: Behavior of Ga, Ge, and First-row Transition Elements (FRTE) During Partial Melting of Pyroxenite and Spinel Peridotite"</i> | | | | | |

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|--|----------|-------------|---|----------------------------|---------------------------------|
| NSF OCE 1433212 | \$92,327 | E. Cottrell | F. Davis K. Kelley J. Warren | Smithsonian Institution | Aug. 1, 2014 - Jul. 31, 2018 |
| Title: "Collaborative Research: Upper mantle oxygen fugacity from source to surface" | | | | | |

Refereed Journal Articles

Davis, FA, Cottrell, E, Birner, SK, Warren, JM, Lopez, OG, 2017. Revisiting the electron microprobe method of spinel-olivine-orthopyroxene oxybarometry applied to spinel peridotites. *American Mineralogist*, 102, 421–435.

Birner, SK, Warren, JM, Cottrell, E, and **Davis, FA**, 2016. Hydrothermal alteration of seafloor peridotites does not influence oxygen fugacity recorded by spinel oxybarometry. *Geology*, G38113–1.

Davis, FA, Hirschmann, MM, 2013. The effects of K₂O on the compositions of near-solidus melts of garnet peridotite at 3 GPa and the origin of basalts from enriched mantle. *Contributions to Mineralogy and Petrology*, 166, 1029-1046. DOI: 10.1007/s00410-013-0907-0.

Davis, FA, Humayun, M, Hirschmann, MM, Cooper, RS, 2013. Experimentally determined mineral/melt partitioning of first-row transition elements (FRTE) during partial melting of peridotite at 3 GPa. *Geochimica et Cosmochimica Acta*, 104, 232-260. DOI: 10.1016/j.gca.2012.11.009.

Davis, FA, Hirschmann, MM, Humayun, M, 2011. The composition of the incipient partial melt of garnet peridotite at 3 GPa and the origin of OIB. *Earth and Planetary Science Letters*, 308, 380-390. DOI: 10.1016/j.epsl.2011.06.008.

Humayun, M, **Davis, FA**, Hirschmann, MM, 2010. Major element analysis of natural silicates by laser ablation ICP-MS. *Journal of Analytical Atomic Spectrometry*, 95, 998-1005. DOI: 10.1039/c001391a.

Davis, FA, Tangeman, JA, Tenner, TJ, Hirschmann, MM, 2009. The composition of KLB-1 peridotite. *American Mineralogist*, 94, 176-180. DOI: 10.2138/am.2009.2984.

Hirschmann, MM, Ghiorso, MS, **Davis, FA**, Gordon, SM, Mukherjee, S, Grove, TL, Krawczynski, M, Medard, E, Till, CB, 2008. Library of Experimental Phase Relations (LEPR): A database and Web portal for experimental magmatic phase equilibria data. *Geochemistry Geophysics Geosystems*, 9, Q03011. DOI: 10.1029/2007GC001894.

Abstracts

**presenting author*

- Birner, S*, **Davis, FA**, Cottrell, E, Warren, JM, Kelley, KA, 2017. Subsolidus cooling of mid-ocean ridge peridotites and implications for the oxygen fugacity of the oceanic upper mantle. American Geophysical Union Fall Meeting, New Orleans, LA. Abstract V33D-0554.
- Davis, FA***, Wall, KT, Cottrell, E, 2017. Upper mantle oxygen fugacity recorded by peridotite xenoliths from oceanic islands. American Geophysical Union Fall Meeting, New Orleans, LA. Abstract/Oral Presentation V24C-06.
- Davis, FA***, Cottrell, E, 2017. Basalt glass Fe-XANES and spinel peridotite oxybarometers agree. Goldschmidt Geochemical Conference, Paris, France. Abstract/Oral Presentation.
- Birner, SK*, Cottrell, E, Warren, JM, Kelley, KA, **Davis, FA**, 2016. Records of upper mantle oxygen fugacity gleaned from high-density sampling of basalts and peridotites at ultraslow ridges. American Geophysical Union Fall Meeting, San Francisco, CA. Abstract T32A-05.
- Birner, SK*, Warren, JM, Cottrell, E, **Davis, FA**, 2016. Oxygen fugacity of the oceanic upper mantle as recorded by basalts and peridotites from the Southwest Indian Ridge. Goldschmidt Geochemical Conference, Yokohama, Japan. Abstract.
- Cottrell, E*, Lanzirotti, A, Kelley, KA, Newville, M, Birner, S, **Davis, FA**, Mysen, B, Botcharnikov, R, 2016. Radiation-induced oxidation of Fe in hydrous basalt glasses. Goldschmidt Geochemical Conference, Yokohama, Japan. Abstract.
- Birner, SK*, Warren, JM, Cottrell, E, **Davis, FA**, 2015. Heterogeneous Oxidation in Supra-Subduction Settings: Evidence from Forearc Peridotites. American Geophysical Union Fall Meeting, San Francisco, CA. Abstract V11D-3086.
- Birner, SK*, Warren, JM, Cottrell, E, **Davis, FA**, 2015. Oxygen fugacity of forearc peridotites from the Tonga Trench: Implications for mantle processes during subduction initiation. Goldschmidt Geochemical Conference, Prague, Czech Republic. Abstract.
- Davis, FA***, Cottrell, E, 2014. Oxygen fugacity profile of the oceanic upper mantle and the depth of redox melting beneath ridges. American Geophysical Union Fall Meeting, San Francisco, CA. Abstract/Oral Presentation V51E-02. **INVITED**.
- Wall, K*, **Davis, FA**, Cottrell, E, 2014. Oxygen fugacity recorded by xenoliths from Pacific oceanic islands. American Geophysical Union Fall Meeting, San Francisco, CA. Abstract V52B-04.

- Birner, SK*, Warren, JM, Cottrell, E, **Davis, FA**, 2014. Untangling the history of oceanic peridotites using spinel oxybarometry. American Geophysical Union Fall Meeting, San Francisco, CA. Abstract V53B-4863.
- Cottrell, E*, **Davis, FA**, Birner, SK, Warren, JM, Wall, K, 2014. Oxybarometry of peridotites from various tectonic settings. Geological Society of America Annual Meeting, Vancouver, BC, Canada. Abstract 164-7.
- Wall, K*, Davis, FA, Cottrell, E, 2014. Oxygen fugacity recorded by xenoliths from Pacific oceanic islands. Geological Society of America Annual Meeting, Vancouver, BC, Canada. Abstract 128-3.
- Davis, FA***, McDonough, WF, Cottrell, E, Ash, RD, 2014. Hawaiian peridotite xenoliths and the use of Ni in olivine as a petrogenetic indicator for basalt. Goldschmidt Geochemical Conference, Sacramento, CA, USA. Abstract/Oral Presentation **INVITED**.
- Davis, FA***, Cottrell, E, 2014. Parameters affecting the depth of redox melting beneath ridges. Goldschmidt Geochemical Conference, Sacramento, CA, USA. Abstract/Poster Presentation.
- Birner, SK*, Warren, JM, Cottrell, E, Lopez, OG, **Davis, FA**, Falloon, TJ, 2014. Oxygen fugacity variations among Tonga trench forearc peridotites. Goldschmidt Geochemical Conference, Sacramento, CA, USA. Abstract.
- Davis, FA***, Cottrell, E, McDonough, WF, Ash, RD, 2013. First-row transition elements (FRTE) in Hawaiian lherzolite xenoliths and their implications for lithologic heterogeneity in basalt source regions. American Geophysical Union Fall Meeting, San Francisco, CA. Abstract/Poster Presentation DI41A-2332.
- Cottrell, E*, Lekic, V, **Davis, FA**, Kelley, KA, 2013. Redox Controls on the Asthenosphere. American Geophysical Union Fall Meeting, San Francisco, CA. Abstract DI31B-03.
- Birner, SK*, Warren, JM, Lopez, OG, Davis, FA, Falloon, TJ, 2013. Variations in Oxygen Fugacity among Forearc Peridotites from the Tonga Trench. American Geophysical Union Fall Meeting, San Francisco, CA. Abstract V13I-02.
- Davis, FA***, Hirschmann, MM, 2012. Experimental investigation of the effects of K₂O on the composition of near-solidus partial melts of peridotite at 3 GPa. American Geophysical Union Fall Meeting, San Francisco, CA. Abstract/Poster Presentation T31B-2601.
- Davis, FA***, Humayun, M, Hirschmann, MM, Cooper, RS, 2011. First-row transition element (FRTE) partitioning between garnet peridotite and near-solidus melts and their use as indicators of OIB source lithology. American Geophysical Union Fall Meeting, San Francisco, CA. Abstract/Poster Presentation T51H-2460.

- Humayun, M*, Campbell, TJ, Brandon, AD, **Davis FA**, Hirschmann, MM, 2011. Iron geochemistry of the mantle. American Geophysical Union Fall Meeting, San Francisco, CA. Abstract U41A-0008.
- Davis, FA***, Humayun, M, Hirschmann, MM, Cooper, RS, 2011. Partitioning of first-row transition elements between peridotite and melt. *Mineralogical Magazine* **75**, 728. Goldschmidt Geochemical Conference, Prague, Czech Republic. Abstract/Oral Presentation.
- Davis, FA***, Hirschmann, MM, Humayun, M, Cooper, RS, 2010. Experimental investigation of properties of low degree partial melts of garnet peridotite and their role in OIB genesis. American Geophysical Union Fall Meeting, San Francisco, CA. Abstract/Poster Presentation V11B-2278.
- Davis, FA***, Hirschmann, MM, Humayun, M, 2009. The composition of low-degree partial melts of garnet peridotite at 3 GPa by modified iterative sandwich experiments (MISE). American Geophysical Union Fall Meeting, San Francisco, CA. Abstract/Oral Presentation V31F-04.
- Davis, FA***, Wick, M, Withers, AC, Hirschmann, MM, 2008. Determining low-degree partial melts of garnet peridotite at 3 GPa by modified iterative sandwich experiments (MISE). American Geophysical Union Fall Meeting, San Francisco, CA. Abstract/Poster Presentation V41D-2133.
- Davis, FA***, Waller, C, Wick, M, Withers, AC, Hirschmann, MM, 2008. Low-degree partial melting of peridotite KLB-1 at 3 GPa. from Re melt traps and modified iterative sandwich experiments (MISE). AGU Chapman Conference on Shallow Mantle Composition and Dynamics Fifth International Orogenic Lherzolite Conference, Mt. Shasta, CA, Abstract/Oral Presentation.
- Davis, F***, Cooper, JR, Whittington, A, Fleming, T, Marshak, S, 2005. Xenocryst dissolution in continental basalts: experimentally determined rates and textural comparison with field examples from Colorado and Antarctica. Geological Society of America Annual Meeting, Salt Lake City, UT. Abstract/Poster Presentation

Academic Colloquia and Public Presentations

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| 2016 | University of Minnesota Duluth, Department of Earth and Environmental Sciences, April |
| 2015 | University of Minnesota Duluth, Department of Earth and Environmental Sciences, March |
| 2014 | Miami University, Department of Geology and Environmental Earth Science, October |

University of Rhode Island, Graduate School of Oceanography, February

2013 Geological Society of Washington, January

Teaching Experience

- Fall 2017 GEOL 1110 Geology & Earth Systems
General education course in introductory physical geology and integrated Earth systems (solid earth, hydrosphere, biosphere, atmosphere, soils).
Enrollment: 153
- Spring 2016, GEOL 2120 The Earth's Dynamic Interior
2017 *Undergraduate course in Geology BS core curriculum. Topics in solid earth science (seismology, mantle petrology, plate tectonics) are explored through a lens of hypothesis testing and model construction to describe a system (Earth's interior) that cannot be observed directly.*
Enrollment: 25-30
- Fall 2015, GEOL 2311 Mineralogy
Spring 2017 *Undergraduate course in Geology BS core curriculum. Students learn about the chemistry and internal structure of minerals and how these atomic-scale properties relate to macro-scale properties and environments of formation. Twice-weekly lab meetings focus on petrography and hand sample investigation.*
Enrollment: 25-30
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Students Advised

Graduate students:

2017-present Andrew Regula (Geology MS student)

2016-present Amber Roberts (Geology MS student)

Undergraduate intern:

2014 Kellie T. Wall – Washington State University; summer intern through Natural History Research Experiences (NHRE) program at the Smithsonian Institution; co-advised with E. Cottrell (NMNH); *project title: Oxygen fugacity of hotspot xenoliths: a window into the Earth's mantle.*

Awards and Fellowships

- 2012 Peter Buck Postdoctoral Fellowship, *Smithsonian Institution*
2011 John W. Gruner Graduate Fellowship, *University of Minnesota*
2010 Richard C. Dennis Graduate Fellowship, *University of Minnesota*
2010 Outstanding Teaching Assistant Award, *University of Minnesota*

2006 V.R. Murthy and Janice Noruk Fellowship, *University of Minnesota*
2005 Pearl T. Sando Scholarship, *University of Missouri*
2005 Field Camp Scholarship, *University of Missouri*
2004-2005 Arts and Sciences Undergraduate Research Mentorship, *University of Missouri*

Professional Service

Service to Societies and Professional Organizations

2015 Co-convener of AGU Fall Meeting session V32A. Chemical Evolution of the Earth's Mantle
2014 Co-convener and co-chair of Goldschmidt 2014 session 02e: Compositions and Oxidation States of the Terrestrial Planets
2013-2014 AGU Fall Meeting Outstanding Student Paper Award judge
2013 Co-convener and co-chair of AGU Fall Meeting session V32A. Chemical Evolution of the Earth's Mantle
2012-present Reviewer for *American Mineralogist*; *Chemical Geology*; *Geochemistry*, *Geophysics*, *Geosystems*; *Geology*; *Journal of Petrology*

Service to the University of Minnesota Duluth

2017-present Chair of the Department of Earth and Environmental Sciences Curriculum Committee
Spring 2017 Organized Department of Earth and Environmental Sciences seminar series

Grant Proposal Service

2005-present Proposal reviewer for National Science Foundation (NSF) EAR Petrology and Geochemistry (CH) and GeoPRISMS

Public Outreach

2017 The Dean's Tour – Piedmont Elementary
Mineralogy and Petrography demonstration for 5th grade students from Piedmont Elementary, Duluth Public Schools

2015 Oral Presentation at National Museum of Natural History, Smithsonian Institution, Washington, DC, 6-minute "Lightning Talk", April

Oral Presentation to the Association of Environmental and Engineering Geologists, Baltimore – Washington – Harrisburg chapter, Frederick, MD, January

2014 Oral Presentation to the Gem, Lapidary, and Mineral Society of Montgomery County, MD, November

Professional Affiliations

American Geophysical Union • Mineralogical Society of America • Geochemical Society
• National Association of Geoscience Teachers • Geological Society of Washington