# Neil R. Bennett, PhD

*Curriculum Vitae*

Tel: +1-202-602-9728 Email: neil.bennett@utoronto.ca

## Employment

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| **2021 – Present** | Assistant Professor, Department of Earth Sciences, University of Toronto. |
| **2020 – 2021** | Consultant, Engineering Team, Saildrone. |
| **2019 – 2020** | Sessional Teaching Faculty, Department of Chemistry and Biochemistry, CSU East Bay. |
| **2018** | Curriculum Designer, IXL Learning. |
| **2017** | Postdoctoral Associate, Geophysical Lab, Carnegie Institution of Washington and Visiting Scientist, University of California, Davis. |
| **2013 – 2016** | Postdoctoral Fellow, Geophysical Lab, Carnegie Institution of Washington. |
| **2007** | Junior Geologist, Nunaminerals, Nuuk, Greenland. |

## Education

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| **2008 – 2013** | PhD in Geology, University of Toronto. Thesis title: The solubility and metal-silicate partitioning of some highly siderophile elements: Implications for core-formation and planetary |
| **2004 – 2008** | MSci, Hons, 1$^{st}$ class (undergraduate masters) in Geology, University of Birmingham, UK. Thesis title: The magnetic fabric of the W. Mourne Granite, N. Ireland and its implications for shallow crustal level magma emplacement. |

## Research Interests

Planetary accretion and differentiation, element speciation and partitioning, ore-forming processes, mineralogy, igneous petrology, geochemistry, materials synthesis.

## Equipment Experience

Solid media high-pressure apparatus (piston-cylinder and multi-anvil press); laser-heated diamond anvil cell; controlled atmosphere furnace; muffle furnace; electron probe micro-analysis (WDS); scanning electron microscopy (imaging and EDS); laser-ablation inductively coupled plasma mass spectrometry; focused ion beam milling; X-ray

## Funding

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| **2021 – 2026** | NSERC Discovery Grant: Molten Salts as Agents of Extreme Fractionation; $150,000 CAD. |
| **2021 – 2026** | NSERC Early Career Researcher Supplement: Molten Salts as Agents of Extreme Fractionation; $12,500 CAD. |
| **2013 – 2015** | Barbara McClintock Postdoctoral Fellowship, Carnegie Institution of Washington; ~$65,000 USD pa. |
| **2011** | GSA Graduate Student Research Grant: Soret Diffusion at the Core-Mantle Boundary; $1,250 USD. |

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| **2010** | MSA Student Grant for Research in Mineralogy and Petrology: The Metal-Silicate Partitioning Behaviour of Re and Pt: Implications for Terrestrial Accretion and Core Formation: $5.000 USD. |

## Scholarships, and Awards

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| **2008 – 2013** | Connaught Scholarship; University of Toronto School of Graduate Studies. |
| **2008** | Undergraduate Science Award; University of Birmingham. |
| **2008** | Undergraduate Award for Single Honours Geology; University of Birmingham. |
| **2006** | Undergraduate Student Award in Mineral Science; Mineralogical Society of Great Britain & Ireland. |
| **2006** | Palaeontological Association Undergraduate Award. |

## Students Supervised

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| **2022 - Present** | Zhong-zheng Yuan, PhD Candidate, The role of magmatic salts in fractionating and concentrating critical metals. |
| **2022 - Present** | Jessica Verschoor, MSc Candidate, The effect of phosphorous on Fe-isotope fractionation in meteorites. |
| **2022 - Present** | Alex Guillerez, Senior Thesis, Petrogenetic indicators of magnetite formation from carbonatite melts. |
| **2012** | Juzer Noman, NSERC Summer Research Student, Metal-silicate partitioning of Au as a function of sulfur content. |

## Student Committees

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| **2021 – Present:** | Bruna da Silva Ricardo, PhD Student, The kinetics of melt inclusion formation. |
| **2021 – Present:** | Dilem Herdem, MSc Student, The fate of trace elements during the transformation of pyrite to pyrrhotite. |

## Teaching Experience

**Course Instructor**

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| **2023 (Planned)** | ESS105 Our Home Planet |
| **2022** | ESS490 Capstone Field Course, University of Toronto |
| **2019, 2020** | Introductory Chemistry, California State University East Bay |

**Teaching Assistantships (University of Toronto)**

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| **2012** | Capstone Field Course |
| **2009 – 2012** | Introduction to Field Mapping |
| **2008, 09, 11** | Igneous and Metamorphic Petrology |
| **2010** | Structural Geology |
| **2010** | Introductory Geology |
| **2008, 09** | Introduction to Mineralogy |

## Manuscripts in Preparation

**Bennett, N. R.**, Jackson, C. R. M., Du, Z., Fei, Y. *In Prep* . The metal-silicate partitioning of tungsten at magma ocean pressures: Implications for the tungsten isotope heterogeneity of plume mantle.

## Submitted and Peer-Reviewed Publications

**Bennett, N. R.**, Sio, C. K., Schauble, E., Edwards, P., Lesher, C. E., Wimpenny, J., Shahar, A. *Accepted* . An impact origin for main group pallasites revealed by iron isotopes.

Jackson, C. R. M., Cottrell, E., Du, Z., **Bennett, N. R.**, Fei, Y. 2021. High pressure redistribution of nitrogen and sulfur during planetary stratification, *Geochemical Perspectives Letters* , **18**, 37-42.

**Bennett, N. R.** 2021. Controls on Element Partitioning. *Encyclopedia of Geology, 2 nd Edition* . Elias. S. & Alderton. D. (Eds.) Amsterdam: Elsevier Academic. (Invited

Lesher, C. E., Dannberg, J., Barfod, G. H., **Bennett, N. R.**, Glessner, J., Lacks, D., Brenan, J. M. 2020. Iron isotope fractionation at the core-mantle boundary, *Nature Geoscience* , **13**, 382-386.

Sio, C. K., Parsons-Davis, T., Lee, E., Pascall, A., Kuntz, J. D., Wimpenny, J., Goodell, J., Roberts, K. E., Bandong, B. B., **Bennett, N. R**. 2020. Additive manufacturing of platinum group element (PGE) reference materials with a silica matrix. *Rapid Communications in Mass Spectrometry* , **34**, e8627,1-9.

Brenan, J. M., Mungall, J. E., **Bennett, N. R.** 2019. Control of the highly siderophile elements in lunar basalts by iron sulfide melt. *Nature Geoscience* . **12**, 701-706.

Rizo, H., Andrault, D., **Bennett, N. R.**, Humayun, M., Brandon, A., Vlastelic, I., Moine, B., Poirier, A., Bouhifd, M., Murphy, D. T. 2019. $^{182}$W evidence for core-mantle interaction in the source of mantle plumes. *Geochemical Perspectives Letters* . **11**. 6-11.

Sio, C. K., Roskosz, M., Dauphas, N., **Bennett, N. R.**, Mock, T., Shahar, A. 2018. The isotope effect for Mg-Fe interdiffusion in olivine and its dependence on crystal orientation, composition and temperature. *Geochimica et Cosmochimica Acta* , **239**, 463-480.

**Bennett, N. R.** & Fei, Y. 2018. Pressure, sulfur and metal-silicate partitioning: The effect of sulfur species on the parameterization of experimental results. *American Mineralogist* , **103**, 1068-1079.

Jackson, C. R. M., **Bennett, N. R.**, Du, Z., Cottrell, E., Fei, Y. 2018. Early episodes of high-pressure core formation preserved in plume mantle. *Nature* , **553**, 491-495.

Du, Z., Jackson, C. R. M., **Bennett, N. R.**, Driscoll, P., Fei, Y., Deng, J., Lee, K., Greenberg, E., Prakapenka, V. 2017. Insufficient energy from MgO exsolution to power early geodynamo. *Geophysical Research Letters* , **44**, 1-6.

**Bennett, N. R.**, Brenan, J. M., Fei, Y. 2016. Magma ocean thermometry: Controls on the metal-silicate partitioning of gold, *Geochimica et Cosmochimica Acta* , **184**, 173-192.

Brenan, J. M., **Bennett, N. R.**, Zacjacz, Z. 2016. Experimental results on fractionation of the highly siderophile elements (HSE) at variable pressures and temperatures during planetary and magmatic differentiation, *Reviews in Mineralogy and Geochemistry,* **81**. (Invited Submission)

**Bennett. N. R.**, Brenan, J. M., Fei, Y. 2015. Metal-silicate partitioning experiments at high pressure and temperature: experimental methods and a procedure for the highly siderophile elements, *Journal of Visualized Experiments* , **100**. (Invited Submission)

**Bennett, N. R.**, Brenan, J. M., Koga, K. T. 2014. The solubility of platinum in silicate melt under reducing conditions: results from experiments without metal inclusions, *Geochimica et Cosmochimica Acta* , **133**, 422-442.

Smythe, D. J., Brenan, J. M., **Bennett, N. R.**, Regier, T., Henderson, G. S. 2013. Quantitative determination of cerium oxidation states in alkali-aluminosilicate glasses using $M_{4,5}$-edge XANES. *Iournal of Non-Crvstalline Solids* . **378**. 258-264.

**Bennett, N. R.** & Brenan, J. M. 2013. Controls on the solubility of rhenium in silicate melt: implications for the osmium isotopic composition of Earth's mantle, *Earth and Planetary Science Letters* , **361**, 320-332.

Stevenson, C. T. E. & **Bennett, N. R.** 2011. The emplacement of the Palaeogene Mourne Granite Centres, Northern Ireland: new results from the Western Mourne Centre. *Journal of the Geological Society* , **168**, 831-836.

Brenan, J. M. & **Bennett, N. R.** 2010. Soret separation of highly siderophile elements in Fe–Ni–S melts: implications for solid metal–liquid metal partitioning, *Earth and Planetary Science Letters* , **298**, 299-305.

## Invited Talks

Bennett, N. R., Noble metal logistics: Distributing highly siderophile elements between the core and mantle, *Bayerisches Geoinstitut (BGI)* , Germany, 2019.

Bennett, N. R., Experimental results on fractionation of the highly siderophile elements (HSE) at variable pressures and temperatures during planetary and magmatic differentiation, *RiMG Short Course, Scripps Institution of Oceanography* , USA, 2016.

Bennett, N. R., Magma ocean thermometry: experiments on the metal-silicate partitioning of Au, *University of Maryland* , USA, 2016.

Bennett, N. R., Terrestrial accretion and core formation: insights from the highly siderophile elements, *Smithsonian Museum of Natural History* , USA, 2014.

Bennett, N. R., Metal-silicate partitioning: consequences for the late-veneer and conditions of core metal segregation, *University of Maryland* , USA, 2014.

Bennett, N R., Lateral emplacement of the Western Mourne Granite, N.Ireland, from AMS fabric data, *AGU Joint Assembly,* Canada, 2009.

## Selected Conference Abstracts

Bennett, N. R., Verschoor, J. D., & Sio, C, K. Probing the compositional effects on Fe isotope fractionation between solid and liquid metal alloys. *Goldschmidt Conference,* 2022

Bennett, N. R., Sio., C. K., Schauble, E., Lesher, C. E., Edwards, P., Wimpenny, J., Shahar, A. Experimentally Determined Fe-Isotope Fractionation Between Metal and Olivine: Implications for Pallasite Formation. *GACMAC Meeting* , 2022.

Jackson, C. R. M., Cottrell, E., Du, Z., Bennett, N. R., & Fei, Y. High Pressure Redistribution of Nitrogen and Sulphur During Planetary Stratification. *American Geophysical Union - Fall Meeting* , 2021

Sio, C. K., Render, J., Wimpenny, J., Lesher, C. E., Brenan, J. M. & Bennett, N. R. Nickel Isotope Fractionation in Fe-Ni and Fe-Ni-S Alloys by Thermodiffusion. *American Geophysical Union - Fall Meeting* , 2021

Sio, C. K., Parsons-Davis, T., Lee, E., Pascall, A., Kuntz, J. D., Wimpenny, J., Goodell, J., Roberts, K. E., Bandong, B. B., Bennett, N. R. Additive manufacturing of PGE standards with a silica matrix. *Goldschmidt Conference* , 2020.

Jackson, C. R. M., Cottrell, E., Du, Z, .Bennett, N. R., Fei, Y. Core Formation and Magma Ocean Outgassing Set Planetary NSC Ratios. *American Geophysical Union - Fall Meeting* , 2020.

Bennett, N. R. & Fei, Y. Pressure, Sulfur and Metal-Silicate Partitioning: Does the Formation of Metal-Sulphur Species in Silicate Melt Affect the Parameterisation of Experimental Results? *American Geophysical Union - Fall Meeting* , 2016.

Bennett, N. R., Jackson, C. R. M., Du, Z., Fei, Z. Planetary Differentiation in the Laboratory: Methods for Metal-Silicate Partitioning Experiments in the Diamond Anvil Cell and their Application to Tungsten. *Geological Society of America Annual Meeting* , 2016.

Bennett, N. R. & Fei, Y. Element Redistribution in Fe-Ni-O Melts by a Thermal Gradient: Implications for Siderophile Element Partitioning During Core Formation and Crystallization, *American Geophysical Union - Fall Meeting* , 2014.

Bennett, N. R. & Brenan, J. M. Equilibrium Core Formation Loses its Lustre: High Pressure and Temperature Partitioning of Gold. *Goldschmidt Conference* . 2012.

Bennett, N. R & Brenan, J. M. Suppression of Metal Inclusions and the Effect of Carbon on Pt Solubility in Haplobasalt at High Pressure and Temperature, *American Geophysical Union Fall Meeting* , 2011.

Bennett, N. R & Brenan, J. M. The Metal-Silicate Partitioning of Re & Pt: Constraining Mantle Os Isotope Systematics, *GACMAC Meeting* , 2011.

## Community Service

**Reviewer for:** Geology, Earth and Planetary Science Letters, Geochimica et Cosmochimica Acta, AGU Books, American Mineralogist, Frontiers in Earth Science, NERC Research Fellowship Program, German Science Foundation (DFG).

**2022** Goldschmidt Conference, Session Chair: Understanding the formation and evolution of Earth's mantle and core: Insights from elemental and stable isotope studies of natural samples, experiments, and theory.

**2022** GACMAC Conference, Session Convener: The critical metal-magma connection: Tracing metal source, transport, and ore formation.

**2019** Meritus Scholarship Interviewer.

**2016** Organiser of the Carnegie Institution's inaugraul "Souls of Steel" charity bike ride in support of S.O.M.E. (So Others Might Eat).

**2015** Goldschmidt Conference, Session Chair: The geochemistry of Earth's core.

**2011 – 2012** Association of Geology Graduate Students, President; University of Toronto.

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| **2010 – 2011** | Association of Geology Graduate Students, "Rockfest" seminar series organizer; University of Toronto. |
| **2010 – 2011** | Society of Economic Geologists, University of Toronto Chapter, committee member. |
| **2009 – 2010** | Prospectors and Developers Assoc. of Canada, conference |
| **2009** | American Geophysical Union Joint Assembly, conference |
| **2005 – 2006** | Lapworth Society, committee member; University of |
| **2004 – 2008** | UCAS Prospective Student Visits, volunteer; University of Birmingham. |